Creating Innovative Solutions for a Sustainable Future

Energy Efficiency at Indian Railways

Presentation by:

Sanjay Seth

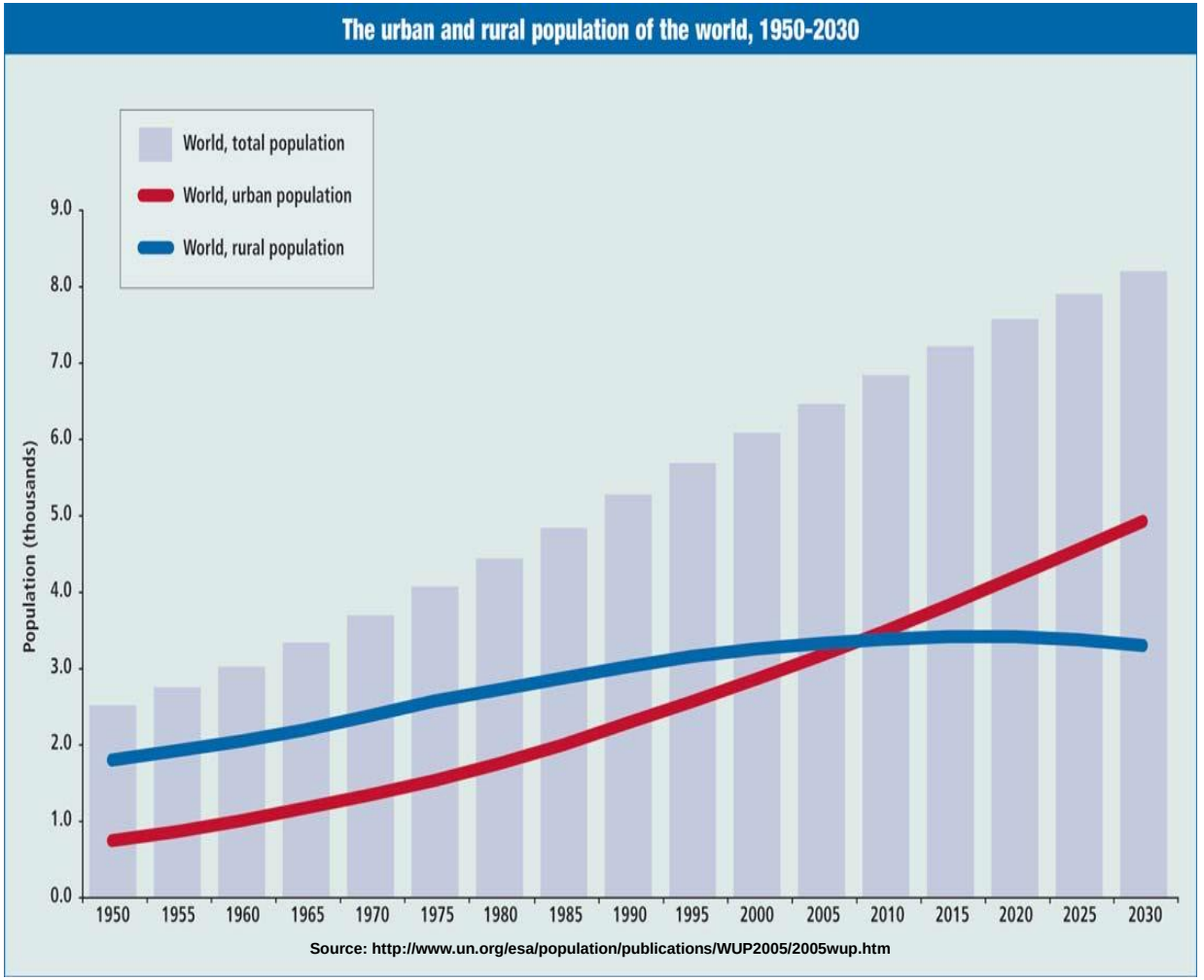
Senior **Director**

Sustainable Habitat Division

The Energy & Resources Institute (TERI)

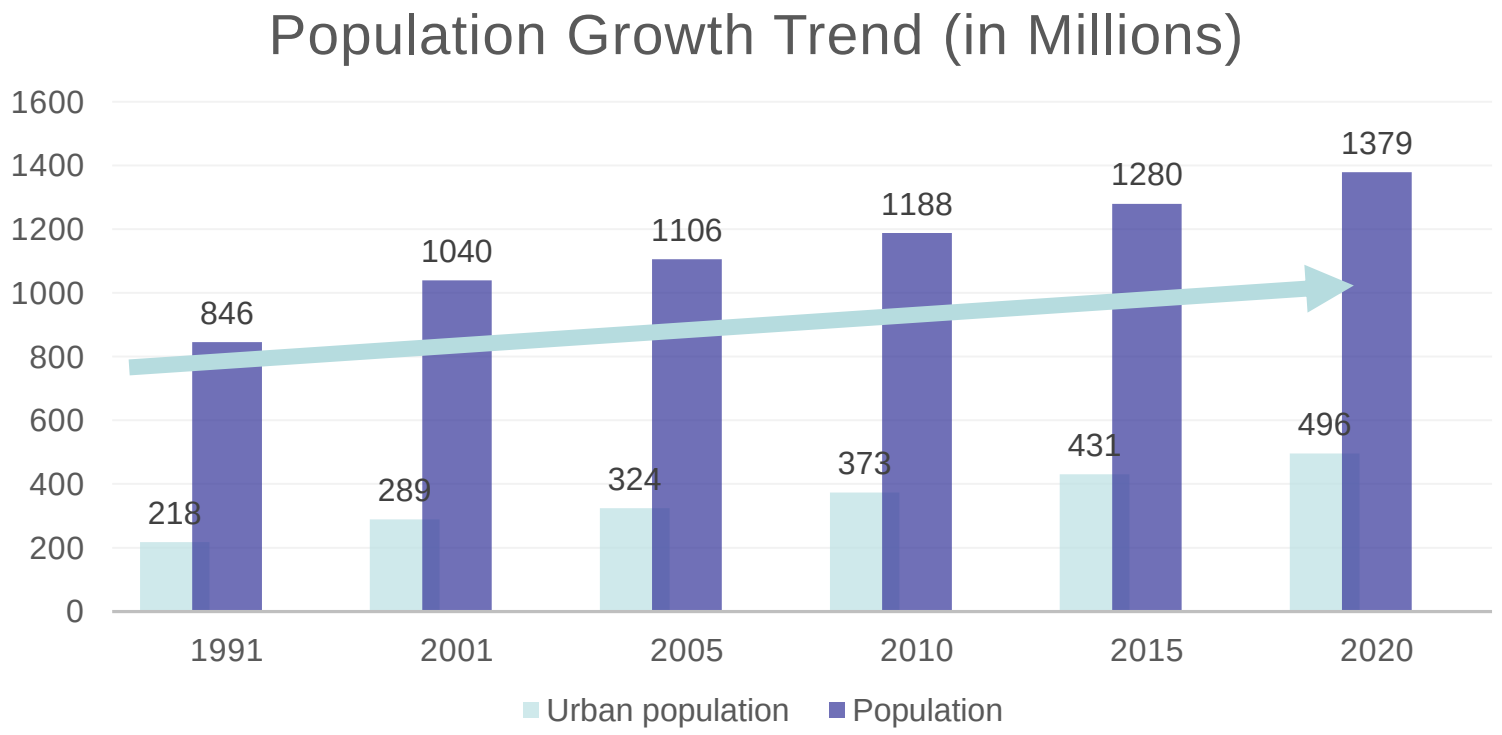
Rising Global Urbanization

- In **1990**, there were 10 mega-cities with **10 million** inhabitants or more.
- In **2014**, there were 28 mega-cities, home to a total **453 million** people.
- The number of mega cities is projected to rise to **41 by 2030.**



Urbanization in India

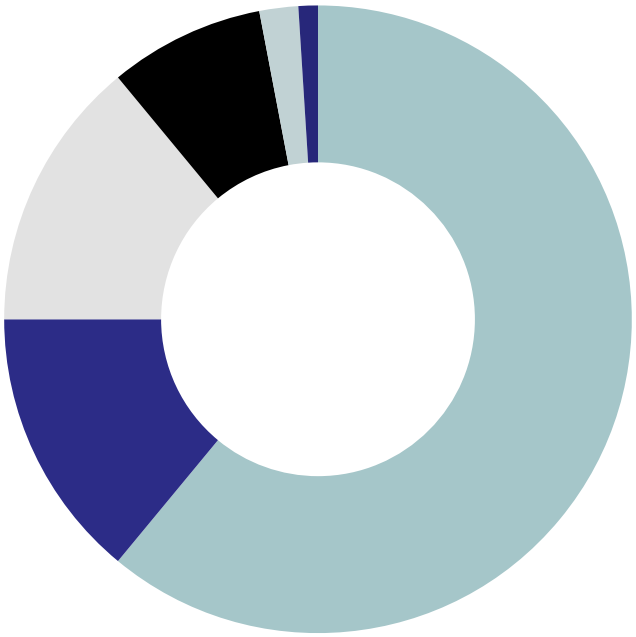
Creating Innovative Solutions for a Sustainable Future



By 2020 almost 500 Million people will be living in Urban India

Source: http://www.unfpa.org/publications/state-world-population-2007

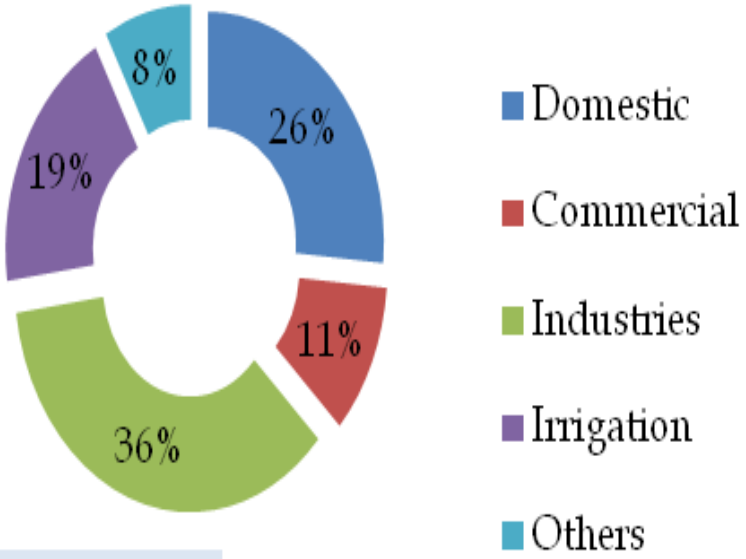
Installed Capacity by Fuel Type



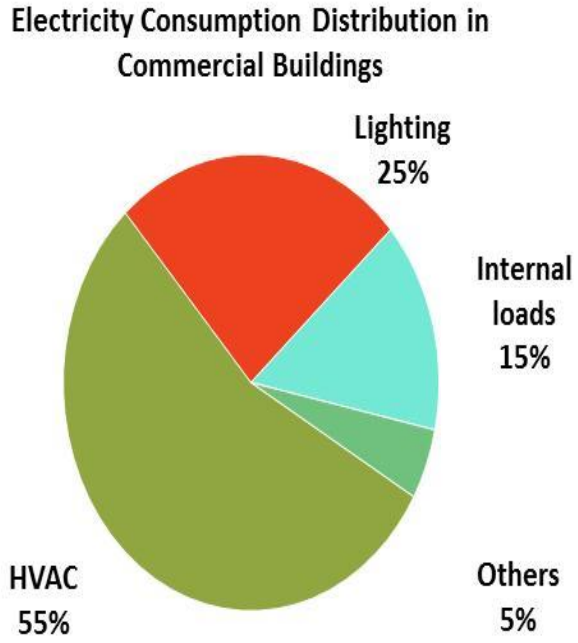
- Coal (61%)
- Renewable (14%)
- Hydro (14%)
- Gas (8%)
- Nuclear (2%)
- Diesel (1%)

Source: All India Installed Capacity of Utility Power Stations" (PDF). Retrieved 19 October 2016.

Sector Wise Electricity Consumption



Source : 18th EPS, CEA



Residential & Commercial Buildings consume 37% of total electricity

55% of electricity consumption is due to HVAC
25% of electricity consumption is due to lighting

India's Intended Nationally Determined Contributions

Creating Innovative Solutions for a Sustainable Future

- To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.

- To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance including from Green Climate Fund (GCF).

India's On-Going Mitigation Strategies

Creating Innovative Solutions for a Sustainable Future

NATIONAL ACTION PLAN ON CLIMATE CHANGE

- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- National Mission on Sustainable Habitat

INDIA'S URBAN PROGRAMS

- Smart Cities Mission
- Atal Mission for Rejuvenation and Urban Transformation (AMRUT)
- National Heritage City Development and Augmentation Yojana (HRIDAY)

Smart City
MISSION TRANSFORM-NATION

अमृत
Atal Mission for Rejuvenation and Urban Transformation

HRIDAY
Rejuvenating the Soul of Urban India

स्वच्छ भारत
एक कदम स्वच्छता की ओर

TERI's National Engagements

Creating Innovative Solutions for a Sustainable Future

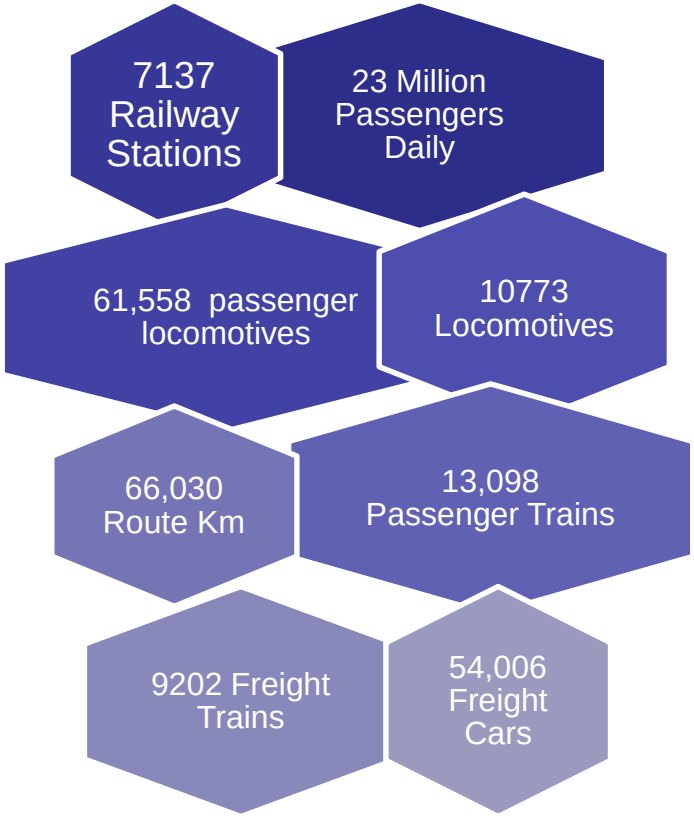
- **Centre of Excellence on Urban Development** for the Ministry of Urban Development, Government of India
- **Empanelled Consulting Firm for Regions 1 and 2** under the Smart City Mission of Government of India
- Working closely with the Institute of Urban Transport (IUT), MoUD's urban transport think tank, in **creating knowledge material, capacity building and training public officials in the country**
- Member of **key urban development and urban transport committees** set up by the Ministry and States
- **TERI-Mahindra Center of Excellence** - Research on sustainable and low cost building materials.
- **TERI- United Technologies Corporation (UTC) Center of Excellence** - For energy efficiency in existing buildings

TERI's International Engagements

Creating Innovative Solutions for a Sustainable Future

- **Founding members of the Partnership on Sustainable, Low Carbon Transport (SLoCaT), hosted by the United Nations Department of Economic and Social Affairs (UN-DESA).**
- **Anchor institute for UN Global Energy Network for the Urban Settlements (GENUS) in Asia - Improved urban mobility for the poor**
- **Recognized as a Centre of Excellence under the Global Network on Energy for Sustainable Development (GNESD), facilitated by UN Environment Programme**
- **National partner to the Asian Cities Climate Change Resilience Network (ACCCRN) facilitated by The Rockefeller Foundation**
- **Partner to 'City Climate Planner' Program of the World Bank/ Korea Green Growth Partnership**
- **South-Asia Regional Secretariat for Renewable Energy and Energy Efficiency Partnership (REEEP)**

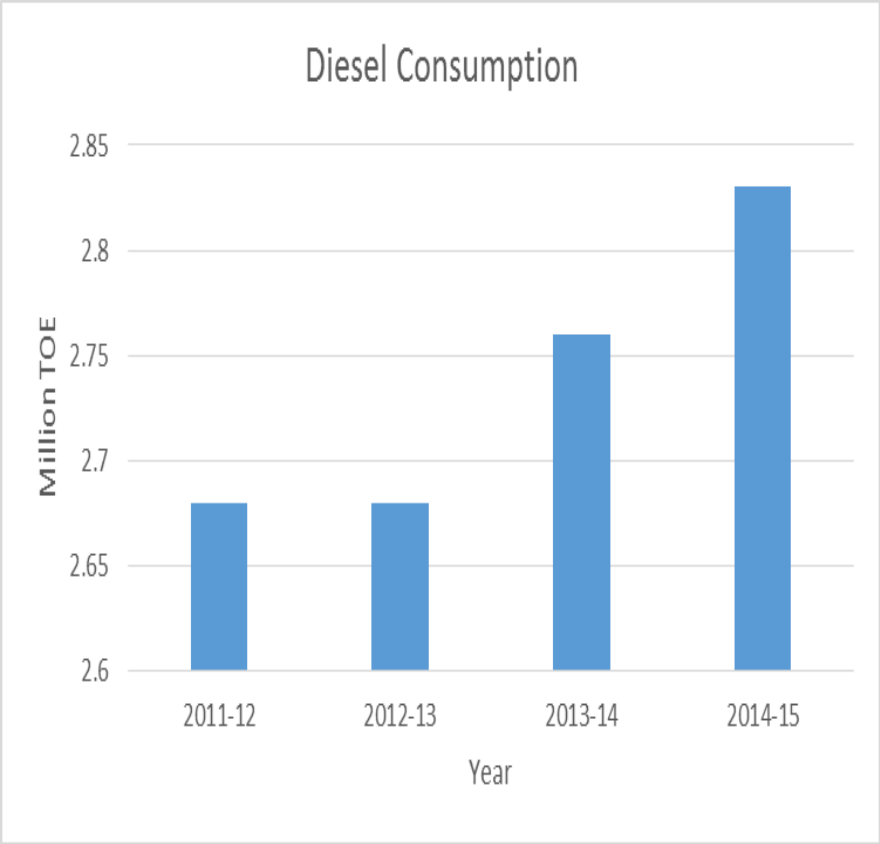
Railways – Energy Consumption Scenario

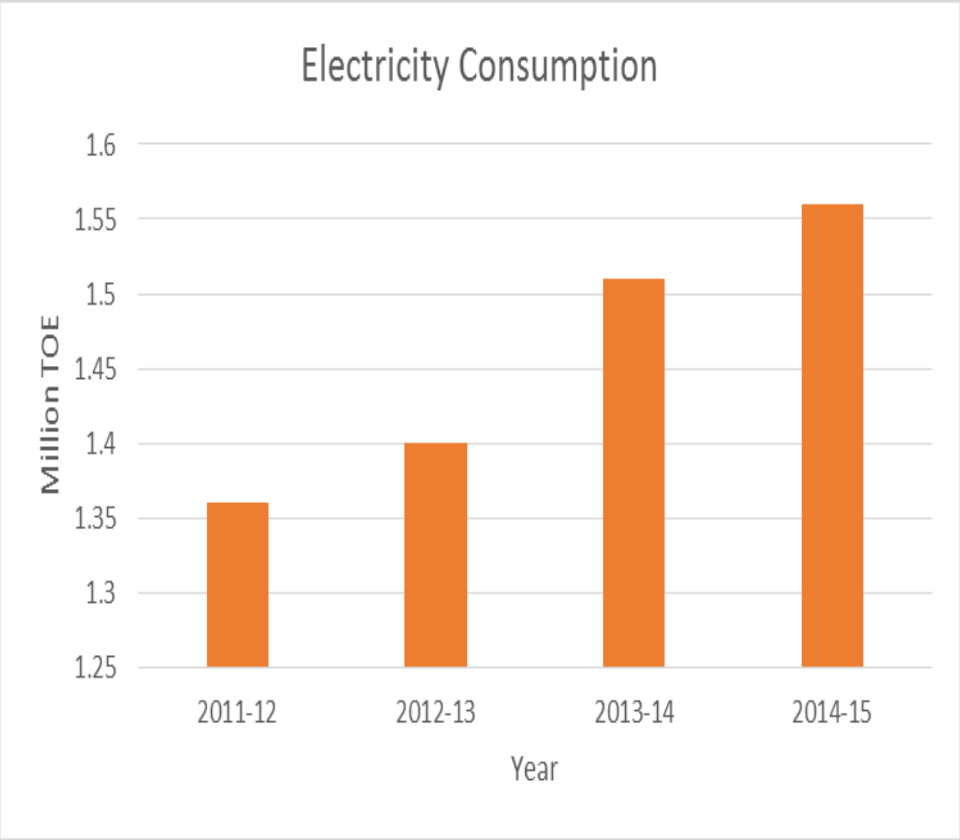


- Significant potential for energy savings
  - **'Vision 2020' document of IR lays emphasis on energy conservation and envisages achieving 15% enhanced energy efficiency by 2020.**

Source: Annual Statistical Publication Railway 2014-15

Total Energy Consumption Trend



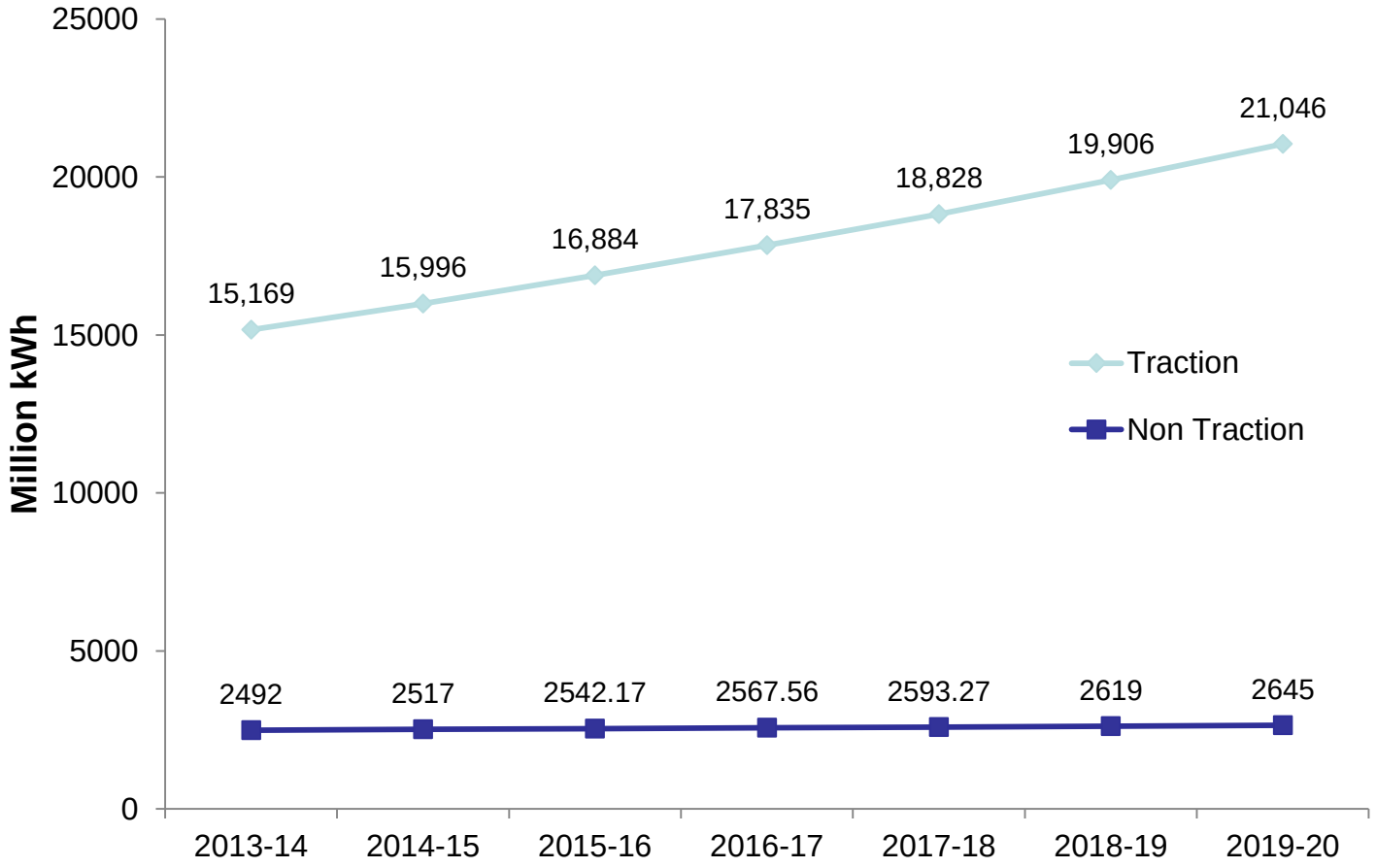


In 2014-15, IR consumed

- 2893 Million litres of diesel (equivalent to 2.83 Million toe)
- 18.2 BU of electricity (2% of national electricity consumption)

Source: Indian Railways Year Book 2011-12, 2012-13, 2013-14, 2014-15

Projected growth of Traction and Non-Traction



Source: CEA

Railways as Designated Consumer (DC)

Creating Innovative Solutions for a Sustainable Future

- All zonal railways having annual energy consumption of 70,000 metric tonne of oil equivalent (MTOE) per year and above
- Diesel loco sheds in each zonal railways.
- All six production units i.e. Integral Coach Factory, Rail Coach Factory, Chittaranjan Locomotive Works, Diesel Locomotive Works and Rail Wheel Factory
- Workshop of IR consuming energy more than 30000 toe and above.

Metric Adopted for Target Setting

Creating Innovative Solutions for a Sustainable Future

For Zonal Railway Traction:-

Zonal Railway			
Diesel		Electrical	
Passenger (Litres/1000GTKm)	Goods (Litres/1000GTKm)	Passenger (kWh/1000GTKm)	Goods (kWh/1000GTKm)
Target	Target	Target	Target

Metric Adopted for Target Setting

Creating Innovative Solutions for a Sustainable Future

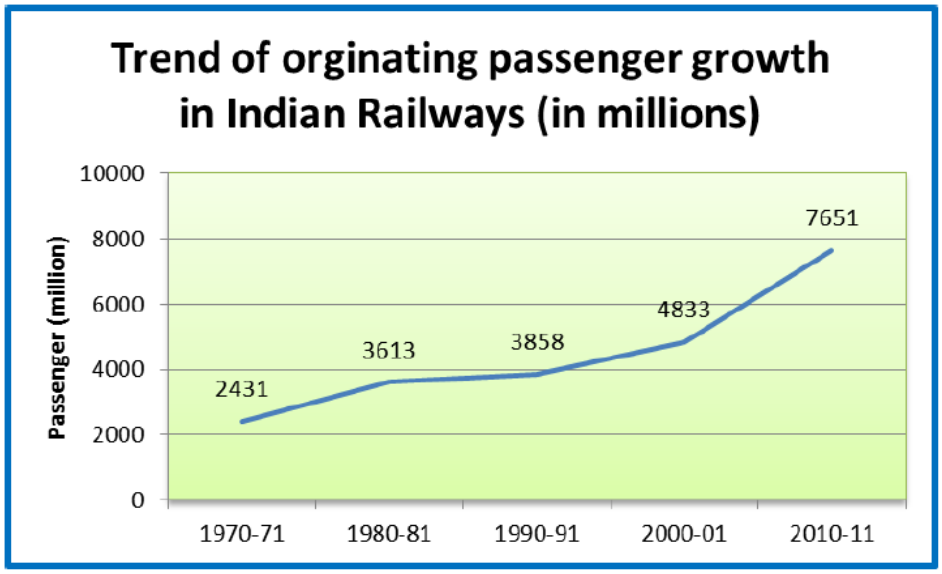
For Production Units :-

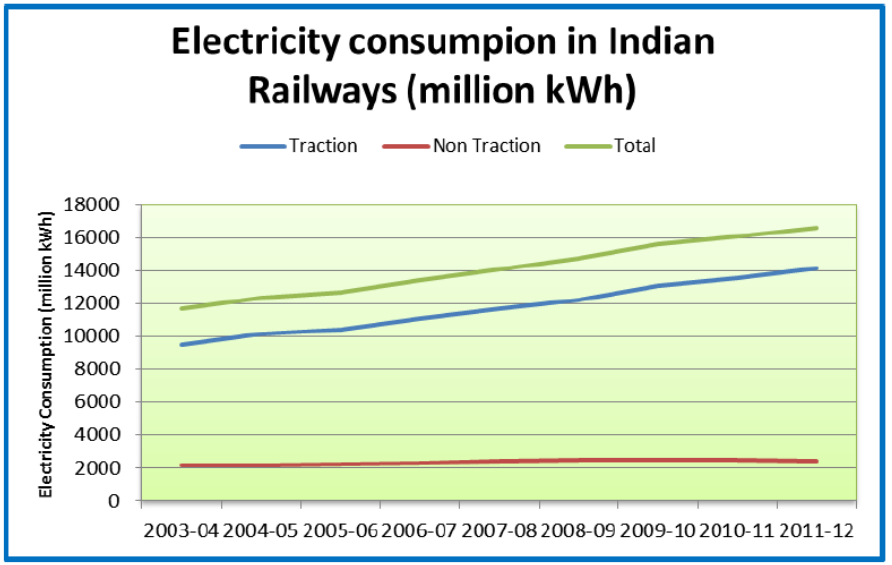
- Energy consumption per unit of production i.e. Locomotives, Coaches, wheels etc. should be considered as performance metric.
- All the energy consumption will be converted into toe and metric will be Kgoe /unit of production.
- For the time being Rail Coach Factory (Raebareili) now known as Modern Coach Factory has not been included in PAT II as the factory is in construction phase and not fully operational

A study conducted for International Union of Railways (UIC) for station buildings

Creating Innovative Solutions for a Sustainable Future

Resource use benchmarking and performance enhancement in selected Asian Railway Stations with comparative analysis of resource use





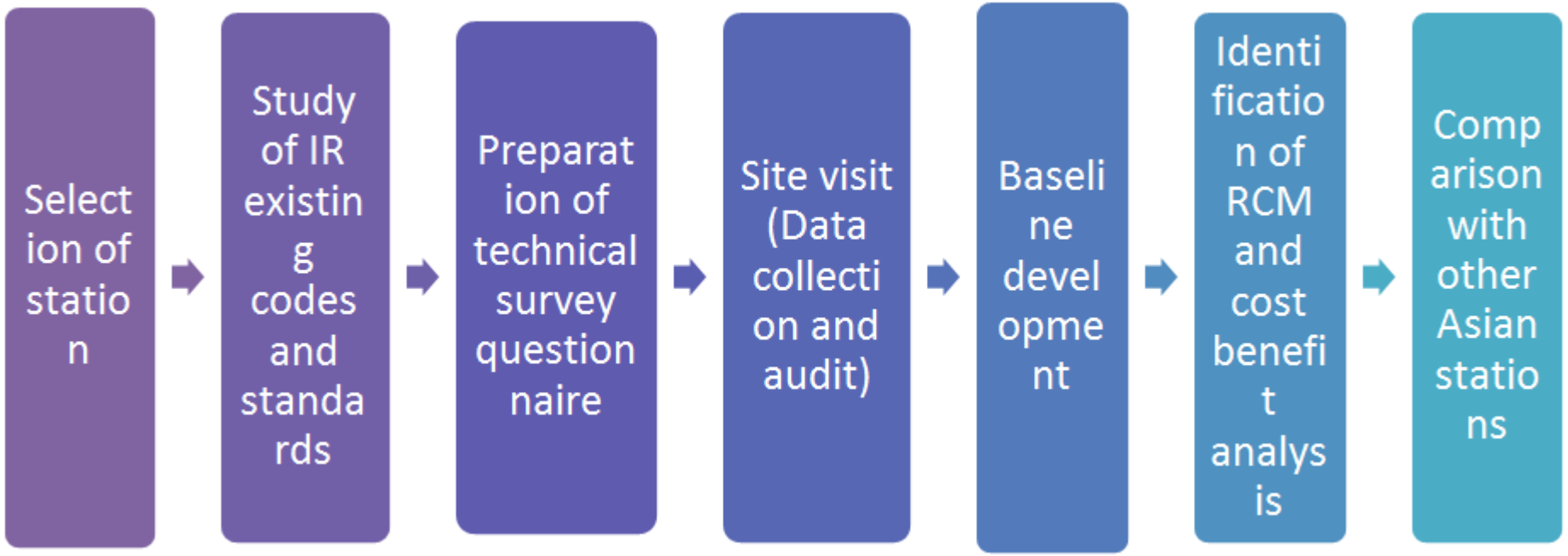
IR is one of the major consumer of vital resources such as energy and water

Study Objectives

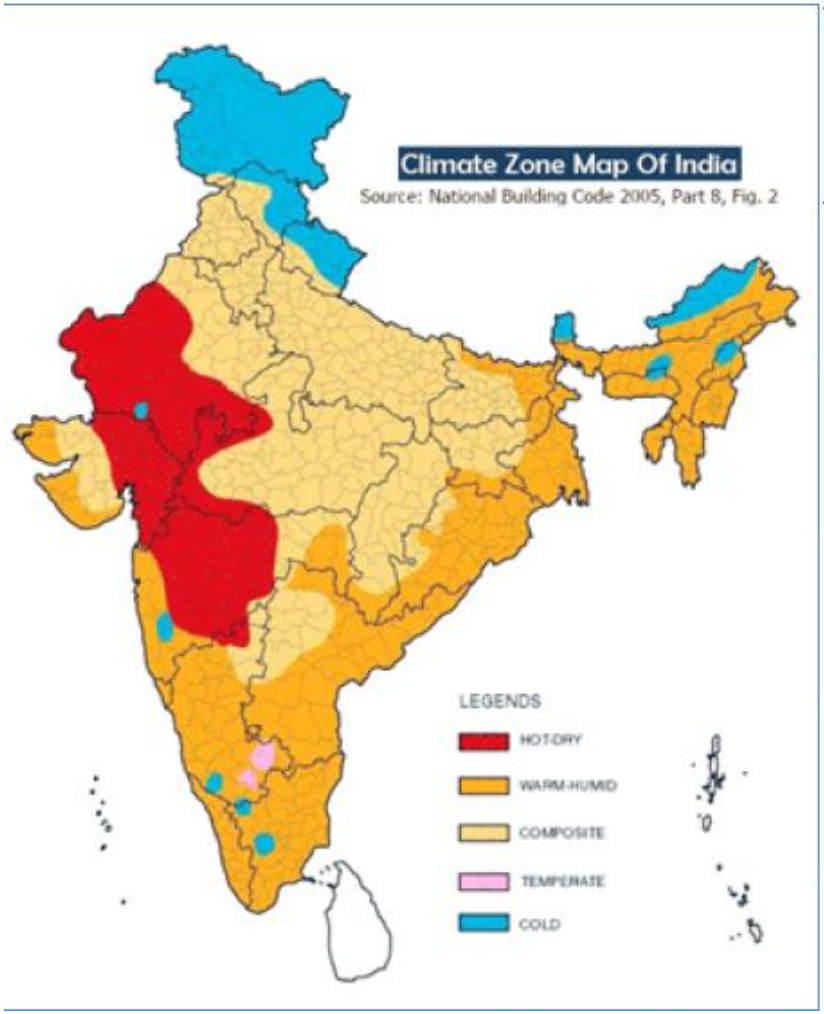
Creating Innovative Solutions for a Sustainable Future

- To assess current resource consumption and end use patterns by conducting preliminary / walkthrough energy, water and waste audits in station complex of five (5) Indian locations .
- Develop baselines of current performance based on data collected and analysis from the energy, waste and waste audits.
- Evolve set of green measures that may be potentially applied to improve performance of energy and water consumption, reduce waste generation and application of renewable and recyclable resources
- Develop achievable benchmarks
- Carry out benchmarking of select stations.

Study Approach

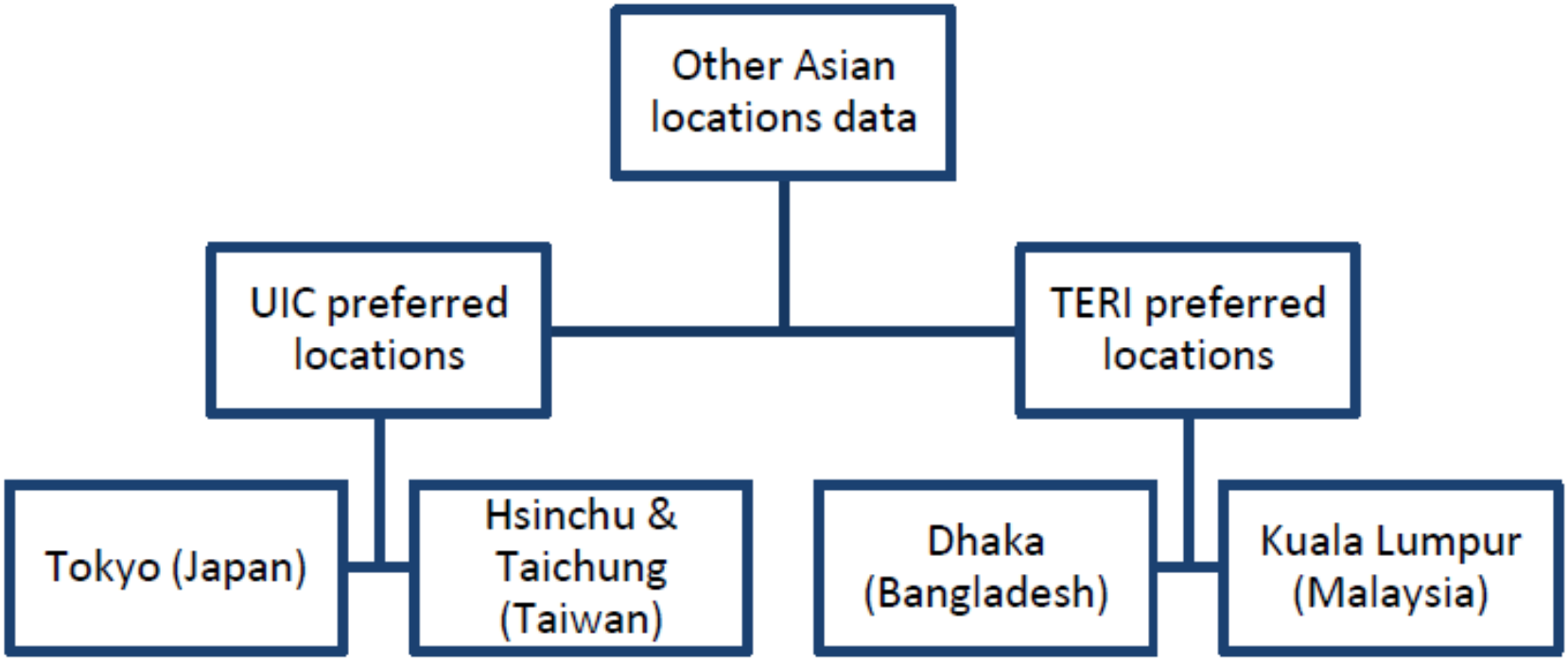


Selected IR stations for Physical Resource Audit



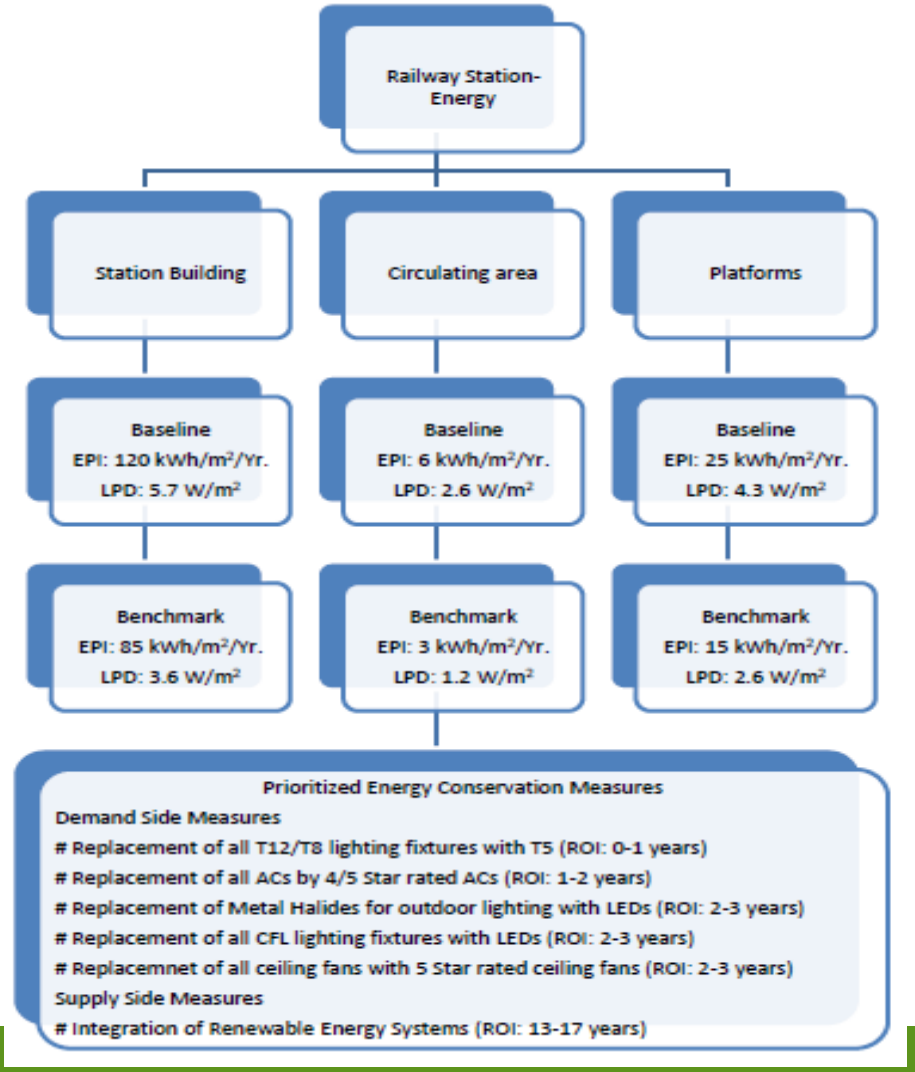
Station	Climatic Zone	Passenger Footfall (in millions)
New Delhi (A)	Composite	0.5
Bangalore SBC (A1)	Temperate	0.15
Howrah Junction (A1)	Warm & Humid	0.7
Mumbai Junction (A)	Warm & Humid	0.25
Ahmadabad (A1)	Hot & Dry	0.12

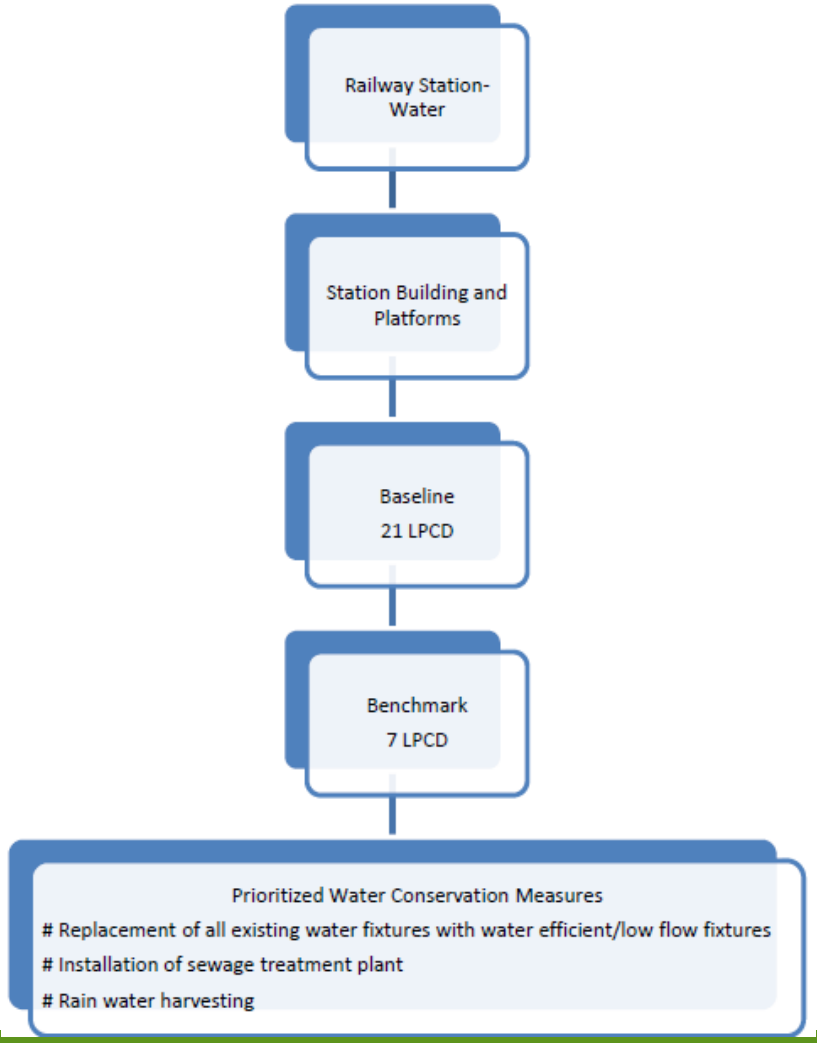
Other Asian Railways Stations



Final Outcomes & Recommendations

Creating Innovative Solutions for a Sustainable Future





Thank you

Contact us at: www.teriin.org

Email: Sanjay.Seth@teri.res.in