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INDIAN RAILWAYS a Sustainable Mass Transportation System

ENVIRONMENTAL SUSTAINABILITY ANNUAL REPORT 2018-19

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Indian Railways



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

- Mahatma Gandhi

विजन

भारतीय रेल पर्यावरण प्रबंधन

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 सरंक्षण उपायों को बढ़ावा देना।
- स्वच्छ ऊर्जा के वैकल्पिक स्वरूपों को अधिकतम उपयोग करना, जिसके
 परिणामस्वरूप 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 निर्माण छायादार वृक्ष-क्षेत्र को बढ़ावा देना।
- प्रभावी पर्यावरण प्रबंधन प्रणाली स्थापित करने के लिए संगठन के भीतर क्षमता विकसित करना।
- रेलवे परिचालन में ध्वनि प्रदूषण को कम करना।

INDIAN RAILWAYS ENVIRONMENT MANAGEMENT

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.
- Building in house capacity to set up an effective Environment Management System.

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Some important Waste Management Rules



Indian Railways A Sustainable Mass Transportation System

1.0

Indian Railways (IR) is one of the world's largest rail networks, spread over 68,400 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 1,160 million tonnes of freight annually, as it traverses the length and breadth of the 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. It has been estimated that for the sustainable development of Indian Economy, the inter-modal share of freight traffic by rail should go up from the current share of 36% to 45% by 2030. Accordingly, Indian Railways is gearing up for a massive growth to achieve such increase in inter-modal share by augmentation of its network and rolling stock fleet along with increase in productivity.

For IR to become a low carbon mass transport system an integrated approach, which includes resource efficiency at its core, will be critical.

As the country's lifeline, the national transporter, 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, Renewable and Alternate sources of Energy, Water Conservation, Afforestation, Waste Management and Green Certifications.

Reducing Global Carbon Footprint

India has a population of over 1.3 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 13% 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, suburban 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.

TERI was engaged with the Ministry of Railways for assisting in developing the strategies for emissions reduction for the Ministry with a horizon period of 2030. IR strategies on operational and technical energy efficiency measures, along with efforts to move greater share of traffic to electric traction, were modelled, and resulting numbers for the same were estimated. The strategies, duly approved by the Board, were thereafter shared with MoEFCC for their consideration in the INDC document.

The INDC document submitted by India in October 2015, was widely discussed at the 21st Conference of Parties (CoP 21) organized by the UNFCCC in Paris, in November 2015. 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.

The INDC was ratified by India the following year, and India now had an officially mandated target of activities for meeting its INDC commitments for 2030.

One of the most vital transportation emissions mitigation strategies agreed to by the Government of India was increasing the share of Indian Railways in the movement of freight from the current ~ 35-36% to 45% by 2030.



Conference of Parties to the UNFCCC in its sixteenth session (COP-16) had decided that developing countries should also 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. India's second Biennial Update Report (BUR-2) was submitted to UNFCCC in December 2018 which included updates on part of Indian Railways coordinated by EnHM directorate.

2.2 IR's Role in India's NDC for combating Climate Change

- Reducing emission intensity by 33% upto 2029-30 over 2004-05.
- IR should aim to enhance the share of the Railways in the overall land based freight transport from the present 36% to 45% by the year 2030.
- IR should target setting up of Dedicated Freight Corridors (DFCs) across the country. The first two corridors are already under construction and expected to be completed by 2020. This 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.
- PAT Scheme to be implemented in railway sector.
- Use of 5% blending of biofuels in traction diesel fuel.
- Improve water use efficiency by 20% up to 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 IR.
- Role in 'Swachh Bharat Mission'

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

3.0

Climate change has had 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 and will review and extend these targets every five years. Ministry of Railways were 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.

Ministry of Railways also participated in COP-22 held at Marrakech, Morocco in November 2016 and COP-23 at Bonn, Germany in November 2017. Sessions on sustainable transport network were organised at India Pavilion.

24th UNFCCC conference of parties was held at Katowice, Poland from 2nd to 14th December, 2018. Like previous three years, Ministry of Railways was once again given the responsibility of hosting a side event on transport sector. MoR coorganized this event with FICCI as technical partner. Executive Director/EnHM – CE, Railway Board represented Ministry of Railways.

In the session hosted by MoR on the topic 'Sustainable Transportation – Creating a mobility ecosystem in India', MoR, MoRTH, DFCCIL and CEEW delivered their talk on 'Sustainable Mobility framework in India'. The discussions were centered around the initiatives by Indian Railways to achieve 'Greening the Railways: India's vision and opportunities for collaboration' and the

7.2/



achievements in this direction covering key sustainability initiatives, water conservation, water use efficiency and Green certification of buildings, workshops etc. MoRTH did their presentation on the 'Impact of Eastern Peripheral Expressway in Environmental Pollution control in National Capital Region'. DFCCIL delivered a

talk on Leapfrogging on sustainable mobility in India and CEEW covered the topic -'Strategies for decarbonising India's transport sector' and made the audience aware of benefits of holding the increase in global average temperature to well below 2° C.

Session II was conducted by FICCI on the theme of 'Creating a sustainable Mobility Ecosystem for India'. In this session Dr Hans-Joern-Weddige, Group coordinator, Thyssenkrupp, Germany, Mr Kollurur Krishan, Chairman CVC India Infrastructure Pvt Ltd and Dr Anand Iyer, Executive Director, Meraclus Global covered their topics.

FICCI had also invited MoR to speak in their side event on 11th December, 2018 titled 'Scaling up climate finance for India and Private Sector Action'. MoR participated in the side event on the topic 'Investing in Climate Mitigation- An opportunity for businesses in Indian Railways'. In this session, an introduction to Investment opportunities in Indian Railways was given to the audience along with steps taken to ramp up the investments covering various initiatives to regain the lost modal share of Railways. It was explained that Indian Railways is gearing up for massive growth by augmenting its network, Rolling stock fleet, Construction of Two dedicated freight corridors and High speed corridor. Other opportunities also exist in the fields of water use efficiency, renewable energy and alternate fuel etc. Given the relative advantage of efficiency of the rail based transport, increasing the share of Railways in both passenger and freight transport will be vital for increasing the energy efficiency of transport sector and achieve the reduction in GHG emissions in the country.

The broad objective of the side event was to provide a platform for various stakeholders in the Sustainable Mobility space to engage in the bottom up as well as top down approach to facilitate the implementation of a holistic strategy and action plan in this direction.



Energy Efficiency in Mass Transportation System

4.1 Improvement in Energy Efficiency in Electric Traction

Introduction of energy efficient Three Phase locomotive technology is expected to reduce 500 tonnes of CO2 annually. These locomotives are equipped with regenerative braking feature capable to regenerate electricity during braking action which is fed back to grid.

Regenerative braking feature has now been developed in Conventional Electric Locomotive WAG7 also and first such locomotive was turned out from BHEL Jhansi in February 2019.

Adoption of 3 phase IGBT Technology for EMUs in Mumbai Suburban area is expected to reduce emission of 600 tonnes of CO2 per annum per train due to regenerative braking features.

erative braking features.

Other improvements

- Fitment of 1000 kVA Hotel load converters to supply electricity for train lighting, air-conditioning and for pantry cars.
- 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 encouraging for maximum use of regenerative brakes on three phase electric locomotives for reduction in traction energy bill.
- Energy consumption and energy regeneration in each trip by individual crew is being monitored through Crew Management System.

4.2 Improvement in Fuel efficiency in Diesel Traction

Auxiliary Power Unit (APU) has being provided in 762 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



Auxiliary Power Unit



and tear of the main engine. It also results in lower CO2 emission and other pollutants like HC, NOx, CO etc.

Computerized Fuel Management System (FMS) has been developed and on pilot basis RCDs have started daily entry of all HSD issuance and receipt data in the FMS system. The system is being strengthened for real time data entry. HSD issuance data is being analysed.

Common Rail Electronic Direct Injection (CReDI) : A first on large diesel engines, CReDI is being developed by RDSO for diesel locomotives. CReDI provides accurate metering of fuel, complete combustion, reduction in emission and optimizing power output while reducing fuel consumption.

Some other measures undertaken / planned are :

- Hotel load on diesel locomotives to reduce power car fuel consumption.
- Guidance for Optimized Locomotive Driving (GOLD).
- Multi Genset locomotives.

4.3 Improving Energy efficiency with trailing Rolling Stock

- **BOXNS** wagon having a higher pay load to tare ratio of 4.05 has been designed and 2500 such wagons have been inducted.
- Commodity specific wagon like BTAP which was conventionally used for Alumina transportation, has been cleared by RDSO for carrying fly ash and bulk cement.
- **BCACBM** wagon capable of carrying **Auto Cars** has been developed by RDSO and is being widely used by the automobile sector. With this development, the loading of cars has increased by 65% during this year.
- **BFNSM** wagons have been inducted for **Steel Coils** during this year, increasing the rake throughput at 4100 tonnes per rake which is 35% higher than conventional BFNS and BRN wagon rakes.
- A **dwarf container** has been designed which can move with double stack loading even under electrified sections thus enabling increase in throughput. This service has been opened on Jamnagar-Ludhiana route.
- Commercial operation of multimodal **Road-Railers** started in August, 2018.
- These measures will enable higher throughput and/or bring some road traffic on rail, resulting in reduced GHG emissions for the same freight traffic.
- 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. A record 4429 **LHB coaches** were manufactured by the 3 Production units of IR

– ICF Chennai, MCF Raebareli and RCF Kapurthala in 2018-19 as against total 2480 in 2017-18 and 1469 in 2016-17.

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 underslung propulsion equipments, has advanced regenerative braking system and need for power cars 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.

4.4 Head on Generation system

Most of the Rajdhani / Shatabdi and a few Mail / Express trains are working in EOG configuration with power cars provided at both ends to cater to Hotel load requirement i.e. lighting and HVAC. It has been decided to progressively convert all EOG trains to HOG, which is energy efficient system. By the end of last fiscal, a total number of 168 trains have been converted into HOG. With this conversion, a total net saving of Rs 313.8 crores per annum has been achieved by way of reduction in diesel consumption.



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 manifold over the next decade.

5.1 Indian Railways 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 carried out energy audit of various facilities.

5.2 100% LED lighting

5.0

- All railway installations including stations, offices, maintenance depots and other buildings have been fitted with 100% LED luminaries.
- 100% LED lights at residential quarters as a one-time provision is also progressing well (more than 64% work already completed).
- 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.

5.3 LED lights in coaches

Instructions have been issued to Zonal Railways to replace all CFL/FL lights in all TL/AC and self propelled (EMU/MEMU/DEMU) coaches with LED lights which is likely to save electrical energy to the tune of Rs. 19764/- per AC coach per annum and Rs. 8424/- per non AC coach per annum. All new coaches from production units are

being turned out with LED light fittings. 12,755 coaches were provided with **LED** lights from 2014-15 to 2017-18 and 7,755 more coaches have been provided with LED lights during 2018-19.



5.4 Energy Efficiency Studies

To facilitate Indian Railways and Confederation of Indian Industry (CII) to work together on Green Rating and Energy Efficiency studies of IR's Production Units & major Workshops, a Memorandum of Understanding (MOU) was signed between IR and CII on 26th July 2016.



Energy Efficiency studies were completed in six PUs (RCF, ICF, RWF, DLW, CLW, DMW) and 4 workshops (JUDW, JHS, JMP, GOC) under MOU with CII in 2017-18 and 7% to 15% energy efficiency improvement achieved. Activities included :

- Identification of significant energy saving opportunities in the facilities.
- One-day training program on the technological aspects of energy efficiency, and the best practices adopted by related Indian industries.



- Identification of potential technology suppliers who can offer energy saving technologies to the units.
- Organising visits of IR officials to some of the best performing units in similar sectors, such as automobile and engineering.
- 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 IR units to guide them in the implementation of energy efficiency measures.

The activities led to implementation of more than 100 energy efficiency and renewable energy measures / projects, resulting in an estimated energy saving of 11 million units annually, translating into monetary savings of INR 78 million, and a reduction of 9,766 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.

In second phase, Energy Efficiency studies for 10 additional units (2 PUs and 8 workshops) have been started in 2018-19 which are in progress.









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. Indian Railways has been taking several steps to install clean and efficient energy.

- Vision 2020 document of the Indian Railways states that the key target is to utilize at least 10% of its energy requirement from renewable sources.
- As a part of this, Indian Railways has planned to set up
 - 1000 MW solar power plants, and
 - about 200 MW of wind power plants by 2020 across Zonal Railways and Production Units.
- IR has installed 82.42 MW Solar and 53 MW Wind power across Railway installations.

Solar for Traction

6.0

2 projects of about 2 MW each have been assigned to BHEL at Sukhi-Siwania in WCR and to Railway Energy Management Company Limited (REMCL) at Diwana in NR.

100% Green Powered Station

- Asangaon Railway station of CR under Mumbai Division has been declared 100% Green Powered Station powered with windmill and solar panels in March 2018.
- Guwahati Railway station in the NFR became the first Railway station in Northeast to run completely on solar power in May 2018.
- In addition, 12 more stations have been declared Green Railway stations across IR, 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.



Solar Panel at CCG Station Building / WR



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Alternate Fuel and Clean Energy initiatives – IROAF

With growing global population and rising Energy consumption, the expanding use of coal and oil threaten the existence of human kind. These fuels are major sources of Green House Gases (GHG) and pollutants such as NOx, SOx, Volatile Organic Compound (VOCs) and particulate matter (PM). Indian Railways Organisation for Alternate Fuel (IROAF) was established to explore possibilities in proliferating new sources of Environment friendly Fuels / Energy in Indian Railways. Some steps taken by IROAF in this direction are as follows –

7.1 Blending of Bio- diesel with HSD

7.0

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 Biofuel 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 RCDs of Indian Railways in different Zones.

To check the feasibility of increasing percentage of blending, a trial for 25% blending of bio-diesel (B-25) first time in Indian Railway was conducted by EC Rly. in Samastipur division on 18 Sept 2018.

At present the Bio-Diesel is being procured by Indian Railways from the trade. However IR (IROAF) is setting up Two 30 Ton per day (TPD) capacity plants at Tondiarpet /Chennai and



Raipur /Chhatisgarh. These two plants will meet 15-20% of total requirement of blending of HSD on IR.





Environment friendly CNG/LNG in Duel Fuel Mode for Railway Traction

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. IROAF is pioneering implementation of CNG based dual fuel fumigation technology on CNG DEMUs DPCs of 1400 hp to achieve up to 20% substitution of Diesel. 25 Diesel Power Cars of

DEMUs have been converted into CNG based dual fuel engine.

The use of CNG has been proliferated at Shakurbasti and Vijayawada Diesel Sheds while developing dedicated CNG gas supply and filling station there.



IROAF is now moving towards the next level of HSD substitution by 40%.

7.3 Solar Energy

7.3.1 Solar Energy based solutions for Passenger Services

The trailer coaches of first rake of 1600 HP DEMU have been provided with Solar PV system at its roof which takes care of electric supply for the fan and lighting load inside the coach. This will 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.

The operation of this rake was inaugurated on 14th July 2017 by the then Minister of Railways Shri Suresh Prabhakar Prabhu.



The trailer coaches of one rake of 1400 HP DEMU at Jamalpur have been provided with solar PV panels.

IR (IROAF) has planned for provision of Flexi Solar Panels with Lithium, ion batteries on 450 nos. trailer coaches.

7.3.2 Solar Energy based solution for guards of freight trains

IROAF 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.



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

7.3.3 Provision of Solar Panels on Swachata Express

IROAF has fitted Solar Panels of 4.5 KWp capacity each on 10 Coaches of Swachata Express, which is capable of producing 10 KWh per day for electric supply to lights and fans inside the coach. Swachhta Express is an exhibition train to showcase the achievement of Swachh Bharat Mission.



7.3.4 Solar Panels on Workshops and Stations

Solar PV Plant of 2 MWp capacity at roof top of DMW Patiala was arranged and commissioned successfully by IROAF under CAPEX through BHEL, to meet approx. 25 % of annual requirement of electricity at DMW.

Commissioning of PV solar plants of 30 KWp capacity each on roof top of 03 Railway Stations i.e. Jalandhar City, Jammu Tawi and Pathankot was competed in July-August 2018.



7.4 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. IROAF coordinated with Matunga Workshop of CR and Kota Workshop of WCR 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 and projected savings per annum to the order of Rs 8 - 10 Cr. It is planned to replace industrial gases by CNG in 15 workshops and production units and other railway premises in those cities where CNG is available.

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 has also commenced the use of Natural Gas and trials have been done at RYPS and LGD workshops in SCR.

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.



7.5 Methanol Economy

IROAF is working with RDSO and IIT Kanpur on a project for development of Methanol based Power Cars fitted with 1400/1600 HP Diesel Engines.

7.6 Development of Bio-Fuels

IROAF has tied up with Indian Institute of Petroleum (IIP), Dehradun and National Institute of Solar Energy (NISE) to develop Solar Assisted Biomass Pyrolysis Technology for production of Methanol and other Bio-Fuels as a next generation fuel resources for cutting edge commercial application.

7.7 Waste to Energy

IROAF has set up a pilot project at Kishanganj Railway colony, Delhi for converting bio-waste into electricity. This plant can convert 01 ton of Bio-degradable Waste to 80 KWH of energy per day.

8.0

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. 52 Water Recycling Plants were set up on Indian Railways up to the year 2017-18. WRPs have been commissioned at another 9 locations in 2018-19. Besides this, 28 more WRPs have been sanctioned and work is in progress at 24 locations.

13 Automatic Coach Washing Plants (ACWP) have been installed over Indian Railways, including 12 installed during 2018-19. Automatic Coach Washing Plants are provided with water recycling plants and thus reduce water consumption during exterior cleaning of coaches.

8.2 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.

A total of 1591 water bodies are functional on Indian Railways as on March 2019. 77 no. water bodies have been recreated and 44 no. of non - functional water bodies

have been rejuvenated. The water bodies in the form of pond are also being utilised on commercial term for fisheries purpose.

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



8.3 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. Up to the year 2018-19 a total of 319 Water Audits have been conducted by various Zonal Railways out of which 62 were completed in the year 2018-19 itself. Further, water audit at 9 locations is under progress and at 56 locations the same is in planning stage.

8.4 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 Rain Water Harvesting is being monitored across all Railway Zones. During the year 2018-19, Roof Top Rain Water Harvesting were installed on 751 locations/ buildings having roof top area more than 200 sqm.

Water recycling plant at ADRA / SER

Phyto remediation plant with ETP installed at NBVJ / WR



Water bodies constructed/ revived in Asansol division / ER

8.5 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.

8.6 Sixteen Quick Watering Systems have been deployed over Indian Railways for watering of coaches, including 14 installed during 2018-19. Quick Watering System helps to save water as it limits wastage to a large extent. It also enables reduction of stoppage thus improving mobility.

Afforestation

9.0

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 1.1 crore saplings during the year 2018-19.





Plantation at SWR



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 & major Workshops, a Memorandum of Understanding (MOU) was signed between IR and CII on 26th July 2016.

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 and eighteen more Units were certified during the year 2017-18.

10.4 Twenty four Units were certified during 2018-19. At present, 5 Production Units, 36 Workshops, 3 Diesel Sheds and one Stores Depot, total 45 Units are GreenCo certified. 10 of these are GreenCo Gold certified – ICF / Chennai, Diesel Loco Modernisation Works / Patiala, Carriage Repair Shop Tirupati / SCR, Rayanapadu Workshop / SCR, Mysuru Workshop / SWR, Jagadhri Workshop / NR, Liluah Workshop / ER, Pratap Nagar Workshop / WR, Golden Rock Workshop / Trichy / SR and Diesel Loco Shed Moula Ali / Hyderabad / SCR.



Green Industrial Units

10.0



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.
- Indian Railways Institute of Civil Engineering (IRICEN), Pune achieved the highest LEED **Platinum** and GRIHA **5 Star** rating.
- Integral Coach Factory (ICF) GM office was certified as **Platinum** rated Green Building by CII-IGBC in 2017-18. RWF Administrative Building and DMW Administrative Building have been awarded IGBC **Platinum** rating in the year 2018-19.
- Rail Nilayam Headquarter building, Secunderabad and Hyderabad Bhavan office building, Hyderabad Division of South Central Railway were awarded
 Gold certification in 2017-18 by CII- IGBC.
- In the year 2018-19, Rail Vikas Bhawan DRM Office, Guntur/ SCR has been awarded **Platinum** rating and SWR Headquarters Building - Rail Soudha, was awarded Green Existing Building **Gold Rating** and by IGBC. Administrative Building CLW, Chittaranjan was also certified in this year.

11.2 Green Railway Stations

- Indian Green Building Council Confederation of Indian Industry (IGBC-CII), have developed Green Railway Stations Rating system to assess and facilitate the transformation of existing railway stations into eco-friendly ones.
- Secunderabad Railway Station and Jaipur Railway Station had achieved Green Railway Station **Silver** rating during the year 2017-18. Both these stations, SC and JP were upgraded to **Platinum** rating during 2018-19.
- Another 7 stations were assessed and certified in 2018-19. Kachiguda Station and Vijayawada Station of South Central Railway achieved **Gold** rating. New Delhi Station of Northern Railway and Howrah Station of Eastern Railway achieved **Silver** rating. Varanasi Station of North Eastern Railway, Katra Station of Northern Railway and Chennai Station of Southern Railway were also certified.



11.3 Other Green Certifications

Supervisor's Training Centre (STC) Secunderabad, SCR had achieved **Gold** Certification in March 2018 under IGBC Green Campus Rating system. STC, Lucknow/NR achieved **Silver** Certification 2018-19.

ICF School, Chennai achieved IGBC Green Schools **Platinum** Certification and SECR Higher Secondary School (No. 1), Bilaspur achieved IGBC Green Schools **Gold** certification during the year 2017-18. ICF **Silver** Jubilee Nursery and Primary School, Chennai achieved IGBC Platinum rating in 2018-19. Attempt to certify schools is unique as this will generate environmental awareness among next generation.

Divisional Railway Hospital, Ajmer / NWR achieved **Silver** rating in Green Healthcare facilities in Sept., 2018. This is the first Railway Hospital to be Green certified.

Railway Officers Enclave, S.P. Marg, New Delhi of Northern Railway achieved **Platinum** rating in Residential Societies during the year 2018-19.







Environment friendly Bio – Toilets for Passenger Coaches

12.0

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). An MoU has been signed between IR and DRDO for development of bio-toilets.

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 l a v a t o r i e s a n d t h e h u m a n w a s t e, 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.



Bio-toilet Tank

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, these bio-toilets were fitted in more coaches for in-service trials. The pace of fitment of bio toilets has been increased substantially in last 3 years. Upto March 2019, more than 1,95,900 bio-toilets have been installed in nearly 53,900 coaches including 69,166 bio toilets fitted in 19,137 coaches during 2018-19.

IR has committed to eliminate direct discharge toilet system from its entire coaching fleet by 2019 in line with 'Swachh Bharat Mission'.



Year-wise progress on installation of bio-toilets in coaches

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, display of models etc.



Model of bio-toilet at Hubali Station / SWR

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

With an aim to provide clean and efficient toilets and to reduce the water consumption in toilets, IR is doing a trial of Bio-Vacuum toilets. 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. During the year 2018-19, ICF has provided bio-vacuum toilets in 230 AC coaches, MCF has provided in 24 coaches and RCF in 92 coaches.



13.0

13.1 Solid Waste Management Rules, 2016 identify railways as a bulk waste generator and 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 have taken up a pilot project for disposal of municipal solid waste (MSW) generated at railway terminals in an environment friendly manner, including conversion of waste to energy. Pilot plants are being set up at Jaipur and New Delhi Railway Stations which will convert bio-degradable waste to energy through bio-methanation process. Energy generated from these plants would be utilized for suitable services at/ near Railway Station. One more such plant is being set up at Chennai.

Bio-degradable waste to energy (bio-methanation) plants were set up earlier at Jaipur and Kishanganj/New Delhi. In this year, bio-degradable waste to energy / bio-gas plants have been set up Puri, MMCT Stations and Liluah Workshop.



Biogas plant at Liluah Workshop



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.

Integrated waste management system is commissioned at ICF where about 6 ton per day bio-degradable waste from the colony is converted as compost.

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.

Environmental Sustainability in Infrastructure Projects

14.1 Dedicated Freight Corridor Corporation of India Ltd. (DFCCIL)

I. Sustainability Performance Framework in DFC Project

Various potential environmental and social impacts were identified in the DFC project through series of surveys, field investigations, hiring of subject experts and expert agencies, and use of international techniques and impacts assessment methodology relevant to the Railway projects. To offset any significant impacts, technically and practically feasible Mitigation, Management and Monitoring Measures were designed and integrated in the design and contractual documents during construction stages.

II. ISO Certifications and Work Place policies

In both WDFC and EDFC, all contract packages are 100% in compliance with respect to certification on ISO 14001-2015: Environmental Management Systems and OHSAS 18001-2007: Occupational Health and Safety Management Systems.

Policy on Labour Protection and Work Place Policy on HIV/AIDS Prevention and Control for Workers engaged by Contractors adopted.

CTP-3R Contract of WDFC (between Iqbalgarh and Makarpura in Gujarat) has been awarded Excellence Award in the Category of HIV/AIDS Mainstreaming Activities for the year 2017-2018 and 2018-2019 by the Gujarat State AIDS Control Society.

III. Safety, Health and Environment (SHE) Compliance

Selection of DFC alignments was such that land acquisition, forest land diversion and impact to environment is minimum.

Railway and Bridge construction projects are exempted from the national environmental clearance process. Yet as a responsible corporate, a Detailed and Comprehensive Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) studies with data generation in all critical seasons have been conducted for both Western and Eastern Freight Corridors to meet the JICA and World Bank safeguard policies.

Some of the major environmental measures being taken during construction phase include –

- Site-specific finalization of Contractor's level Safety, Health & Environment (SHE) Policy and SHE Plans.
- Regular environmental monitoring for air, water, noise (environmental & occupational), vibration, soil, etc.
- Regular meetings with all stakeholders to monitor implementation of environmental management.
- Dust control on all sites with measures such as limiting vehicle speed, covering all trucks/dumpers carrying fine grained loose materials with secured tarpaulins, daily water sprinkling on roads etc.
- Noise and vibration reduction and abatement measures are in-built in the project design, locomotives technology, track design, and construction methodology.



Ducting arrangement at the outlet of all exhaust fans and connecting to dust extraction system



Provision of water sprinklers for both coarse and fine aggregates for dust suppression

IV. Energy Conservation and Energy Efficiency

- 2X25 kV OHE system being used on Eastern and Western DFC to reduce number of TSS and increase number of trains in the section. This also gives major operational advantages such as – Improved voltage regulation and reduced transmission losses, Higher OHE current carrying capacity due to doubling of voltage (50 kV), Higher hauling capacity, Increased Traction Substation spacing at 60-80 km against existing norms of spacing of 40 km etc.
- High rise OHE of 7.5 m to carry double stack container traffic.
- Provision of Power Factor Correction Device in Traction Sub-Station (TSS).
- IGBT based 7000kw / 9000hp 3-phase locomotives with state-of-the-art features such as, VVVF drive, vehicle control unit, vigilance control, constant

mode of operation features etc., will be deployed which facilitate regeneration of 14-15% of energy from braking.

• BEE Star Labeled Products for Corporate and Field Offices. DFCCIL Corporate office is among the few office buildings in Delhi/NCR to get BEE 5-star rating.

• DFCCIL has planned to harness solar power to meet part of the energy requirement and install 645 kWp solar capacity by providing integrated modules at level crossing gates, signaling huts, Operation Control Centre (OCC) Building etc.

V. Water Conservation

Water meters at all construction sites for recording Daily water consumption for different activities.

- Display of Posters, Slogans and messages for promoting conservation and prevent wastage of water.
- Recharging through water harvesting methods along the project corridor and adopting rainwater harvesting scheme at road under bridges (RUBs) and building areas (station, residential).
- Reuse waste water for water sprinkling at sites.

Due care has been taken by DFCCIL to avoid / minimize impact of any construction activity on natural resources.

Cleaning of River Bed from plastic pollution etc near construction site done regularly, limiting pollution load in River Bed at bridge sites.



VI. Green Belt Development along the DFCCIL Corridor as Carbon Sink

A Green Belt Development is being done along the alignment within the land acquired by DFCCIL beside the Compensatory Afforestation Plantation drive by the Forest Department. Nearly 2,00,000 trees have been planted upto March 2019 against the total target of around 5,20,000.

Trees remove carbon dioxide and other pollutants and release oxygen into the air thereby improving air quality. Green belt can also help in removing particulate matter from the air and it will also function as sound barrier.

VII. Wildlife and Natural Environment Conservation

• DFCCIL is contributing INR 0.5 million annually to encourage research for improving measures for Wildlife Conservation in Protected Areas - Thol Bird Sanctuary in Gujarat and Koderma Wildlife sanctuary in Jharkhand.

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- Construction of wildlife passes at strategic locations inside Protected Areas -Sanjay Gandhi National Park, Maharashtra and Koderma Wild life sanctuary, Gautama Buddha Wildlife sanctuary, Balaram Ambaji Wild life Sanctuary (BAWS).
- Installation of Wildlife Fencing along corridor.
- Implementation of pre-afforestation (1:10 ratio) in eco-sensitive areas to increase tree cover Dahanu eco sensitive zone, Maharashtra.
- Mangrove plantation to arrest soil erosion and reduce salinity due to sea ingress.

VIII. Noise Barriers for Reducing Impact of Train Noise

All schools, hospitals and other sensitive area that are within 100 m distance from centre of Rail, require noise control measures. Noise barriers shall be provided at such locations to mitigate the impact of high noise of running train during operations.

IX. Construction Materials and Waste Management

- Maximum use of locally available materials to reduce transportation impacts.
- Contractors have to implement and monitor Solid Waste, Hazardous Waste, C&D Waste and e-Waste Management throughout the construction period.
- Contractors have MOU with Government Certified / Approved Agency for disposal of Solid Waste, Hazardous waste, to respective secured landfill sites and/or authorised recyclers.
- Recycling and Reuse of waste within the work sites itself, e.g.; preparation of brick cubes from waste construction materials.
- Provision of mobile toilets/ bio toilets at different construction work sites.

X. CSR Initiatives

- Corporate Social Responsibility (CSR) Policy of DFCCIL is in place.
- DFCCIL supplied, installed and commissioned 200 SPV (Solar Photovoltaic System) Street Lighting System in total 34 villages in Ajmer, Rajasthan (7 villages) and Allahabad East, Uttar Pradesh (27 villages) under CSR Initiatives under Project 'Jyoti' during FY 2017-18. The project will be maintained for 5 years from commissioning.
- DFCCIL earmarked INR 220 lakhs for FY 2018-19 for different activities under Swachh Bharat Mission / Namami Gange :
 - o Disabled friendly ramp on ghat at Varanasi and Floating Toilet under CGM Mughalsarai and Tundla Unit
 - o Construction of Toilet Blocks under CGM (North) and CGM (South).

14.2 National High Speed Rail Corporation Ltd. (NHSRCL)

- State-of-art energy-efficient high-speed rail trains selected. Higher energy efficiency of the HSR operations expected to reduce 10% emissions per annum over BAU.
- Significant reduction in fuel consumption due to expected shift in traffic plying between Mumbai and Ahmedabad to MAHSR.
- As an alternative against air travel, MAHSR offers convenience through better connectivity to local transport infrastructure.
- Developing, building, and operating infrastructure designed to reduce energy consumption.
- Methodology of construction of HSR planned to minimise noise pollution considering eco-sensitive and residential area.
- Zoological Survey of India conducted study of Faunal Components and prepared Management and Conservation Plan for Flamingo Sanctuary at Thane Creek in Mumbai, to minimise impact on Fauna.
- MAHSR Alignment designed to have minimum impact on the Forest, CRZ and Wildlife.
- Trees being transplanted / relocated.
- Water harvesting and recycling planned in depots at Sabarmati and Thane.



Other Green Initiatives

15.1 Shield on Environment Management

An 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.

15.2 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. Detailed policy guidelines have been issued in this regard vide CC No. 36/2015 dated 16/06/2015. 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.

15.3 EMS / IMS Certification

8 Production Units and 42 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.

15.4 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.

15.5 Noise reduction in power car

Present design power car employing two DG sets has noise level of 99 dBA. RCF has manufactured two such power cars with acoustic panel and reorientation of radiator assembly which was introduced in service in April, 2017 and has resulted in reduction of noise level to 81 dBA. The power car is presently running in train no. 22415/16 NDLS-VSKP AC express and 12497/98 NDLS-ASR Shan-e-Punjab express with satisfactory performance. PUs are manufacturing all power cars with low noise feature.

15.6 Plastic Bottle Crusher Machines are being installed at Railway Stations. 110 such machines were provided up to March 2019.



Sanitary Napkin Vending Machine/ Incinerator

Plastic Bottle Crusher

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

15.8 Saving paper Saving Trees

Railway Recruitment Boards have introduced online examination through Computer Based Test (CBT) for all Group 'C' posts since 2015 and recently in 2018 for Group 'D' posts. RRBs have dispensed with paper pen examination (OMR sheets). This initiative is estimated to have saved 332460 trees in 2015-16 and 795535 trees in 2018-19.

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.

15.9 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. 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 :

16.1 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

16.0

 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

16.2 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

16.3 Waste Management

- IR shall convert all existing coaches fitted with conventional toilets to those fitted with environment-friendly bio-toilets by 2019
- 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

16.4 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

16.5 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
- 37 major Railway Stations will be certified for implementation of Environment Management System to ISO 14001 in 2018-19
- 'Consent to Establish' and 'Consent to Operate' / 'Consent for Operation' for sidings 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.



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



Bio-Medical Liquid Waste ETP at JRH / WR



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