Mission 100% Electrification
Moving towards net Zero Carbon Emission

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Ministry of Railways
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Introduction

Prior to 2014, the Railway Electrification had been moving at a normal pace. However, today six years later, it is remarkable to consider the positive changes that have taken place. The worldwide energy sector has also moved a great deal during this period, particularly in terms of efforts made by all the stakeholders to strengthen the policies to tackle the threat of climate change. Net-zero emissions pledge is being taken by more & more countries.

Focusing on India’s energy scenario in general and Railway’s Mission 100% electrification in particular, two main positive developments that stand out are:

a) Decision to electrify its entire Broad Gauge network in a Mission mode to provide environment friendly, green & clean mode of transport to its people.

b) Decision to unleash its potential to use renewable energy especially solar, by making use of huge land parcel available along the railway track.

Approach adopted by Indian Railways

Railways has framed a well-designed policy -Mission 100% electrification- a game changer in Indian energy sector and there is tremendous opportunity for India to develop and successfully meet the aspirations of its citizens both for freight & passenger segment; without following the high-carbon pathway that other economies have pursued in the past.

India is the world’s third largest energy consuming country, Energy use has doubled since 2000, with 80% of demand still being met by coal, oil and solid biomass.
Presently, solar accounts for less than 4% of India’s electricity generation, and close to 70%. The scenario is going to change very fast now as India has a target to reach 450 GW of renewable capacity by 2030, in which Indian Railways has a big role to play. India has therefore, specific targets to be achieved by 2030, including 450 GW of renewable power capacity. Additionally, the electrification of railways has a direct bearing on the reduction of crude oil imports thereby leading to precious saving of foreign exchange.

A lot of emphasis has been given to Railway Electrification in recent years with a view to reduce the Nation's dependence on imported petroleum-based energy and to enhance the country's energy security, with a vision of providing eco-friendly, faster and energy-efficient mode of transportation.

Need for electrification

After running of trains on electric traction, the diesel locomotive hauled trains cease to work, which eliminates pollution as well as India’s dependence on the imported fuel and trains are operated from the electricity produced in self-reliant India, also saving significant foreign exchange. Apart from this, the average speed of trains increases along the routes of electrification due to increased throughput and there are development of industries, agro-based businesses and progress of villagers and farmers along the electrified routes.

Current status of Electrification of Railway Lines in India

By the time India gained independence in 1947, its railway network extended for more than 50,000 km. It has since grown to around 68,000 km, making it fourth largest railway network in the world. India’s railway network was for a long time being largely fuelled by coal and diesel. However, after the decision of increased emphasis on electrification, the share of electrified track has surged
in past 3-4 years rising from 24% in 2000 to 40% in 2017 and over 65% by the end of 2020.

The share of electricity in total energy use by Indian Railways has seen a corresponding increase, albeit at a more moderate pace. In recent years, there has been a renewed focus on transforming railways to make them a desirable option for long distance transport as well as urban public mobility, wherein Railway electrification has a big role to play. The phenomenal growth in Indian Railways electrified network over the year can be seen in the Fig 1:

**Fig 1. Growth of Electrified railway network in India in Five Year Period**

The total Broad Gauge network for electrification is 64,689 RKM. Out of which more than 42,600 RKM has already been completed i.e. more than 66% of railway lines are already electrified.

With the continuously increasing electrified network in India, there has been complete turnaround in share of GTKMs hauled by electric traction in recent past. For instance in Eastern Railway of India, the GTKMs hauled by electric traction during 2020-21 (upto Jan.) on freight are 85% and coaching 98% as compared to 58%
and 58% respectively during the same period of 2019-20. With enhanced electrics under wire, freight GTKMs on electric traction has increased by 40% upto Jan, 21 compared upto Jan,20 even when total Goods GTKMs hauled are less by 4% due to COVID-19. This has resulted in reduction in consumption of diesel fuel by about 76% i.e. approx. Rs 550 Crores upto Jan, 21 compared to Jan,20 which will result in saving of foreign exchange on import, besides reduced carbon footprints.

By March 22, major resource earning States for IR like Odisha, Madhya Pradesh, Chhattisgarh, Jharkhand, Himachal Pradesh, Haryana and Bihar shall be fully electrified.

Total Broad Gauge (BG) Route kilometer (RKM) Indian Railways (including Konkan Railway) is 64,689 RKM. As on 01.02.2020, 42,354 RKM have been electrified. Trend of Railway Electrification in last 12 years is given in Fig.2:

![Fig.2 Projects sanctioned & commissioned](image)
Zone and State wise status of electrification of Rail lines is shown in Fig.3:

**Fig.3a Electrified Network- Zone wise**
With the increased emphasis on electrification, allocation of funds for Electrification projects has been steadily increasing & in the recently announced budget highest ever allocation of 7,542 Cr has been made for Railway electrification projects during 2021-22 and highly remunerative projects are allocated funds importance and not zone wise. Budget for railway electrification work of recent past and current year is shown in Fig.4:

![Budget Allocation](image)

**Fig.4** Budget allocation over the years

Indian Railways have recorded an increase in electrification work of **371%** during the period of **2014-2020** as compared to **2009-2014**. Around 18,065 km of Railway routes have been electrified during these 6 years.

This has been made possible due to change in thinking over the years and there has been a change in the way we work, under the visionary leadership of Hon’ble PM.
Post 70+ years of independence, India has been able to add to railway network impressively but the extent of electrification trails, resulting in close to 66% of the entire Broad Gauge network length of country being electrified till now.

The advantage of 66% electrified network is that it accounts for 60% of passenger traffic and 67% of freight traffic for the Indian Railways at only 38% of the total fuel bill incurrence. Hence, the need for full electrification has been long felt and is regarded as a game-changer in pushing railways further to handle greater freight hauling requirement tune as well as passenger traffic with enhanced speed and lower operating costs.

In 2018-19 the Railways had consumed about 18 billion units of electricity and with 100 percent electrification and the rail traffic projected to grow, it is estimated that the Indian Railways would be consuming around 28-30 billion units of electricity for its traction requirement.

**Impact of Railway Electrification**

Government of India plans to fully electrify the balance 34% Broad Gauge network by December 2023

- Close to 30 billion units of electricity shall be required for railway electrification on annual basis by 2024 leading excellent opportunities for renewable power
- Direct power purchase agreements likely to go up with more solar & wind power installations coming up may supply directly for railways
- Overhead line equipment suppliers to gain massive opportunities to supply for the equipment like conductors, transformers & insulators etc.
- Sub-station capacity to enhance leading for opportunities for transmission & distribution utilities
• Engineering procurement and construction (EPC) contractors shall have multitude of opportunity in terms of infrastructure creation for railway electrification
• Opportunity for rolling stock companies shall be massive, electric locomotives shall gain pace
• Original Equipment Manufacture's (OEM) shall have greater opportunity coming their way in terms of equipment supplies & order
• With more & more sidings getting electrified, much faster loading, unloading is possible & thereby providing opportunities for siding owners to transport more & more goods through electric trains.

Innovative ways adapted to ramp up progress of electrification

a) Use of cylindrical mechanized foundation

The conventional type of OHE foundation requires enormous man power to perform excavation and is time consuming. To overcome such difficulties and improve foundation progress, cylindrical foundations with mechanised auguring is introduced in Southern part of the country which takes considerably lesser time.

b) Use of State of Art Automatic Wiring Train for Expeditious Completion of RE Work
Automatic Wiring Train used in RE work is capable of stringing both Catenary and Contact wire together to achieve desired tension in over head conductors. This has helped in wiring at a faster pace to achieve the set targets.

Way forward:

Indian Railways has embarked upon an ambition plan of electrification of its complete Broad Gauge network by 2023-24 which would not only result in a better fuel energy usage resulting in increased throughput, reduced fuel expenditure but also savings in precious foreign exchange. Planning to complete electrification of balance Broad Gauge railway routes is shown in Fig.5:

Fig.5 Planning for commissioning balance routes

Indian Railways have also planned to gradual shift towards green energy usage for traction and non-traction purpose, which would enable the country to be Net Zero Carbon emitter by the year 2030.
Acknowledgement of Achievements

“Hon’ble Prime Minister during Rail Vikas Shivir on 20.11.16 has emphasized for expediting Railway Electrification so as to reduce fuel bill, reduction in oil import bill of country, use of environmentally friendly technology for reducing carbon foot print.”

Source: Indian Energy outlook 2021