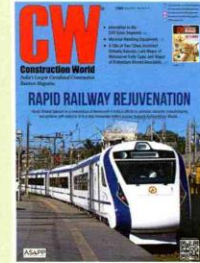


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TRAINS FOR TOMORROW

The rollout of Vande Bharat trains has now gathered pace after a relatively measured start. And to augment train building capacity, the need of the hour is to instil the right infra support.

Few nations are truly said to be characterised by their railway systems and India's recent history cannot be separated from the growth of its enormous rail system. Railways are one of India's most distinctive features, from the jam-packed commuter trains in Mumbai to the express mail trains that resemble a metropolis on wheels, and the latest entrant, the Vande Bharat trains. It is improbable that the nation would have grown into the economic superpower it is today without them. However, as the nation develops, there is a growing demand on railways to keep up with the times and provide speedier travel and more freight capacity to support India's developing industries.

The government has invested

35 per cent of GDP in infrastructure. And it is assumed that \$1.5 trillion is needed to get our infrastructure at the level of other superpowers. This goes hand-in-hand with the agenda of 'Make in India' as good infrastructure is said to be the backbone of manufacturing.

Comprising 126,510 km of track in total, the Indian Railways (IR) network is the fourth largest in the world, operating 19,000 trains every day and serving almost 8,000 stations. Further, over 12,700 locomotives are available to haul 76,000 passenger coaches and almost 3 million freight wagons.

A new era

The Vande Bharat trainset is a momentous achievement in India's

efforts to promote domestic manufacturing and achieve self-reliance. While there are challenges and limitations in realising the full potential, it is a step forward in India's journey towards Atmanirbhar Bharat.

The Vande Bharat Express, the erstwhile Train 18, was conceptualised, designed, engineered, and delivered by a group of engineers from Integral Coach Factory (ICF), Chennai, along with allied rail rolling stock stakeholders. It took just 18 months to build this world-class railway in India, a fraction of the time and money it would have taken



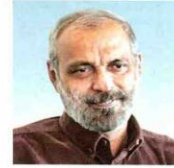
to do so elsewhere in the world. Instead of just being an organic continuation of the Railways' history of building trains, it opened the door for a completely new era in rail transportation.

Three years later, the storyline changed to one of hostility, team victimisation and general disappointment. Between 2019 and 2022, just two trains were put into service. However, a change came on August 15, 2021, when Prime Minister Narendra Modi announced that 75 Vande Bharat trains would travel the nation in 75 weeks.

The energy abruptly changed direction. The Finance Minister announced in the 2022 Budget that 400 Vande Bharat trains would be produced in three years and ICF once again got into action mode. Since then, 12 more Vande Bharat trains have been rolled out in

QUICK BYTES

- Indian Railways has been focussing on the rollout of 75 Vande Bharat trains by August 2023.
- The tender for manufacturing of 200 Vande Bharat sleeper trains is expected to be awarded soon.
- Consortium of BHEL and Titagarh Wagons has been awarded contract to build 80 sleeper Vande Bharat trains.



"The first priority should be to upgrade the infrastructure to accept 160 kmph

Vande Bharat trains."

- Sudhanshu Mani, Former General Manager, ICF Chennai



"With many rolling stock manufacturers in the country and companies ready to

supply diesel/CNG based propulsion systems, the whole project looks doable."

- Lalit Chandra Trivedi, Ex General Manager, Railways

operation across various routes. All these trains run at almost full capacity with favourable public response.

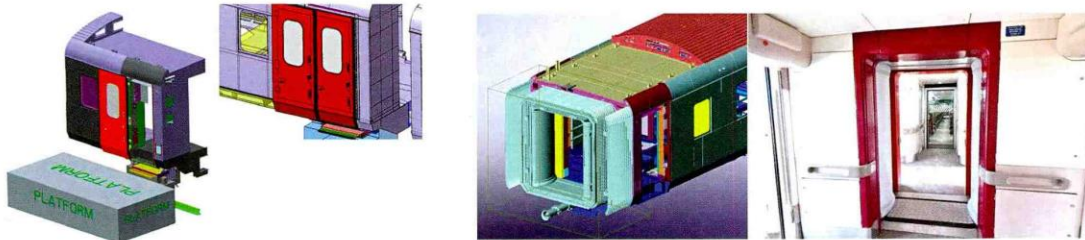
Full speed ahead

The Vande Bharat trains are extremely popular among commuters. With a top speed of 180 kmph and an operational speed of 130 kmph owing to safety concerns, these are the fastest trains in India. The debate over whether there should be so many trains without the necessary infrastructure has obscured the fact that they have fundamentally altered passenger transport. It is estimated that there will be 50 Vande Bharat trains by 2024, and 100 by 2025.

The goal of 200 trains by 2025-2026, and around 500 trains four years from now, is certainly achievable with committed



COVER STORY



Computerised 3D rendering of the sealed gangway of the Vande Bharat trainset during the designing stage.



“There is a need for higher speed and safety in passenger movement, which leads

to requirement of the locomotives with a higher tractive effort.”

- **Chirag Sethi**, Business Head,
Rail-traction & Power Solutions,
Delta Electronics India



“Over the past 75 years, India has leapfrogged from steam traction to Vande Bharat.

This transformational journey has helped India carve a unique identity.”

- **Manobendra Ghoshal**,
Chief Strategy Officer, RITES

planning, preparation and execution. ICF should have no trouble adding an additional 125 trains during this time. Furthermore, some sleeper trains might even push the number past 125 trains.

Russia's Transmashholding and Rail Vikas Nigam, and BHEL and

Existing routes of Vande Bharat trains

1. New Delhi - Varanasi Vande Bharat Express
2. New Delhi - Shri Mata Vaishno Devi Katra (J&K) Vande Bharat Express
3. Gandhinagar - Mumbai Vande Bharat Express
4. New Delhi - Amb Andaura in Himachal Pradesh Vande Bharat Express
5. Chennai - Mysuru Vande Bharat Express
6. Nagpur - Bilaspur Vande Bharat Express
7. Howrah - New Jalpaiguri Vande Bharat Express
8. Secunderabad - Visakhapatnam Vande Bharat Express
9. Mumbai - Solapur Vande Bharat Express
10. Mumbai - Shirdi Vande Bharat Express
11. Hazrat Nizamuddin - Rani Kamalapati Vande Bharat Express
12. Secunderabad - Tirupati Vande Bharat Express
13. Chennai - Coimbatore Vande Bharat Express
14. Ajmer-Delhi Cantt Vande Bharat Express

Upcoming Routes of Vande Bharat Trains

1. Patna-Ranchi Vande Bharat Express
2. Kannur to Thiruvananthapuram Vande Bharat Express
3. Bengaluru-Hyderabad Vande Bharat Express
4. Bengaluru-Hubballi-Dharwad Vande Bharat Express

Titagarh Wagons consortia have already received orders for the production of 120 and 80 Vande Bharat trains respectively.

Delivery will start in 2025-26 and be completed in the next four

years. The trains produced during the next five years will all come from the same generation as the first two, albeit many will be sleeper versions.

The newer form of 100 Vande Bharat replicas with aluminium bodies and 200 kmph capabilities are supposed to be produced in Sonipat. This needs to be decided upon quickly to elevate the Vande Bharat experience to the level of a truly world-class train. The technical bids for the project were opened some months ago.

The 500 Vande Bharat trains, all with the same look and feel, will be running across India in the next five years. That said, the infrastructure needed to support these trains would need to be developed soon.

“We should aim to make Vande Bharat a world-class train.”

- **Sudhanshu Mani**, Former General Manager, ICF Chennai

In an exclusive interview, **Sudhanshu Mani, Former General Manager, Integral Coach Factory (ICF)**, considered the force behind the development of the Vande Bharat trains, shares the journey of these iconic trains.

How did the idea of designing the Vande Bharat train germinate?

Being from a railway family, I used to admire the sleek, aesthetically superior and speedier trains from Germany and Japan and always wondered when India would have a train like that. Even when I joined the railways, this dream or angst was always in my mind. In 2016, when I was posted as GM at ICF in Chennai, I eventually had the power, authority and platform to do something about it. I was fortunate to have a team of competent engineers in designing and manufacturing who were also raring to go flat out and had the technical audacity to do something new. That is how the notion to conceptualise, design and manufacture such a train took shape. The idea was already there and as soon as I was able to get the right platform and opportunity, I was able to do something about it.

Can you take us through the various challenges faced initially?

We kept sending proposals to the Railway Board since 2016 but, somehow, they were not getting cleared for various reasons. Although the government has empowered the GMs to spend any



amount of money on projects they feel appropriate in the interest of the country, a sanction was needed from the Railway Board to design a new concept train that requires 180 km per hour (kmph) testing and 160 kmph for operations. Fortunately, the chairman of Railway Board knew me and I requested him to give us the sanction to manufacture two trains that would be manufactured at one-third the price. Eventually, after a lot of pleading and assurances, we managed to get the sanction.

Until then, whatever we manufactured came through a transfer of technology. Hence, for this high speed yet aesthetically superior train, there were doubts creeping in. I agreed to be the scapegoat in case we failed. But if we succeeded, everyone would bask in the glory for all their lives for giving to the country what it had been waiting for decades. That got the team excited and the mental barrier challenge was overcome.

All of us had to work hard and

burn the midnight oil. We took up the challenge to do what had never been done anywhere in the world – execute a train in just about 18 months. To remind everyone that the train would go out in calendar year 2018, we gave it the name ‘Train 18’. The rest was a story of hitches, glitches, synergy, disappointments and roadblocks; but, interestingly, there was a solution to every hurdle. The train lived up to its name by getting completed in exactly 18 months as we were able to turn it out in October 2018. There were other technical challenges but the team was good enough to find solutions. It is always important that teams work together without departmental feeling and, as the leader, I am proud to say I was able to inculcate that spirit in the team.

How was the funding sought and how was it utilised?

We estimated that we would make this train at ₹1 billion each. All we needed was ₹2 billion for the two pilot trains, which was sanctioned by the Railway Board. It was entirely up to us how to use that money. Even if we had exceeded the budget by ₹ 50 million, it would not have been a problem for the Railway Board. However, we were able to manufacture the train at ₹980 million each. So, the sanction was the issue; funding was never an issue.

How did the final design of the train evolve?

When you design something, you

have to keep certain applications and parameters in mind. We were making the country ready with a train capable of 160 kmph speed. At that time, there was only one stretch in the country, between Delhi and Bhopal, fit to run a 160 kmph train. The train that we designed was to be tested at 180 kmph and operated at about 160 kmph. And for that, a new design bogey was needed on which the coach would rest. This design capability did not exist anywhere else in the country, barring ICF Chennai.

The other important component for such a high-speed train is the propulsion system for which the Indian allied industry came of age. A company in Hyderabad could make these systems on a par with the world's best. Further, the exterior and interior aesthetics were also worked upon to give a finished product. Other than that, there were many new amenities that we had to give to passengers.

Some features like the brake system, sealed gangway, and automatic doors, came from the allied manufacturers. A first for India was the feature that the door would open only once the train stops; unless the door closes, the train would not start. The train also had a modern toilet with vacuum evacuation of the dirt matter. These were the design components that went into making the train.

What were the various rigours of testing through the manufacturing process?

As this was a new type of a train, the testing aspect was crucial. Every part of the design had to go through rigorous testing on software packages to check the ability to withstand stresses. The bogey had to be simulated and the entire train had to be run through a

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A first for India was the feature that the door of the train would open only once the train stops; unless the door closes, the train would not start.

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package to see that the ride index and the lateral forces that can derail a train were within limits. The aerodynamic profile of the train was tested to see if it met the initial air resistance reduction requirement.

Most key components and equipment were tested through simulation software. Once the equipment was manufactured, the prototype of all equipment went through rigorous testing. We made sure that none of the rigorous testing prescribed internationally was short-circuited. Our target was to turn out the train by August 2018 but certain equipment had to be tested rigorously.

Finally, when the train was assembled, it underwent a road worthiness test by RDSO. Testing

was done at 180 kmph speed. It was introduced into commercial service only after it came out with flying colours from all the testing rigours.

What factors made manufacturing these trains relatively cheaper than assumed? What is the cost of manufacturing one train?

The economy of scale of just two trainsets did not justify importing or engaging any manufacturer, as their minimum demand would be for at least 15-20 trains. We, as a railway unit, were ready to make two trains. The cost of the design work, components and fat technology fees were saved, as everything was managed inhouse by us.

We engaged the best manufacturers of the country at a relatively cheaper rate with the vision of being part of the revolution. All this resulted in the train being made at ₹980 million whereas if we had imported 15 trains of similar designation and looks, including the technology fee, the train would not have cost anything less than ₹2,250 million. To my understanding, the cost of each train has gone up to around ₹1,100 million today.



In the last Budget, the Finance Minister had announced 400 more Vande Bharat trains, which have been tendered out to be manufactured in railway premises by private builders.

COVER STORY

Can you elaborate on the technological and sustainability aspects of these trains?

As the regular 20-vehicle trains are replaced by 16-vehicle Vande Bharat trains, it makes them 15-20 per cent more energy-efficient. They have efficient regenerative braking, which means the energy consumed is produced in the traction motors during braking. The energy generated in these motors is fed back to the line. So, when the train is braking, it is actually working like a powerhouse, which also results in less energy consumption. These are the main contributors towards the train being greener than other trains of the Indian Railways.

What are the shortcomings of Vande Bharat trains that can be rectified in the future?

To quote Shakespeare, "A fool thinks he's a wise man, but a wise man knows himself to be a fool." There are people in high places who would say that a great train has been made and we have beaten the bullet train. We should realise what we have made and be proud of it; however, we should not be a prisoner of hype. We made a train that was near world class, but was not by any means so. In the first attempt itself, one cannot reach world-class levels. Having said that, in the next five to ten years, we should aim to make it a world-class train.

I started with the exterior and interior finish but it still does not match the best in the world and needs a lot of improvement. The real comparison of the finish should be with an aircraft to find the differences. It is linked with the manufacture of the structure itself. We should aim to work to a tolerance of 0.5 mm. We could not



A sneak peek into the driver's cabin of the iconic Vande Bharat trainset.

do it in the first two trains but those are the things we must work on so that the exterior and interior looks of the train match the world-class level. Unfortunately, it is not happening now.

Although higher numbers are being made, the trains are exactly the same as they were made earlier. Instead of too many numbers, we first need to focus on improving the quality. Broadly, I would not say anything is greatly missing. However, there were some fittings like the diffused light fitting that had many complaints and this needs to be addressed. We have to concentrate on improving the looks and finish of the train. As we are charging a higher fare, we owe it to passengers to give them a better experience, like an aircraft.

How many Vande Bharat trains have been manufactured till now and how many are on the bucket list for the next few years?

Our Prime Minister has been fashioning the train as a symbol of aspirational India. Soon, the railways realised that stopping this train won't work. Beginning August

2022, three years after the first train was rolled out, the railways started making one train per month; today, three trains are getting made per month. ICF has an order to make 100 trains over the next two years.

By 2025, we will witness 100 Vande Bharat trains from ICF running across the country. Further, in the last Budget, the Finance Minister had announced 400 more Vande Bharat trains, which have been tendered out to be manufactured in railway premises by private builders. In the next decade, I would not be surprised if we have 700-800 trains rolling out, thus changing the face of the nation.

However, the first priority should be to upgrade the infrastructure to accept 160 kmph trains. Also, the Ministry should concentrate on making the sleeper version instead of focusing too much on short distances. ICF is quite capable of making these versions. We do not have that much patronage for day trains. We have to make sleeper trains to run between cities at night to increase patronage.

COVER STORY TRAINS FOR TOMORROW

The rollout of Vande Bharat trains has now gathered pace after a relatively measured start.

**Interview: Sudhanshu Mani,
Former General Manager,
ICF Chennai**

"We should aim to make Vande Bharat a world-class train."

Mission Possible?

The ambitious order of 90,000 wagons by 2025 is highly dependent on manufacturing and import of cast iron wheel sets.



Sustainable Mobility

The railways have been the backbone of India, acting as the wheels of progress for the citizens and the economy.



Mission Possible?

The ambitious order of 90,000 wagons by 2025 is highly dependent on manufacturing and import of cast iron wheel sets.



With the opening of the freight corridors, the ambitious plan of Indian Railways (IR) calls for an addition of 90,000 wagons by 2025. This will have a significant positive impact on domestic wagon manufacturing and enhance the proportion of freight transportation through the railways.

Currently, India has the ability to produce between 30,000 and 40,000 wagons annually; however, this capability has typically been underutilised. This forceful move has generated a ton of orders for wagon manufacturers, which would

increase the entire capacity utilisation from a modest 40 per cent to roughly 70-80 per cent in the coming years.

Growing intensity

The government has astutely planned to purchase wagons in large quantities to take advantage of cost savings, while also giving wagon manufacturers better visibility into their revenue flow. Historically, IR has never declared orders for more than 10,000 wagons in a single fiscal. This massive order of 90,000

wagons has substantially boosted the prospects for the sector.

It is anticipated that somewhere around 25,000 and 40,000 wagons will be produced annually during the next three years. In the current fiscal year, the flow of orders from the private sector has significantly increased, and this substantial order has added to the opportunity. A modest intensity of pricing is predicted from wagon manufacturers given the strong order pipeline. However, given the current production capacity, it is still questionable whether wheels and

axles can be supplied in such a significant quantity within the allotted period.

Productivity boost

The average number of wagons purchased by IR annually throughout previous years ranged between 12,000 and 15,000. The National Rail Plan (NRP) predicts that, over the next 10 years, 28,000 to 32,000 wagons will be needed annually to handle planned freight loads. To boost the network's capacity and productivity over the next five years, the NRP plans to modernise the existing IR track network to support a 25 tonne axle load. However, the entire 90,000 wagon fleet purchased under the IR is of 22.9 tonne axle load. The introduction of such a huge number of low-capacity wagons will have a major long-term detrimental impact on the efficiency and productivity of the network given that a wagon has an operational life of 30-35 years.

According to **Lalit Chandra Trivedi, Ex General Manager, Railways**, "Railways, on an average, has been inducting 15,000-16,000 wagons into its fleet every year conventionally. The supply order of 90,000, over a period of three years, is basically doubling the historical annual supply. Most important, this is the first time that an order has a time duration of three years. This will help industry in planning inputs for manufacturing and commit resources for a longer term perspective, helping to bring down cost and improve quality."

IR planned to purchase these 90,000 wagons at a time when steel prices were at their highest point ever. The cost of wagons has increased solely as a result of rising steel prices. Notably, the price of a

wagon has increased from ₹3 million to almost ₹4 million.

Reality check

The massive wagon procurement plan has also become complicated owing to problems with the sourcing of wheel sets. The only supplier of wheel sets for wagons in India was the Rail Wheel Factory (RWF) in Bengaluru, owned by IR. IR permitted the import of wheel sets up until 2017, and 30-40 per cent originated from China.

However, as a result of the border issues in 2017, the government has banned all imports from China and ordered that wheel sets can only be bought from RWF. Another reason was to ensure that RWF's growing capacity was utilised to the best extent possible. However, it has allowed the private sector to import wheel

sets after the tender to acquire 90,000 wagons and authorised RWF to only supply wheels to the wagons it had purchased as RWF's capacity increased.

"The biggest bottleneck for all wagon manufacturers is currently the availability of wheels and axles from RWF, Bengaluru, whose capacity is limited and may not be able to fulfil the requirement to meet such a huge order," **Sanjiv Garg, Managing Director, Pipavav Railway Corporation**, says candidly.

"Further, imports from Ukraine and other European countries are not an option currently due to the ongoing war, leaving China as the only source. In fact, in the case of privately owned BLCS/BLSS wagons, the supply has been

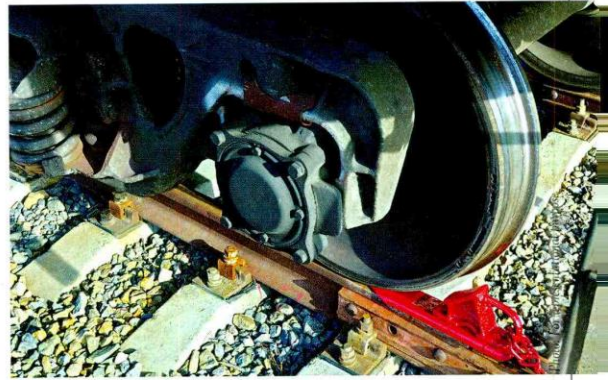


Sanjiv Garg,
Managing Director,
Pipavav Railway
Corporation



Railways have been inducting 15,000-16,000 wagons into its fleet every year.

COVER STORY



Industry players are trying to emerge with railway wagons and work around their manufacturing facilities.

severely affected during the last two years as RWF has not been able to produce wheels of 840 mm diameter. Only recently, since January 2023, a limited supply of 840 mm diameter wheels has been resumed from RWF, which has been exclusively reserved for internal use of wagon repair depots."

He continues, "However, the bigger challenge faced by IR will happen once the additional 90,000 wagons are inducted into the operational fleet (currently about 300,000 plus) and with the plan to generate capacity for their maintenance. Rolling stock maintenance is only done in-house departmentally, although rail users have been seeking at least part outsourcing to the private sector. Unless the private sector is roped in to assist in wagon maintenance, the utilisation of the additional wagon fleet will remain suboptimal."

Pricing effect

Owing to the price of steel and the supply and demand situation, the price difference for wheel sets has reached ₹400,000 per wagon. When the difference in imported wheel sets and the increase in the price of steel are added, the effect

on a wagon is almost to the tune of 35-40 per cent. Wagons have previously been leased by the Indian Railways Financial Corporation (IRFC), IR's financing section. Because it is a sovereign-backed institution, IRFC can obtain funds from the market at advantageous rates. Due to the recent increase in bond yields, which would impact the cost of borrowing for IRFC, this is also starting to become a restriction.

Because of the high asset prices and the increased cost of borrowing, the lease fees IR will pay IRFC for leasing the wagons will increase. The rising lease charges would increase IR's operating expenses even more. This could eventually lead to IR being forced to increase tariffs or haulage charges, which would harm not just the competitiveness of rail transport and IR's primary goal of increasing modal share but also the government's efforts to reduce the cost of logistics for the manufacturing and agricultural sectors.

For his part, Vivek Lohia, Managing Director, Jupiter Wagons, says, "The government has been promoting private entrepreneurs, investors and enterprises to join hands with

multi-facility and multi-engineering skills.

The private sector will be clear on how much they will require to alter, and the kind of resources needed to bring in the necessary developments to the supply chain.

This can be seen across the industry worldwide, including companies in India. Industry players

are trying to emerge with railway wagons and work around their manufacturing facilities.

Jupiter Wagons is actively considering fructifying the Make in India scheme by promoting and actually effecting manufacture of rail-wheel sets in India with both foreign and domestic companies."

Over the next three years, IR expects to buy roughly 90,000 wagons and 400 Vande Bharat trains in addition to the 7,000 LHB coaches that would be purchased in the current fiscal.



Vivek Lohia,
Managing Director,
Jupiter Wagons

COVER STORY

Sustainable Mobility

The railways have been the backbone of India, acting as the wheels of progress for the citizens and the economy.

The capacity expansion of current rail infrastructure and development of new infrastructure present a variety of opportunities and constraints. Increasingly, the Indian rail industry has to develop indigenous technology and innovative potential to produce smart solutions for safety, security, connection, seamless operation and sustainability to address the many difficulties that lie ahead.

One such effort to increase train safety is the automatic train protection system, Kavach, developed exclusively by the Indian Railways (IR). Additionally, IR is one of the few railway systems worldwide that has pledged to achieve net-zero carbon emissions by 2030. This is a bold move towards creating an effective, self-sufficient, economical and modern carrier of passengers and freight services providers to meet the expanding needs of the new India.

IR's objectives

- 100 per cent electrification.
- Increase in freight share to 45 per cent.
- Net-zero carbon emission.
- Improvement of haulage capacity.

"There is a need for higher speed and safety, both in freight and passenger movement," affirms **Chirag Sethi, Business Head, Rail-Traction and Power Solutions, Delta Electronics India**. "This is leading to the requirement for locomotives with a higher tractive effort and modern signalling equipment and systems like train collision avoidance systems, crew voice and video recording systems, and so on. The second key focus seems to be on providing modern

amenities for customers, which include station modernisation initiatives, providing services like Wi-Fi, passenger information systems, ticketing systems, CCTV and safety systems. The third trend and focus is towards energy-efficient solutions to achieve the goal of net zero."

Getting electrified

The target of 100 per cent electrification may or may not be achieved, and is also not critical as it will have minimal impact on the overall operational efficiency of IR. This is primarily because IR will be forced to continue to operate diesel locomotives under wire for at least the next five years, owing to non-availability of an adequate number of electric locomotives and concomitant maintenance facilities throughout the network. Moreover, the codal life of existing diesel locomotives



Photo: For representational purpose



COVER STORY

will not be completed so soon and IR will have to willy-nilly continue to operate them for lack of any other use, as condemning such a large number of diesel locomotives much before completion of their codal life would be terribly expensive, despite the high price of imported fossil fuel used by them.

"The newly established diesel loco factory at Marhowrah in Bihar is a JV of GE Transportation of the US with IR for the production of 1,000 high-power freight locomotives over a period of 10 years designed to run on Indian railway tracks," points out **Sanjiv Garg, Managing Director, Pipavav Railway Corporation**. "The company is also setting up two maintenance depots at Gandhidham in Gujarat and Roza in Uttar Pradesh. What will happen to these high-technology newly produced diesel locomotives (committed for purchase of 1,000 locos by IR in the next 10 years), is not clear to anyone."

That said, electrification is the way ahead and is an area where IR has performed well. "It has significantly brought down the cost of energy required for moving trains, besides bringing down the dependence of country on HSD oil, which needs to be imported," observes **Lalit Chandra Trivedi, Ex General Manager, Railways**. "Further benefits will accrue in the future when the Indian electricity grid is supported by renewable sources of energy. Electric traction has also enabled induction of high horsepower locomotives, which can haul heavier trains at higher speeds in graded sections."

Smart moves

While the moment is right to invest in IR's entire digital and

Electrification update

- IR electrified 58,812 route km (rkm) till March 31, 2023, which is about 90 per cent of the total broad-gauge network (65,300 rkm).
- Of a total of 58,812 rkm, the Central Organisation for Railway Electrification (CORE) has carried out electrification work of 45,912 rkm, which is roughly 78 per cent of the electrification work of the entire IR.
- CORE, along with other organisations, has planned to electrify the entire broad-gauge network routes of IR by December 2023.
- The pace of electrification has gathered momentum in the last few years; since 2014, a record 37,011 rkm has been electrified against electrification of 3,874 rkm from 2007-14.
- Remarkably, of the total 58,812 rkm electrified so far on a pan-India basis, 50 per cent has been electrified during the past five years.

infrastructure transformation, it is equally crucial to automate the process and make technology a central component of delivery.

Sharing his views on strategies to be adopted by industry for reliable and efficient power supply, Sethi says, "We see the railways being receptive to adoption of the latest technologies. This has also encouraged industry to bring state-of-the-art technology for deployment in railway infrastructure. Design and project management consultants with international experience and expertise working with mainline and metro operators also guide and share best practices and the latest technologies for adoption in India. This has given an opportunity to a company like Delta Electronics to bring in its global technology and manufacture and offer the same locally in India. We have a strong presence in the Indian rail infrastructure market, offering our solutions for automation, video walls, power quality, UPS and EV charging solutions."

Intelligent system

It is getting simpler to overcome obstacles as the railway network

becomes more digitalised. In terms of production, design, network effectiveness, punctuality, infrastructure, services, customer experience, safety and maintenance, digital technology has improved IR's operations. Further, the government has pushed for the creation of novel technologies, goods and technical solutions through incentivising and supporting entrepreneurs and innovators. While IR still has some obstacles to overcome before achieving the total transformation it seeks, the movement made thus far is encouraging.

"One of the main benefits of intelligent transport systems is their ability to utilise real-time data to optimise operations," says Sethi. "By using sensors and other monitoring technologies, these systems can collect and analyse data on traffic patterns, weather conditions and other factors that impact transportation. This data can then be used to make more informed decisions about routing, scheduling and other aspects of transportation management, leading to reduced congestion and improved travel times," concludes Sethi.