STRENGTHENING ENERGY EFFICIENCY MECHANISM IN INDIAN RAILWAYS THROUGH PAT SCHEME

By

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2. PAT - Regulatory Framework & Sectoral Coverage
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National Action Plan on Climate Change (NAPCC)
Nation Mission for Enhanced Energy Efficiency (NMEE)
Perform, Achieve & Trade

A **market based regulatory instrument** to reduce specific energy consumption in industries, **to enhance the cost effectiveness** through tradable **energy saving certificates**.

- **Section 14 (g): Establish norms**
- **Section 14 (n): Direction to Industries**
- **Section 14A: Energy Saving Certificates**
- **Section 26: Penalty & Enforcement**
- **Section 27: Adjudication**

**Energy Conservation (EC) Act 2001**

- Norms for Energy Intensive Industries
- Standard & Labeling
- Energy Conservation Building Code
- Demand Side Management
- Certification of Energy Professionals
2001

Energy Conservation Act enacted

National Mission for Enhanced Energy Efficiency (NMEEE)

2008

Sector studies to identify DCs

National Action Plan on Climate Change released

2009

Baseline data collection begins

Sector studies Commenced to identify DCs

2010

Financial outlay approved

Consultations on Target setting methodology and targets

2011

Energy Conservation Act amended to make provisions for issue of energy saving certificates, imposition of penalty for non compliance and trading of ESCerts

2012-15

Performance Verification

2015-16

PAT Cycle I Notified

2016-17

PAT Cycle II Notified

2017-18

PAT Cycle III Notified

2008-2015

Consultations on Target setting methodology and targets

2015-

Performance Verification

2016-

PAT Cycle II Notified

2017-

PAT Cycle III Notified

2017-

PAT Cycle III Notified

2018
PAT- Salient features

• Regulatory instrument linked with market mechanism
  - Certification of energy saving

• Consultative approach
  - Ministries/DCs/Associations/FIs/Research Organizations

• Outreach/ Capacity Development
  - Workshops/Seminars/ Visits

• “Self - competing”
  - Unit specific targets

• Relative responsibility
  - Less target for more efficient and more for less efficient
Concept of Target, Compliance, ESCerts & Penalty

- Baseline SEC
- Target SEC
- Issued ESCerts
- Achieved SEC
- Penalty
- Compliance

Scenario 1
- Saving Target

Scenario 2
- Purchase ESCerts
Sectoral Coverage

Criteria for Identification of Sectors

- Listed in Schedule of EC Act
- Intensity or quantity of energy consumed
- Amount of investment needed
- Capacity to invest
- Availability of energy efficient technology

Sectors in PAT Cycle I (2012-15)

1. Aluminum
2. Cement
3. Chlor Alkali
4. Fertilizers
5. Iron and Steel
6. Pulp and Paper
7. Textile
8. Thermal Power Stations
TPES: Total Primary Energy Supply
TFEC: Total Final Energy Consumption
Industry includes Thermal Power Plants
mtoe: Million tonnes of Oil Equivalent

Baseline Year: 2010
Data Source: IEA and BEE
### PAT Cycle I - Notified Sectors

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Sectors</th>
<th>Annual Energy Consumption Norm to be DC (mtoe)</th>
<th>No. of Identified DCs</th>
<th>Annual Energy Consumption (Million toe)</th>
<th>Share Consumption (%)</th>
<th>Apportioned Energy Reduction For PAT Cycle-1 (Million toe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power (Thermal)</td>
<td>30000</td>
<td>144</td>
<td>104.56</td>
<td>63.38%</td>
<td>3.211</td>
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<tr>
<td>2</td>
<td>Iron &amp; Steel</td>
<td>30000</td>
<td>67</td>
<td>25.32</td>
<td>15.35%</td>
<td>1.486</td>
</tr>
<tr>
<td>3</td>
<td>Cement</td>
<td>30000</td>
<td>85</td>
<td>15.01</td>
<td>9.10%</td>
<td>0.815</td>
</tr>
<tr>
<td>4</td>
<td>Aluminium</td>
<td>7500</td>
<td>10</td>
<td>7.71</td>
<td>4.67%</td>
<td>0.456</td>
</tr>
<tr>
<td>5</td>
<td>Fertilizer</td>
<td>30000</td>
<td>29</td>
<td>8.20</td>
<td>4.97%</td>
<td>0.478</td>
</tr>
<tr>
<td>6</td>
<td>Paper &amp; Pulp</td>
<td>30000</td>
<td>31</td>
<td>2.09</td>
<td>1.27%</td>
<td>0.119</td>
</tr>
<tr>
<td>7</td>
<td>Textile</td>
<td>3000</td>
<td>90</td>
<td>1.20</td>
<td>0.73%</td>
<td>0.066</td>
</tr>
<tr>
<td>8</td>
<td>Chlor- Alkali</td>
<td>12000</td>
<td>22</td>
<td>0.88</td>
<td>0.53%</td>
<td>0.054</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>478</strong></td>
<td><strong>164.97</strong></td>
<td><strong>100%</strong></td>
<td><strong>6.686</strong></td>
</tr>
</tbody>
</table>
Sectoral Share of Target and Achievement

**Target Energy Saving Share**

- Aluminium: 7%
- Cement: 12%
- Chlor-Alkali: 1%
- Iron & Steel: 22%
- Paper & Pulp: 2%
- Textile: 1%
- Thermal Power Plants: 48%

**Achieved Energy Saving Share**

- Aluminium: 8%
- Cement: 17%
- Chlor-Alkali: 1%
- Iron and Steel: 25%
- Fertilizer: 9%
- Pulp and Paper: 3%
- Textile: 1%
- Thermal Power Plant: 35%

**Target**: 6.686 mtoe

**Achieved**: 8.67 mtoe
Policy objectives

- **INDC**
  - Intended Nationally determined Contribution (INDC): reduction of emission intensity by 33-35% of GDP by 2030 from the base year of 2005

- **GOALS**
  - Reduction in energy intensity between 2016 and 2019 by 7%

**Energy Saving**
- 8.67 mtoe
- 5635 MW
- 1.25% of India’s total primary energy supply

**Emission Reduction**
- 31 million tonnes of CO2
- 1.93% of India’s emissions

**Skill Development**
- Capacity building: 5000+ Engineers and operators
- 13718 Energy Auditors & Managers
- 219 Accreditation

**Savings**
- Rs 9,500 Crores from saved energy consumption and avoided generation

**Investment**
- Encouraged investments for energy efficient technologies for domestic manufacturing
- Rs 24,517 Crore invested
Sectoral Coverage: Cycle II and beyond

Additional Sectors in PAT Cycle II (2016-19)

1. Railways
2. Petroleum Refineries
3. Electricity Distribution Companies

Proposed Sectors in Coming Cycles of PAT

1. Chemicals
2. Commercial Buildings or Establishments
3. Hydel power stations, Electricity Transmission Companies
4. Petrochemical, Gas Crackers Naphtha Crackers
5. Port Trust
6. Sugar
7. Transport Sector (Industries and Services)
TPES: Total Primary Energy Supply
TFEC: Total Final Energy Consumption
Industry includes Thermal Power Plants and Railways
mtoe: Million tonnes of Oil Equivalent

TPES: 825 mtoe
TFEC: 556 mtoe
Industry: 390 mtoe

PAT II - 227mtoe (58% of Industry)

Target Energy Saving Share

Target : 8.869 mtoe
Baseline Year: 2014-15
Data Source: IEA and BEE
## PAT Cycle II- Notified sectors

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Sector</th>
<th>No. of DCs in PAT Cycle-I</th>
<th>Additional DC in PAT Cycle-II</th>
<th>Total no. of DCs PAT-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aluminum</td>
<td>10</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>Chlor-Alkali</td>
<td>22</td>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>Textile</td>
<td>90</td>
<td>14</td>
<td>99</td>
</tr>
<tr>
<td>4</td>
<td>Pulp &amp; Paper</td>
<td>31</td>
<td>4</td>
<td>29</td>
</tr>
<tr>
<td>5</td>
<td>Iron &amp; Steel</td>
<td>67</td>
<td>9</td>
<td>71</td>
</tr>
<tr>
<td>6</td>
<td>Fertilizer</td>
<td>29</td>
<td>8</td>
<td>37</td>
</tr>
<tr>
<td>7</td>
<td>Cement</td>
<td>85</td>
<td>27</td>
<td>111</td>
</tr>
<tr>
<td>8</td>
<td>Thermal Power Plants</td>
<td>144</td>
<td>22</td>
<td>154</td>
</tr>
<tr>
<td>9</td>
<td>Refinery</td>
<td>NA</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>10</td>
<td>DISCOMS</td>
<td>NA</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td>11</td>
<td>Railway</td>
<td>NA</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>621</td>
</tr>
</tbody>
</table>

PAT Cycle II
Baseline Year: 2014-15
PAT Cycle 2016-2019
Assessment Year: 2018-19
Projected Outcome – PAT 2

**Energy Saving**
- 11407 MW
- 17.5 mtoe
- 2.09% of India’s total primary energy supply

**Emission Reduction**
- 60 million tonnes of CO2
- 3-4% of India’s emissions

**Capacity Building**
- 12000+ Engineers and operators
- 15000 Energy Auditors & Managers
- 500 Accreditation

**Savings**
- Monetary savings due to energy
  - Rs 19100 Crores

**Investment**
- Encouraged investments for energy efficient technologies
  - Rs 30,000 Crore (Projected)
PAT II and Beyond (Rolling Cycle)

**PI**
- BY: 2007-10
- AY: 2014-15
- PI
- BY: 2014-15
- AY: 2018-19
- PII
- BY: 2015-16
- AY: 2019-20
- PIII
- BY: 2016-17
- AY: 2020-21
- PIV
- BY: 2017-18
- AY: 2021-22
- PV
- BY: 2018-19
- AY: 2022-23
- PVI
- BY: 2019-20
- AY: 2023-24
- PVII

**Left Over in existing sector + New Sectors**
- 2012: 478
- 2016: 621
- 2017: 116
- 2018: 62
- 2019: 1
- 2020: 11
- 2021: 6

**Rolling Cycle**
- PAT II and Beyond
Institutional Structure

MoP

BEE - Administrator

CERC – Market Regulator

Technical Committee

SDA

AEA

Designated Consumers (DCs)

Regulator & Central Registry

Trading Exchange

MoP

Baseline setting, Development of sector specific Pro-forma & Normalisation Factors

Updated list of DCs and AEA

Any Baselines Improvement

Any Baselines Improvement

Apply for Empenalmant

E-filing /Energy Return

PAD Information

Apply for ESCerts through Performance Assessment Document (PAD)

Issuance of ESCerts

Verified Result of DCs

Regular updates

Adjudicator

Appointed by State Commission for holding inquiry

Regular Checks & Levy Penalties in case of defaults

ESCerts Trading

Updated Obligation of DCs: Deficit or Surplus

Updated ESCerts Account Info

Settlement Details
“Excellent ‘baseline’ data established”

“Excellent methodology and formats for monitoring developed - ACC, Ultratech etc.. using these formats for regular monitoring”

The "Perform, Achieve and Trade" (PAT) mechanism is the most innovative and challenging initiative introduced under NMEEE (National Mission for Enhanced Energy Efficiency). FICCI

“It’s really interesting. There’s no other country in the world that’s doing this so ambitiously.” Noah Sachs, a law professor at the University of Richmond in Virginia, who spent the spring studying the program.

“The Indian program is particularly promising because it is a national, as opposed to a regional or statewide or provincial, program,”, Richard Sandor, the chairman of Environmental Financial Products a firm that has helped introduce several climate-related financial exchanges.
Inclusion of Railways in PAT Scheme:
Comparison of Energy intensity in various Transport modes

- Railways is the most energy efficient mass transport system
- Energy intensity comparison- 2004-05

<table>
<thead>
<tr>
<th></th>
<th>Pass.</th>
<th>Railways</th>
<th>Taxis</th>
<th>Bus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terra Joule/ BPKM</td>
<td>71</td>
<td></td>
<td>1338</td>
<td>196</td>
</tr>
<tr>
<td>Freight</td>
<td>Railways</td>
<td></td>
<td>HCVs</td>
<td></td>
</tr>
<tr>
<td>Terra Joule/ BTKM</td>
<td>91</td>
<td></td>
<td>1125</td>
<td></td>
</tr>
</tbody>
</table>

Railways is 2.8 times energy efficient in Pass. Traffic and 12.4 times in Freight Traffic
Indian Railways
- 3rd largest network
- IR consumes about 2% of electricity and about 3% of diesel of the country.

In 2015-16, IR consumed
- 2894 Million litres. of diesel
- 18.22 BU of electricity
- Energy bill of about 25,800 Cr. INR, i.e. about 25% of Ordinary Working Expenses.
- 9475 Cr. INR for electric traction & 16,100 Cr. INR for diesel traction.
- Further 1,600 Cr. INR for Non- Traction power
Railways’ INDC - Key targets

- To reduce emission intensity (i.e. tCO2 per million GTKM) by 32.6% in 2030 as compared to 2005 level.

- Reduction in Emission Intensity to be achieved by 2030 mainly through improved Energy / Fuel efficiency in traction from 2013-14 level.
  - Improvement in SEC, 4.8 % in Pass. and 13.2 % in Frt.
  - Improvement in SFC, 9.6 % in Pass. and 7.6 % in Frt.

- Use of 10% Solar Energy & Wind Energy by 2030.
- Use of 5 % blending of bio fuels.

Source: Annual Statistical Publication Railway 2015-16
Specific actions for IR in India’s INDC

- Increase share of Railways in total land transportation from 36% to 45%.
- Construction of Dedicated Freight Corridor to reduce 457 million tonnes of CO2 in 30 years,
- To improve Specific Fuel / Energy consumption in Traction system,
- PAT scheme to be extended to railway sector,
- Production of energy efficient 3 phase locomotives and switchover to 100% from 2016-17 onwards.
- To install solar Power on land, roof tops, coaches.
- Bulk users like Railways to use 5% blending of bio-fuels
Over the years, the electricity consumption of Indian Railways is growing at the rate of 4 percent and 3 percent in case of diesel consumption as per year on year basis,

Simultaneously, the railways network being electrified at pace of 3.7 percent year on year basis to move towards low carbon emissions and proficient transport segment.

Source: Annual Statistical Publication Railway 2015-16
Indian Railways Energy Consumption (Traction) Trend

Energy Consumption (Billion kWh)

- 2006-07: 11.06
- 2007-08: 11.68
- 2008-09: 12.24
- 2009-10: 13.09
- 2010-11: 13.57
- 2011-12: 13.45
- 2012-13: 13.85
- 2013-14: 15.17
- 2014-15: 15.74
- 2015-16: 15.70
- 2016-17: 15.7

Diesel oil (Million Kilo-litres)

- 2006-07: 2.21
- 2007-08: 2.28
- 2008-09: 2.26
- 2009-10: 2.40
- 2010-11: 2.52
- 2011-12: 2.71
- 2012-13: 2.70
- 2013-14: 2.79
- 2014-15: 2.86
- 2015-16: 2.87
- 2016-17: 2.96

Source: Annual Statistical Publication Railway 2015-16
As per the schedule of the Energy Conservation (EC) Act, 2001, industries in 15 energy intensive sectors are being identified as a “Designated Consumer (DC)”. 

1. Aluminium;  
2. Fertilizers;  
3. Iron and Steel;  
4. Cement;  
5. Pulp and paper;  
6. Chlor Akali;  
7. Sugar;  
8. Textile;  
9. Chemicals;  
10. Railways;  
11. Port Trust;  
12. Transport Sector (industries and services);  
13. Petrochemicals, Gas Crackers, Naphtha Crackers and Petroleum Refineries;  
14. Thermal Power Stations, hydel power stations, electricity transmission companies and distribution companies;  
15. Commercial buildings or establishments;
### Railways as Designated Consumer

<table>
<thead>
<tr>
<th>As per earlier notification</th>
<th>As per amended notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>The electric traction sub-section (TSS) in each zonal Railway</td>
<td>All zonal railways having annual energy consumption for traction of 70,000 metric tonne of oil equivalent (MTOE) per year and above</td>
</tr>
<tr>
<td>Diesel loco sheds in each zonal railways</td>
<td></td>
</tr>
<tr>
<td>All six production units i.e. Integral Coach Factory, Rail Coach Factory, Chittaranjan Locomotive Works, Diesel Locomotive Works and Rail Wheel Factory</td>
<td>All six production units i.e. Integral Coach Factory, Rail Coach Factory, Chittaranjan Locomotive Works, Diesel Locomotive Works and Rail Wheel Factory</td>
</tr>
<tr>
<td>Workshop of IR consuming energy more than 30000 toe and above</td>
<td>Workshop of IR consuming energy more than 30000 toe and above</td>
</tr>
</tbody>
</table>
Railways as Designated Consumer

Railways Sector DCs:-

- 16 Zonal Railways for Traction having Annual Energy Consumption of 70,000 toe or above are notified as Designated Consumer.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Zonal Railway</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Central</td>
</tr>
<tr>
<td>2</td>
<td>East Central</td>
</tr>
<tr>
<td>3</td>
<td>East Coast</td>
</tr>
<tr>
<td>4</td>
<td>Eastern</td>
</tr>
<tr>
<td>5</td>
<td>North Central</td>
</tr>
<tr>
<td>6</td>
<td>North Eastern</td>
</tr>
<tr>
<td>7</td>
<td>North Frontier</td>
</tr>
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<td>8</td>
<td>Northern</td>
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<td>9</td>
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<td>14</td>
<td>South Western</td>
</tr>
<tr>
<td>15</td>
<td>West Central</td>
</tr>
<tr>
<td>16</td>
<td>Western</td>
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</table>
Railways as Designated Consumer

Railways Sector DCs:-
- 6 Production Units notified as Designated Consumer.

<table>
<thead>
<tr>
<th>S.No</th>
<th>PRODUCTION UNIT</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Chittaranjan Locomotive Works</td>
</tr>
<tr>
<td>2</td>
<td>Diesel Locomotive Works</td>
</tr>
<tr>
<td>3</td>
<td>Diesel Modernization Works</td>
</tr>
<tr>
<td>4</td>
<td>Integrated Coach factory</td>
</tr>
<tr>
<td>5</td>
<td>Rail Wheel Factory</td>
</tr>
<tr>
<td>6</td>
<td>Rail Coach Factory (Kapurthala)</td>
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</table>
For Zonal Railway Traction:-

<table>
<thead>
<tr>
<th>Zonal Railway</th>
<th>Diesel</th>
<th>Electrical</th>
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<tbody>
<tr>
<td></td>
<td>Passenger (Litres/1000GTKm)</td>
<td>Goods (Litres/1000GTKm)</td>
</tr>
<tr>
<td></td>
<td>Target</td>
<td>Target</td>
</tr>
</tbody>
</table>
For Production Units :-

• Energy consumption per unit of production i.e. Locomotives, Coaches, wheels etc. is 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.
PAT Target-Fuel Consumption SFC (litre/1000GTKM) for targeted year (with Base line 2014-15)

Source: Annual Statistical Publication Railway 2015-16
PAT target - Electricity Consumption in SEC (kWh/1000 GTKM) for targeted year (with Base line 2014-15)

Source: Annual Statistical Publication Railway 2015-16
Percentage reduction of SEC & SFC under PAT target

- Under PAT cycle-II, all 16 zonal Railways’ specific energy/fuel consumption norms of electric & diesel traction were considered for setting up the target for reduction of following, considering base year as 2014-15 against a target year of 2018-19 are linked with INDC targets/projections.
  - 2.7 percent for diesel-passengers,
  - 1.9 percent for diesel-freight,
  - 1.1 percent for electric-passengers
  - 3.6 percent for electric-freight

- Looking at pace of Indian Railways energy consumption reduction, it is easily expected to achieve the PAT cycle-II targets with saving of 75,469 Ton of oil equivalent (TOE) by the end of 2018-19.

Source: Annual Statistical Publication Railway 2015-16
Over the years, under business as usual scenario - the specific energy and fuel consumption of Indian Railways were reduced gradually i.e., as follows (considering year to year comparison from 2006 to end of 2015).

- 2.3 percent for diesel-passenger,
- 4.5 percent for diesel-freight,
- 1 percent for electric-passenger,
- 5.4 percent for electric-freight
Reduction of Specific Energy/Fuel Consumption in Electric & Diesel Traction

<table>
<thead>
<tr>
<th>Year</th>
<th>SEC (Passenger)</th>
<th>SEC (Freight)</th>
<th>SFC (Passenger)</th>
<th>SFC (Freight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006-07</td>
<td>4.27</td>
<td>3.85</td>
<td>2.6</td>
<td>7.98</td>
</tr>
<tr>
<td>2007-08</td>
<td>4.09</td>
<td>3.83</td>
<td>2.52</td>
<td>7.72</td>
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<td>2008-09</td>
<td>4.01</td>
<td>3.8</td>
<td>2.32</td>
<td>6.82</td>
</tr>
<tr>
<td>2009-10</td>
<td>4.03</td>
<td>3.72</td>
<td>2.22</td>
<td>7.29</td>
</tr>
<tr>
<td>2010-11</td>
<td>3.85</td>
<td>3.78</td>
<td>2.19</td>
<td>6.79</td>
</tr>
<tr>
<td>2011-12</td>
<td>3.83</td>
<td>3.8</td>
<td>2.21</td>
<td>6.43</td>
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<tr>
<td>2012-13</td>
<td>3.8</td>
<td>2.23</td>
<td>2.23</td>
<td>6.13</td>
</tr>
<tr>
<td>2013-14</td>
<td>3.72</td>
<td>2.23</td>
<td>2.23</td>
<td>6.08</td>
</tr>
<tr>
<td>2014-15</td>
<td>3.78</td>
<td>2.23</td>
<td>2.1</td>
<td>6.86</td>
</tr>
<tr>
<td>2015-16</td>
<td>3.8</td>
<td>2.23</td>
<td>2.1</td>
<td>7</td>
</tr>
</tbody>
</table>

Source: Annual Statistical Publication Railway 2015-16
Indian Railways Energy Consumption (Traction) - Projection @ 2030

Source: Annual Statistical Publication Railway 2015-16
IR’s Energy saving potential by PAT target (Cycle-V) - under BAU

- For moderating Indian Railways annual energy consumption in forthcoming years,
- Railways may adopt the aggressive targets for specific energy/fuel consumption for zonal railways in next PAT cycle-V against as BAU/INDC scenario.
- In case of BAU, it is expected that the energy consumption reduction as follows (considering base year as 2018-19 against a target year of 2022-23).
  - 7 percent in diesel-passenger,
  - 13 percent in diesel-goods,
  - 3 percent in electric-passenger
  - 15 percent in electric-goods
- Which is expected to save the energy of 2,99,716 Ton of oil Equivalent (TOE) by end of 2022-23.

Source: Annual Statistical Publication Railway 2015-16
IR’s Energy saving potential by PAT target (Cycle-V) -under Aggressive side

- Whereas aggressive targets setup for specific energy/fuel consumption,

- it is projected to reduce the energy consumption as follows, considering base year as 2018-19 against a target year of 2022-23.

  - 10 percent in diesel-passenger,
  - 15 percent in diesel-goods,
  - 10 percent in electric-passengers
  - 15.3 percent in electric-goods

- Which is expected to save the energy of 4,30,776 Ton of oil Equivalent (TOE) against business as usual scenario.

Source: Annual Statistical Publication Railway 2015-16
IR’s Energy saving potential by PAT target (Cycle-V) in TOE by 2022-23 (with base line as 2018-19)

**BAU- Energy consumption reduction (as per projections) by 2022-23:**

<table>
<thead>
<tr>
<th>Category</th>
<th>Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel-Passenger</td>
<td>7.00%</td>
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<tr>
<td>Diesel-Goods</td>
<td>12.90%</td>
</tr>
<tr>
<td>Electric-Passenger</td>
<td>3.0%</td>
</tr>
<tr>
<td>Electric-Goods</td>
<td>15.3%</td>
</tr>
</tbody>
</table>

**Aggressive PAT target - Energy consumption reduction (as per projections) by 2022-23:**

<table>
<thead>
<tr>
<th>Category</th>
<th>Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel-Passenger</td>
<td>10%</td>
</tr>
<tr>
<td>Diesel-Goods</td>
<td>15%</td>
</tr>
<tr>
<td>Electric-Passenger</td>
<td>10%</td>
</tr>
<tr>
<td>Electric-Goods</td>
<td>15.3%</td>
</tr>
</tbody>
</table>

Source: Annual Statistical Publication Railway 2015-16
Indian Railways’ initiatives for Energy Efficiency

- Indian Railways may also explore to adopt the aggressive and stringent targets in **PAT cycle-V** for paradigm shift of Indian railways by 2022-23 in energy consumption reduction.

- Zonal railways may explore to adopt the innovative technologies in rolling stock especially in **electric and diesel locomotives** for contributing **towards paradigm shift**.

- Additionally, IR planning for medium and long term scenario for traction area i.e.,
  - Introduce latest energy efficient technologies,
  - Produce only 3 phase regenerative type locomotives and EMU’s
  - Take up manufacturing of new locomotives of 12000 HP with similar or better capabilities,
  - Speed up electrification to 24,000 kms by 2020
  - Progressively bring down diesel loco production

Source: Annual Statistical Publication Railway 2015-16
Thank you