Presentation to Kochi delegation

Barry HOWE

19th Jan 2016

ALSTOM
Designing fluidity

Alstom: A global leader in the rail industry

Four activities

TRAINS

SYSTEMS*

SERVICES

SIGNALLING

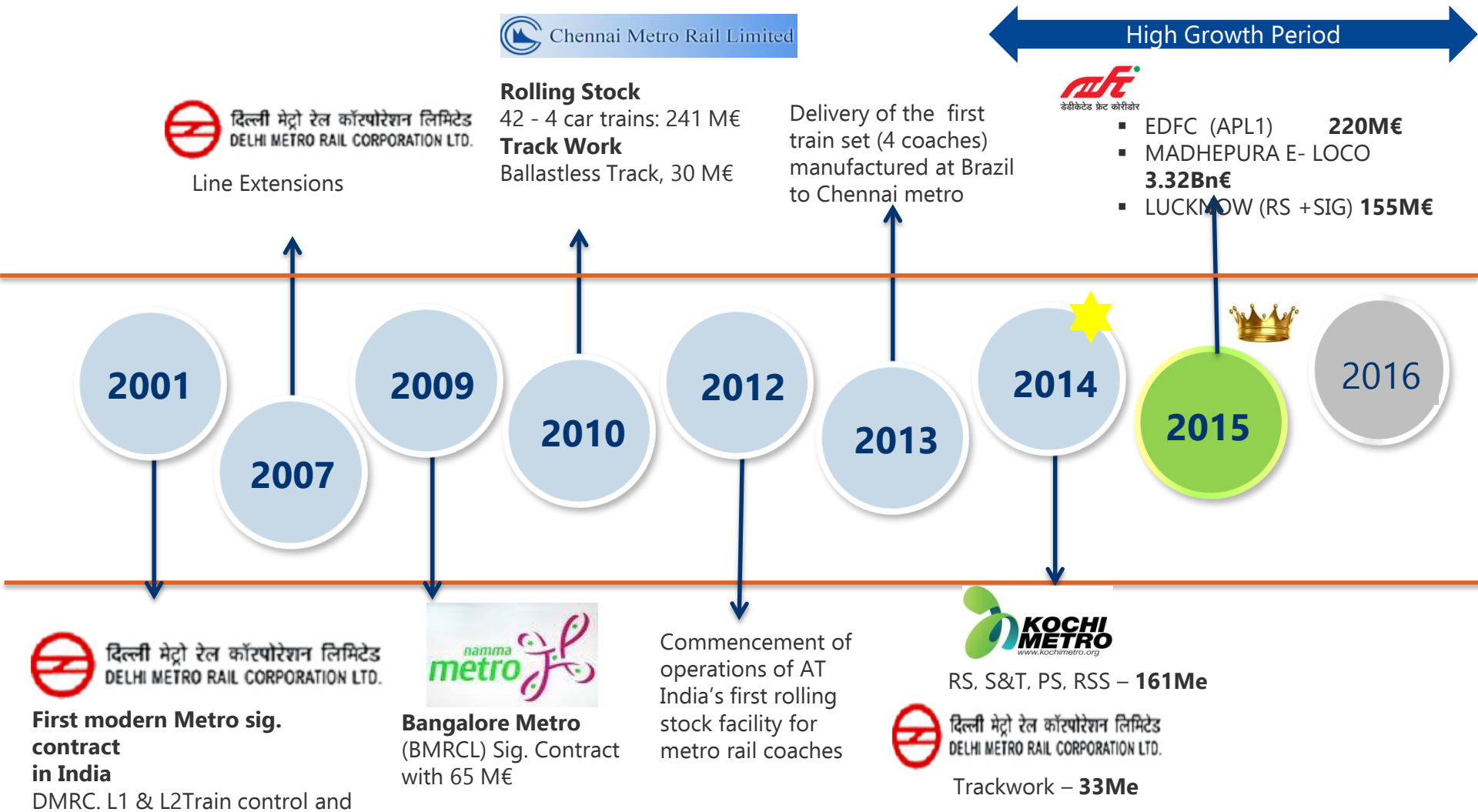
**Including Infrastructure*

ALSTOM

Agenda

- **India**
- Sustainability
- Smart Transportation

Alstom in India: The Journey So far



First modern Metro sig. contract in India
DMRC. L1 & L2Train control and Signalling System 43 M€ +

Line Extensions

Bangalore Metro
(BMRCL) Sig. Contract with 65 M€

Rolling Stock
42 - 4 car trains: 241 M€
Track Work
Ballastless Track, 30 M€

Commencement of operations of AT India's first rolling stock facility for metro rail coaches

Delivery of the first train set (4 coaches) manufactured at Brazil to Chennai metro

RS, S&T, PS, RSS – **161Me**

Trackwork – **33Me**

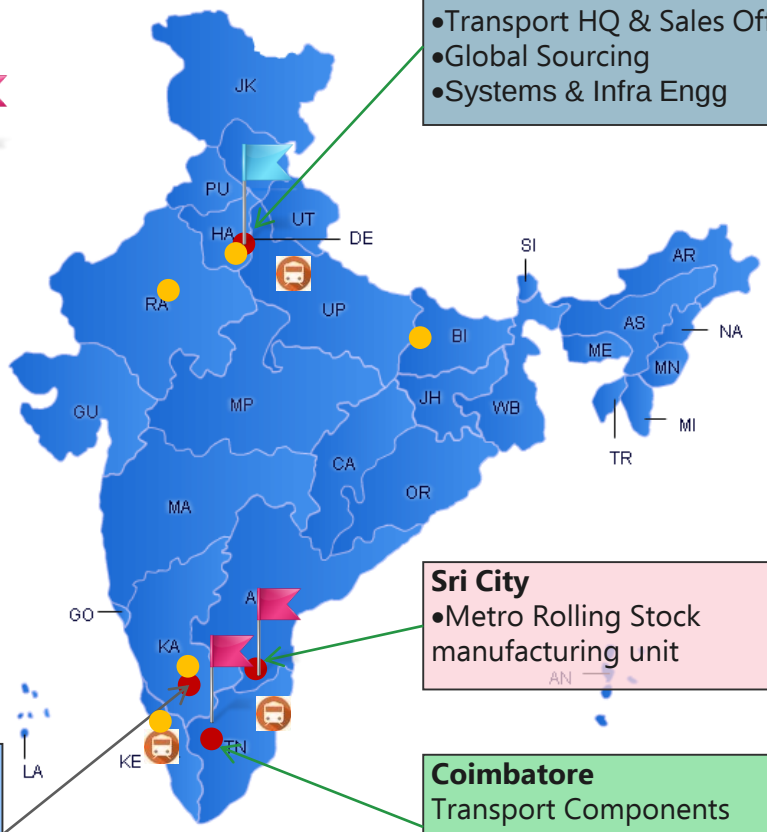
- EDFC (APL1) **220M€**
- MADHEPURA E- LOCO **3.32Bn€**
- LUCKNOW (RS +SIG) **155M€**

Presence in India

- ✓ More than 1600 Employees in India*
- ✓ **Corporate & Commercial Centre**: Noida
- ✓ **Manufacturing sites:** 2 (Sricity, Coimbatore)
- ✓ Systems Engineering & Product Development Centre, Transport Information Solutions (TIS) & Rolling Stock Engineering Centre: Bengaluru

RS Projects : Chennai Metro, Kochi Metro,Lucknow Metro

Other Project Offices : Delhi, Jaipur, Bangalore, Tundala



Delhi / NCR
- Transport HQ & Sales Office
- Global Sourcing
- Systems & Infra Engg

Sri City
- Metro Rolling Stock manufacturing unit

Coimbatore
Transport Components
- Traction Equipment
- Looming of wiring harness
- Audio Frequency Track Circuits and Point Machines

Bengaluru
Transport Information Systems [TIS] Site
- Systems design, Application Engineering
- Software Factory

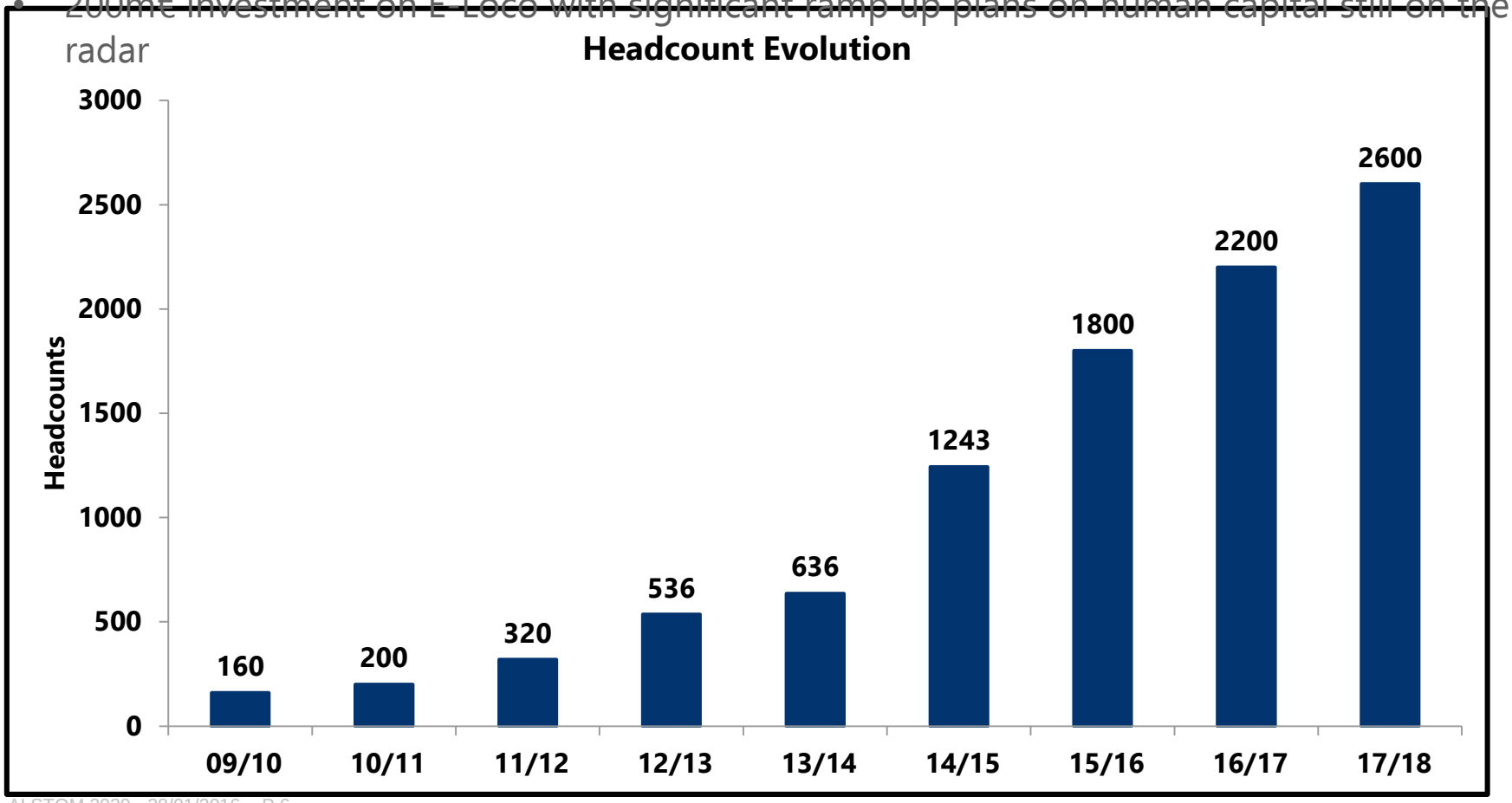
Rolling Stock Engineering Site

* More recruitment in progress

ALSTOM

India Headcount Evolution

- More than 50 m€ investment in India
- Investment in human capital & engineering capabilities bolstered to 1600+ engineering workforce
- 200m€ investment on E-Loco with significant ramp up plans on human capital still on the radar



Ongoing projects

● Project office

Urban Metro

Kochi (KMRL)

- Rolling Stock
- Signalling & Telecom
- Track & Power Supply

Chennai (CMRL)

- Rolling Stock
- Track & Power Supply

Bengalore (BMRC)

- Signalling

Kochi Metro highlights

- 1st Train delivery on 2nd Jan 2016, Before schedule delivery

Chennai Metro highlights

- 7 Trains in Revenue service
- 33 Trains delivered

North

Urban Metro

Delhi (DMRC)

- Signalling
- Track work
- Spares

Jaipur (JMRC)

- Signalling

Lucknow (LMRC)

- Rolling Stock
- Signalling

Mainlines

- EDFC – S&T, Infra
- E-Loco-Madhepura

ALSTOM

Current Contracts: in Brief

डेडीकेटेड फ्रेट कोरीडोर
Dedicates Freight Corridor Corporation of India

LUCKNOW METRO

CHENNAI METRO RAIL LIMITED

KOCHI METRO RAIL

E-loco

- Project Value: **3.32B€**
- Deliverables: **800 locomotive + Maintenance**
- Start Date:**Sep'15**
- End Date: **Jan 2029**
- Status: Contract Signed

EDFC

- Project Value:**220M€**
- Deliverables:**343 km Track work-Sig +PS**
- Start Date: **AUG 2015**
- End Date: **Dec 2018**
- Status: Contract Signed. Design Phase in progress

Lucknow Metro

- Project Value:**155M€**
- Deliverables: **20 Trains+22.87km CBTC SIG**
- Start Date: **2nd Sept 2015**
- End Date
- Status: Contract Awarded

Chennai Metro

- Project Value:**271m€**
- Deliverables:**42 Trains + Track works**
- Start Date: Sep'10
- End Date :Jun'16
- Status: **@10km in revenue service , 33 trains (9 Lapa,**

Kochi Metro

- Project Value:**161M€**
- Deliverables:**25Trains+CBTC Sig+Tel+750VDC third rail PS (in four separate contracts)**
- Start Date:**Oct'15**
- End Date :Dec'17
- Status:1st train delivered,, two

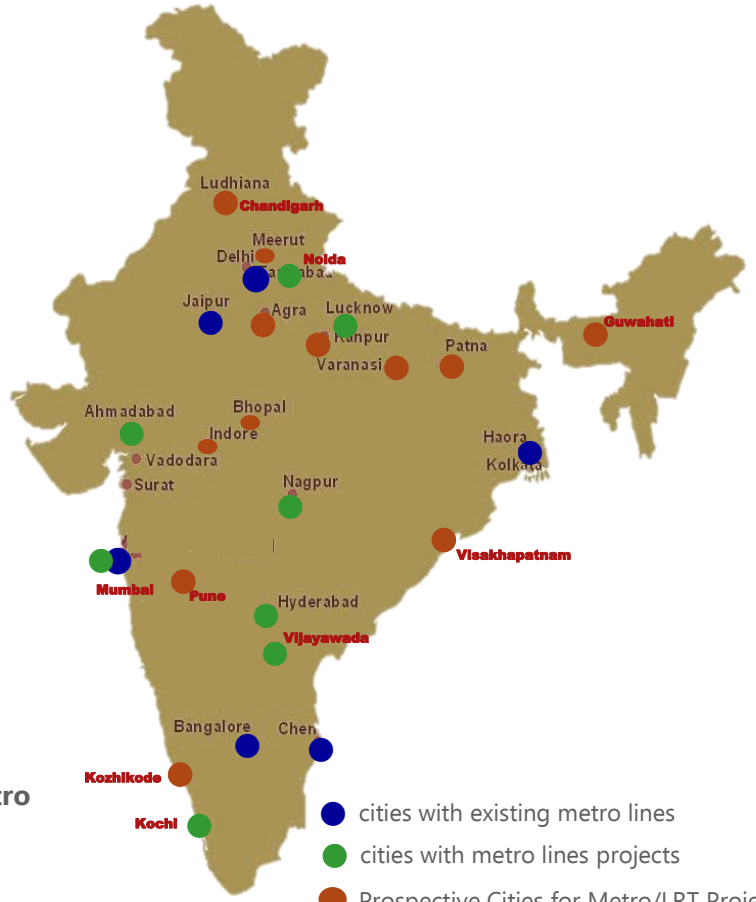
Need For Standardisation in Metro Projects

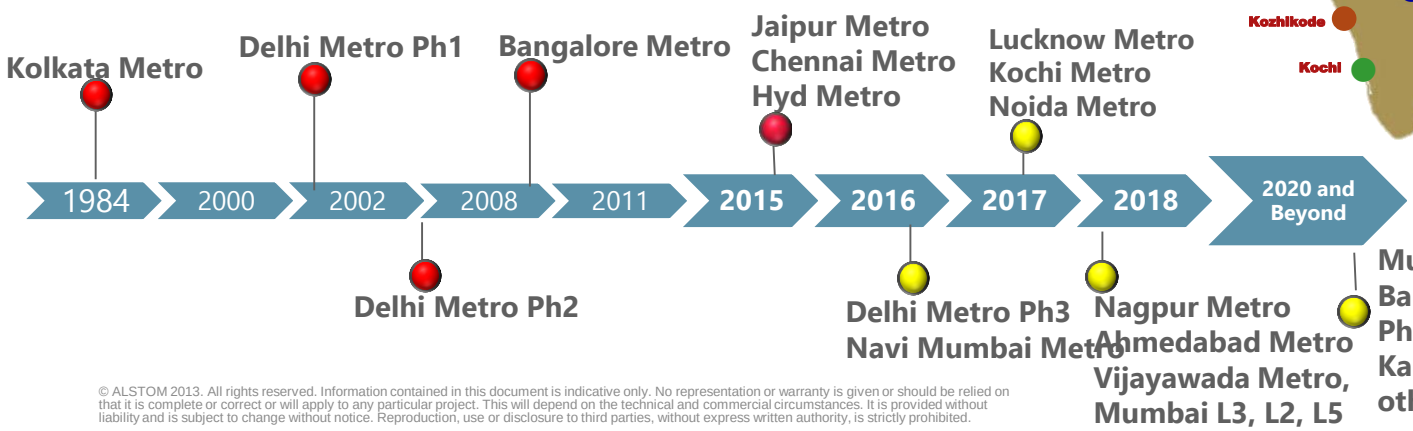
More Proj

ALSTOM

Metro and LRT rail network – the Indian scenario

- Delhi, Bangalore, Chennai, Jaipur, Mumbai & Kolkata already have operational metro lines. Construction is under way in Kochi, Lucknow, Noida more cities.
- **Massive investment to the tune of 1.3 trillion INR (17.5 Bn€) required**. Possible modes of funding:
  - 100% Central/State Govt. funded (eg: Kolkata metro N-S Line)
  - Combination of govt. funding and loans from multi-lateral agencies.(eg: DMRC)
  - PPP projects with VGF from State Govt (eg: Hyderabad).
  - 100% private (light metros like Rapid Rail Metro in Gurgaon)
- Global majors are setting up local manufacturing facilities to cater to the huge volume and prospects for future growth. Rolling stock is a case in point.





ALSTOM

Upcoming Metro Projects

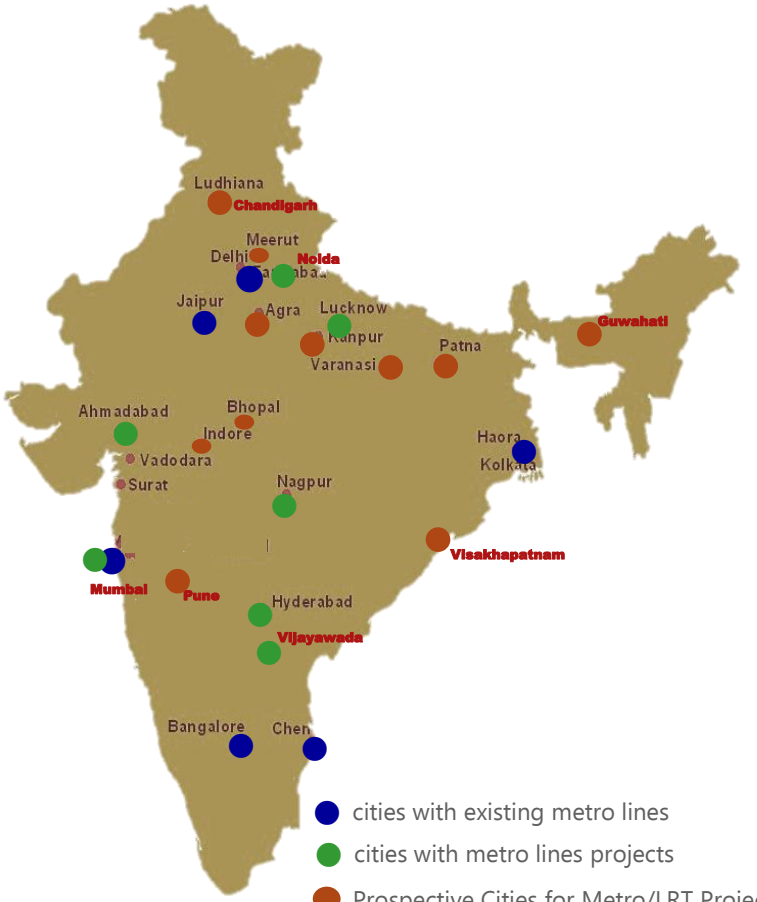
More than 25 prospective new cities has been identified with Urban Metro projects. **LRT /Trams** are going to be the next most preferred mode of Transportation that will address high volume traffic & clean energy solution simultaneously in Tier II cities

North India

- ✓ Delhi **Metro** | **LRT**
- • **Chandigarh LRT**
- • **Ludhiana LRT**
- • **Meerut LRT**
- • **Agra LRT**
- • **Kanpur LRT**
- • **Varanasi LRT**
- ✓ Lucknow **Metro**
- ✓ Greater Noida **Metro**
- ✓ Gurgaon **Metro**

West and Central India

- ✓ Mumbai **Metro**
- • **Nagpur Metro**
- • **Pune Metro**
- ✓ Ahmedabad **Metro**
- • **Bhopal LRT**
- • **Indore LRT**
- • **Raipur LRT**



East India

- ✓ Kolkata **Metro**
- • **Patna LRT**
- • **Guwahati LRT**
- • **Bhubaneshwar LRT**

South India

- ✓ Chennai **Metro**
- ✓ Bangalore **Metro**
- • **Kozhikode and Thiruvananthapuram LRT**
- • **Vishakhapatnam LRT**
- • **Vijayawada –Guntur LRT**
- • **Coimbatore LRT**
- • **Tirupati LRT**

ALSTOM

In search of the best combination for these promising cities:

Light Rail transport solution e.g. Axonis

- Elegant & Easy to insert in Cities
- Fast to design, build , integrate
- Economical to acquire and operate
- Available & non-proprietary
- Safe & Secure
- Low Energy consumption
- Tailor-made to each city's architecture thanks to Alstom Design & Styling expertise
- Civil works optimisation leading to up to 20% lower cost of construction
- Lowest LCC calculated amongst all modes over life span
- Narrower viaduct width, can be inserted on road median

Turnkey Projects

- Reduces its management and coordination team
- Transfers a maximum of risks to the contractor
- Negotiates with only one supplier
- Transfers the interface management to the contractor
- Transfers the global project performance & quality responsibility to the contractor
- Benefits from facilitated transverse innovations proposed by the contractor
- Benefits from a cost and delivery time optimization by the contractor

LRT/Tram systems can complement the urban growth of public transport in India in tier 1 and tier 2 cities with cost, planning and environmental benefits

French transport companies operating in India have the expertise to develop a **LRT/Tram** solution using their present knowledge of successfully building and/or operating public transport systems in **India**

ALSTOM

AXONIS –An integrated system on turnkey basis meets the specific transport needs of fast growing and densely populated cities

Civil Work
45 m minimum curve
Up to 6% slope
Viaduct (Tunnel possible)
Depot at grade
Test Track possible

Capacity
10000 to 45000 PPHPD

Rolling Stock
2 to 5 cars train configuration
Cars size : 18 m x 2,7 m
100% motorised
Front Evacuation Door
Max speed 80 kph

Power Supply
750 Vdc power supply
HESOP 2x1,2 MW or 2MW
Medium Voltage Network of 22KV

Signalling
GoA4 : UTO / U400
Driverless
70 s headway minimum
Centralised control center
Operation supervision
Communication network (Audio + Video)

Track
Slab or Plinth concrete
3rd rail 750Vdc
Underneath captation

Depot Equipments
Bogie wheel reprofiling
Cleaning Lifting
Shunting vehicle
Hydraulic & Electrical tooling ...

PSD
Full or Medium height

ILS
Spare parts for warranty
Specific Tooling for sub systems
Training / Documentation

Quick construction, easy urban insertion and improved life-cycle costs.

ALSTOM

TRAMWAYS- Advantages

- **Environment:** Eco friendly mode of transport

- **Safety:** Safer than Buses and Cars

- **Speed:** Average speed higher than Buses stuck in traffic

- **Effectiveness:** More reliable journey time

- **Regularity & continuity of service**

- **City embellishment:** Road upgrading works

ALSTOM

What India means to Alstom going forward (both as a market and as a base for export)

India - A very promising market

(To 2020 & Beyond)

Central & State government initiatives| Competitive Advantage | Understanding of the Market

AT Value proposition

ALSTOM has a strong footprint in India having two factories each at Coimbatore & Sricity for manufacturing propulsion systems and metro cars respectively. These were set up in 1968 & 2013 with a capital investment of over INR 300 crores. In addition, two innovation hubs - one for Signalling and one for Rolling Stock Engineering & Design - currently provide employment to over 1000 employees and are well equipped to cater to the immediate and long terms needs of Indian Railways & the Urban Metro market.

The upcoming opportunities in India and Alstom's investments & establishments offers immense opportunities for realizing the **"Make in India"** dream of the Hon'ble Prime Minister

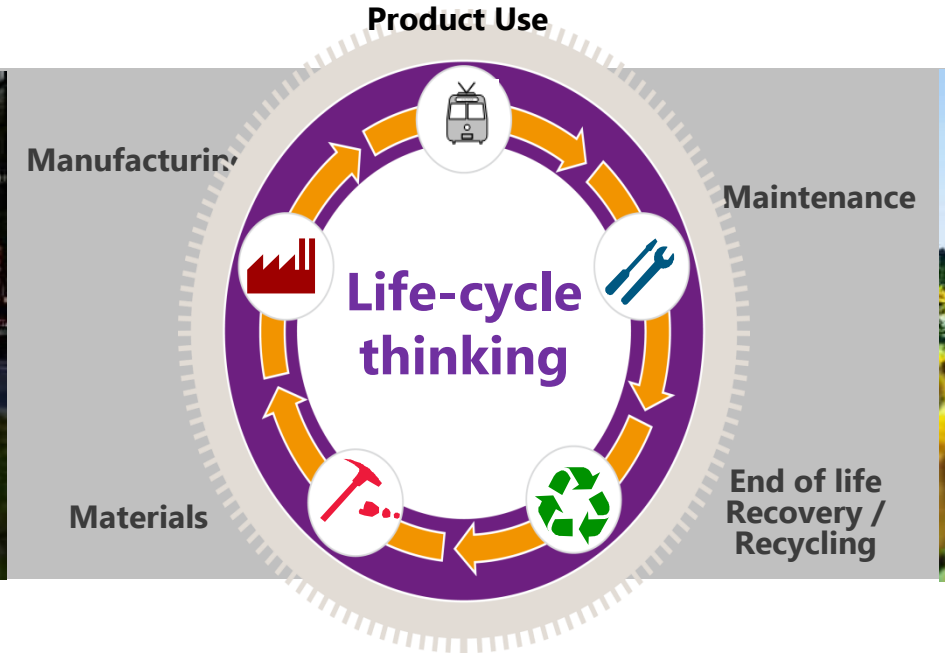
ALSTOM

Agenda

- India
- **Sustainability**
- Smart Transportation

Trains designed to reduce environmental impact and optimise lifecycle costs

5 Eco-design priorities				
Energy efficiency	Use of clean and recyclable materials	Noise reduction	Air emission reduction	Easy end-of life



- **A network of 100 experts** (eco-design, acoustics, materials, energy…)
- Eco-design **processes, lifecycle assessment** tools**, environmental product profiles**

ALSTOM

Rail offer true environment-friendly solutions

Less energy consumption

High-speed
& very high-speed trains

5 times less energy consumption
than planes per passenger*

Less CO_2 emissions

Metro

5 times less emissions than a bus, 7 times less than a car per passenger**

Less impact on landscape

Citadis tram

Full integration in urban landscape
Catenary-less solutions preserving historical

* In primary energy equivalent
** With an European energy mix and standard occupancy rates

TRANSPORT | ALSTOM

Alstom offering for energy efficiency and CO2 reduction

High environmental performance rolling-stock

- Weight Reduction
- Aerodynamics
- Insulation
- Efficient Traction & auxiliaries
- Hybrid Traction
- Braking energy recovery & storage
- Optimized cleaning modes

Energy Efficiency Services

- Energy Diagnosis
- Energy metering
- Eco-driving
- Re-tractioning & Retrofit for energy efficiency

Addressing existing fleets is key to rail's contribution in the fight against climate change

Smart Railway Systems

- Electrification
- Reversible electrical sub-stations for braking energy recovery
- Driverless metros & ATO

We also provide solutions to reduce air and noise emissions and improve

ALSTOM

Agenda

- India
- Sustainability
- **Smart Transportation**

Emergence of Smart is fuelled by changing customer behaviors, evolving market and global trends

Customer behaviours, market and mega trends

Customer & market trends

Enhanced interconnectedness

> People, vehicles and infrastructure are increasingly connected (e.g. by real-time data, smartphones)

Altered consumer behavior

> People use and share instead of own (share economy)

Soaring individuality

> Niche segments arise
> People strive for autonomy

Increasing convenience

> People face more time pressure, while increasing comfort expectations

Diminishing boundaries

> New players enter established markets
> Players increasingly tend to cooperate

Opportunities in Smart Transportation

Globalization | Urbanization and growth of megacities | Demographic change | Scarcity of resources and climate change | Technological progress

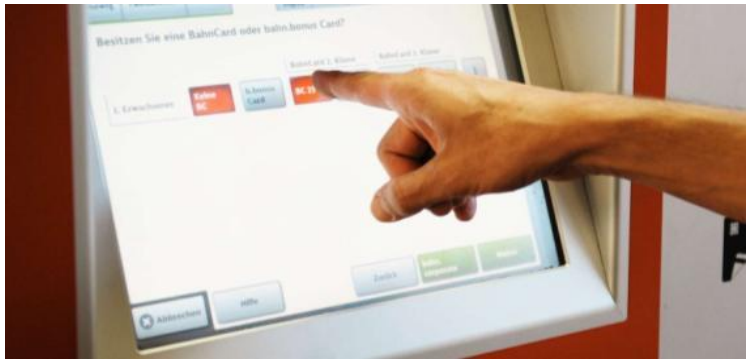
Global trends

Transportation is becoming Smarter

Traditional Transportation

- Conventional, rather asset-intensive transport modes and services
- Limited view on single element of travel chain – no focus on optimizing the entire customer journey
- Rather "passive administration" instead of disruptive or continuous improvement"

Smart Transportation



- Application of Information & Communications Technologies to the transport industry
- Attract people to use public transport (e.g. through reducing transport time)
- Decrease operation costs
- Intelligent combination of several transport modes and concepts with improved interfaces between modes
- Shifting paradigms towards sustainability and flexibility of service offering

THANK YOU

FOR YOUR ATTENTION

TRANSPORT | ALSTOM

Projects : Chennai Metro Rolling Limited

Rolling Stock

Scope: Design, manufacture, supply, testing and commissioning of 42X4 metro cars including training on operation and maintenance

Main features:

- Alstom Metropolis Metro Cars.
- Config: DMC+TC+TC+DMC
- 25 kV 3 phase AC IGBT traction ,Regenerative braking.
- Stainless steel car-body.,Max operating speed: 80 km/h

Track Work

Scope: Design and Construction of Track Work in Viaduct, Tunnel, Underground and Depot in Corridors 1 & 2 and supply of all materials including rails, sleepers, turnouts, fastenings etc.

Main features:

- Ballast-less Standard Gauge[1435 mm] track
- Total track length – 105 km(48 km elevated, 42 km UG and 15 km in depots)
- Mobile flash-butt welding, high attenuation sleepers
- 2 turnouts in line, 35 in depot.

ALSTOM

Projects : Delhi Metro Rail Corporation

Signalling Phase 1

Scope: Design, manufacture, supply, installation, testing and commissioning of train control and signaling systems for Lines 1 & 2 of Delhi Metro.

Main features:

- Total length of 33 km with 28 stations and 2 depots.
- Design headway of 120s (with ATP)
- URBALIS 200 solution for Automatic Train Control with ATP+ATO.
- ICONIS Automatic Train Supervision

Signalling Phase 2

Scope: Design, manufacture, supply, installation, testing and commissioning of train control and signaling systems for extension of Lines 1 & 2 of Delhi Metro .

Main features:

- Total length of 36.80 km with 27 stations and 1 depot:
- UG section:12 km, 10 stations - Elevated section: 27 km, 17 station
- URBALIS 200 solution for Automatic Train Control including ATO
- ICONIS Automatic Train Supervision

ALSTOM

Projects : Delhi Metro Rail Corporation

DMRC L7 Track works

Scope: Supply, Installation, Testing and commissioning of Ballastless Track of Standard Gauge, Part - 1 Corridor of Sections of Lajpat Nagar (Including) - Shiv Vihar (Line - 7) in elevated and underground sections along with Ballasted I Ballastless Tracks in Depot at Vinod Nagar of Delhi MRTS Project of Phase-III

Main features:

- manufacture & supply of materials (except Rails, Turnouts, Scissors X-over, Derailing Switches and special fastenings for turnouts, which shall be supplied by the Employer), verification, delivery, installation, testing, including integrated testing and commissioning, technical support, training of Employer's staff and documentation for a completesystem
- Track length 31 Km elevated and Underground from Lajpat Nagar (including) to Shiv Vihar.
- Depot and workshop facilities at Vinod Nagar Depot.
- 21 Stations.

ALSTOM

Project : Bangalore Metro - Signaling

Scope: Design, manufacture, supply, installation, testing and commissioning of an advanced train control and signalling system [Lines 1(E-W) and 2(N-S) of Bangalore Metro]

Main features:

- Total length of 42 km
- Headway of 120s(design) / 150s(operating)
- Design capacity of 40,000 pphpd
- URBALIS 200 solution for Automatic Train Control
- ICONIS Automatic Train Supervision
- 750 VDC 3rd rail
- 41 stations, 2 depots

Project : Jaipur Metro Signaling

Scope: Design, manufacture, supply, installation, testing and commissioning of train control and signaling systems at Jaipur for Jaipur Metro Rail Project

Main features:

- Total length of 9.7 km with 9 stations and 1 depot:
  - Underground section: 0.26 km, 1 stations
  - Elevated section: 9 km, 8 stations
- URBALIS 200 solution for Automatic Train Control including ATP+ATO.
- ICONIS Automatic Train Supervision

Back

Projects : Kochi Metro Rail Limited

Rolling Stock

Scope: Design, manufacture, supply, testing and commissioning of 25 standard gauge 3car trains with an option for 25 additional trains

Main features:

- 25 three-car trains ,Length: 66.5 m , Width: 2900 mm
- 975 passengers (8p./m 2),136 seating places
- Max axle load: 16TDesign Speed: 90 km/h
- Electrical braking down to 10 km/h

CBTC Sig & Tele

Scope: Design, manufacture, supply, installation, testing and commissioning of Urbalis 400 CBTC and of an integrated telecom solution comprising CCTV, Passenger Information, Passenger Announcement

Main features:

- Automatic Train Protection and Automatic Train Operation
- SMARTLOCK 400 Computer-based interlocking
- Point machines and signals, Axle Counter
- Automatic Train Supervision (ATS)
- Maintenance Support System (MSS)

Back

Projects : Kochi Metro Rail Limited

Power Supply System - 3rd Rail & Receiving Sub-Station

Scope: Design verification, engineering, manufacture, supply, installation, testing and commissioning of 750 vDC third rail traction electrification ,33kv/415v auxiliary substations, and associated MV, DC cabling & SCADA systems.

Main features:

- 110/33kV GIS (Gas Insulated Substation), receiving substations
- Auxiliary Main substation with 33kv/415V Dry Type Transformers
- 750V DC Third Rail Traction Electrification for Total 60 Track KM
- DC Traction Substation with 590-590V dry type rectifier transformer at selective locations & Depot and associated
- DC Switchgears and Cabling
- 33/0.415kV Auxiliary Substations at all the stations and Depot
- SCADA systems for control and Monitoring at OCC and BCC

Back

Projects : Lucknow Metro Rail Corporation

Rolling Stock + CBTC Signalling

Scope: DESIGN, MANUFACTURE, SUPPLY, TESTING, COMMISSIONING INCLUDING TRAINING OF 80 NO. STANDARD GAUGE CARS ELECTRICAL MULTIPLE UNITS (EMUS) & TRAIN CONTROL, SIGNALLING SYSTEMS (Communication based train control and signaling system (CBTC)

Main features:

- 4 car configuration (DTC-MC-MC-DTC) later expandable to 6 car (DTC-MC-TC-MC-MC-DTC)
- Acceleration : 1.2 m/s^2 (with 50% motorization)
- 16T Axle load (EL@8p/m2 : 340 pax)
- Max. Design Speed : 95 kmph
- Headway - 90 sec (design), 100 sec (operational)
- Stopping Accuracy: ±300 mm for 99.98% of station stops
- Wrong side failure: less than 10-9 per train operating hour for complete system
- SIL: SIL4 for Primary detection, ATP, IXL, Secondary Train detection

Projects : Dedicated Freight Corridor Corporation

डेडीकेटेड फ्रेट कोरीडोर

Back

Electrification , Signalling & Telecom and Building Works

Scope: Design & Build of 2x25kv AC Electrification, S&T of double track mainline railways lines on Lump Sum Basis for Bhaupur- Khurja Section of Eastern Dedicated Freight Corridor

1. Electrification works -: Design, supply, system quality management, installation, testing incl. integrated testing & comm. of the complete system; 2x25 KV AT System , 5 Traction sub-stations, 6 SPs, 11 SSPs

OHE – approx. 800 Tkms SCADA- includes interface with SCADA system of adjacent section

2. Building & Structure including E&M Works –

Buildings: Stations ,OCC ,Staff Qtrs, Maint Depots, Ancillary Bldgs.

E & M works: Non-Traction Power Supply and distribution system ,Electricals in all Bldgs. , DG sets, UPS ,SCADA/BMS ,HVAC ,Training

3. Signalling works- Automatic Block sig, 11 IXL stations, Track detection – Axle counter , Interlocking for 34 LC gates, Train Management System -SIL 2

4. Telecom works: OFC System ,Data Networking System ,Telephone , Mobile Train Radio Comm., Master Clock, Video Surveillance system, DC Power Supply

ALSTOM

Projects : Electric Locomotives

E-Loco Manufacturing & Factory at Madhepura

Scope: Setting up Electric 'Locomotive Factory at Madhepura, Bihar and Long Term Procurement and Maintenance of ELECTRIC LOCOMOTIVES

- Design development manufacture testing supply commissioning of 800 , 1676mm Gauge 9000 KW (12000 hp)
- IGBT based 3 phase drive double Bo-Bo locomotive over a period of 11 years
- Maintenance of first 250 loco supplied for 13 years and subsequent 250 locos for 4 years
- Design , finance , construct and operate the Factory suitable for manufacturing and assembly of locomotives per annum
- Design , finance , construct and operate the two depots till end of maintenance period
- Design , finance , construct a township comprising the social and commercial infrastructure

Back