Indian Railways

Lifeline to the nation...

सत्यमेव जयते

Traction Directorate, Railway Board

04th Sept.'18

Responsibilities of Traction Directorate

- **Electrification** of Railway Lines
- **Operation and Maintenance** of Electric and Diesel Locomotives
- **Manufacturing** of Locomotives
- Operation and Maintenance of Traction **Overhead Equipment**
- Electrical **Energy Management**

Achievements

- **Highest ever electrification** of **4087 Rkm** during 2017-’18, more than 3 times the average electrification done during previous five years.

- Introduction of 12000HP Electric Locomotives and 4500HP Diesel Locomotives– one of the highest power locomotives globally

- **Highest ever in house Electric Loco production of 377** during 2017-’18 (CLW-350; DLW-25; DMW-2)

- **Up-gradation** of **speed potential** of our existing WAP_5 locomotive from **160 kmph to 200 kmph**.

Achievements Contd..

- **100% LED lighting** provided at all Railway Stations.
- **371 Lifts and 496 escalators** have been provided so far. Target for 2018-’19: Lifts-277; Escalators-298.
- Reduction in cost of OHE with optimised design.
- **Mechanised erection** of OHE.
- **Reduction in production cost of WAG9 locomotive by around 10%**, from 11 Cr to 10 Cr per loco.
- Commissioning of **high rise OHE** to enable running of double stack container trains.

New Initiatives

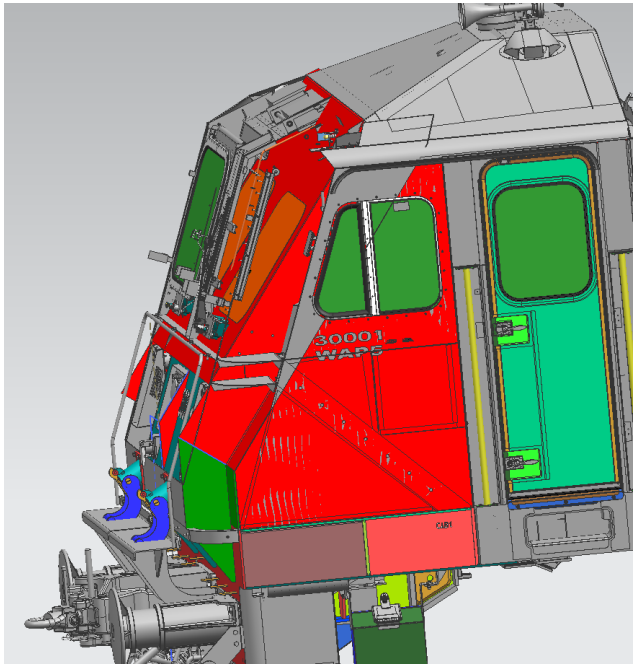
- **Up-gradation** of existing Electric locomotives from **6000 HP** to **9000 HP**.
- **Conversion** of Diesel locomotives to Electric Locomotives – *First such initiative undertaken globally*
- Development of **Shunting locomotives** operating on **Battery**, 25kV traction and Diesel Engine for battery charging.
- Operation of trains in **Push Pull Mode** with locomotives in front and rear.

New Initiatives Contd..

- Upgradation of WAP5 loco from 5400 HP to 6000 HP.
- Upgradation of speed potential of WAP7 loco from 140 kmph to 160 kmph.
- EP Assist brake system in 3-phase locomotives.
- Provision of Hotel load converter.
- Provision of **Regenerative braking feature in WAG7** locomotives *(Cost saving: around Rs.24.6 lakhs per loco per year).*
- Distributed Power Wireless Control System

New Initiatives Contd..

Aerodynamic re-profiling of CAB

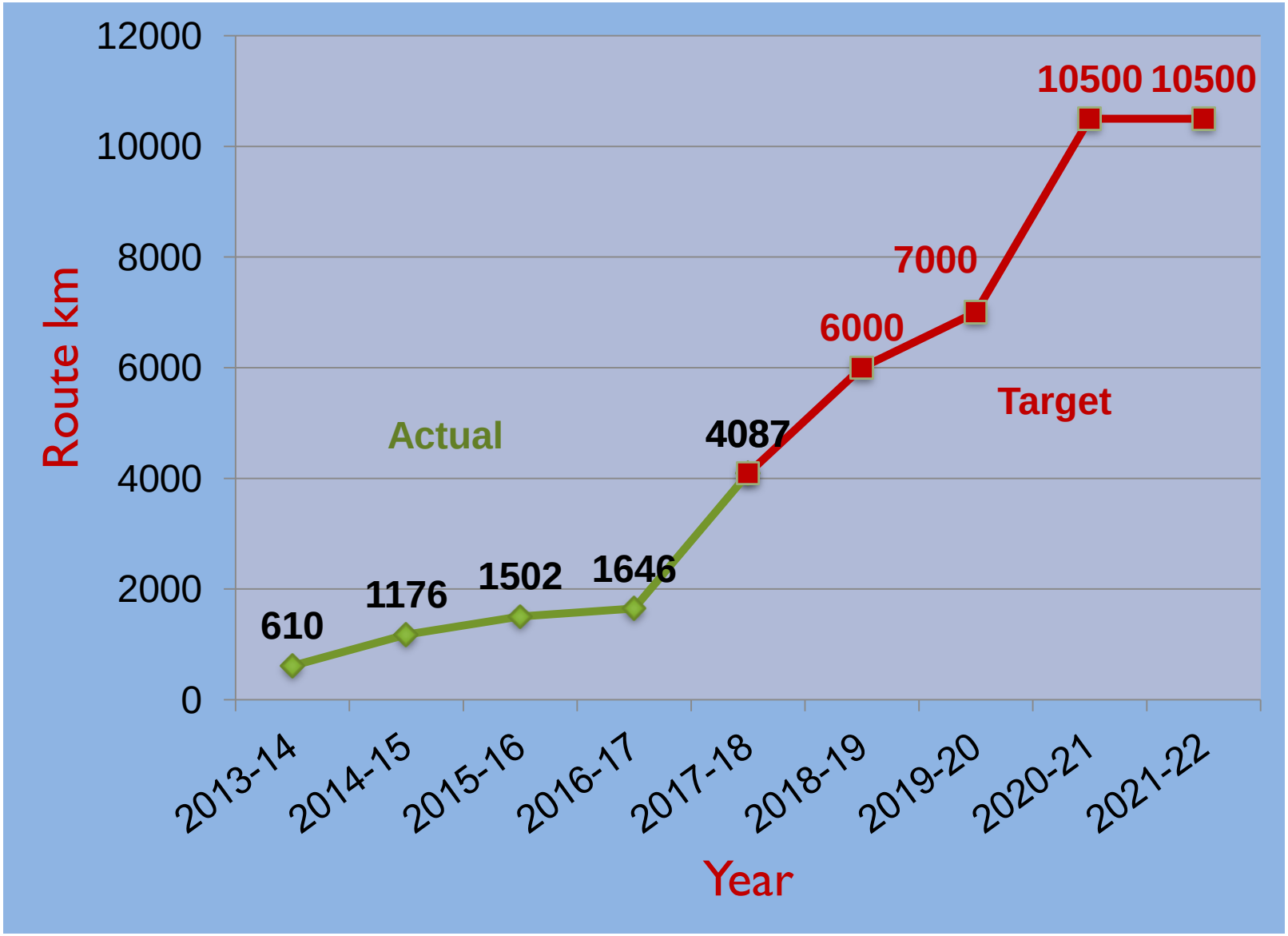


Railway Electrification- At a Glance

Electric Traction, huge economic benefits to IR

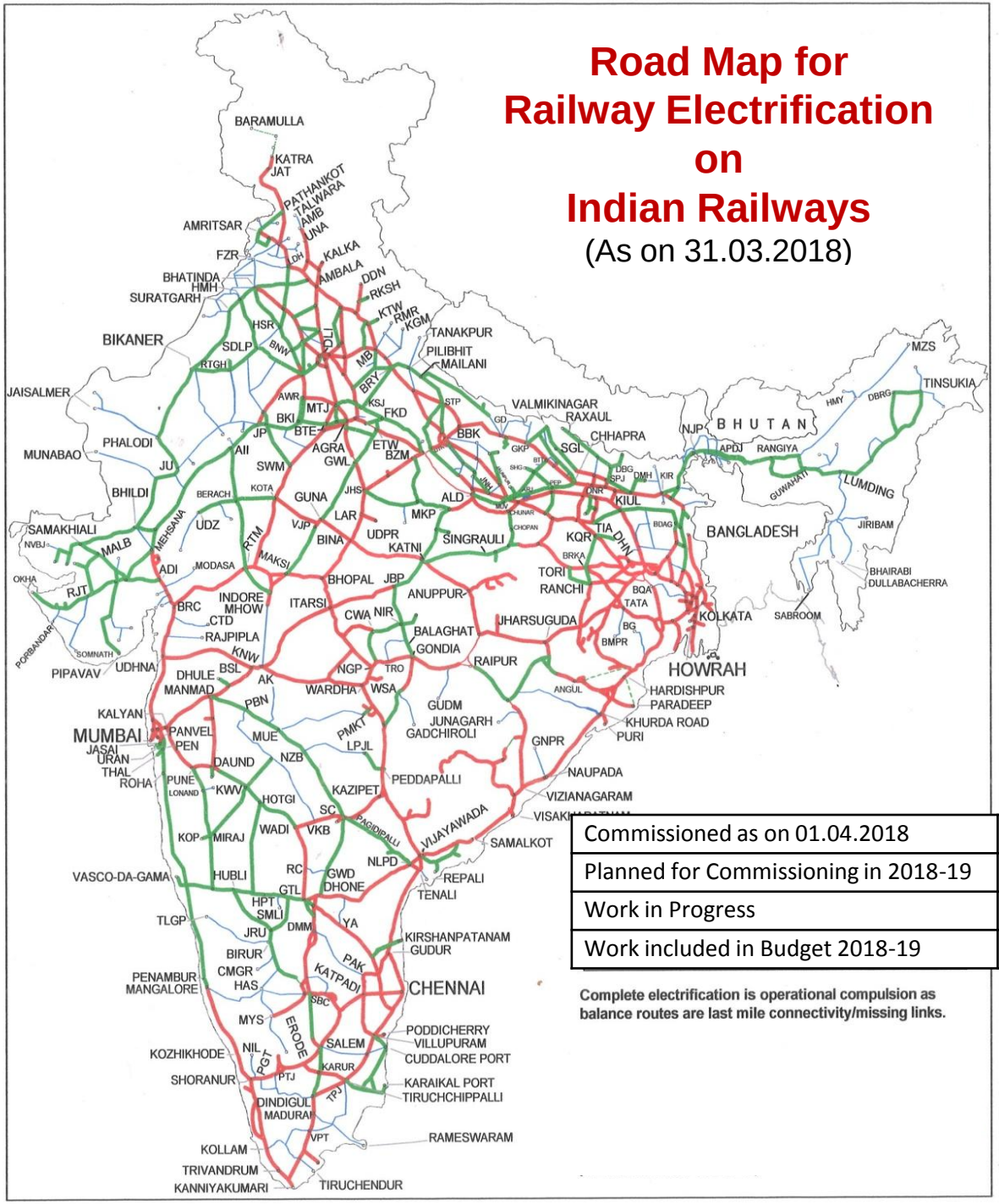
- **65.1% of total freight traffic** hauled by Electric Traction
- **54.3% of total passenger traffic** hauled by Electric Traction
- Electric Traction accounts for just **37% of IR's total Fuel Expenses** (*Total- Rs.27,000 cr., Electric- Rs.10,000 cr.)*
- **48.98% of the IR's BG Network** (*61,680 rkm*) is electrified (30,212 *rkm*)

Commissioning of RE Projects



Road Map for Railway Electrification on Indian Railways

(As on 31.03.2018)



Section Electrified

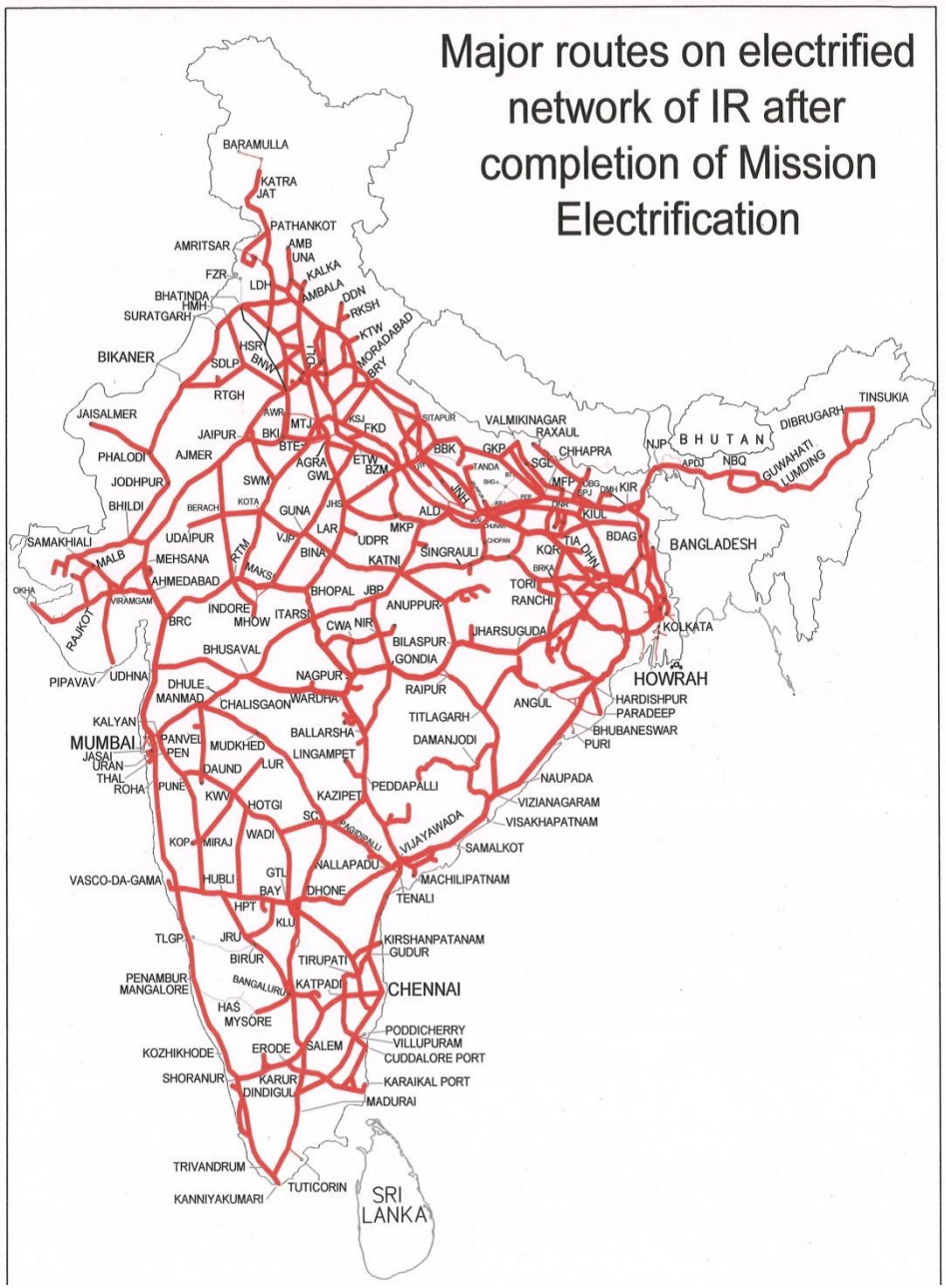
Work in Progress

Sections included in Pink Book 2018-19 (Pending Approval)

Commissioned as on 01.04.2018	30,212 Rkm
Planned for Commissioning in 2018-19	6,000 Rkm
Work in Progress	14,260 Rkm
Work included in Budget 2018-19	13,675 Rkm

Complete electrification is operational compulsion as balance routes are last mile connectivity/missing links.

Target for Electrification by Apr.'22



Plan to Achieve Target for Electrification

- **Increase the execution** capacity from existing 4000 Rkm per annum to 10500 Rkm per annum
- **Policy initiatives** for faster execution of projects and for reduction in cost of electrification.
- **EPC mode** of contracting is likely to ensure,
  - **Timely completion** at **determinate cost**
  - Efficient contract execution
- Accordingly, EPC Mode of Contracting has been adopted for large Electrification Projects.

Electric Locos in IR

<5000 HP	5000 HP	5400 HP	6000 HP	12000 HP
WAG_5, WAM_4 & others	WAP_4, WAG_7	WAP_5	WAG_{9H}, WAP_7	WAG_{12}

Total Electric Locomotive Holding as on 1st Apr.'18 = 5716

WAM_4

WAP_4

WAP_5

WAG_5(BHEL)

WAG_7

$WAGC_3$

WAG_{11}

Diesel Locomotives on IR

Total Diesel Locomotive Holding as on 1st Apr.'18 = 6076

Service	Type	Capacity (HP)	Class	Holding
Passenger	ALCO	2600-3100	WDP1 & WDP3A	100
	HHP	4000-4500	WDP4, WDP4B & WDP4D	644
Mixed		2600–3600	WDM2, WDM3A, WDM3D & WDM3F	1917
Freight	ALCO	2600-3100	WDG3A	1137
	HHP	4000-4500-5500	WDG4B, WDG4D & WDG5	1703
Shunting		1350-1400	WDS6	362

HISTORY CREATED

New Innovations

Conversion of Diesel Loco into Electric loco

First-Ever in the History of traction application World-wide

Diesel to Electric Conversion- WAGC3

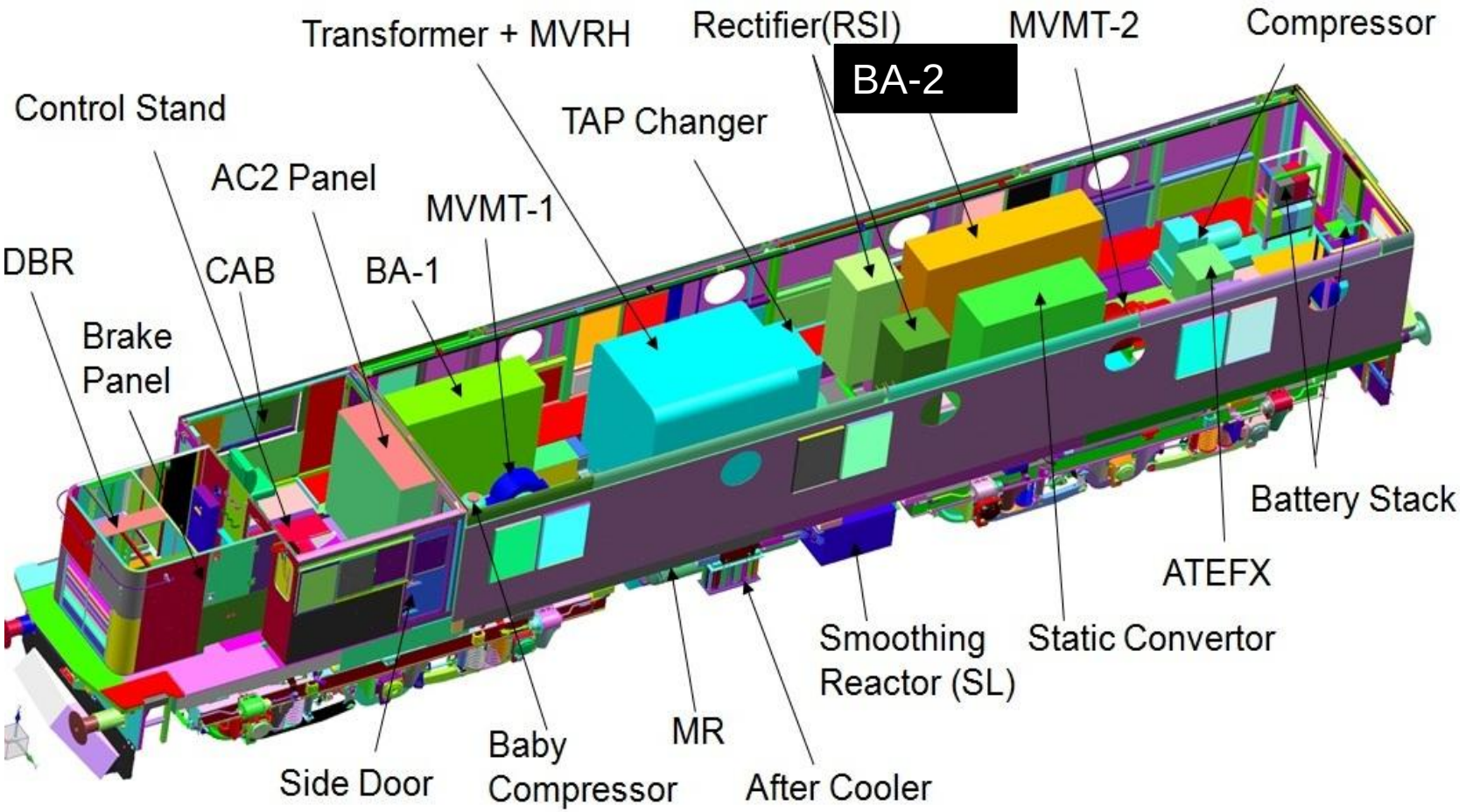
Two WDG3A Diesel Locos

Twin CO-CO WAGC3 Electric Loco

Salient Features of WAGC3 locomotive

Description	Parameters
Formation	Twin Loco
Weight (Ton)	123 x 2
Axle Load	20.5 T
Gear Ratio	18:74
Horse Power (HP)	5000x 2 = 10000 HP increased by 92% due to conversion
Max. Speed	105 KMPH (Under Trial)
Transformer	5400 KVA x 2
Traction Motor	Type 4907 BZ
Starting Tractive Effort	43 T x 2

Equipment Layout- WAGC3 locomotive



Diesel to Electric Conversion- WAG11

WDG4

WAG11

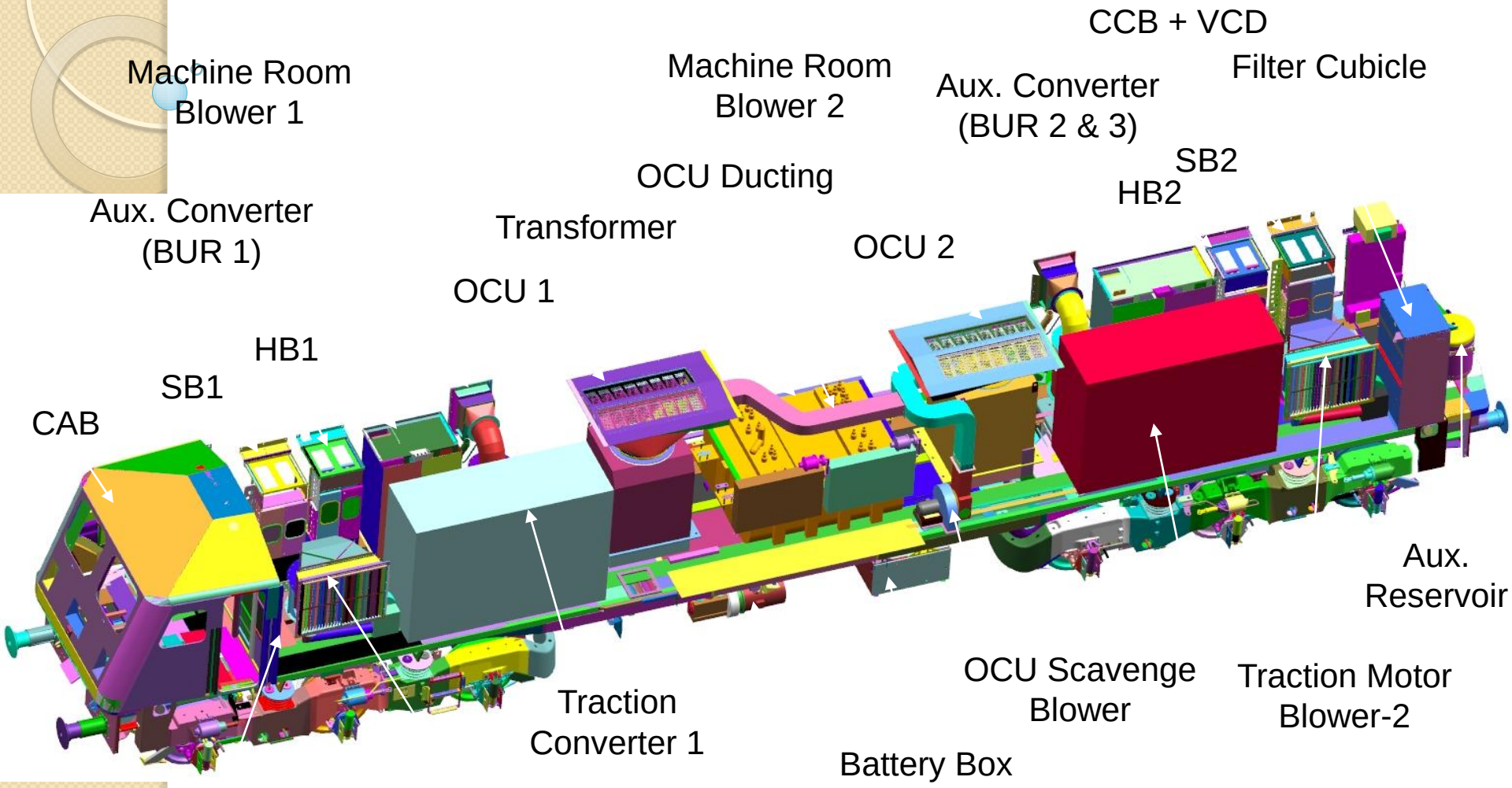
Salient Features of WAG11 Locomotive

SN	Description	Parameters
1	Type of Service	Freight
2	Axle Arrangement	Twin Co-Co
3	Horse power	2X6000 HP
4	Gear Ratio	17:90
5	Gauge	1676 mm
6	Length over Buffer	2X21244 mm
7	Overall width	3180 mm
8	Max. height with Pantograph locked	4255 mm
9	Wheel diameter (New/Worn)	1092 mm/1016 mm
10	Total weight	2X126 T

Salient Features of WAG11 Locomotive Contd..

SN	Description	Parameters
11	Power supply to Aux.1,2,3 Converter	415 V +/- 10%, 0 to 50 Hz
12	Battery voltage	110 V
13	Power supply to TM	2180 V
14	No. of power converters	2
15	Traction Motor	2X6 nos., 3-Phase Induction motor
16	Power of TM	1000 HP
17	Tractive Effort (Stall)	2X540 kN
18	Braking	Regenerative, Pneumatic
19	Braking effort	2X270 kN
20	Maximum speed	105 kmph

Equipment Layout- WAG11 locomotive



Locomotive Production- In house

In Nos.

Year	Elect Loco	Diesel Loco	Total
2014-15	250	266	516
2015-16	280	330	610
2016-17	294	332	626
2017-18	377	227	604
Target			
2018-19	603	107	710
2019-20	725	0	725
2020-21	725	0	725
2021-22	725	0	725

Maintenance of Electric locos

- Additional 2500 electric locomotives to be maintained by 2020.
- Electric locos will be maintained in identified Diesel loco sheds, **thereby eliminating need for additional homing sheds**.
- Necessary guidelines for requirement of infrastructure, machinery and plants have been issued for homing electric locos in diesel sheds.
- 128 Electric locomotives have already been homed at 08 DSL sheds

Madhepura Locomotive Project

- Long Term Procurement cum Maintenance Agreement entered into with MELPL (*JV company of MoR and Alstom*) in Nov.'15.
- **Scope:**
  - Setting up of Factory at Madhepura and two Depots at Saharanpur and Nagpur.
  - Supply of 800 nos of 12000HP locomotives over 11 year period.
  - Maintenance of 250 locomotives for 13 years
  - Maintenance Support of 250 locomotives for 4 years.
- **Status:**
  - First Stage of Factory Completed
  - Saharanpur Depot has been Operationalised
  - Prototype Locomotive undergoing tests and trails.
- Key Performance Indicators meeting global benchmarks for guaranteed operations.

Some Pictures of Madhepura Project

Locomotive

Factory Assembly Line

Saharanpur Depot

Saharanpur Depot

Marhowra Locomotive Project

- Long Term Procurement cum Maintenance Agreement entered into with GEDPL (*JV company of MoR and GE)* in Nov.'15

- **Scope:**
  - Setting up of Factory at Marhowra and two Depots at Roza and Gandhidham.
  - Supply of 700 nos of 4500HP and 300 nos of 6000HP capacity locomotives over 11 year period;
  - Maintenance of 250 locomotives for 9 years ;
  - Maintenance Support of 250 locomotives for 4 years.
  - 50 locomotives to be imported and next 50 locomotives to be assembled in India in the current year

- **Status:**
  - Factory under Construction, would be completed by Feb.'19
  - Roza depot has been operationalised
  - Prototype Locomotive undergoing tests and trails.

- Key Performance Indicators meeting global benchmarks for guaranteed operations.

Some Pictures of Marhowra Project

Locomotive


Factory


Roza Depot

Roza Depot

Energy Management- Initiatives to Improve Energy Efficiency

- Target for **20% reduction in non-traction energy** by 2020.
- **100% LED lighting** at all **Railway installations** by 31.12.18; 97.5% work completed.
- One time provision of LED lights in residential quarters
- 100% LED will reduce energy consumption by about 10% i.e., about 240 million units; **Saving of Rs.180 Cr. per annum**.
- Induction of 3- Phase Locos.
- Monitoring of regeneration by Loco pilots.
- Head on Generation leading to a **total saving** of around **Rs. 136 crore per annum** from 80 trains.

Traction Energy Cost- Open Access

Initiatives:

- Procurement of power under open access as Deemed Licensee.
- Medium/Long term contracts through open competitive bidding.
- Part procurement through captive and bilateral agreements.
- Explore Exchange power under short term.

Result:

- **Savings- More than Rs.7504 cr.** since Nov.'15.

Issue:

- Reluctance of some States to grant NOC.

Rationalization of Traction Energy Cost

- About **1100 MW** power flowing under **open access** in **ten states** (M.P, Maharashtra, Gujarat, Jharkhand, Haryana, Karnataka, Bihar, Delhi, UP & Rajasthan) and DVC area out of **total requirement** of about **2000 MW**.
- Power tied up- 2025 MW (ex-bus)
  - RGPPL (540 MW @ Rs.5.50)
  - BRBCL (900 MW @ Rs.5.50)
  - JIPTL (585 MW @ Rs.4.00)

Renewable Energy

- **Solar** Power generation of **1000 MW** by 2020-21.
  - 500 MW on rooftops.
  - 500 MW on land banks.
  - Planning completed for 750 MW.
  - 60 MW commissioned (57MW-Rooftop, 3MW-Land based)
- **Wind** Power generation of **200 MW** by 2020-21.
  - Planning completed for 107 MW.
  - 36.5 MW commissioned.
  - 16.5 MW would be commissioned by Dec.'18
  - 54 MW procurement process would be completed by June.'19
  - Balance under planning.
- Savings of more than Rs.3.0 per unit in non-traction power cost already resulting.

Outcome of the Initiatives

- By sourcing power under Open Access and use of 3-phase locomotives, **saving of Rs.41,000 cr.** is envisaged during the 10 year period, 2015-25.
- **Saving of around Rs.13,000 cr.** per annum is envisaged after the planned electrification of Railway lines.
- **Other Savings** envisaged include,
  - Adoption of LEDs- **Rs.180 cr.** per annum
  - Renewable Energy- **Rs.400 cr.** per annum
  - Open Access in Non-Traction areas- **Rs.500 cr.** per annum.

Conclusion

With all these initiatives, IR is thriving to provide **affordable**, **environment friendly** and **reliable transportation** to people of India using best in class technologies.

THANK YOU