सत्यमेव जयते

स्वच्छ भारत
एक कदम स्वच्छता की ओर

INDIAN RAILWAYS

Working to become "Net Zero Carbon Emitter"

ENVIRONMENTAL SUSTAINABILITY







ANNUAL REPORT 2021-22



ENVIRONMENTAL SUSTAINABILITY

ANNUAL REPORT 2021-22

"Earth provides enough to satisfy every man's need but not every man's greed"



- Mahatma Gandhi

INDIAN RAILWAYS
Environment Management

VISION



VISION

To promote Green environment and clean energy while making the Indian Railways a global leader in sustainable mass transport solutions.

MISSION

- To promote energy conservation measures.
- To maximize the use of alternate forms of clean energy, thereby minimizing the carbon footprint of Railways.
- To provide clean and hygienic environment to customers.
- To promote conservation of water and other natural resources.
- To march towards Zero waste discharge from the major Railway units.
- To promote Green built-up spaces and expand tree-cover.
- To obtain Consent to operate from concerned Pollution Control Board under Environment Protection Act for major railway stations & goods siding
- Building in house capacity to set up an effective Environment Management System.
- Noise reduction in Railway operations.

भारतीय रेल
पर्यावरण प्रबंधन



Dr. M.G. Ramachandran Central Railway Station

विज़न

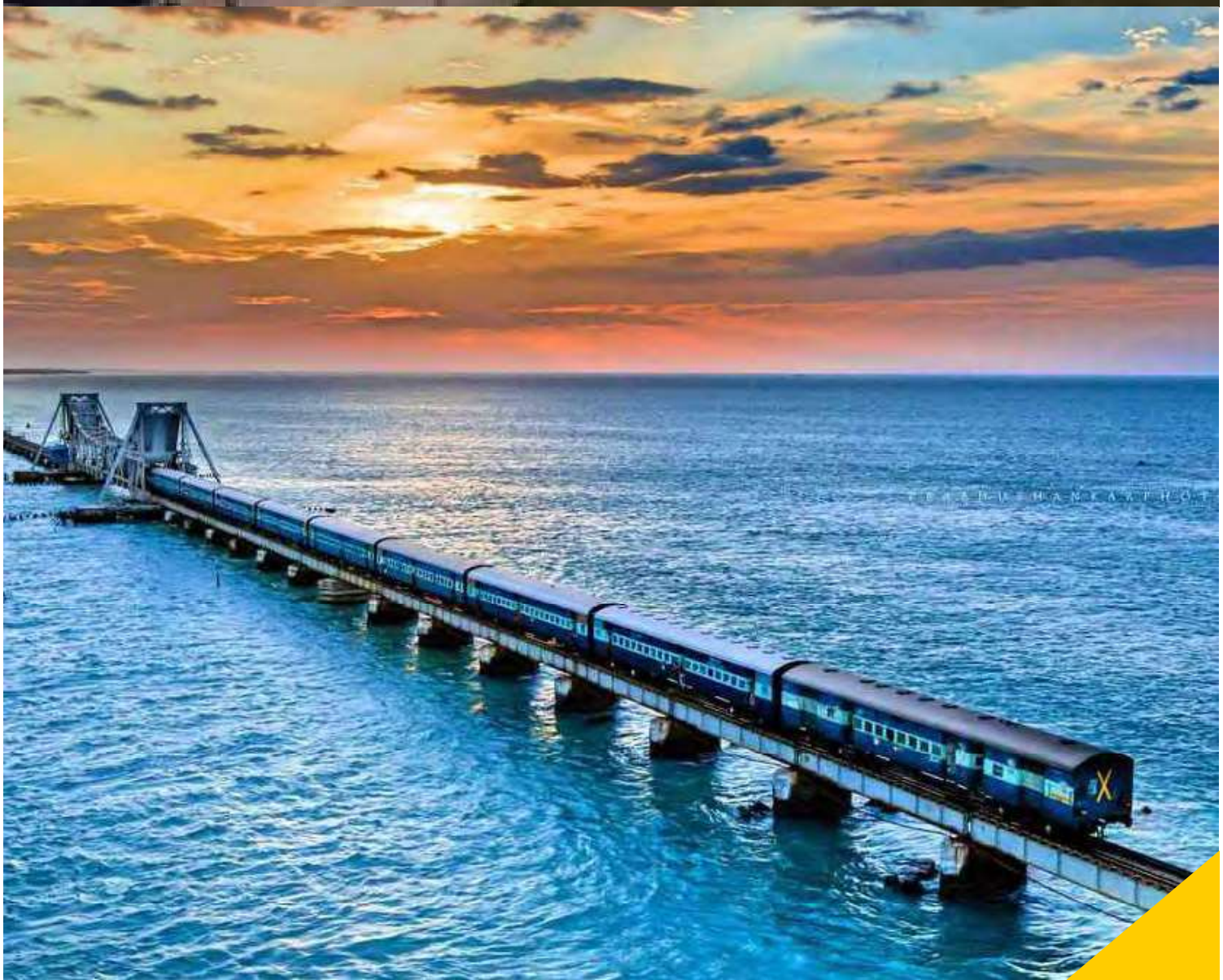
भारतीय रेलवे को व्यावहारिक द्रुत परिवहन समाधान के क्षेत्र में ग्लोबल लीडर बनाते समय हरित पर्यावरण तथा स्वच्छ ऊर्जा को बढ़ावा देना।

मिशन

- ऊर्जा संरक्षण उपायों को बढ़ावा देना।
- स्वच्छ ऊर्जा के वैकल्पिक स्वरुपों का अधिकतम उपयोग करना, जिसके परिणाम स्वरुप रेलवे में कार्बन फुटप्रिंट को न्यूनतम करना।
- ग्राहकों को स्वच्छ एवं स्वास्थ्यपरक पर्यावरण उपलब्ध कराना।
- जल और अन्य प्राकृतिक संसाधनों के संरक्षण को बढ़ावा देना।
- प्रमुख रेलवे इकाइयों से कचरे का उत्सर्जन न होने देने का प्रयास।
- हरित निर्माणतथा छायादार वृक्ष–क्षेत्र को बढ़ावा देना।
- प्रमुख रेलवे स्टेशनों और माल साइडिंग के लिए पर्यावरण संरक्षण अधिनियम के तहत संबंधित प्रदूषण नियंत्रण बोर्ड से संचालन के लिए सहमति प्राप्त करना
- प्रभावी पर्यावरण प्रबंधन प्रणाली स्थापित करने के लिए संगठन के भीतर क्षमता विकसित करना।
- रेलवे परिचालन में ध्वनि प्रदूषण को कम करना।



INDIAN RAILWAYS



CONTENTS

S.No.	SUBJECT	Page No.
1	Indian Railways –Working Towards Carbon Neutrality	1
2	Reducing Global Carbon Footprints	2
3	Conference of the Parties to UNFCCC	4
4	Energy Effciency in Mass Transportation System	6
5	Energy Conservation Initiatives	13
6	Harnessing Renewable Energy	16
7	Alternate Fuel and Clean Energy Initiatives	18
8	Water Conservation	22
9	Afforestation	25
10	Green Industrial Units	26
11	Other Green Built-up Spaces	29
12	Bio Toilets	33
13	Solid Waste Management	36
14	Other Green Initiatives	39
15	Policy Initiatives of IR towards Environmental Sustainability	43
16	Some important Waste Management Rules	52



INDIAN RAILWAYS



1.0 Indian Railways –Working Towards Carbon Neutrality

Indian Railways (IR) is one of the world's largest rail networks, spread over 68000 route Km. IR is the lifeline of the country carrying nearly 23 million passengers every day making it the largest passenger carrying system in the world. It is also the 4th largest freight transporter in the world moving 1418.103 MT of freight in 2021-22 (an increase of 1.15% over 2020-21), as it traverses the length and breadth of the country. Hence it is rightly called as lifeline of country.

Rail-based transport is the most environment friendly mass transport system due to the inherent gains it provides in terms of energy efficiency and resource optimisation. Railways are about 12 times more efficient in freight traffic and 3 times more efficient in passenger traffic as compared to road transport. As the Indian economy transitions, with economic growth and sustainable development as twin goals, mobility will play a key role.

Indian Railways, in January 2015, set up the Environment Directorate in the Railway Board, to coordinate all environment management initiatives across the Indian Railways. Since then, the Railways has taken steps to streamline its initiatives with regards to environmental management, with some notable initiatives including Energy Efficiency Management, paced electrification of railway tracks, Renewable and Alternate sources of Energy, Water Conservation, Afforestation, Waste Management and Green Certifications of railway establishments, Consent to Operate from concerned State Pollution Control Board for major railway stations and sidings, etc.

Indian Railways (IR) has planned to reduce its carbon footprint primarily through sourcing of its energy requirements through renewable energy sources. Other strategies include taking a multipronged approach of shifting from diesel to electric traction, promotion of energy efficiency, 100% electrification of railway tracks. Some of the key initiatives undertaken in this direction are use of Renewable Energy Sources, Mission 100% Railway Electrification, use of 3 phase technology for regenerative braking (locomotives/EMUs/MEMUs), Head on Generation technology (HOG) (eliminating the need for separate diesel fueled power cars), provisioning of LED lights at all Railway installations and creation of additional carbon Sink by afforestation.

2.0 Reducing Global Carbon Footprints

India has a population of over 1.38 billion people spread over a vast geography. Mobility will play key role with urbanisation and the growth of cities. The transport sector is and will continue to remain a critical enabler of development and would also have to grow in a sustained manner for the country to meet its developmental objectives.

Transport accounts for more than half of India's total petroleum consumption and more than 25% of the overall energy needs. It accounts for about 10% of the total GHG emissions. Given the relative advantage of the efficiency of rail-based transport, increasing the share of rail for both passenger movement (regional, sub-urban and urban) and freight movement is vital for increasing the energy efficiency of the transport sector thereby, reducing the GHG emissions of the country.

2.1 Nationally Determined Contributions (NDCs)

The Government of India, as part of its Nationally Determined Contributions (NDCs), has set a target of 33% emissions intensity reduction, with the transport sector being one of the key sectors with substantial mitigation potential.

The India's Nationally Determined Contributions (INDC) document submitted by India in October 2015, was widely discussed at the 21st Conference of Parties (COP21) organized by the UNFCCC in Paris, in November 2015. The Energy & Research Institute (TERI) also supported the Ministry of Railways, the nodal ministry for India's transport sector dialogue, to set up the Government of India's official transport sector event at COP21.

Conference of Parties to the UNFCCC in its sixteenth session (COP-16) had also decided that developing countries should submit Biennial Update Report (BUR) as an update to the most recently submitted national communication. India furnished its first Biennial Update Report (BUR-1) in January 2016, second Biennial Update Report (BUR-2) in December 2018, and the third BUR-3 was submitted on 20th February, 2021.

2.2 Indian Railways' role in India's NDC towards combating Climate Change

- To enhance the share of the Railways in the overall land based freight transport.
- Setting up Dedicated Freight Corridors (DFCs) across the country. The first phase of the project alone is estimated to reduce emissions by about 457 million ton CO2 over a 30 year period.
- Increase the share of renewable energy in its energy mix.
- Railways to further improve its energy efficiency for both diesel and electric traction thereby facilitating the reduction of GHG emissions for the country.
- Perform Achieve and Trade (PAT) Scheme to be implemented in railway sector.
- Use of 5% blending of biofuels in traction diesel fuel.
- Improve water use efficiency by 20% upto 2030.
- Tree Plantation to increase Carbon Sink.
- Waste Management and Pollution Control
- Adopting the good practices on Green Buildings, Industrial Units and other establishments for the management of resources and infrastructure to achieve Environmental Sustainability in growth of Indian Railways.
- Contribution in 'Swachh Bharat Mission'
- Indian Railways (IR) has set a target of becoming a "Net Zero" entity by 2030 by completing electrification of all railway tracks.



3.0 Conference of the Parties to the UN Convention on Climate Change (UNFCCC)

Climate change has widespread impact on human and natural systems. Accordingly, Climate Change Conferences are held annually in the framework of the United Nations Framework Convention on Climate Change (UNFCCC). India, through Ministry of Environment, Forests and Climate Change (MoEFCC) has been participating in these conferences.

A decisive step to address the issue was taken with the adoption of the Paris Agreement in Conference of Parties (COP-21) in December 2015. Participating countries submitted near-term targets to address GHG emissions, called 'Nationally Determined Contributions' or NDCs to be reviewed and extending the targets every five years. Ministry of Railways was designated as Nodal Ministry by MoEFCC for holding event on 'Transport Sector GHG Emissions' at 'Indian Pavilion' as part of COP-21 at Paris, France in the year 2015.

Ministry of Railways have also participated in COP-22 held at Marrakecha Morocco in November 2016, COP-23 at Bonn, Germany in November 2017 and COP-24 at Katowice, Poland in December 2018. Sessions on sustainable transport network were organised at India Pavilion. 25th UNFCCC conference of parties was held at Madrid, Spain from 10th to 13th December, 2019.

Government of India has articulated and put across the concerns of developing countries at the 26th session of the Conference of the Parties (COP26) to the United Nations Framework Convention on Climate Change (UNFCCC) held in Glasgow from 31 Oct to 12 Nov. 2021, United Kingdom. Further, India presented the following five nectar elements (Panchamrit) of India's climate action:

i. Reach 500GWNon-fossil energy capacity by 2030.

ii. 50 per cent of its energy requirements from renewable energy by 2030.

iii. Reduction of total projected carbon emissions by one billion tonnes from now to 2030.

iv. Reduction of the carbon intensity of the economy by 45 per cent by 2030, over 2005 levels.

v. Achieving the target of net zero emissions by 2070.

The mantra of LIFE- Lifestyle for Environment to combat climate change was also shared in COP 26. It was stated that Lifestyle for Environment has to be taken forward as a campaign to make it a mass movement of Environment Conscious Lifestyles. The message conveyed by India was that the world needs mindful and deliberate utilization, instead of mindless and destructive consumption.

Hon'ble Prime Minister during his speech at COP 26 stated that passengers numbering more than the entire population of the world, travel by Indian Railways every year and railways have set itself a target of making itself 'Net Zero' by 2030. This initiative alone will lead to a reduction of 60 million tonnes of emissions annually.

Indian Railways being a mass transporter have an important role to play in fulfilling aforesaid targets. Ministry of Railways also participated in the session hosted by CII at India Pavilion on "Practices in Indian Railway Transport and Automobile Sector towards climate mitigation". A short video film on development and benefits of dedicated freight Corridors for increasing the modal share of Railways in freight transportation was also played.



4.0 Energy Efficiency in Mass Transportation System

4.1 Advances in Energy Efficiency in Electric Traction

Indian Railways' Production Units have completely switched over to production of energy efficient three-phase electric locos. These locomotives are equipped with regenerative braking feature capable to regenerate electricity during braking action which is fed back to grid.

4.1.1 12000 HP Electric Freight Locomotive :

First, made in India 12000 HP WAG12 electric locomotive has been manufactured by Madhepura Electric Locomotive Pvt. Ltd. (MELPL). This is a state of the art IGBT based, 3 phase drive and 12000 horse power electric locomotive equipped with regenerative braking system which provides substantial energy savings during operations. These high horse power locomotives will help to decongest the saturated tracks by improving average speed and loading capacity of freight trains. Upto 2021-22, around 200 such locomotives have been inducted in commercial service on Indian Railways. These locomotives have already clocked over 15.2 million kilometres hauling a wide range of commodities across 20 states.

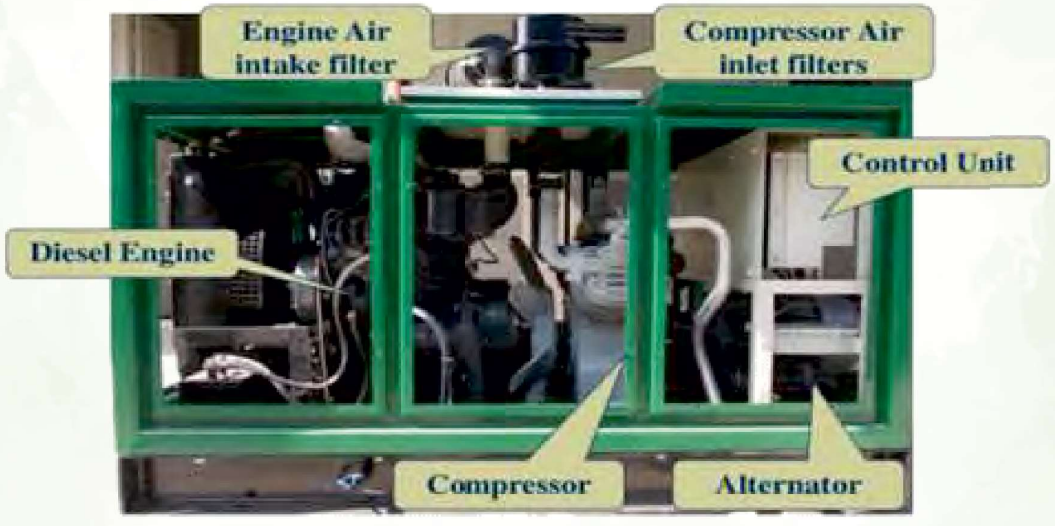


4.1.2 Additional achievements

- All electric locomotives are provided with Energy cum Speed Monitoring (ESMON) systems for monitoring the performance of Loco Pilots with respect to energy conservation.
- Loco Pilots are being encouraged for maximum use of regenerative brakes on three phase electric locomotives for reducing traction energy bill.
- Energy consumption and energy regeneration in each trip by individual crew is being monitored through Crew Management System.

4.2 Advance in Fuel efficiency in Diesel Traction

a. **Auxiliary Power Unit (APU)** has been provided in 974 Diesel Locomotives to save fuel during idling. In APU system, the Main Engine shuts down and a small 25 HP Engine starts for charging batteries and air brakes pipes, when loco idles for more than 10 min. APU consumes only 5 litres of diesel per hour in comparison to 18 litres by the main engine. Besides fuel saving, there would be a reduction in lubricating oil consumption and wear and tear of the main engine. It also results in lower CO2 emission and other pollutants like HC, NOx, CO etc.



Auxiliary Power Unit

b. **Computerize Fuel Management System (FMS)** has been developed and RCDs have started daily entry of all High Speed Diesel (HSD) issuance and receipt data in the FMS system. The system is being strengthened for real time data entry. This strengthens the data analysis to help in regulating diesel consumption for traction purpose.

c. **Diesel Consumption reduction :- IR** has witnessed a 10.44 % reduction in diesel consumption in 2019-20 as compared to 2018-19, and 50.29% in 2020-21 as compared to 2019-20 for lesser operation due to COVID situation, and approximately decrease of 17.55% in 2021-22 as compared to 2019-20.

d. **Reduced Carbon Emission:- IR** has taken up the task of further reducing the emission from diesel locomotives and to standardize them in line with the international emission practices. Diesel Locomotives for Indian Railways are now being manufactured only at Diesel Locomotive Factory/Marhowra and these locomotives comply with UIC-624-I Emission Standards.

e. **Development of fuel cell locomotives :- IR** has initiated development of fuel cell locomotives. The fuel-cell-hybrid locomotive combines the environmental advantages of an electric locomotive with the lower infrastructure costs of a diesel-electric locomotive. Its energy source is hydrogen, which can be produced from various renewable energy and thus does not depend on imported oil. Depending on the primary energy source, it can be totally zero emissions locomotive.

f. **Development of Battery operated locomotives :- IR** is presently having large scale applications of batteries in rolling stock and other stationary applications. 100% of electrification of railway network will also obviate the need of diesel eventually from the system for rolling stock applications. However, there would still remain certain rolling stock which will require use of diesel or alternative fuel viz. Locomotive for shunting purposes and emergency requirement, inferior services, banking services emergency vehicles like ART/ARME etc. Indian Railways have, therefore, initiated development of battery operated hybrid electric locomotives.

g. Energy consumption are regularly monitored through Microprocessor based Energy Meters provided in all the electric locomotives and benchmarking is done based on average energy consumption.

4.3 Improving Energy efficiency with trailing Rolling Stock Containerisation:

Innovative design of portable frame has been provided to allow 6-feet containers on one BLC type wagon. This will facilitate movement of 2 & 3 – Wheelers at about 20% lower cost of transportation.

12 feet high domestic containers for low weight and voluminous cargo like FMCG, paper, furniture has been approved to enable shift of this premium traffic from road to rail.

25 feet containers have been approved on BLL-Wagons to optimally utilize capacity with 20-feet & one 25-feet container for this wagon design.



Two - wheelers loading from side door

- BFNV wagon developed for carrying steel coils. Oscillation trials successfully conducted for operation at 100/75 kmph over Indian Railways & 100/100 kmps over DFC at 22.9t axle load.
- BOBSNS Wagon: Prototype has been manufactured and oscillation trails planned to provide 11% increase in rake throughput over existing wagons.

- BCFCM: Oscillation trials in progress. 8% increase in throughput over BCCW for carrying fly-ash/cement.
- BCPVN Wagon: Prototype manufactured. Oscillation trials successfully completed for 100/100 kmph. The wagon uses bogie and has 30% more volumetric capacity than existing ICF Parcel Vans.

4.4 Coaches

Improved design Stainless Steel Coaches provide higher carrying capacity. With increasing share of such coaches, PKM to GTKM ratio will improve resulting in reduced GHG emissions for carrying the same passenger traffic.The Production units of Indian Railways are producing only LHB coaches from April 2018 onwards. A total number of 6291 LHB coaches were manufactured by the 3 Production units of Indian Railways – ICF Chennai, MCF Raebareli and RCF Kapurthala in 2021-22 as against total 4323 in 2020-21.

4.5 Train Sets

India's first semi high speed train set manufactured under 'Make in India' programme by ICF during 2018-19, Train-18 is an energy efficient train. It has been provided with 3-phase IGBT based under slung propulsion equipments, has advanced regenerative braking system and need for power car is eliminated. Such features help in saving energy up to the tune of 30%. Further the aerodynamic profile of the train also helps to reduce air drag and thus reduce energy consumption. 02 Vande Bharat trains, Delhi-Varanasi and New Delhi-Shri Mata Vaishno Devi Katra commissioned by year 2021-22.



Train set:
Train -18 Make in India

4.6 Vistadome coaches

Vistadome coaches provide panoramic view, through wider body side windows as well as through transparent sections in the roof, thus enabling the passengers to enjoy the scenic beauty of the places through which they travel. By year 2021-22, 36 Vistadome coaches are available over Indian Railways. ICF manufactured LHB type BG Vistadome 07 coaches in 2020-21 and 15 coaches in 2021-22.

Indian Railways have introduced AC-III tier Economy Class to cater to the needs of general masses with more berths than conventional AC-III tier coaches. 271 such coaches were turned out in year 2021-22.

4.7 EMU/MEMU

- Induction of energy efficient 3 phase IGBT based propulsion system with regenerative braking feature have been introduced way back and same has been continued as detailed below:
- 3-Phase MEMU: During 2021-22, 31 MEMU rakes of 8 cars with energy efficient 3 phase propulsion system with regenerative braking feature have been introduced in service.
- Energy efficient LED based Twin Beam head lights are being used in EMU/MEMU



3-Phase MEMU

4.8 Head on Generation system

The LHB trains running in End on Generation (EoG) configuration require power cars equipped with Diesel Alternator (DA) sets for feeding air conditioning, train lighting and other electrical loads in the coaches. Each such train has two power cars, each power car having 2 DA sets. This system has inherent disadvantage of air and noise pollution.

In HOG system power is drawn through converters provided in locomotives. The electrical power drawn by the pantograph of the locomotive is suitably converted and supplied for air conditioning, train lighting and other electrical loads in the train. All LHB coaches have been made compliant during 2020-21. Upto year 2021-22, 1644 trains have been made compliant to HOG, resulting in reduction in diesel consumption as well as reduction in air and noise pollution.

4.9 Capacity Augmentation & Network Expansion:

NHSRCL
National High Speed Rail Corporation Ltd.



Indian Railways have developed a National Rail Plan (NRP) 2030 with the aim of making Indian Railways future ready by 2030 to create capacities for handling projected traffic requirements upto 2050. NRP targets reducing transit time of freight substantially to divert road traffic (major polluter) towards Railways. A total route length of 1357 KM of Dedicated Freight Corridor (618 Km of EDFC and 739 Km of WDFC) have been completed by 31st March 2022.

Government of India has sanctioned 508 Km long Mumbai-Ahmedabad High Speed Rail (MAHSR) Project in December, 2015 to be executed with technical and financial assistance from Government of Japan. National High Speed Rail Corporation Limited (NHRCL) was incorporated in February, 2016 for execution of the project. With maximum design speed of 350 Kmph and operating speed of 320 Kmph this energy efficient and environment friendly rail transport system as per global standards will result in reduced Co2 emission.

5.0 Energy Conservation Initiatives

Given the massive scale of its operation, it is not surprising that the Indian Railways has a growing appetite for the consumption of electricity. Indian Railways consumes over 20 billion kWh of electricity annually, comprising around 2% of the country's total power consumption. With rail traffic projected to register an increasing growth in the coming years, it is estimated that the demand for electricity by the Indian Railways will go up over the next decade.

5.1 IR has taken a series of measures to cut down its energy consumption and rationalise its energy procurement process by implementing several energy conservation measures, procurement of power under Open Access and harnessing Renewable Energy. Railways also carry out regular energy audits at consumption points. Use of 5 Star rated electrical equipment is emphasised.

5.2 100% LED lighting

- All railway stations, service buildings & residential quarters have been provided with 100% LED lights.
- 100% LED across Railway installations will reduce about 10% of total energy being utilized on its Non-traction thus leading to savings of about 240 million units of electricity i.e. savings of Rs 180 Cr. per annum.
- Indian Railways have been consistently trying to improve the illumination levels at various stations. A total of 978 Railway stations have now been provided with improved illumination till 31.3.2021. These were further increased to 1327 by 31.03.2022.
- Indian Railways have exceeded the targets set under Perform Achieve and Trade-II (PAT-II) and have achieved additional energy savings of 0.11 Million Tonne of Oil Equivalent (mTOE), totalling to 0.196 mTOE. The emission reduction through the implementation of PAT Cycle-II is about 1.0 million tonnes of CO2. Total Energy Saving Certificates earned by Indian Railways are 1,18,790 ESCerts.

5.3 Star rated buildings Certified by Bureau of Energy Efficiency (BEE): Around 50 buildings (including 4 Divisional Hospitals) have been given Star rating by BEE.

5.4 LED lights in coaches

Zonal Railways have been replacing CFL/FL lights in TL/AC and self-propelled (EMU/MEMU) coaches with energy efficient LED lights. All newly manufactured coaches from production units are being turned out with LED light fittings. On an average there is a saving of around Rs. 6000/- per coach per annum.

5.5 Energy Efficiency Study Initiatives of Indian Railways

■ To facilitate Indian Railways and Confederation of Indian Industry (CII) to work together on Green Rating and Energy Efficiency studies of Indian Railway's Production Units and major Workshops, Memorandum of Understanding (MOU) was signed between Indian Railways and CII on 26th July 2016 for a period of 3 years. Upon expiry, another MoU was signed with CII on 13th Sept 2019 for Facilitation of Green initiatives on Indian Railways for another 3 years.

IR units covered in the study:-

Phase-I	Phase -II
DLW, Varanasi	MCF, Raibareli
CLW, Chittaranjan	Rail Wheel Plant, Bela
ICF, Chennai	Carriage Repair Workshop, Matunga
RCF, Kapurthala	Coach Rehabilitation workshop, Bhopal
DLMW, Patiala	Coach & Wagon workshop, Liluah
RWF, Bengaluru	Coach Repair workshop, Hubali
Locomotive Workshop, Jamalpur	Carriage Repair Workshop, Alambagh
Wagon Repair Workshop, Jhansi	Carriage and Diesel Loco Repair Workshop, Ajmer
Golden Rock Railway Workshop, Trichy	Rail Spring Kharkhana, Sitholi
Carriage & Wagon Workshop, Jagadhari	Carriage, Wagon and Diesel Loco workshop, Kharagpur

These activities included:-

- Identification of significant energy saving opportunities in the facilities.
- Awareness workshops and training programs on the technological aspects of energy efficiency, and the best practices adopted by related Indian industries.
- Organising visits of railways officials to some of the best performing units in similar sectors, such as automobile and engineering.
- Identification of potential technology suppliers who can offer energy saving technologies to the units.
- Formulation of 'Best Practices Manual' for energy efficiency.
- Organization Energy Efficiency Award for the Indian Railways on the sidelines of the Annual CII Energy Efficiency Award, to felicitate the best performing units.





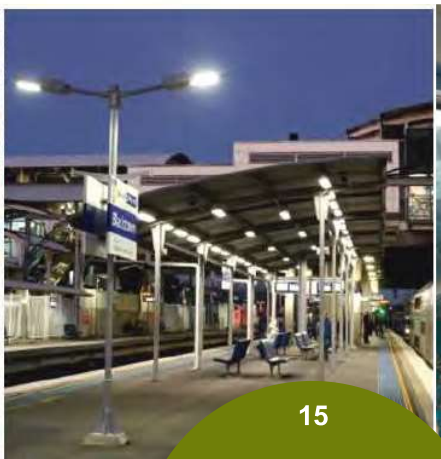
- Continuous hand holding of the Indian Railways units to guide them in the implementation of energy efficiency measures.

The activities led to implementation of more than 250 energy efficiency and renewable energy measures / projects, resulting in an estimated energy saving of 21 million units annually, translating into monetary savings of Rs16 crore and a reduction of 17,400 tCO2 emissions per annum. Some of the energy efficiency measures implemented are:

- Optimising pressure settings and distribution / circulation of compressed air as per requirement.
- New energy efficient Screw Compressor to optimize the compressed air power consumption.
- Small blower/LP compressors for aeration in de-greasing tanks etc.
- AC energy saver which provides dual sensors to measure both room and coil temperatures as feedback, and its multiple algorithm in the closed-loop circuit adapts the AC to ambient temperatures and climatic changes to ensure energy saving.
- Regenerative drive system for EOT cranes.
- Power factor improvement by installing additional automatic power factor correction systems where power factor was 0.90 - 0.95.
- Daylight Pipes.









6.0 Harnessing Renewable Energy

- Indian Railways being a significant consumer of energy, identifying cost-effective options to achieve and realizing an energy system with least environmental impacts is essential. IR has been taking several steps to install clean and efficient energy.
- Indian Railways has planned to set up
  - 1000 MW solar power plants, and
  - About 200 MW of wind power plants across Zonal Railways and Production Units.

6.1 Harnessing Solar Energy on Indian Railways:

- Indian Railways have planned to set up 500 Mega Watt (MW) solar plants on roof top of Railway buildings through developers with 25 years power purchase agreement by Railways, which will be used for meeting non-traction power supply loads at Railway Stations etc.
- About 20.85 MW of Solar plants (rooftop) were commissioned in 2021-22. 140.85 Mega watt (MW) (134.15 MW on roof tops + 6.7 MW on land) capacity has been commissioned till 31.03.2022.
- Total 1743 railway stations and service buildings have been provided with solar rooftop plants up to March'2022.
- 3 MW land based solar plant was commissioned in MCF Raebareli.
- RUMS (400 MV) (under Optimum Scheduling Mode)-400 MW land based solar power plant tied up with Rewa Ultra Mega Solar, a joint Venture of M.P. & SECI.
- IR is also taking up following pilot projects for feeding solar power directly to 25 kV AC traction system.



- Diwana Solar Plant Project (2 MWp) through REMCL: Plant commissioned in Sept.'2020.
- Bina Solar Project (1.7 MWp) through BHEL: Plant commissioned in July'2020.
- Bhilai (50 MWp) – Work awarded and under progress.

6.2 Solar Plants along the Railway Track for Traction purpose

IR has planned to utilize its unused vacant Land parcels for setting up of Land Based Solar Plants for its traction power requirement as 'Green mode of transportation' and become a 'Net Zero Carbon Emission Railway' by 2030. The plants will be set up on unused vacant land. There is about 51,000 hectare of Railway land which has a potential of installing 20 GW land based solar plants. The Solar power so generated will be fed to CTU/STU Grid or directly to 25 kV AC traction system.

6.3 Innovative Energy Conservation:



Solar Tree: The first of its kind in Indian Railway an innovative concept of energy conservation. To ensure optimal usage of renewable energy, a 5KWP solar tree has been set at Guntkal Railway station on 5 June 2021.

6.4 Harnessing Wind Energy over Indian Railways:

- Out of 200 MW target of IR, 103.4 MW wind-based power plants have already been installed.
- Wind based power plants of 10.5 MW (for non-Traction) and 10.5 MW (for Traction) capacity in Tamil Nadu, 26 MW (for traction) capacity in Rajasthan, 6 MW (for non-traction) and 50.4 MW (for traction) capacity in Maharashtra have been installed.

6.5 100% Green Powered Station

25 Railway stations have been made "Green Stations", which are meeting their energy needs completely either through Solar or by Wind. Railways are making extensive efforts in this direction to make more and more stations 100% green powered stations.

6.6 Accolades earned by Indian Railways

National Energy Conservation Awards (NECA): The continuous efforts of Ministry of Railways and Zonal Railways to embrace various energy efficient technologies and energy conservation measures had resulted in bagging 14 National Energy Conservation Awards (NECA) in 2020 in 03 categories and 11 in 2021 in 02 categories, 03 awards from Telangana State Energy Conservation Awards 2021 and 02 from Andhra Pradesh State Energy Conservation Awards 2021.

7.0 Alternate Fuel and Clean Energy Initiatives

7.1 Blending of Bio- diesel with HSD

The Bio-based fuels produced from renewable biomass and other natural products present complete carbon neutrality as CO2 generated by burning these fuels is captured again by trees and plants thus eliminating the adverse environmental impact. The pollutants created by burning of the conventional fossil fuels arising from Sulphur and other harmful elements contained in fossils fuels are absent in Bio-fuel which results in much lower emission. The substitution of H.S.D with bio-diesel results in reduction of 44 % hydrocarbon (HCs), 89.3 % reduction of carbon mono oxide (CO) and no sulphur content in exhaust. Indian Railways started 5% Bio-Diesel blending with HSD on 5th June 2015. Blending of Bio-Diesel to the extent of 5% has commenced at 76 Railway Consumers Depots of Indian Railways in different Zones.

To arrange Bio-Diesel in-house IR is setting up Two 30 Ton per day (TPD) capacity plants at Tondiarpet /Chennai and Raipur /Chhattisgarh. These two plants will meet 15-20% of total requirement of blending of HSD on IR. Palm oil, jatropha oil, cotton seeds oil, used cooking oil, animal fat etc. can be used as raw material to produce Bio-Diesel in these plants. The construction of plant at Tondiarpet is at advance stage.





7.2 CNG/LNG based Dual Fuel Diesel Engines for DEMU Trains

Natural Gas usage emits less GHG than liquid fuels due to fewer Carbon atoms in its molecular structure.





Indian Railways have the distinction of being the only Railway in the world to be using CNG run locomotives for passenger transportation with implementation of CNG based dual fuel fumigation technology on CNG DEMUs DPCs of 1400 hp to achieve up to 20% substitution of Diesel. 26 Diesel Power Cars of DEMUs have been converted into CNG based dual fuel engine at Shakurbasti and Vijayawada Diesel Sheds.



BGL Installation for CNG filling in Dual Fuel DPCs at DEMU Shed, Vijaywada

7.3 Solar Energy based solutions for Rolling Stock of Indian Railways

7.3.1 Solar Energy based solutions for Passenger Services

The trailer coaches of one rake of 1600 HP DEMU were initially provided with Solar PV system at its roof which takes care of electric supply for the fan and lighting load inside the coach. This result in

- Saving of 5.25 Lakh Litres of Diesel
- Cost saving of Rs. 3 Cr
- Reduction of 1350 Tons of CO2 per train over life time of 25 years.

7.3.2 Solar Energy based solution for guards of freight trains

IR has done successful trial of electricity generation from Solar PV modules for Guard comfort system on 50 BVZI wagons used on freight trains. A 400 Wp Solar PV system with batteries has been provided on each guard van to supply round the clock electricity for fan, light and a charging point to the guards who have until now worked without these facilities. E-tender for provision of Guard Comfort Kits for 700 BVZI/BVCM wagons is being processed for further proliferation.


Renewable Solar Energy based Guard Comfort Kit in BVZI wagons



Hybrid system with PV Solar panels and fuel cell, is being planned for 300 nos. brake vans to provide un-interrupted electric supply.

7.4 Solar Panels on Workshops and Stations:

During the year 2021-22, total 11.604 MW capacity of Rooftop Solar plant have been installed. Zone-wise details are as under:-





Railway-wise Solar power installed 2021-22		
SN	Railway	Rooftop Solar (MW)
1	CR	1.744
2	ER	0.438
3	ECR	0.336
4	ECoR	0.407
5	**NR**	**3.092**
6	NCR	0.000
7	NER	0.000
8	NFR	0.585
9	NWR	0.000
10	SR	0.192
11	SCR	0.445
12	SER	0.002
13	SECR	0.500
14	SWR	0.019
15	WR	1.175
16	WCR	0.542
17	Metro	1.240
18	RCF	0.887
	Total	**11.604**

7.5 Use of Natural Gas in Workshops/ Production Units/ Railway premises

CNG is an environment friendly alternate fuel for metal cutting as compared to Dissolved Acetylene (DA) or BMCG. It also has higher thermal efficiency. Matunga Workshop of CR and Kota Workshop of WCR coordinated to switch over to the use of CNG for metal cutting, thereby not only improving sustainability but also saving about Rs 1 crore per annum. RWF/Yelahanka also commenced the use of Natural Gas for

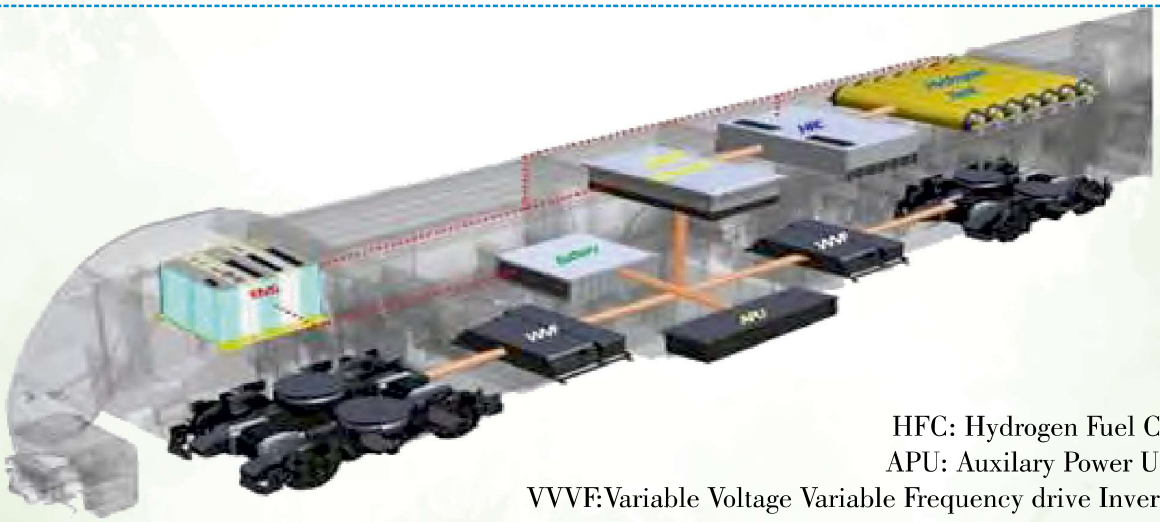
operation of its furnaces. RWF has reported a saving of 420 KL of HSD as furnace oil per month.

An MoU has been signed between IR and GAIL on 30.08.2018 to streamline the system and develop infrastructure for use of Natural Gas in IR. DLW, Varanasi and RYPS and LGD workshops in SCR are in the process of this change.

To extend the use of Natural gas through Pipes and save the LPG for Ujjwala Scheme, the facilities have been developed by GAIL and its subsidiaries in Bhubaneswar, Badhwar Park and DLW Railway colonies and NAIR. Surveys have been conducted by GAIL subsidiaries at Jhansi, Parel, Lower Parel, Jamshedpur and Danapur townships.

7.6 Development of Hydrogen Fuel Cell based distributed Power Stock (DPRS) 1200KW DEMU

Hydrogen is envisaged to be the future fuel to replace fossil fuels. Using power from renewable energy, termed as green hydrogen, is one of the major requirements towards environmentally sustainable energy security of the nation. Indian Railways is pioneering development of Technical Specifications for manufacture of Hydrogen Fuel Cell Powered Rolling Stock (DPRS) with regenerative braking system. The new technology envisages zero emissions with water as net exhaust. IR will be using DEMU platform for developing this technology. Retrofitment of two DEMU rakes for conversion to hydrogen fuel power mode in Sonipat-Jind section of Northern Railway is in process.



HFC: Hydrogen Fuel Cell
APU: Auxilary Power Unit
VVVF:Variable Voltage Variable Frequency drive Inverter

8.0 Water Conservation

Shortage of water in India is becoming a very serious issue. The tube wells drilled are lowering water tables in most parts of the country. This problem gets further compounded in areas where rain fall is poor. To overcome this problem, Railways have taken initiative in Rain Water Harvesting (RWH), Water Recycling Plant (WRP), Water Audits and Water bodies.

8.1 Water Recycling Plants

Water Recycling Plants (WRP) are being provided at major consumption centre locations (stations /sheds etc) where there is heavy demand for water and provision of same is economically justified. 112 Water Recycling Plants were set up on Indian Railways up to March'2022.

8.2 Automatic Coach Washing Plants (ACWPs):

Automatic Coach Washing Plants have been installed over zonal Railways to clean exterior of coaches more effectively and efficiently. In addition to excellent cleaning the direct water consumption also gets reduced avoiding wastage and recycling the water through water recycling plant integrated with this plant. 112 locations have been identified for provision of ACWP. A total 52 ACWPs have been installed over Indian Railways till March' 2022.





8.3 Water Bodies

Ministry of Railways has decided to assess and review the Water Bodies existing in the Railway Land including the ones which are presently non-functional and take action to ensure that all the existing Water Bodies are protected and nurtured and Water Bodies which are non-functional are restored early. As on March 2022, a total of 1653 water bodies are functional on Indian Railways. The water bodies in the form of pond are also being utilised for fisheries purpose on commercial terms.



Revival of 200 year old Salarjung well at Hyderabad yielding average 2.5 lakhs litres water per day is an example worth emulating.

8.4 Water Audit

To minimize water wastage, Zonal Railways have been asked to conduct water audit at major water consumption centres through third party for quality as well as quantity and to take up Works of water recycling plants based on the report of water audit. During the year from 2015-16 to 2021-22 (i.e. up to March'2022) a total of 980 Water Audits were conducted by various zonal railways out of which 252 were completed in the year 2021-22 itself.

8.5 Rain Water Harvesting (RWH)

To promote water conservation, Indian Railways have been providing Rain Water Harvesting (RWH) at various locations as per extant policy. In 2001, Railways were asked to adopt roof top rain water harvesting to recharge ground water especially in areas experiencing seasonal shortage of water and to take necessary assistance from Regional offices of Ministry of Water Resources. In 2013, it was decided that RWH scheme shall be an essential sub-set of all the project estimates related to constructions of built assets like service buildings, hospitals, stations buildings (including remodelling etc), Railway quarters, workshops/sheds, yard modelling as also in doubling, new line and gauge conversion and sidings. Installation of Roof Top

Water Conservation

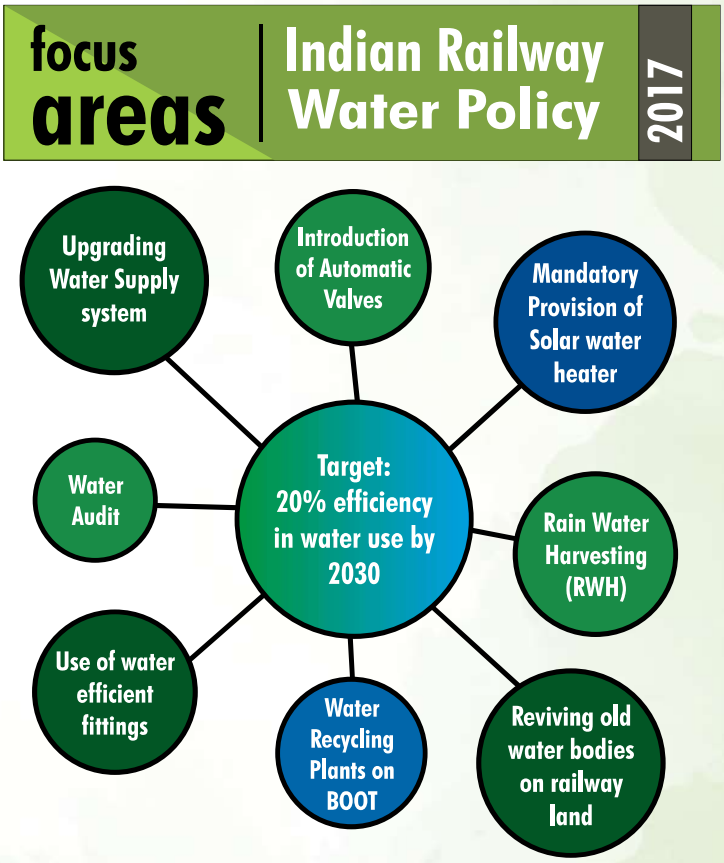
Rain Water Harvesting is being monitored across all Railway Zones. With consistent effort of Zonal Railways, 6698 nos of RWH system have been installed in Railways up to March'2022 out of which 559 nos of RWH have been installed in the year 2021-22 itself having roof top area more than 200 Sqm.

8.6 44 Quick Watering Systems have been deployed over Indian Railways for watering of coaches at stations which helps to save water as it limits wastage. 26 stations have been provided with Quick Watering facilities in 2021-22 taking the total to 95 stations till March'2022 equipped with Quick Watering facility.

8.7 Water Policy

'Water Policy' for IR was issued in March, 2017 covering all aspects of water use efficiency, water recycling, conservation, recharge of ground water and restoration of water bodies.





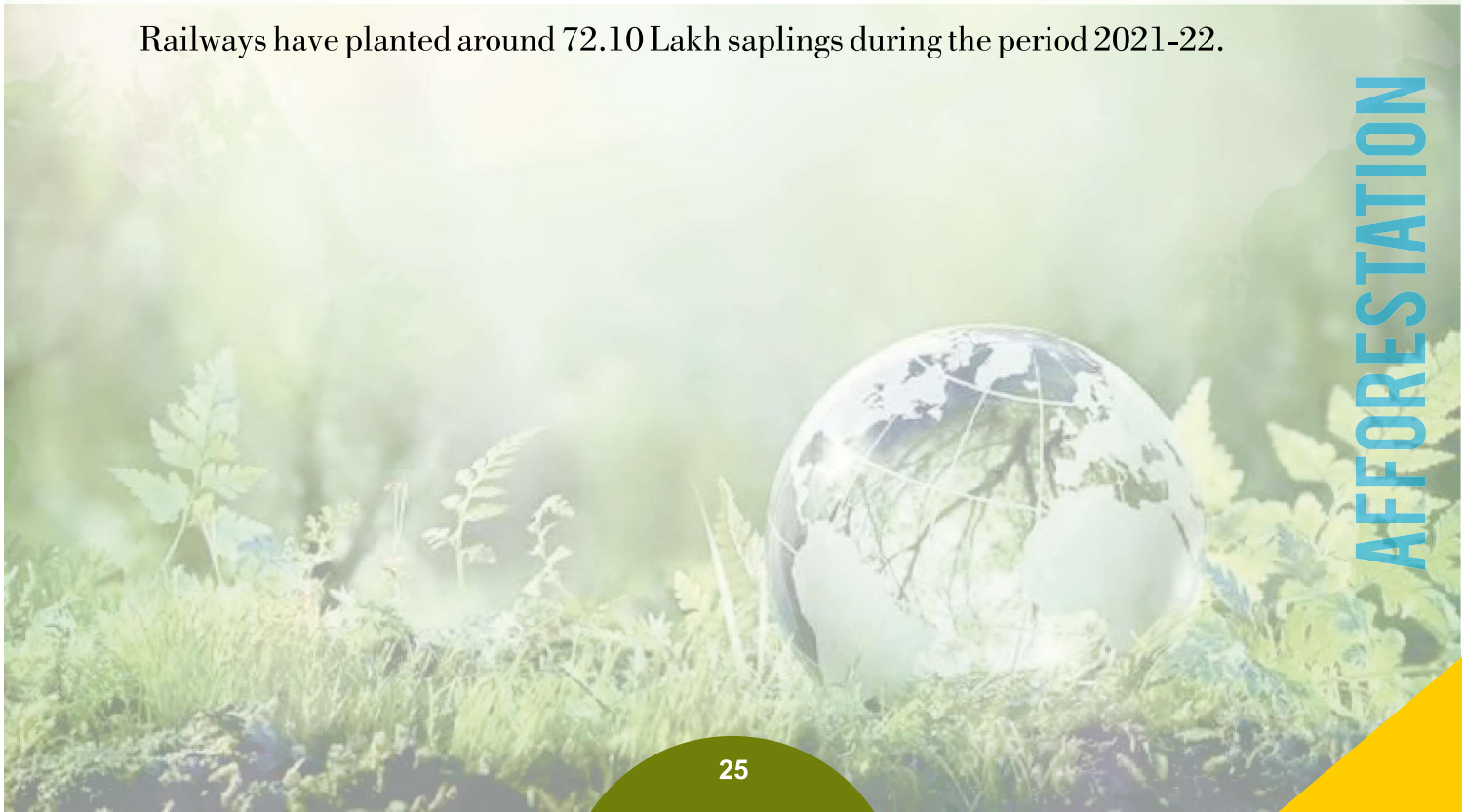
9.0 Afforestation

Afforestation on vacant Railway land in between sections is carried out by Railway departmentally and also with a view to safeguard Railway land against unauthorized occupation.

In pursuance of Railways' commitment towards environmental improvement and sustainable development, Forest Departments of the States are being involved in plantation as well as maintenance and disposal of trees, thus bringing in their expertise in afforestation. For this purpose, Ministry of Railways have finalised a model agreement in consultation with Ministry of Environment, Forest and Climate Change (MoEFCC) in January 2016 to be entered between Zonal Railways and respective State Forest Department for plantation of trees on Railway land along the Railway track and station yards without transferring the ownership of the land in favour of State Forest Department. As per this Agreement, plantation along the Railway track on railway land boundary can be done by Forest Department without declaring such land as protected forest and can be re-used by Railways at any time without any hindrance to Railway works/development projects. Cost of the plantation including its protection and maintenance can be borne by State Forest Department or Railway Administration or can be shared by both.

The agreement has already been finalised with State Forest Departments of Maharashtra, Haryana, Punjab, Assam, Andhra Pradesh, Chhattisgarh, Odisha and Karnataka.

Railways have planted around 72.10 Lakh saplings during the period 2021-22.



10.0 Green Industrial Units

10.1 GreenCo rating developed by Confederation of Indian Industry (CII) offers significant value addition and direction to organizations in terms of resource conservation, waste reduction, climate change mitigation, greener supply chain and superior environmental performance. It has been acknowledged in India's Intended Nationally Determined Contribution (INDC) document, which was submitted to UNFCCC, as a proactive voluntary action undertaken by Indian private sector aimed towards combating climate change.

10.2 In order to facilitate IR and CII to work together on Green Rating and Energy Efficiency studies of IR's Production Units and major Workshops, a Memorandum of Understanding (MOU) was signed between IR and CII on 26th July 2016 for 3 years. New MoU was signed with CII on 13thSept 2019 for Facilitation of Green initiatives on IR for another 3 years.



Assesment areas for Green Certification



10.3 Three Units, Diesel Locomotive Works (DLW) (GreenCo Silver), Lallaguda Carriage Workshop (GreenCo Silver) and Perambur Carriage Workshop (GreenCo Bronze) were certified by CII GBC as Green Units by March, 2017. 18 units were certified in 2017-18, 24 units in 2018-19, 8 units in year 2019-20 and 2 more units were certified during the year 2020-21.

Status of Green Co Rating in Railway units:-

SNO	Location Name	Place	Rating
1	Modern Coach factory	Rae Bareilly	Platinum
2	Wagon Workshop	Guntupalli	Platinum
3	Carriage Repair shop, SCR, Tirupati	Tirupati	Gold
4	Diesel Loco Modernisation Works	Patiala	Gold
5	Mysuru Workshop	Mysuru	Gold
6	Jagadhri Workshop	Jagadhri	Gold
7	Diesel Loco shed, Moula ali	Hyderabad	Gold
8	Liluah, Workshop	Liluah	Gold
9	Pratap Nagar workshop	Pratapnagar	Gold
10	Railways - ICF / Chennai	Chennai	Gold
11	Golden Rock Workshop	Trichy	Gold
12	Ratlam Diesel Shed	Ratlam	Gold
13	Diesel loco Shed Kazipet	Kazipet	Gold
14	Diesel Loco Shed	Vatva	Gold
15	Wagon Repair Shop, Kota, WCR	Kota	Gold
16	Northern Railway Alambag Workshop	Alambagh	Gold
17	Charbagh Workshop	Lucknow	Gold
18	Diesel Locomotive Works / Varanasi	Varanasi	Silver
19	Carriage Workshop, Lallaguda	Secunderabad	Silver
20	Carriage Repair Workshop, Ajmer	Ajmer	Silver
21	Wagon repair Workshop, Nagra, Jhansi	Jhansi	Silver
22	Rail Spring Karkhana	Gwalior	Silver
23	Kharagpur Workshop	Kharagpur	Silver
24	Mettuguda Stores	Hyderabad	Silver
25	Diesel Loco Shed	Vizag	Silver
26	Kalka Workshop	Kalka	Silver
27	Bhavnagar Workshop	Bhavnagar	Silver
28	Rail Wheel factory, Yelahanka	Bangalore	Silver
29	New Bongaigaon Workshop	New Bongaigaon	Silver
30	Amritsar Workshop	Amritsar	Silver
31	Diesel Loco Shed, Gooty	Gooty	Silver
32	Diesel Loco Shed	Guntakal	Silver

Green Industrial Units

33	Coach Rehabilitation Workshop	Bhopal	Silver
34	Eastern railway Workshop	Kanchrapara	Silver
35	Electric Loco Shed ,Kazipet	Kazipet	Silver
36	Railways - Carriage Workshop / Perambur	Chennai	Bronze
37	Mechanical Workshop, Izzatnagar	Barielly	Bronze
38	Carriage Repair Workshop,Hubli	Hubli	Bronze
39	Mancheswar Workshop	Bhubaneswar	Bronze
40	Wagon Repair Shop	Raipur	Bronze
41	Carriage Workshop, Matunga	Mumbai	Bronze
42	Lower Parel workshop	Mumbai	Bronze
43	Dibrugarh Workshop	Dribrugarh	Bronze
44	Carriage Repair Workshop, Harnaut	Harnaut	Bronze
45	Ajmer Loco Workshop	Ajmer	Bronze
46	Bikaner Workshop	Bikaner	Bronze
47	Jodhpur Carriage Workshop	Jodhpur	Bronze
48	Rail Coach Factory	Kapurthala	Bronze
49	Gorakhpur Workshop	Gorakhpur	Certified
50	Loco, C & W Workshop, Dahod	Dahod	Certified
51	Parel Loco Workshop	mumbai	Certified
52	EMU Mahalaxmi	Mumbai	Certified
53	Locomotive workshop,	Jamalpur	Certified
	Jamalpur		
54	Bela Wheel factory	Bela	Certified
55	Budge Budge Bogie manufacturing facility	Kolkata	Certified



11.0 Other Green Built up Spaces

IR has taken the initiative of undertaking Green Rating Certification for different types of Railway establishments, including the industrial units. Such certification mainly covers assessment of parameters having direct bearing on environment, such as, energy conservation measures, use of renewable energy, impact on GHG emission, water conservation, solid and liquid waste management, green cover etc.

11.1 Green Buildings

Green Buildings are an effort to reduce the negative impact of buildings on the environment during its construction and use. The aim of green building is to minimize demand on non renewable resources, maximize the utilization efficiency of resources, and maximize the reuse, recycling and utilization of renewable resources.

The rating systems in India like LEED, GRIHA, IGBC offer green rating for existing buildings as well as new buildings.







Rail Nirman Nilayam, the construction organization HQ at Secunderabad was the first Green rated Building on Indian Railways when it achieved GRIHA '3 Star' rating

Status of Green Buildings & other establishments:-

Status of Green Buildings & other establishments:-

SNO	Railway Buildings	Description	Rating type
1	IRICEN, Pune	New Building	Platinum
2	ICF Administration Building, Chennai	Existing Building	Platinum
3	Rail Nilayam, Hyderabad	Existing Building	Gold
4	Hyderabad Bhavan, Hyderabad	Existing Building	Gold
5	Supervisor Training Center, Hyderabad	Campus	Platinum

Other Green Built up Spaces

6	SEC railway Higher Secondary School, Bilaspur	School	Gold
7	Rail Vikas Bhavan, Guntur	Campus	Platinum
8	Divisional Railway Hospital, Ajmer	Healthcare	Silver
9	Rail Wheel Factory - Admin Building, Bengaluru	Existing Building	Platinum
10	Rail Saudha, Hubli	Existing Building	Gold
11	Supervisors Training Centre, Lucknow	Existing Building	Silver (2018), Platinum(2020) Recer
12	ICF Silver Jubilee Matriculation Higher Secondary School, Chennai	School	Platinum
13	ICF Nursery & Primary School, Chennai	School	Platinum
14	Administrative Building at DMW Railway Colony	Existing Building	Platinum
15	Office Building of DRM Guntakal	Existing Building	Platinum
16	DRM Building Danapur	Existing Building	Silver
17	National Academy of Indian Railway, Vadodara	Campus	Certified
18	Railway Officers Enclave, New Delhi	Green Residential Society	Platinum
19	NWR Headquarters, Jaipur	Existing Building	Platinum
20	Northern Railway Central Hospital, Delhi	Healthcare	Platinum
21	Railway School Kalyan, Mumbai	School	Platinum
22	Rail Bhawan, New Delhi	Existing Building	Gold
23	DRM Office Building, Ratlam	Existing Building	Gold
24	Supervisor's Training Centre, Kharagpur	Existing Building	Gold
25	Central Railway Hospital, Jaipur	Healthcare	Platinum
26	Administrative Building of Jagadhri Workshop, Haryana	Existing Building	Gold
27	Divisional Railway Hospital Agra	Healthcare	Gold
28	Divisional Railway Office, Ahmedabad	Existing Building	Gold

11.2 Green Railway Stations

IR has embarked on a mission of "Net Zero" Carbon emission by 2030 and as per estimation by CII green certification of each major Railway Station is expected to result in 500 Tonne of CO2 reduction per year. Green Certifications covers assessment of parameters having direct bearing on the environment, such as, energy conservation measures, use of renewable energy, Green House Gas emission reduction, water conservation, waste management, material conservation, recycling etc. 14 stations achieved 'Green' Certification in 2022 from CII. Further, around 200 such green stations have been planned for taken up for Green Certification in upcoming years.

Status of Green Railway Stations by March'2022:-

Sl. No.	Station	Zone	Final Rating Level
Railway Stations			
1	Secunderabad	SCR	Platinum
2	New Delhi	NR	Platinum
3	Jaipur	NWR	Platinum
4	Chennai	SR	Certified
5	Varanasi	NR	Certified
6	Katra	NR	Certified
7	Howrah Station	ER	Silver
8	Kacheguda	SCR	Gold
9	Vijayawada	SCR	Gold
10	Tirupati	SCR	Gold
11	Anand Vihar	NR	Silver
12	Hazrat Nizamuddin	NR	Certified
13	Guntakal	SCR	Gold
14	Tiruchirappalli	SR	Gold
15	Rajendra Nagar Patna	ECR	Silver
16	Visakhapatnam	ECoR	Platinum
17	Chhatrapati Shivaji Maharaj Terminus	CR	Gold
18	Ratlam Junction	WR	Silver
19	Delhi Cantonment	NR	Silver
20	Delhi Sarai Rohilla	NR	Silver
21	Yeshwanthpur	SWR	Silver
22	Asansol	ER	Platinum
23	Coimbatore	SR	Platinum
24	Jodhpur	NWR	Platinum

25	Chittaurgarh Junction	WR	Gold
26	Hyderabad Deccan	SCR	Platinum
27	Solapur	CR	Gold
28	Agra Cantt	NCR	Silver
29	Malda Town	ER	Silver
30	Sir M. Vshveshwaraya Terminal Bengalure	SWR	Gold



IGBC GREEN CERTIFIED
NEW DELHI RAILWAY STATION



IGBC GREEN CERTIFIED
SECUNDERABAD RAILWAY STATION

12.0 Environment friendly Bio – Toilets for Passenger Coaches

12.1 Indian Railways, in their commitment to provide hygienic environment to passengers and to keep station premises/tracks clean, have developed environment-friendly Bio-toilets for its passenger coaches. The technology has been **developed jointly by Indian Railways (IR) and Defence Research & Development Organization (DRDO).**


Bio-toilet tank

This environment friendly, low cost and robust technology, is the first of its kind in Railway Systems in the world. The efficacy of the bacteria used in this system has been tested by DRDO in extreme climates and conditions like those at Siachen Glacier. The anaerobic bacteria used in the bio-digester are hardy enough to survive extreme cold and heat and also survive when subjected to commonly available disinfectants. As stationary application, the technology is being used by Indian Army deputed at high altitude in Himalaya region.

12.2 In these bio-toilets, the waste retention tanks are fitted below the coach floor underneath the lavatories and the human waste, discharged/collected into them, is acted upon by a colony of anaerobic bacteria that convert human waste mainly into water and bio-gases (mainly Methane CH4& Carbon Dioxide CO2). The gases escape into the atmosphere and waste water is discharged after disinfection onto the track. **Raw human waste thus does not fall on the railway tracks and this keeps station premises/tracks clean.**

12.3 The first train, Gwalior-Varanasi Bundelkhand Express, fitted with IR-DRDO bio-toilets was introduced in service in January 2011. After receiving encouraging feedback from the users and railways' maintenance staff and based on the recommendation of Joint Working Group (JWG), the pace of fitment of these bio-toilets in IR's passenger coaches was ramped up, very steeply especially in last few years.



Year wise 2021-2022

ENVIRONMENT FRIENDLY

Environment friendly Bio – Toilets for Passenger Coaches

Indian Railway is proliferating bio-toilets on all its coaching stock to eliminate direct discharge of human waste from trains in line with 'Swachh Bharat Mission'. Indian Railways have completed fitment of bio-toilets in all its coaches running on line. 28,15,62 bio toilets have been fitted in 79,269 coaches (as on 31.03.22), of these 6159 coaches with 22,572 bio-toilets have been fitted in 2021-2022.

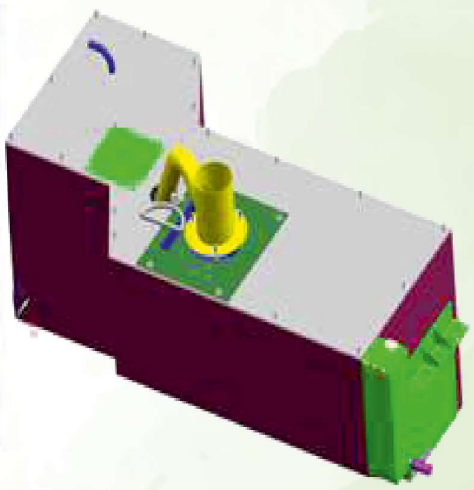
This large scale deployment of bio-toilets in coaches has resulted in a paradigm shift in the level of cleanliness on railway tracks and especially at railway stations, where the foul smell/sight associated with human waste is not to be felt or seen any more.

12.4 The technology adopted by IR to eliminate direct discharge system from passenger coaches is the best suited one as it is developed indigenously. However, it is sensitive to misuse by passengers habits of throwing of items like plastic bottles, paper cups, cloth rags, sanitary napkin, nappies, plastic/poly bags, Gutkha pouches etc. in toilets that causes choking of these toilets and makes the toilet non-functional. Here, the passengers' cooperation is of paramount importance for the success of these bio-toilets.

For this, awareness programme to educate the passengers on "How to use Bio-toilets - Dos & Donts" are regularily being conducted by Zonal Railways by means of providing stickers in coach toilets, playing audio/video clipping etc.







Bio-toilets fitted in Stainless Steel Bodied LHB Coaches

IR owned Inoculum (Bacteria) Generation Facility at Motibagh Workshop of SECR at Nagpur







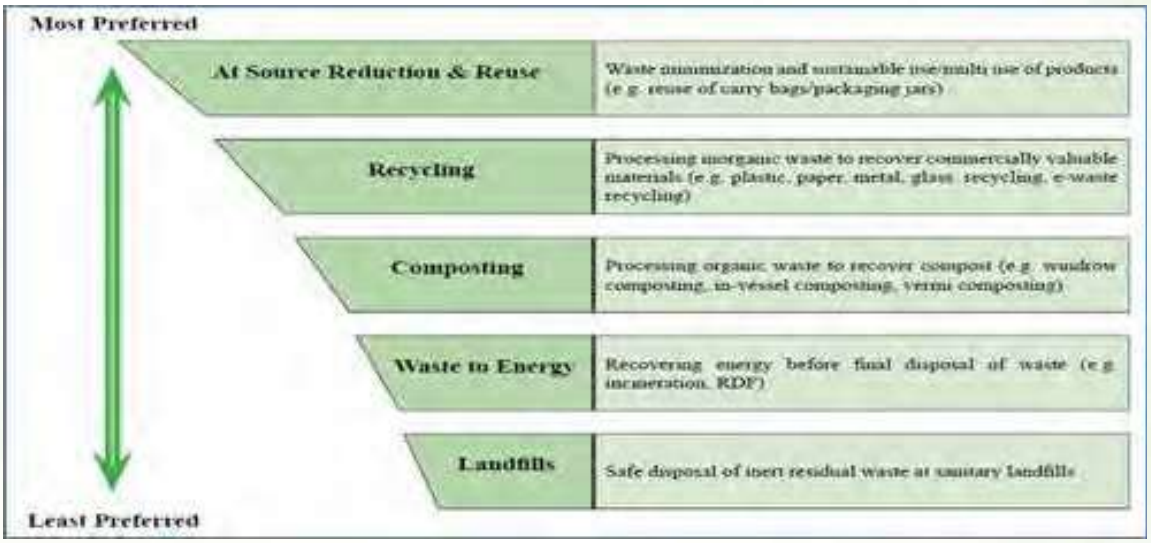
12.5 Bio-Vacuum Toilet in Indian Railways

This has aircraft type vacuum toilet on the passenger interface and bio-digester tank is fitted beneath the toilet area on the coach. The faecal matter gets digested in the bio-tanks on board.

Indian Railways have planned to supplement the existing Bio-toilet system with vacuum flushing system toilet (Bio-Vacuum Toilets), With an aim to provide clean and efficient toilets and to reduce the water consumption in toilets. In year 2018-19, ICF has provided bio-vacuum toilets in 230 AC coaches, MCF has provided in 24 coaches and RCF in 92 coaches. 547 bio vacuum toilets were installed in year 2020-21. UP to 2020-21, 547 bio vacuum toilets were installed which enhanced to 1450 by year 2021-2022.

13.0 Solid Waste Management

13.1 Solid Waste Management Rules, 2016 identify railways as a bulk waste generator. It also specifies the responsibilities of bulk waste generators. Segregation in three separate streams namely bio-degradable, non biodegradable and domestic hazardous wastes is emphasised. Waste hierarchy is the priority order in which the solid waste is to be managed by giving emphasis to prevention, reduction, reuse, recycling, recovery and disposal, with prevention being the most preferred option and the disposal at the landfill being the least.



Hierarchy of Integrated Solid Waste Management (ISWM)



Road constructed with released sleepers in ER

13.2 Railways for disposal of municipal solid waste (MSW) generated at Railway terminals in an environment friendly manner, has setup waste to energy plants at Jaipur/NWR and New Delhi Railway Station/NR, Mumbai Central Station/ WR, Deen Dayal Upadhyay station/ECR, Patna/ECR, Barauni/ECR, Coaching depots at Puri and Bhubaneswar/ ECoR, Liluah Workshop/ER, Mysore Workshop/SWR, NWR HQ Jaipur and RWF Bangalore which convert bio-degradable waste to energy through bio-methanation process.

One Waste to Energy Plant 500 KGD, Commissioned at CRW/MCS on 22.09.2021 and 03 nos more 100 KGD Waste to Energy plant has been sanctioned on 03.12.20 for SBP, WAT & KUR Divisions. One Twin Shaft Shredder for Waste to Energy Plant (WTE) at Mancheswar Coach Repairing Workshop (CRW/MCS) has been commissioned on 16.02.2022.

A Solid Waste Management plant of 2 ton/day solid waste capacity has been constructed atcost of 1.78Cr in an area of 3150 Sqm in compliance with Solid Waste Management Rule, 2016 at Mysuru. Wastes from all the Railway premises in Mysuru are brought here for further processing.



Organic Waste Processing Plant at Coaching Depot Puri / ECoR





Biotech Vermi Composting System at Vadodara / WR

13.3 Zonal Railways and Production Units have taken initiatives to set up solid waste management facilities including segregation and waste processing methods such as composting, vermi-composting, bio-methanation for bio-degradable waste and recycling of recyclable waste.

Waste to compost plants have been set up at over 60 locations for conversion of bio-degradable waste into compost. Integrated waste management system is

commissioned at ICF where about 6 ton per day bio-degradable waste from the colony is converted as compost. During the year, 50 Kg capacity waste to compost plant at Vijaywada & 75 Kg capacity at Guntur station commissioned, Compost Bio-Organic Waste Plant Capacity 0.5 TPD commissioned at TATA, Chakerdharpur, Rourkela & Jharsuguda Railway Stations. Solid Waste Management Plants commissioned at Thanjavur (TJ) [Capacity: 400 Kg per Day], Mettupalaiyam (MTP) [Capacity: 250 kg per Day], Coimbatore (CBE) [Capacity: 500 kg per Day].

13.4 Detailed instructions regarding waste management have been issued for prompt disposal of waste arising out of catering services at stations and in trains.

Instructions have been issued to keep separate dustbins for dry waste and wet waste to enable segregation.

Provision of dustbins is being done in sleeper coaches also in addition to AC coaches provided earlier. Dust bins are also being provided in bio-toilets in all coaches.

13.5 Condemned coach has been utilized as a restaurant i.e. 'meal on wheels' at CSTM station helping in yielding non fare revenue.

13.6 A year long program was launched by Northern Railway, in partnership with Government of Uttar Pradesh (GoUP) and German Development Cooperation (GIZ-India), to create model zero-waste railway station and zero-waste railway colony in the city of Varanasi. This programme also includes creation of training modules for capacity building of railway functionaries at various levels, development of urban forest by miyawaki plantation techniques at selected locations, creation of awareness on source segregations of waste and single-use-plastics.

13.7 Delhi division/NR has awarded an innovative contract to the firm M/s Rekart Innovations Private Limited, gurugram for waste management and resource recovery at New Delhi, Hazrat Nizamuddin, Delhi, Delhi Sarai Rohilla and 26 other railway stations of Delhi area in April 2021. This contract marks a paradigm shift as on expenditure contract has been converted into revenue contract fetching non fare revenue of Rs 50 lakhs for 05 years under the contract, the firms segregates station waste into wet and dry waste. It also ensures treatment of wet waste. Firm has installed mechanised material recovery facility at New Delhi Railway area to recover the recycled dry waste. The firm is also creating awareness about segregation of waste for behavioral change among passenger, vendors etc.

14.0 Other Green Initiatives

14.1 Shield on Environment Management

MR's shield has been instituted to be given for best performing ZR/PU on Environment management. First shield was awarded in April, 2016. Station Cleanliness and Train Cleanliness Shields have been merged with Environment Management Shield from the year 2016-17. For the year 2021-22, Central Railway won the environment management shield.

14.2 Affordable potable drinking water

In order to provide potable drinking water on affordable rates to the railway passengers, Ministry of Railways has mandated IRCTC to install Water Vending Machines (WVM) on stations. This policy also stipulates that the reject water shall be used by Railway for platform washing, apron cleaning, toilets etc. i.e. conservation of water, being a precious natural resource. This is also an important step in the direction of reducing the production and consumption of plastic bottles.

14.3 EMS / IMS Certification

All 8 Production Units and 43 major Workshops are certified to ISO 14001: Environment Management System (EMS) / Integrated Management System (IMS). 38 Diesel Sheds, 61 Coaching Depots, 21 Freight Depots and 8 Electric Loco Sheds have been certified. 3 MEMU/ DEMU Car Sheds, 2 Engineering Workshops and 1 Stores Depot are also certified.

Around 10 Railway Stations have been certified for implementation of Environment Management System to ISO: 14001 in the year 2021-22, which at present has increased to 695 stations. This is also in compliance of Hon'ble NGT requirements.

14.4 ISO 50001

Integral Coach Factory, Chennai was the first major establishment over IR to be certified with ISO: 50001 - Energy Management System, in August 2015. All 8 Production Units and 44 major Workshops have achieved ISO: 50001 certification showing commitment to energy conservation and energy efficiency.



14.5 Plastic Bottle Crusher Machines are being installed at Railway Stations. More than 700 plastic bottle crushing machines have been installed at 450 stations.

14.6 Sanitary Napkin Vending Machines and Incinerators are being installed at a number of stations.

14.7 Rail Green Point (Carbon saving while transportation by Rail):

Policy guidelines have been laid down on 15 March 2022 to assign saving carbon saving points term as rail green points, to freight customers. It will be applicable only to the freight customer who are registered on e-RD portal of FIOS.

Every costumer who places demand online (on e-demand module) for freight service may be prompted by a 'Pop up' thanking him for choosing to transport by Indian Railway giving details of the expected saving of carbon emission called rail green points. Once RR is generated, the saving of carbon emission will be credit to customers account in the form of real green point and the cumulative points will also be shown in account on freight business development portal. Downloadable certificate displaying real green point maybe provided in the system.

The rail green points can't be claimed for any benefit from Railways. It will be reckoned on financial year basis. The 'feel good factor' that customer would get from this information will motivate them to transport more by train tomorrow, moreover, the corporate customers may likely to mention it on their website in their annual reports

14.8 Implementation of e-Office

E-office is Cloud Enabled Software Application developed by NIC. The software helps to improve efficiency, productivity and accountability & Transparency in the workplace by creating a reliable, efficient and effective way to handle office files & documents. A digital workplace also ensures less consumption of paper thus promoting a green workplace. E-Office has been rolled out at 236 Railway locations covering Railway Board, all Zones, Divisions, Production Units, RDSO, CTIs, Workshops and other Railway units.

14.9 Provision of TPaaS (Telepresence)/VC facility

The use of telepresence/VC facility for various meetings/conducting online classes is helping in reducing the carbon footprint. 100 Webex User Host Admins (Internet

based VC facility) and 134 VDCOT Admins with audio and video facility have been issued to Zonal Railways/Centralized Training Institutes (CTIs) for conducting VCs/Online Training during the Covid-19 pandemic.

14.10 Electrical/Electronic Interlocking and Centralized Traffic Control

84 mechanical lever frame signalling have been replaced this year with Electrical/Electronic Interlocking signalling system including major yards at Danapur, Patratu and Bhilai Exchange yard. This will result in savings in coal and diesel used in maintenance of mechanical level frames.

24 hours shifts of Centralized Traffic Control (CTC) Tundla started from March 2019 covering 26 stations and 250 Route Km on Aligarh-Kanpur section. Power consumption at wayside stations reduces with CTC operations.

14.11 Saving paper for saving Trees

Railway Recruitment Boards have introduced online examination through Computer Based Test (CBT) for all Group 'C' posts since 2015 and also for Group 'D' posts in 2018. RRBs have dispensed with paper pen examination (OMR sheets).

MCDO portal has been developed with CRIS for online submission of monthly MCDO to Railway Board. Portal has the facility to generate instant reports for performance comparison. The practice of sending hard copies has been discontinued. This initiative has resulted in saving of about 6000 sheets of paper in a year.

Only limited copies of Budget books/ booklets like Pink Book are printed now and all required books are available online. With merger of Rail Budget with General Budget, the requirement has further come down.

14.12 Capacity Building

Capacity building programmes on Environment Management and Sustainability are organised at different Training Institutes. A number of courses were conducted at NAIR, IRITM and IRIMEE during the year. A virtual capacity building program on Sustainable Public Procurement was conducted at NAIR with the assistance of Switch Asia/UNEP for all levels of management.

14.13 Online consultation with Doctors in Railway Hospitals:

During the COVID-19 Pandemic, facility for online consultation with Doctors has also been rolled out in Railway Hospital in various zones, which besides helping in combating the virus is also helping in reducing the carbon footprint.



14.14 Roll - On Roll - off (RORO) Service:

Roll-On Roll-Off is an innovative service being offered by Konkan Railway to the road transport Industry. This service was started in the year 1998 and it has benefited the truckers in terms of saving on fuel, wear and tear as well as transit time. This service has also helped in reducing congestion and accidents on roads and keeping pollution under control. There is an approximate fuel saving of 180 litres per truck transported over RORO service between Kolad and Suratkal. Total estimated saving in fuel is around 121.60 million litres (till 2021-22) with equivalent fuel saving of Rs 934 crore

14.15 Noise reduction in power car

Indian Railways' Production Units are manufacturing all power cars with low noise feature. Introduction of Head on Generation technology (HOG) resulted significantly reduction in noise and air pollution as it has eliminated the need for separate diesel fueled power cars which produce an unbearable noise of around 100dB and on an average 3000 liters of diesel per trip per train.



15.0 Policy Initiatives of Indian Railways towards Environmental Sustainability

With a pan-India network and linkages to various sectors of the economy, the Indian Railways has always considered environmental management as part of the core operating strategy. A renewed focus and thrust has been given in its activities to achieve a better environment with the launching of the new Environment and Housekeeping Management Directorate in the Railway Board. Some important policy initiatives taken in recent years are noted below :

15.1 Policy on Water Management

- Water Recycling plant to be provided at major water consumption centres subject to techno-economic viability
- Rain water harvesting system to be provided
- Water audit to be done at major water consumption colonies / installations / stations
- Revival of water bodies
- Inclusion of Automatic Coach Washing Plant with Water Recycling in all major coaching depots



Automatic Coach Washing Plant with Water Recycling
at Hazrat Nizamuddin Coaching Depot

15.2 Policy on Energy Management

- 5% energy consumption to come from alternative sources
- Retrofitting with efficient lighting and other star-rated appliances
- Production of only energy efficient 3 phase electric locos from 2016-17 onwards
- Provision of LED lights in coaches during POH

- Use of 5% bio-diesel in traction fuel
- 20% CNG substitution in DEMUs
- 100% Green Powered Stations started
- Certification to EMS 50001 Energy Management System
- IR has joined the Perform, Achieve and Trade (PAT)Progamme of Bureau of Energy Efficiency (BEE) showing its commitment for improving energy efficiency

15.3 Waste Management

- All existing coaches fitted with conventional toilets have been fitted with environment-friendly bio-toilets.
- Provision of dustbins in sleeper coaches also in addition to AC coaches
- Provision of dustbins in bio-toilets in all coaches
- Provision of separate dustbins for bio-degradable and non-bio-degradable waste and more dustbins at stations
- Pilot Plants for Solid Waste Management at major railway stations

15.4 Funding of Environmental Sustainability Works

- Policy frame work to earmark 1% lump sum provision in all works/project estimates towards environment related works has been issued and this has been made part of D&G charges of estimates
- Policy frame work to undertake environmental sustainability works by Zonal Railways through CSR has been put in place

15.5 Other Green policy initiatives

- MOUs with States for planting of trees on vacant railway land
- Use of plastics of less than 20 micron thickness in packaging is banned
- EMS/IMS certification for all PUs, Workshops, Loco Sheds and major Coaching and Wagons Depots

- Green Certification of Railway establishments
- Around 695 major Railway Stations have been certified for implementation of Environment Management System to ISO 14001 by 2021-2022.



Ratnagiri Railway Stations EMS ISO: 14001 certificate

- Consent to Establish' and 'Consent to Operate' / 'Consent for Operation' for stations, siding and goods sheds to be taken from State Pollution Control Board in accordance with the provisions of SPCB, keeping in view the notified areas / air pollution control areas and categorisation of Industrial Sectors. Around 272 stations obtained 'Consent to Establish' and 'Consent to Operate'/ 'Consent for Operation' from concerned SPCB in year 2021-22, taking cumulative to 622 stations.
- CLW has developed children park in 8 acres of township and a golf course having area of about 114 Hectares in CLW township.

SOME IMPORTANT WASTE MANAGEMENT RULES

G.S.R. 320 (E) [18-03-2016] : Plastic Waste Management Rules, 2016
G.S.R. 338 (E) [23-03-2016] : E-waste (Management) Rules, 2016
G.S.R. 343(E). [28-03-2016] : Bio-Medical Waste Management Rules,2016
G.S.R. 317(E). [29-03-2016] : Construction and Demolition Waste Management Rules, 2016
G.S.R No. 395 (E)[04-04-2016] : Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016
S.O. 1357(E) [08-04-2016] : Solid Waste Management Rules, 2016



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