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# Energy Efficiency at Indian Railways

Presentation by:

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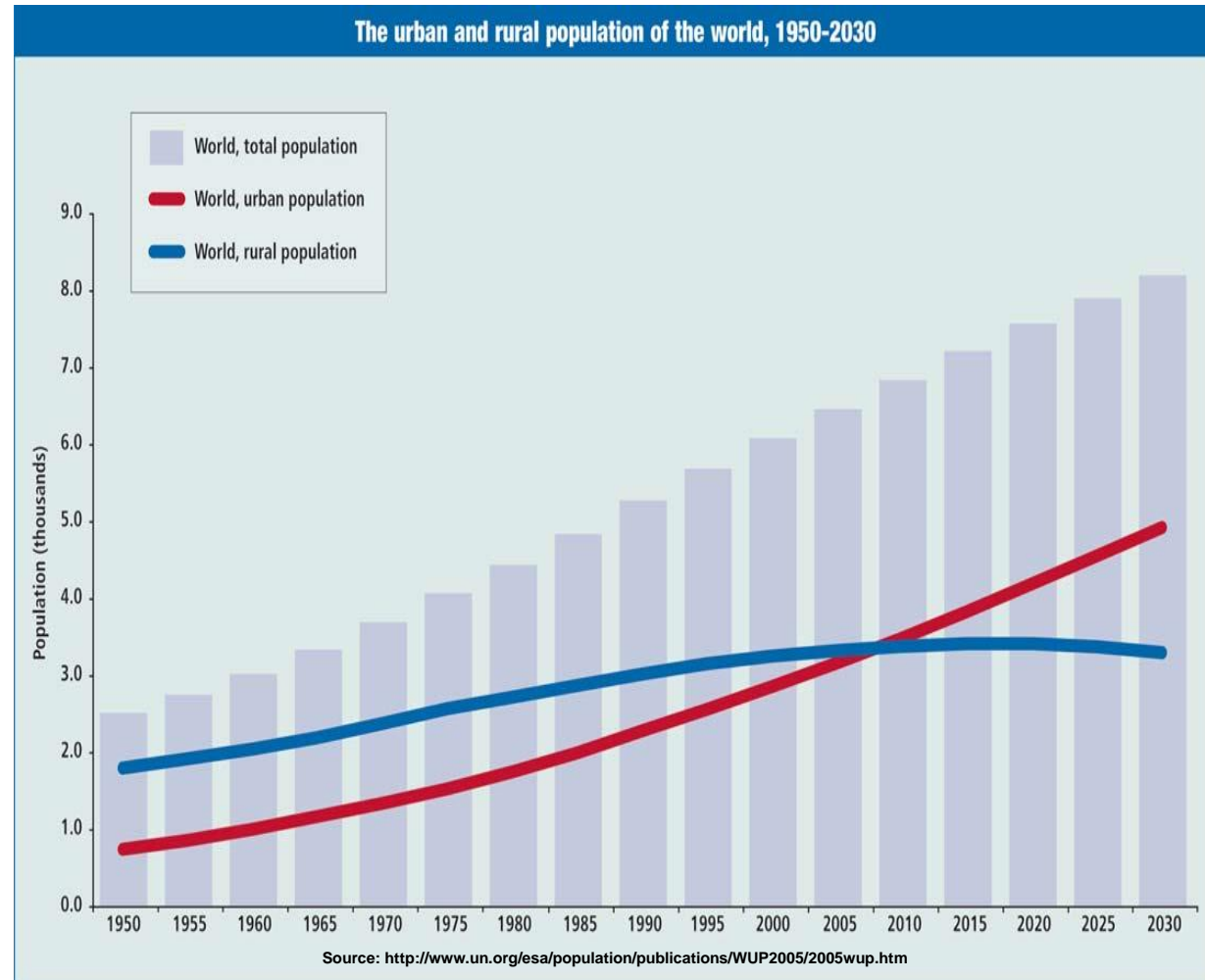
The Energy & Resources Institute (TERI)

# Rising Global Urbanization



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- 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**.

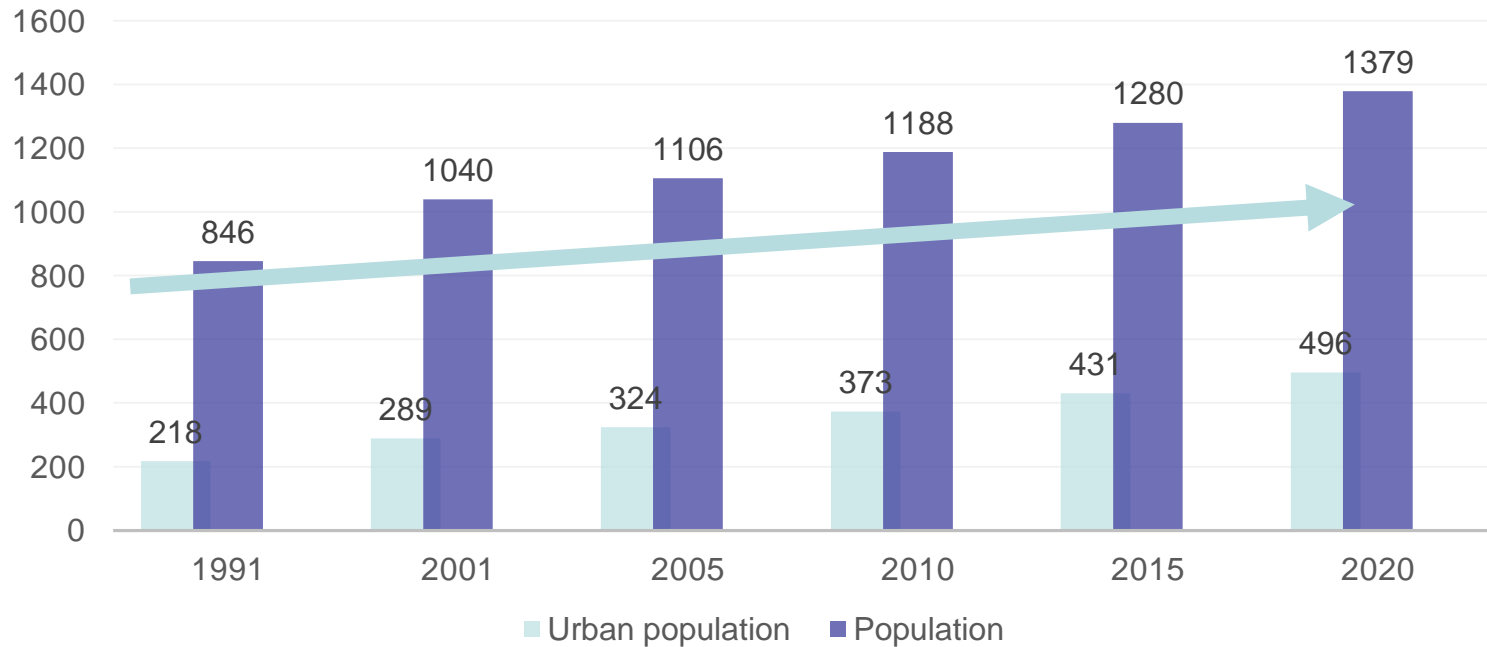


# Urbanization in India



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## Population Growth Trend (in Millions)

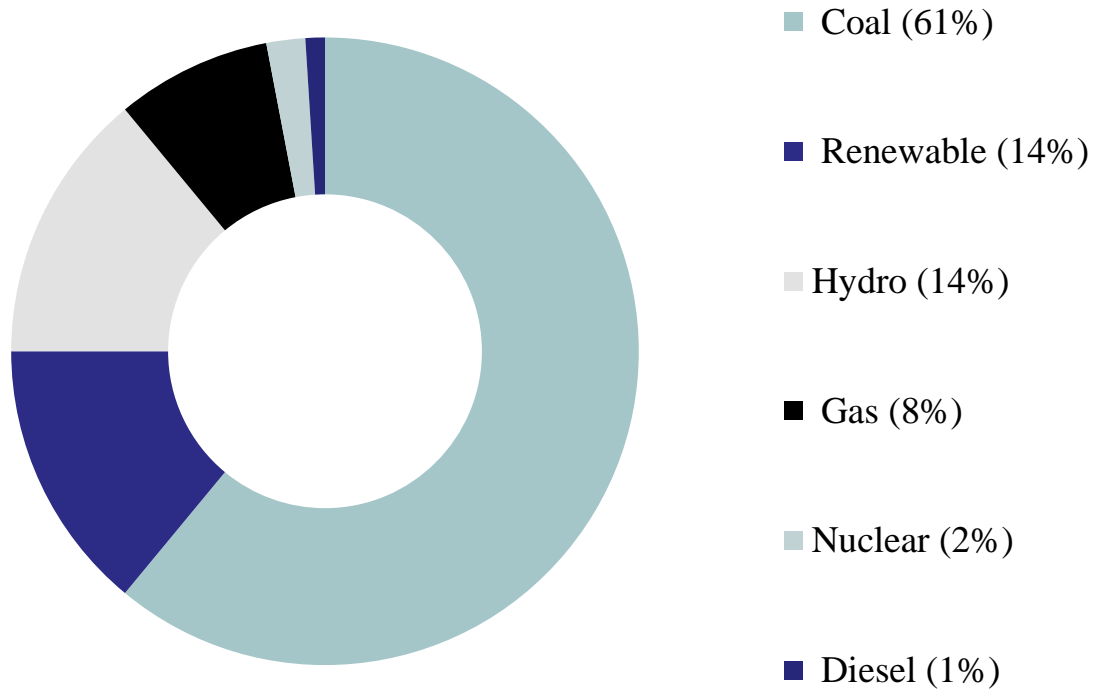


**By 2020 almost 500 Million people will be living in Urban India**

# Installed Capacity by Fuel Type



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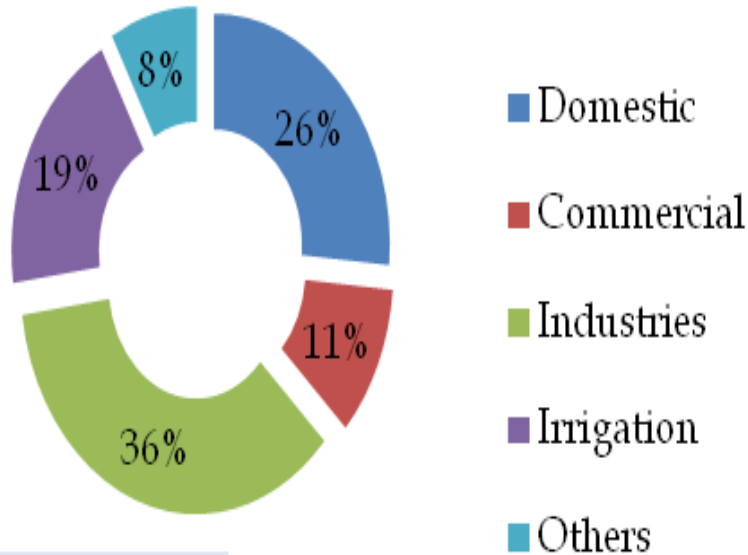


Source: [All India Installed Capacity of Utility Power Stations](#) (PDF). Retrieved 19 October 2016.

# Sector Wise Electricity Consumption



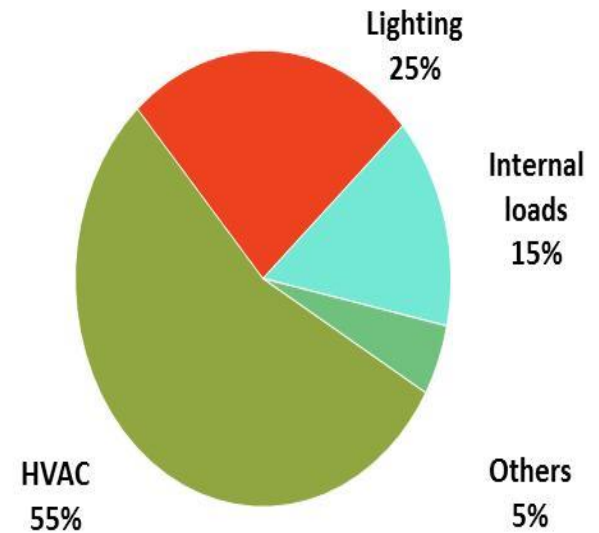
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Source : 18<sup>th</sup>EPS, CEA

**Residential & Commercial Buildings  
consume 37% of total electricity**

Electricity Consumption Distribution in  
Commercial Buildings



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

# India's Intended Nationally Determined Contributions



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- 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



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## 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)





# TERI's National Engagements



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- **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



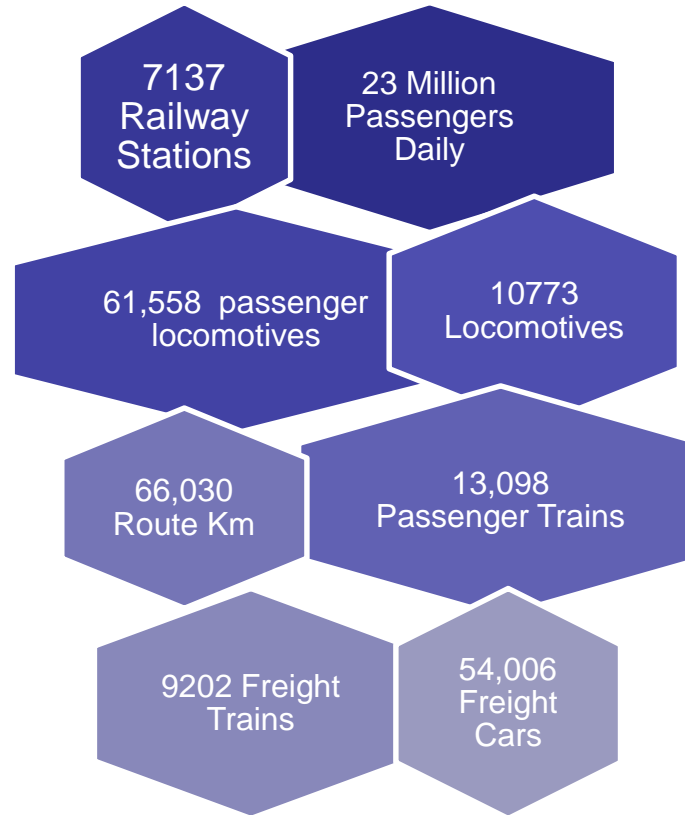
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- **Founding members of the Partnership on Sustainable, Low Carbon Transport (SLoCaT), hosted by the United Nations Department of Economic and Social Affairs (UN-DESA).**
- **Anchor institute for UN Global Energy Network for the Urban Settlements (GENUS) 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



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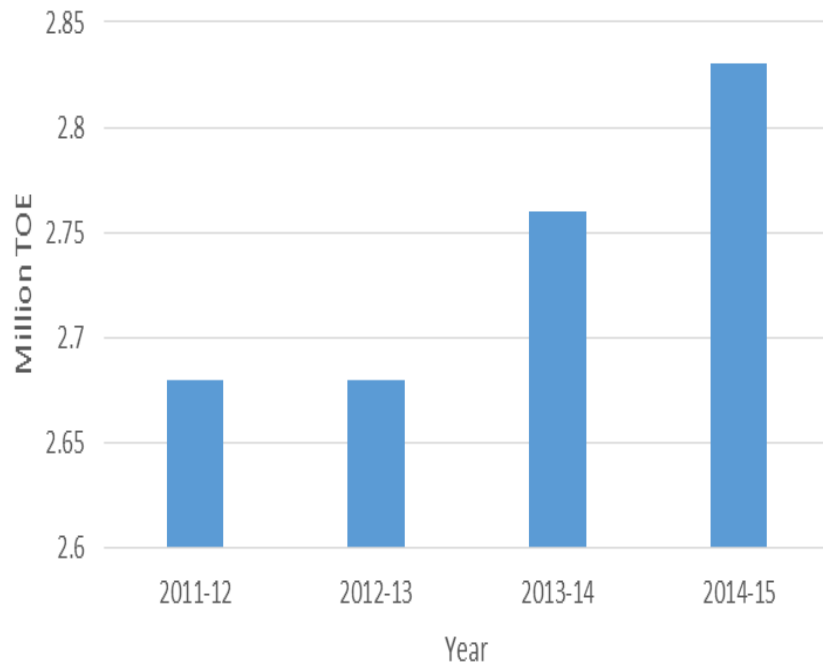
- Significant potential for energy savings
  - **'Vision 2020' document of IR lays emphasis on energy conservation and envisages achieving 15% enhanced energy efficiency by 2020.**

# Total Energy Consumption Trend

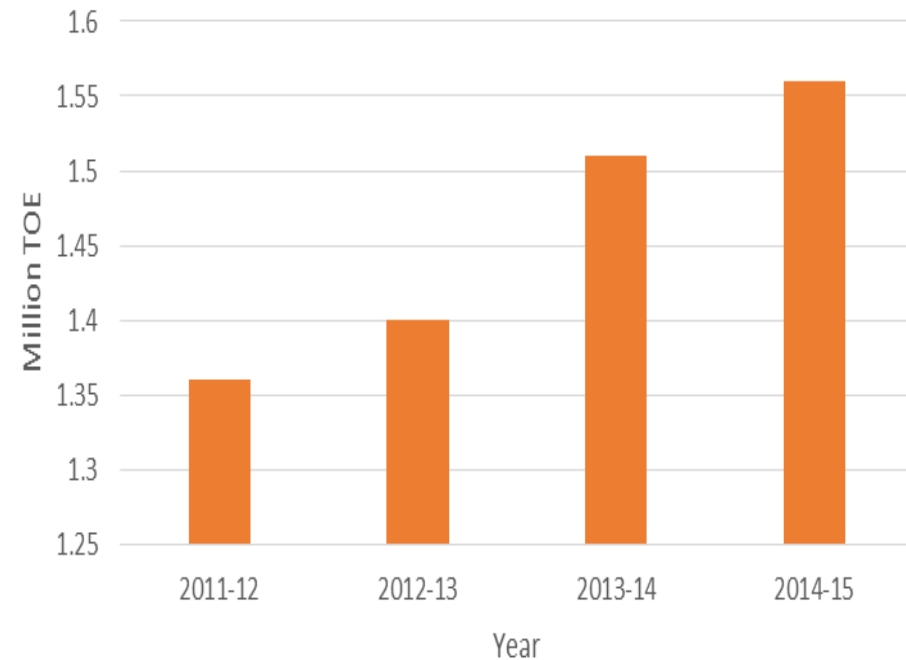


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## Diesel Consumption



## Electricity Consumption



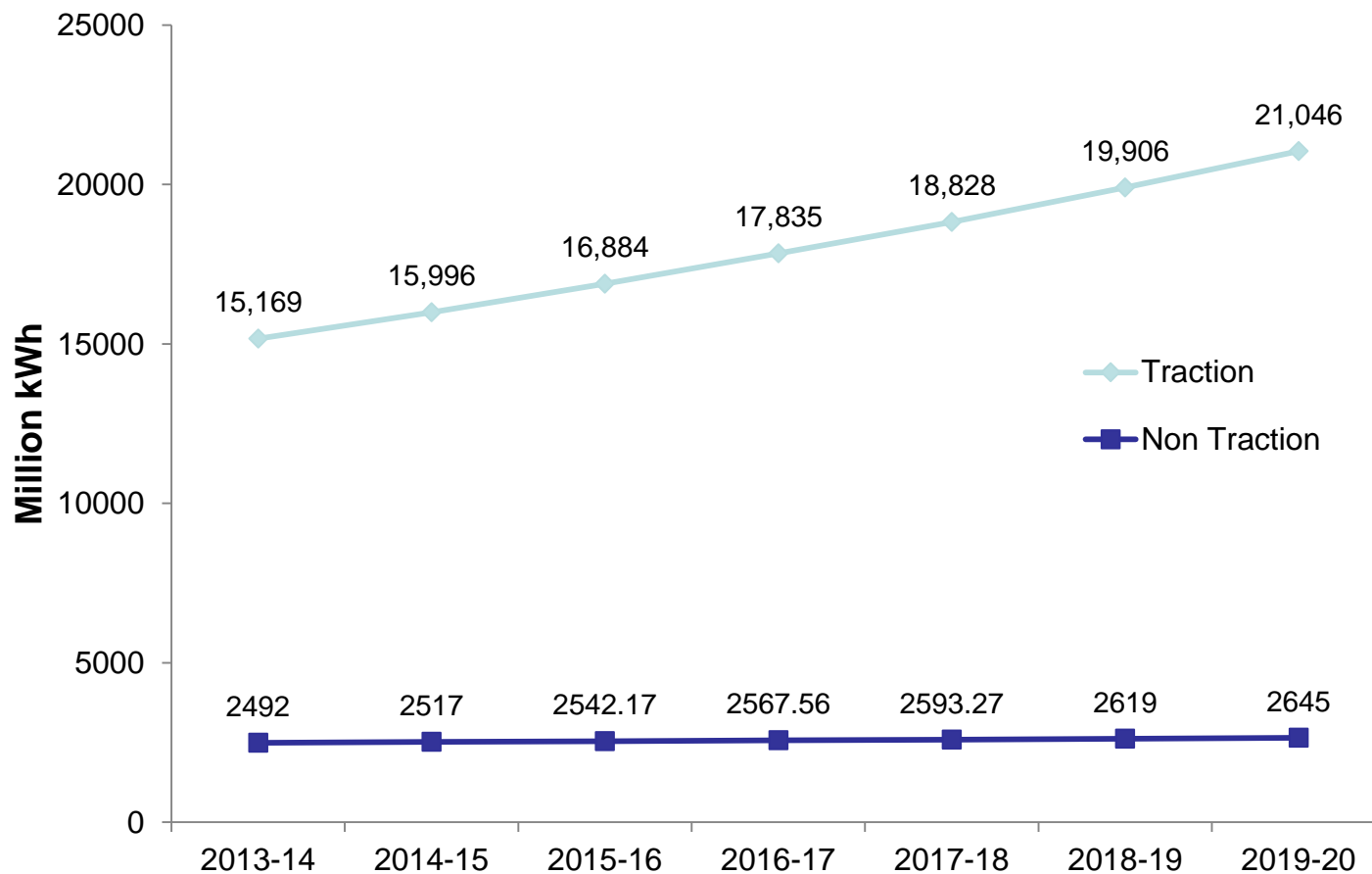
In 2014-15, IR consumed

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

# Projected growth of Traction and Non-Traction



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# Railways as Designated Consumer (DC)



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- 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



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## For Zonal Railway Traction:-

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

## For Production Units :-

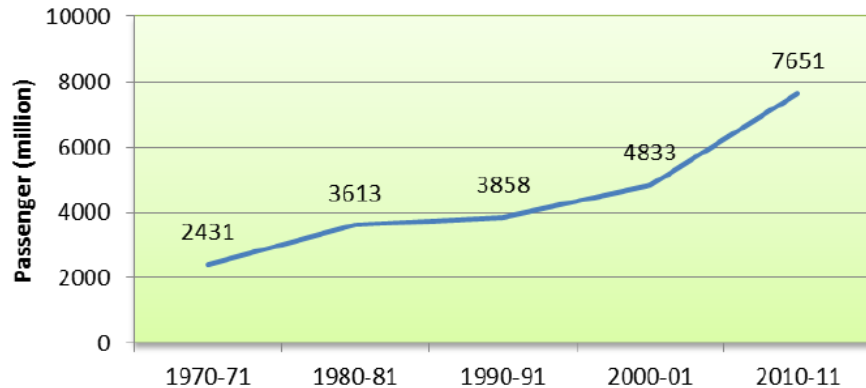
- Energy consumption per unit of production i.e. Locomotives, Coaches, wheels etc. should be considered as performance metric.
- All the energy consumption will be converted into toe and metric will be Kgoe /unit of production.
- For the time being Rail Coach Factory (Raebareili) now known as Modern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



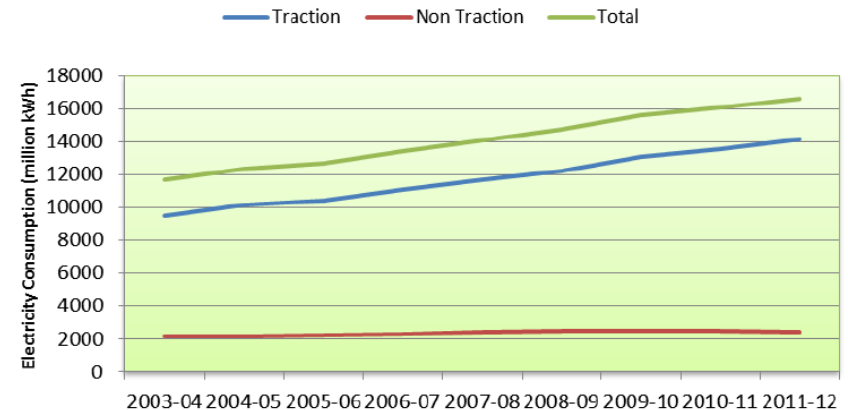
# A study conducted for International Union of Railways (UIC) for station buildings

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

**Trend of originating passenger growth in Indian Railways (in millions)**



**Electricity consumption in Indian Railways (million kWh)**



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

# Study Objectives



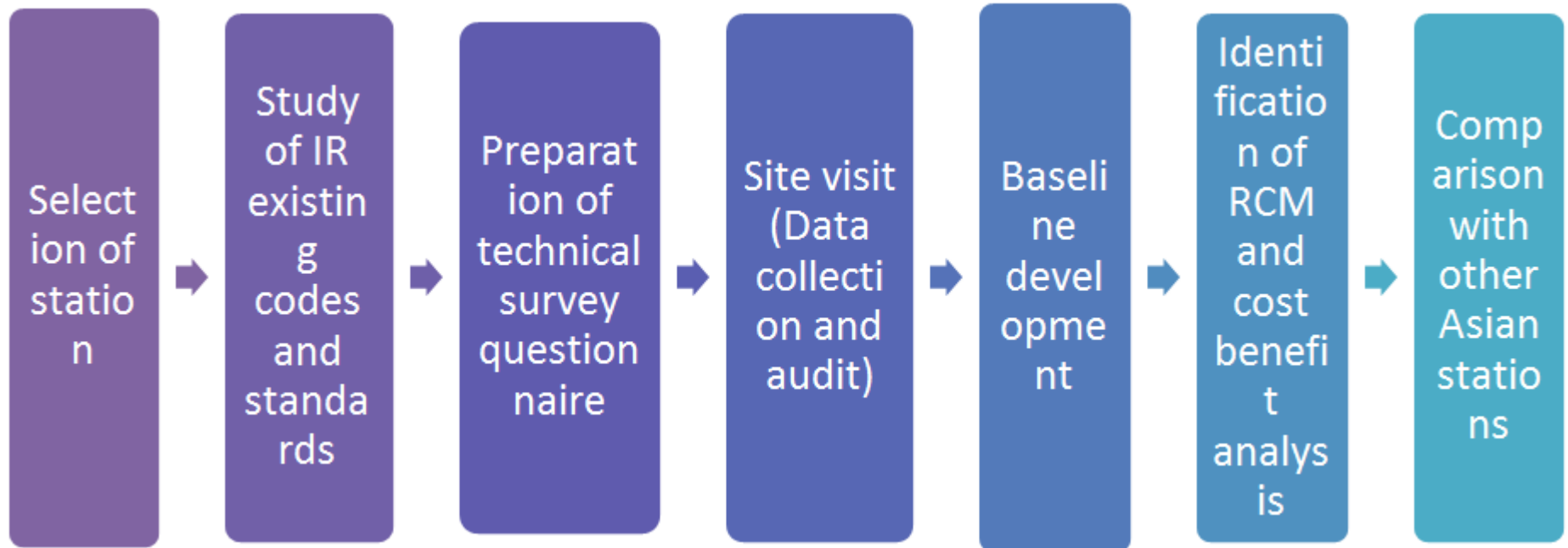
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- To assess current resource consumption and end use patterns by conducting preliminary / walkthrough energy, water and waste audits in station complex of five (5) Indian locations .
- Develop baselines of current performance based on data collected 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



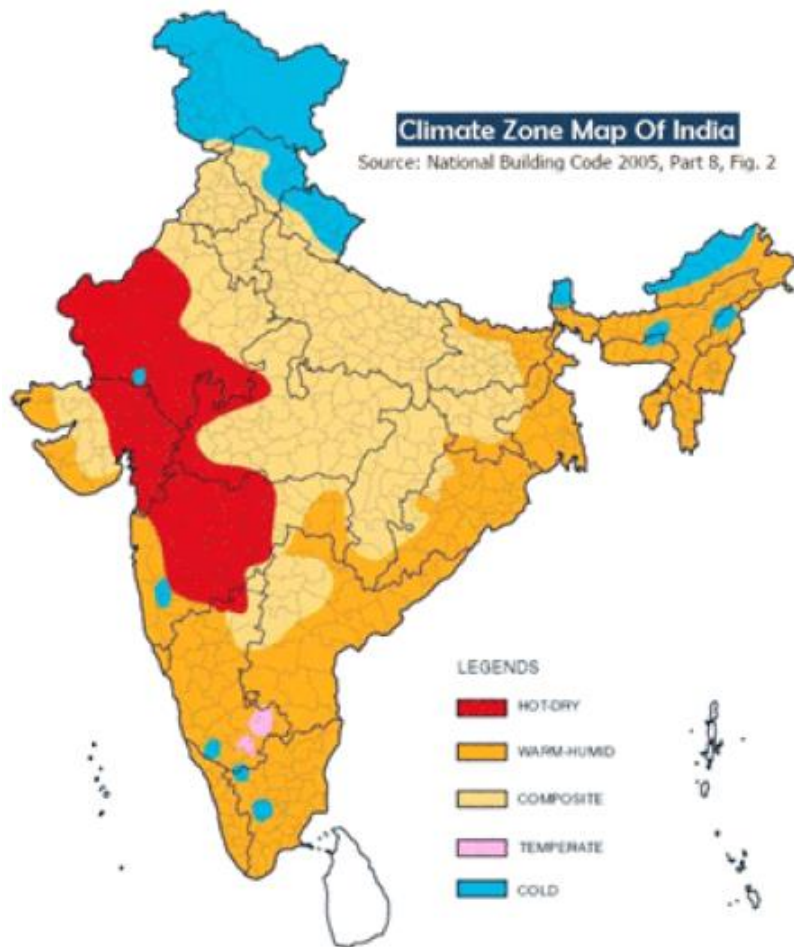
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# Selected IR stations for Physical Resource Audit



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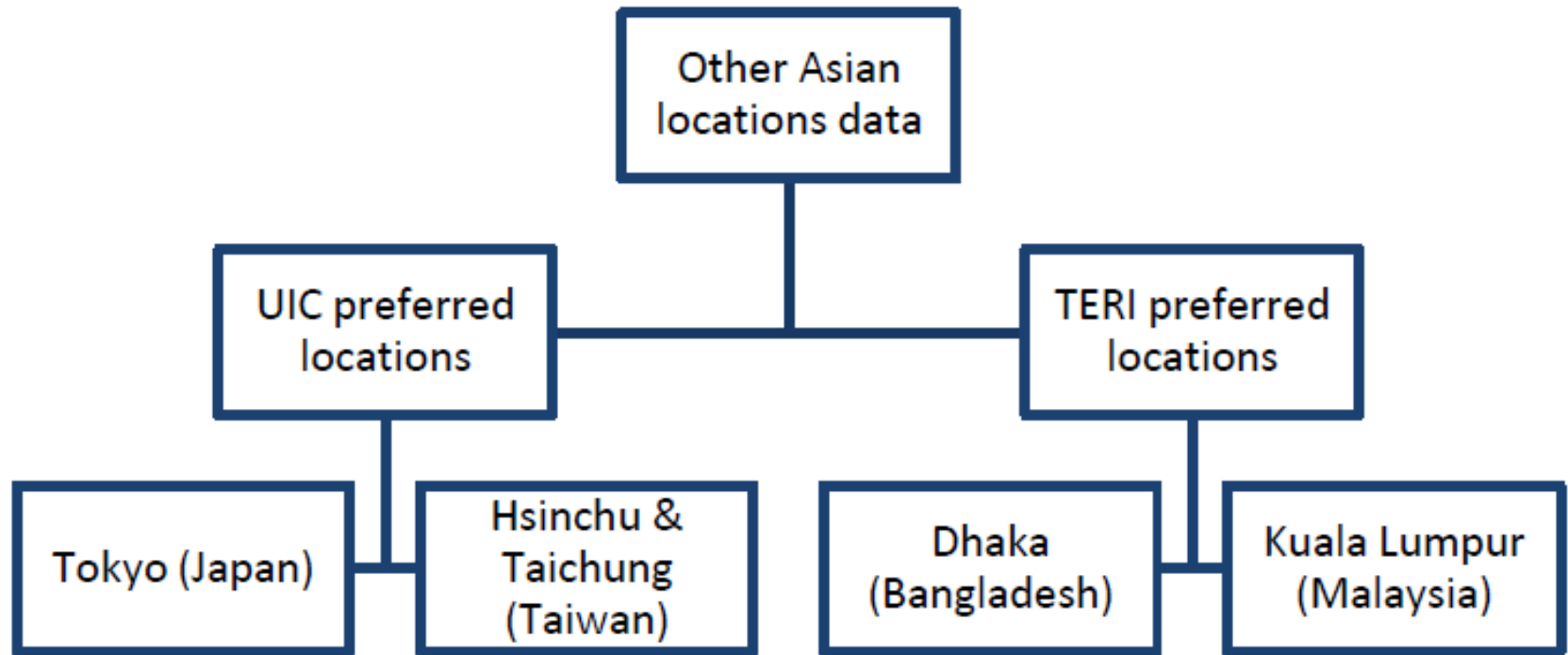


Station	Climatic Zone	Passenger Footfall (in millions)
New Delhi (A)	Composite	0.5
Bangalore (A1)	SBC Temperate	0.15
Howrah Junction (A1)	Warm & Humid	0.7
Mumbai Junction (A)	Warm & Humid	0.25
Ahmadabad (A1)	Hot & Dry	0.12

# Other Asian Railways Stations



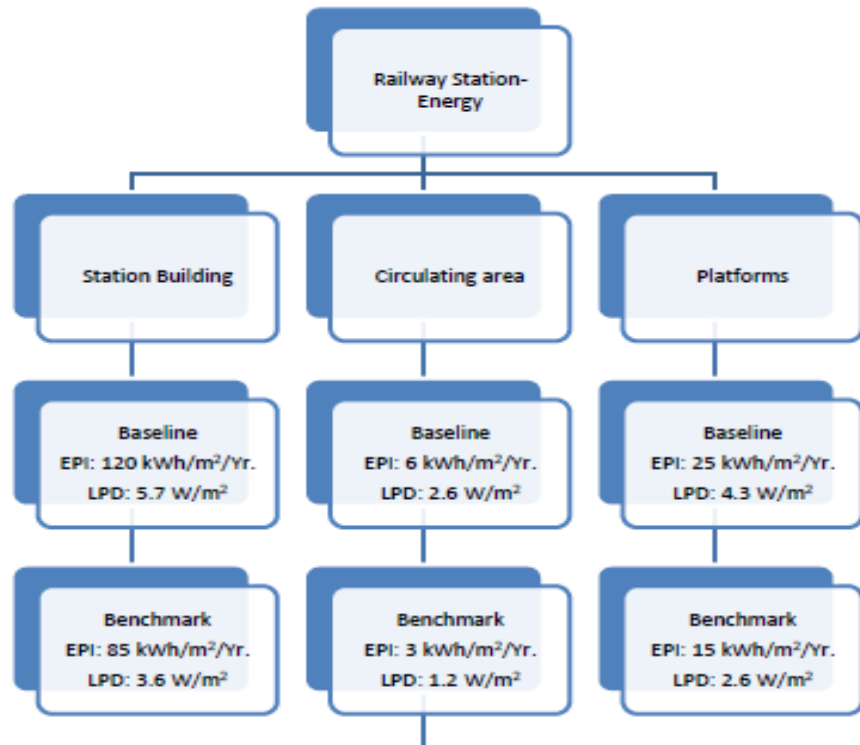
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# Final Outcomes & Recommendations



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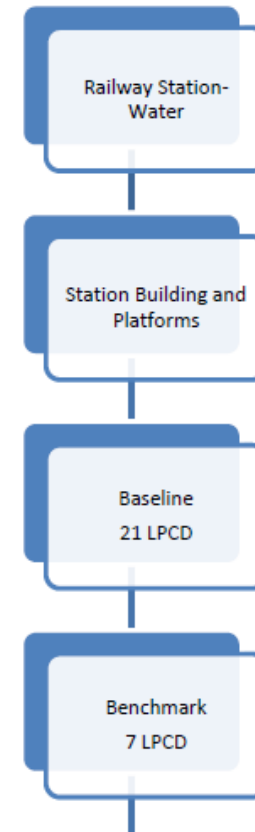
## Prioritized Energy Conservation Measures

### Demand Side Measures

- # Replacement of all T12/T8 lighting fixtures with T5 (ROI: 0-1 years)
- # Replacement of all ACs by 4/5 Star rated ACs (ROI: 1-2 years)
- # Replacement of Metal Halides for outdoor lighting with LEDs (ROI: 2-3 years)
- # Replacement of all CFL lighting fixtures with LEDs (ROI: 2-3 years)
- # Replacement of all ceiling fans with 5 Star rated ceiling fans (ROI: 2-3 years)

### Supply Side Measures

- # Integration of Renewable Energy Systems (ROI: 13-17 years)



## Prioritized Water Conservation Measures

- # Replacement of all existing water fixtures with water efficient/low flow fixtures
- # Installation of sewage treatment plant
- # Rain water harvesting



# Thank you

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