



Perform Achieve & Trade

SEC Targets for Railways under PAT Cycle - II

by
Milind Deore, Energy Economist, BEE

New Delhi

14th June 2016

Contents

1

Energy Conservation Act, 2001

Designated Consumers in Railways

2

3

Energy Consumption Scenario of Railways

Railway Zone wise SEC

4

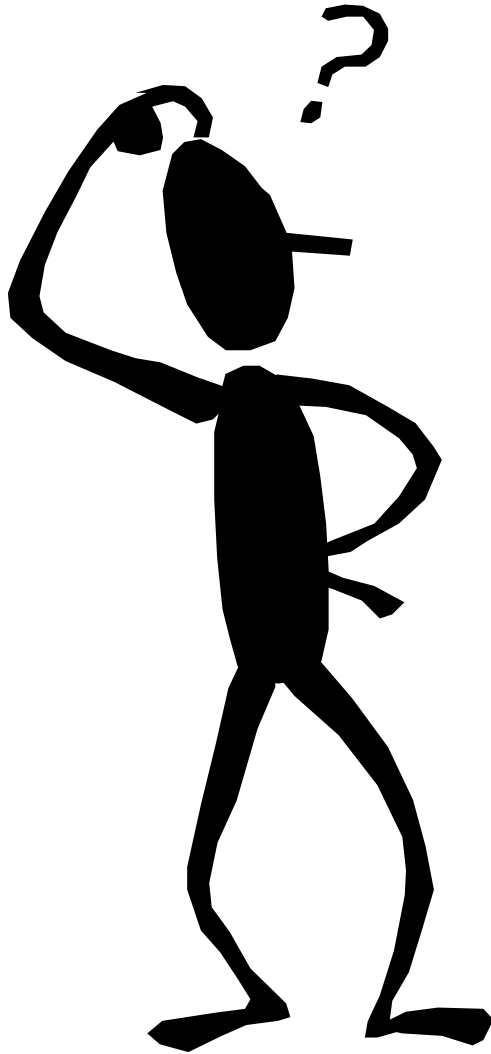
5

Baseline fixation & Target Setting Methodology

SEC targets for Railways

6

Inclusion of Railways under PAT



5 W + 1 H

What?

Why?

Who?

Where?

When?

How?

Energy Conservation Act, 2001

- An Act to provide for **efficient use of energy and its conservation** and for matters connected therewith or incidental thereto
- It extends to the whole of India except the **state of Jammu and Kashmir**
- It was enacted by Parliament in the Fifty-second Year of the Republic of India on **October 2001**
- The Bureau of Energy Efficiency (BEE) came into force from **March 2002 onwards**.
- This act was further amended in 2010 to include the provisions for energy saving certificates and revision of penalties.

Energy Conservation Act, 2001

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;

Energy Conservation Act, 2001

- In exercise of the powers conferred by the section 14(e) and (f) of the EC Act, the Central Government has notified 9 industrial sectors out of 15 as DCs. This notification was issued in March 2007.

- Two more industrial sectors i.e. petroleum refineries and electricity distribution companies are notified as DC on 29th Dec 2015 and notification for railways was also amended.

- Railways are one of the identified energy intensive industries under the Act and notified them as a DC. A DC need to-
 - Appoint or designate certified energy manager
 - Submit Annual Energy consumption return
 - Get energy audit conducted by an accredited energy auditor
 - Implement techno-economic viable recommendations
 - Comply with energy consumption norms and standards

Perform, Achieve and Trade Scheme

- The key goal of the PAT scheme under National Mission for Energy Efficiency (NMEEE) is to mandate specific energy efficiency improvements for the most energy intensive industries.
- The scheme builds on the large variation in energy intensities of different units in almost every sector.
- With respect to Sec 14(g) of the EC act, the Government has notified targets (in the form of SEC) for 478 DCs in the eight industrial sectors during March 2012 under the PAT cycle-I.
- The energy intensity reduction target mandated for each unit is dependent on its current efficiency : the reduction target is less for those who are more efficient, and is higher for the currently less-efficient units.

Railways as DC

As per earlier notification	As per amended notification
The electric traction sub –section (TSS) in each zonal Railway	All zonal railways having annual energy consumption for traction 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	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	Workshop of IR consuming energy more than 30000 toe and above

DCs in Indian Railways

➤ Railways Sector DCs:-

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

S.No	Zonal Railway
1	Central
2	East Central
3	East Coast
4	Eastern
5	North Central
6	North Eastern
7	North Frontier
8	Northern
9	North Western
10	South Central
11	South East Central
12	South Eastern
13	Southern
14	South Western
15	West Central
16	Western

DCs in Indian Railways

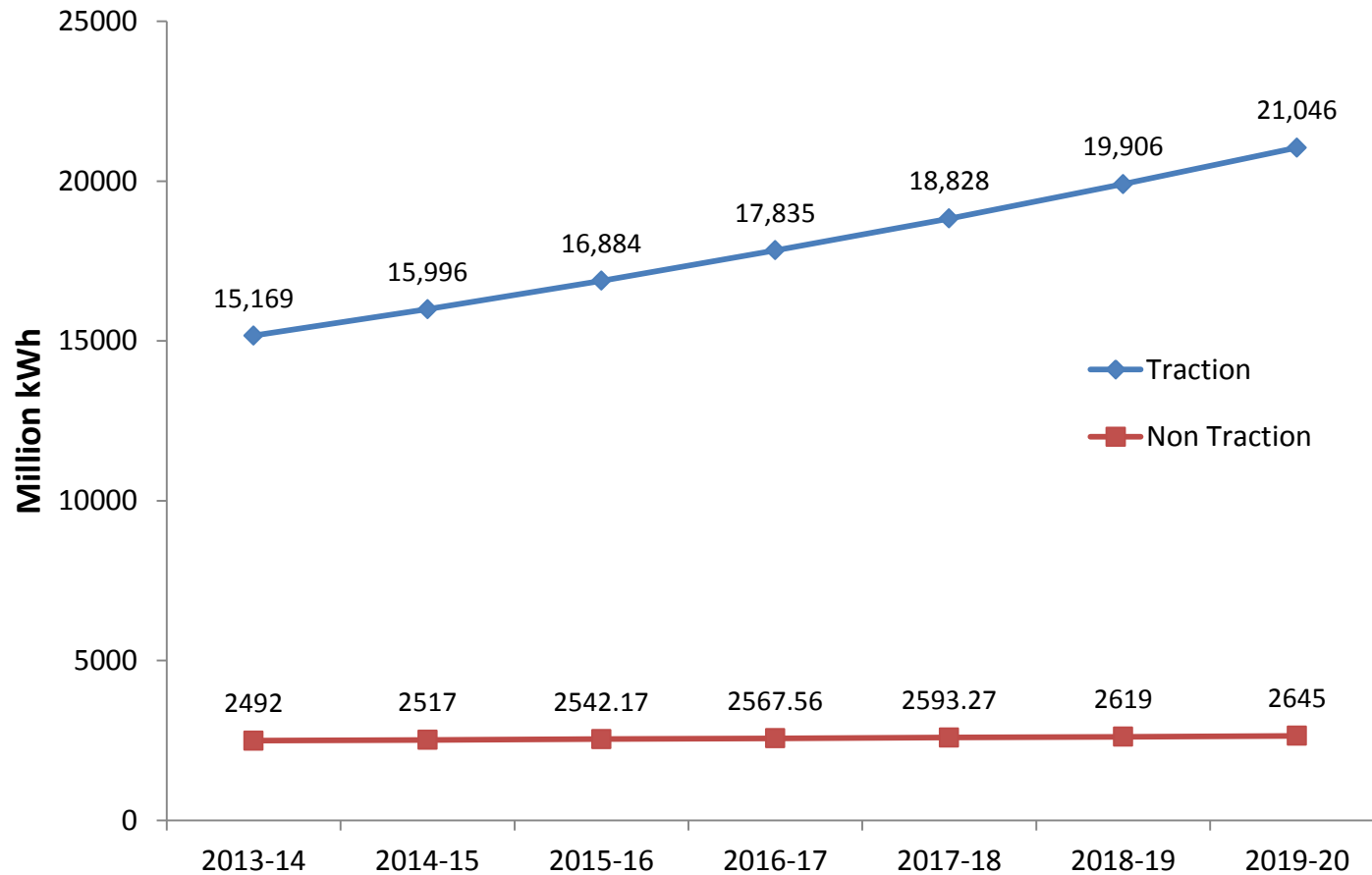
- Railways Sector DCs:-
- 6 Production Units notified as Designated Consumer.

S.No	PRODUCTION UNIT
1	Chittaranjan Locomotive Works
2	Diesel Locomotive Works
3	Diesel Modernization Works
4	Integrated Coach factory
5	Rail Wheel Factory
6	Rail Coach Factory (Kapurthala)

Railways – Energy Consumption Scenario

- Indian Railways is the Second largest railway network in the world under single Management with 7137 Railway stations, 10,773 locomotives, 61,558 passenger locomotives, 2, 54,006 freight cars and 66,030 route Km.
- Indian Railways operates 13,098 passenger trains everyday and 9,202 freight trains. It transports 3.02 million tonnes of freight traffic and 23 million passengers every day.
- 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)
- Significant potential for energy savings
 - 'Vision 2020' document of IR lays emphasis on **energy conservation** and envisages achieving 15% enhanced **energy efficiency** by 2020.

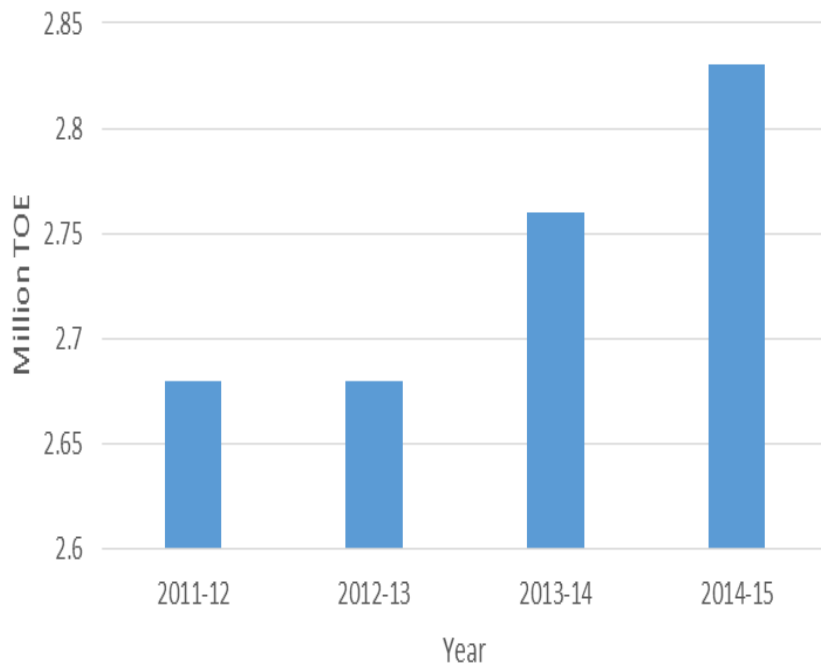
Projected Growth of Traction and Non-Traction



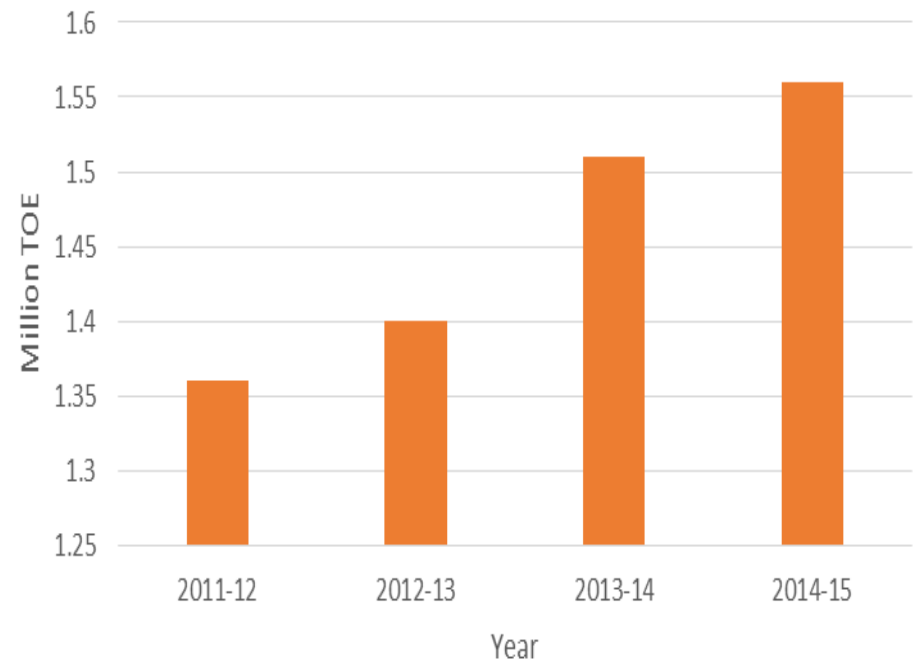
Source: CEA

Total Energy Consumption Trend

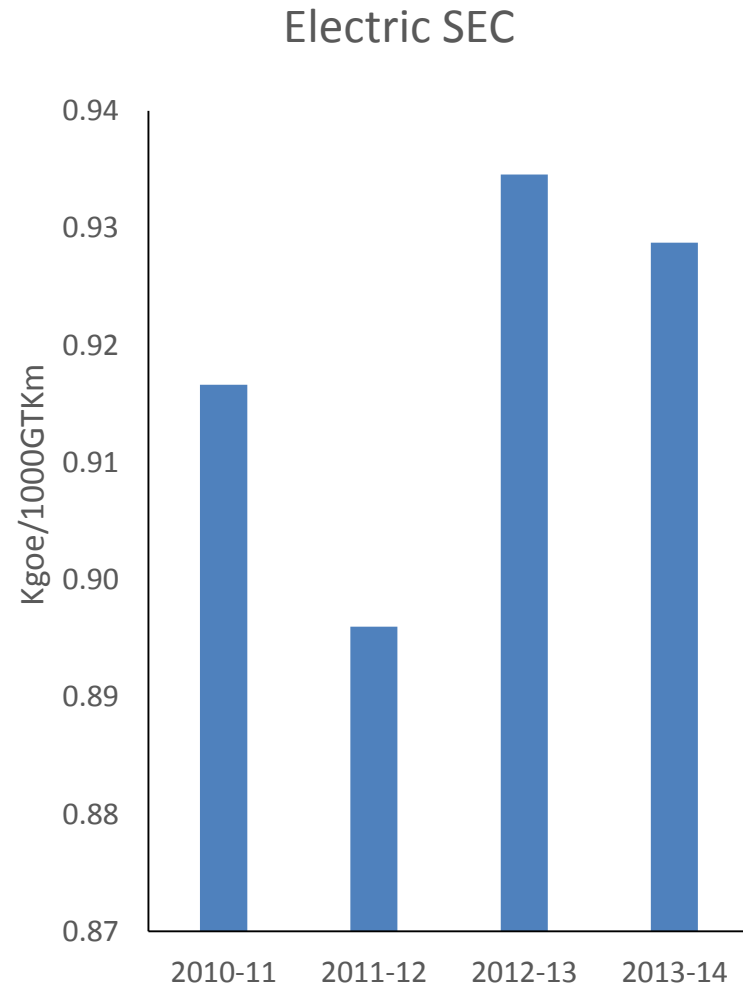
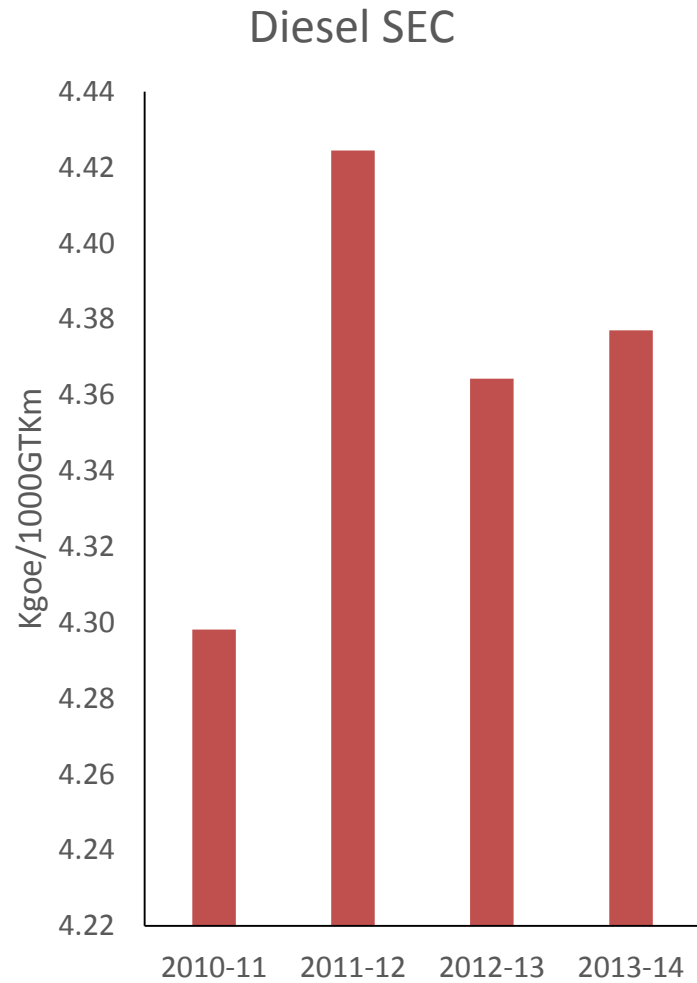
Diesel Consumption



Electricity Consumption



IR - National Specific Energy Consumption (Traction)



Metric Adopted for Target Setting

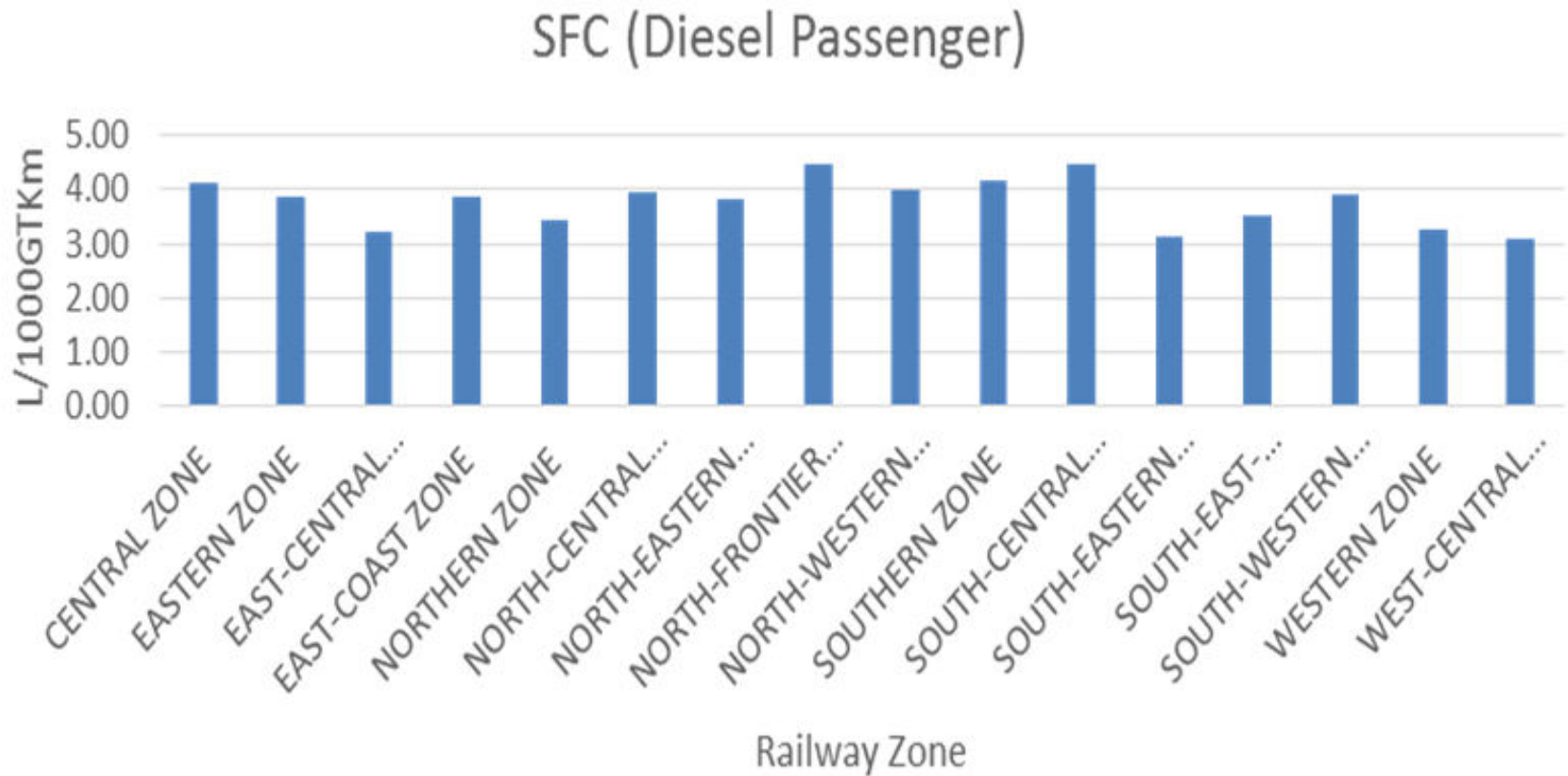
➤ For Zonal Railway Traction:-

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

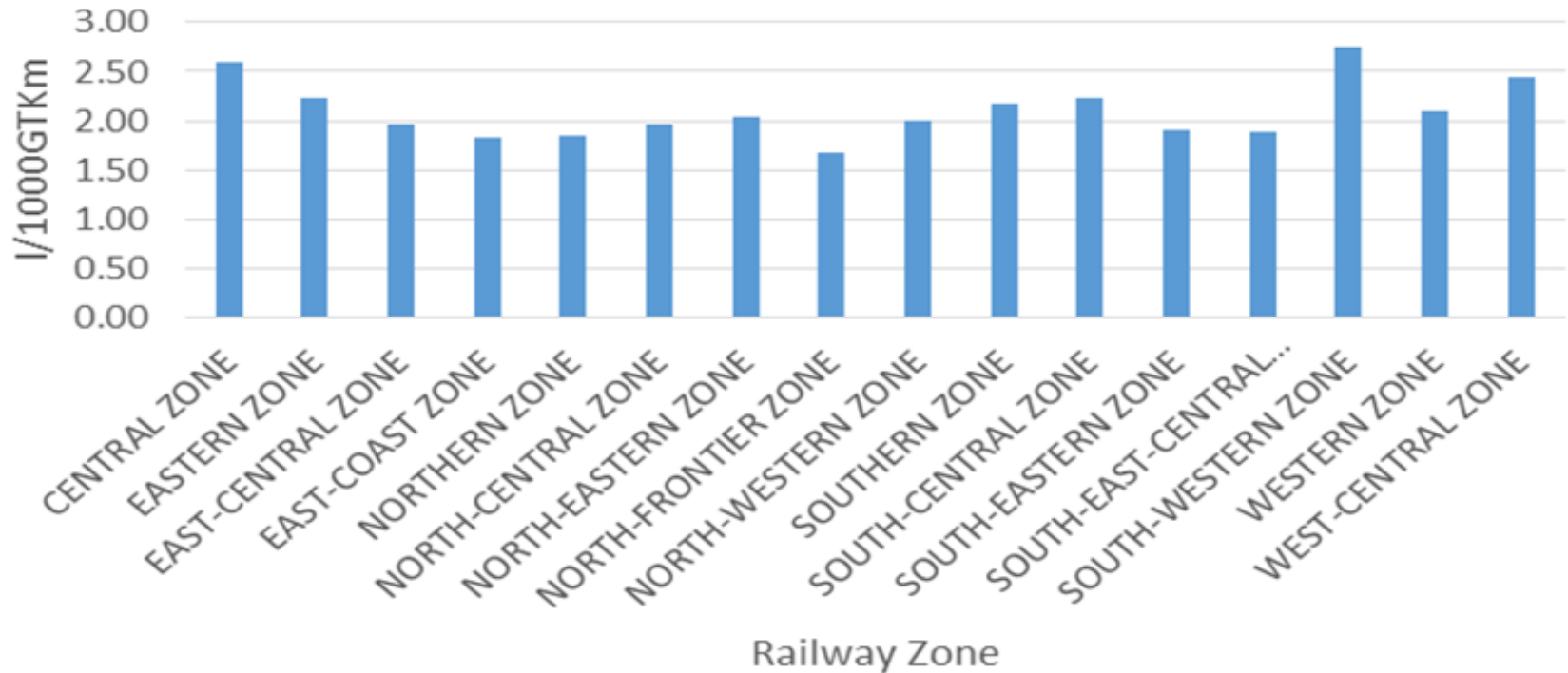
- For Production Units :-
 - Energy consumption per unit of production i.e. Locomotives, Coaches, wheels etc. is considered as performance metric.
 - All the energy consumption will be converted into toe and metric will be Kgoe /unit of production.
 - For the time being Rail Coach Factory (Raebareili)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

Zone Wise SFC (2014-15)- L/1000GTKM



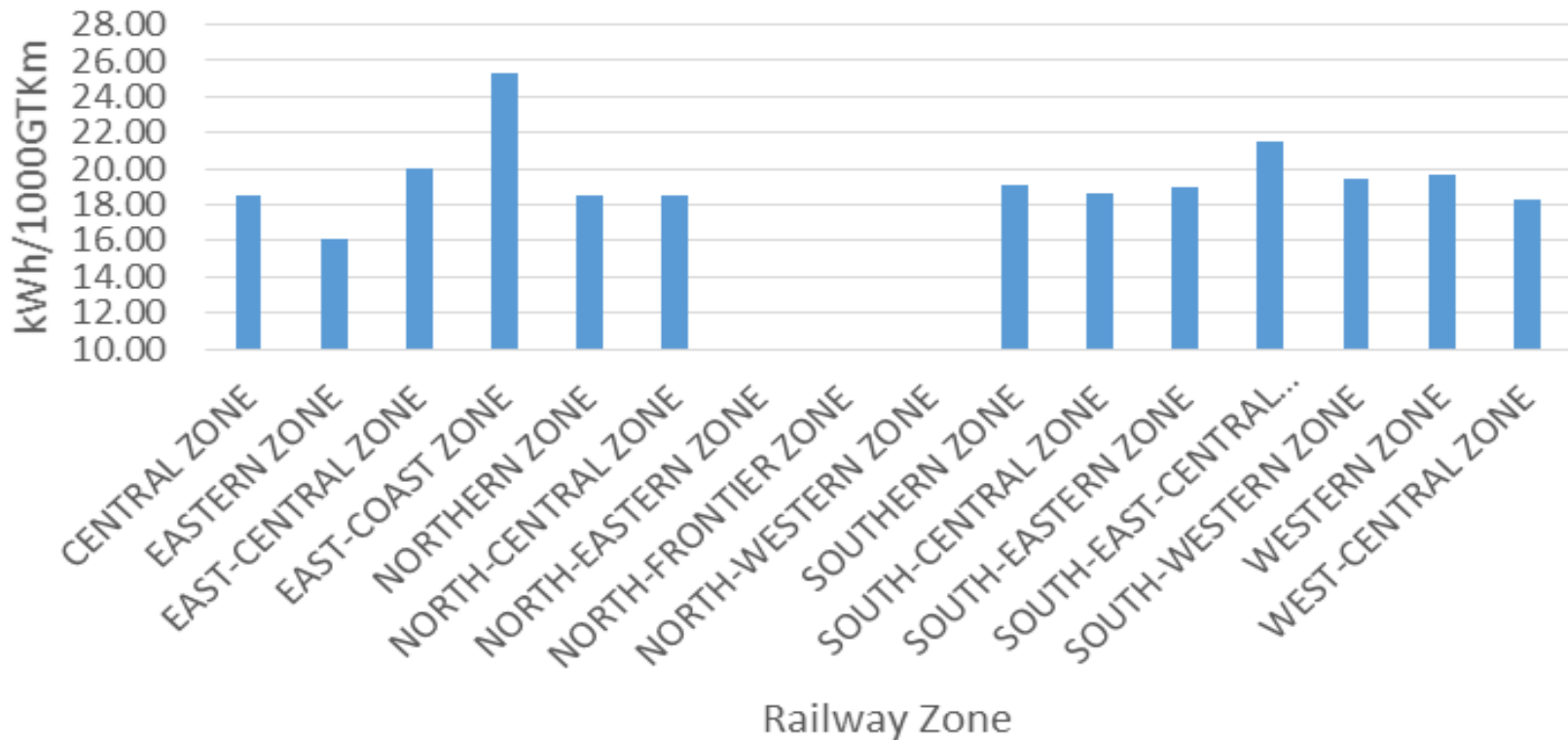
Zone Wise SFC (2014-15)- L/1000GTKM

SFC (Diesel Goods)

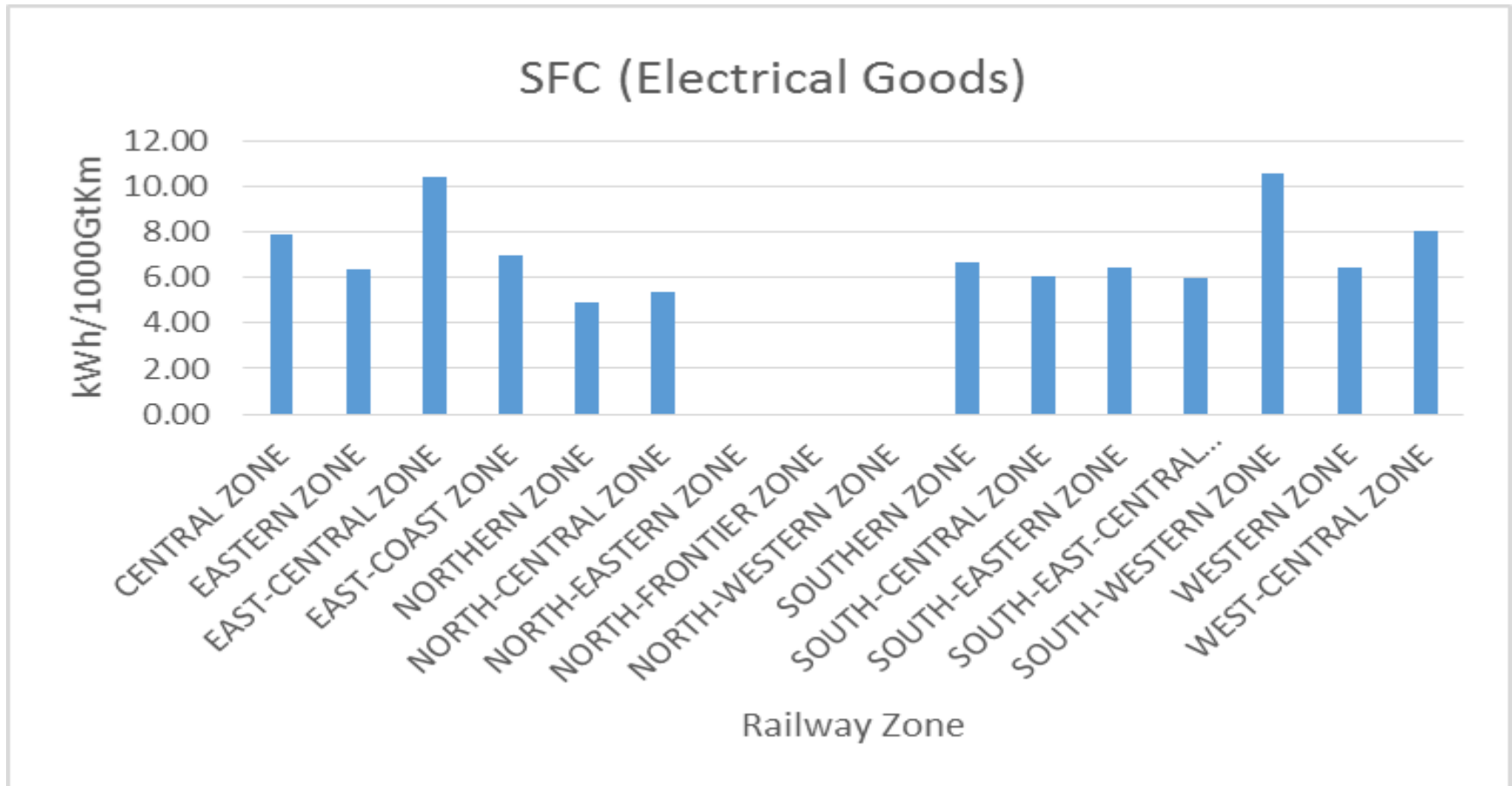


Zone Wise SFC (2014-15)- kWh/1000GTKM

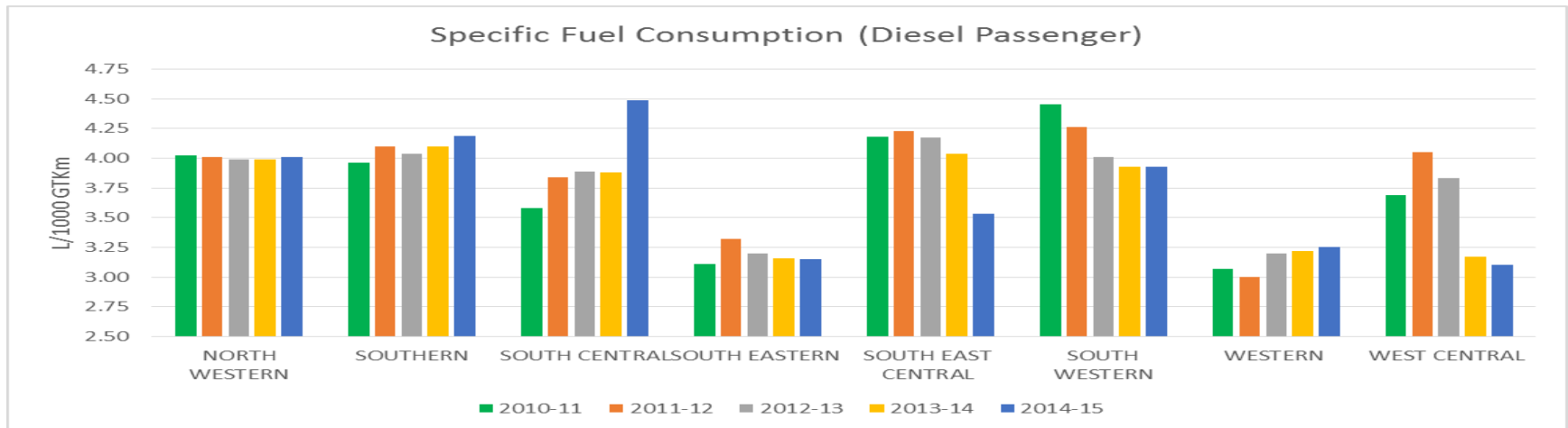
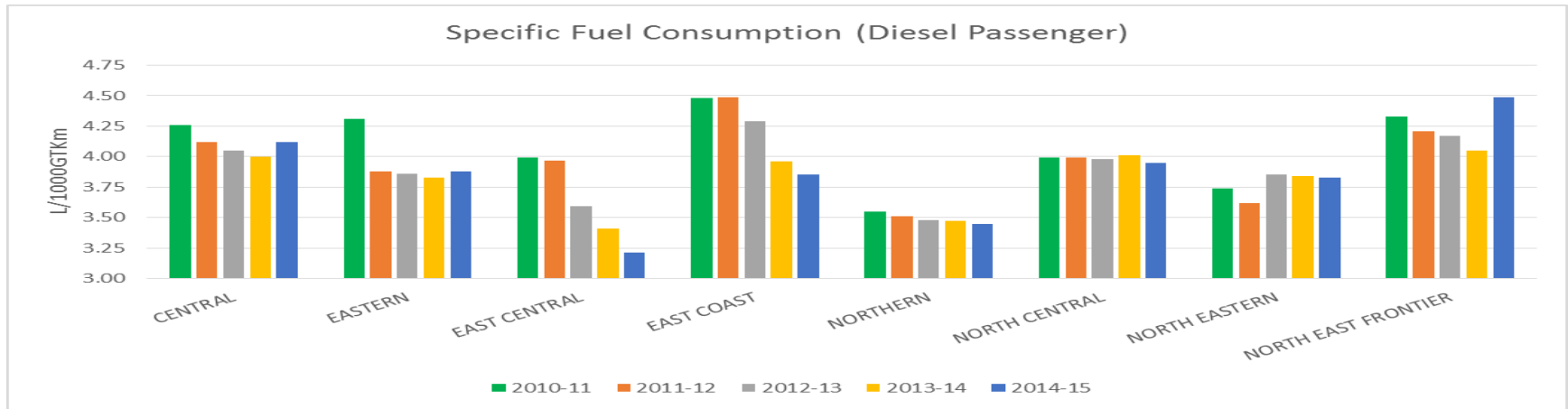
SFC (Electrical Passenger)



Zone Wise SFC (2014-15)- kWh/1000GTKM

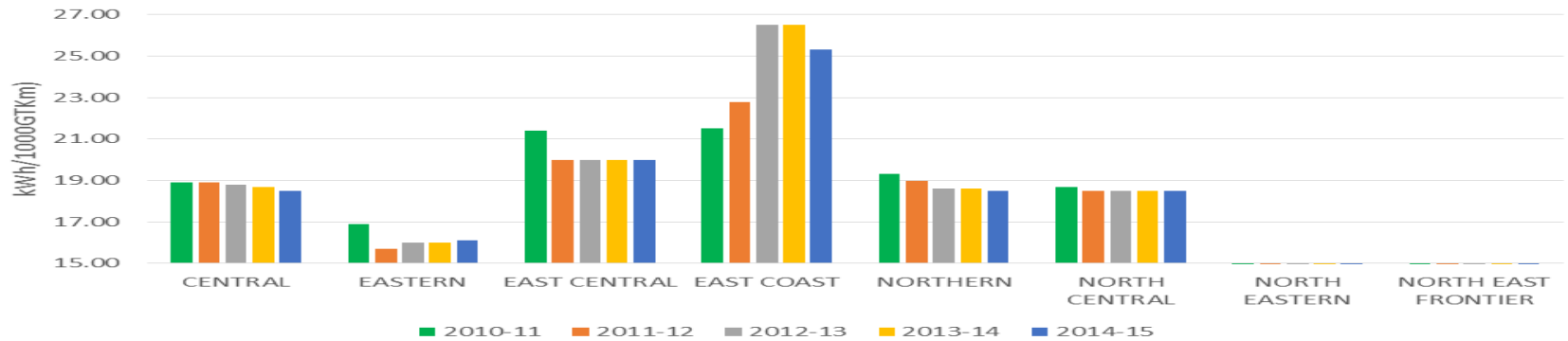


Zone wise Energy Consumption

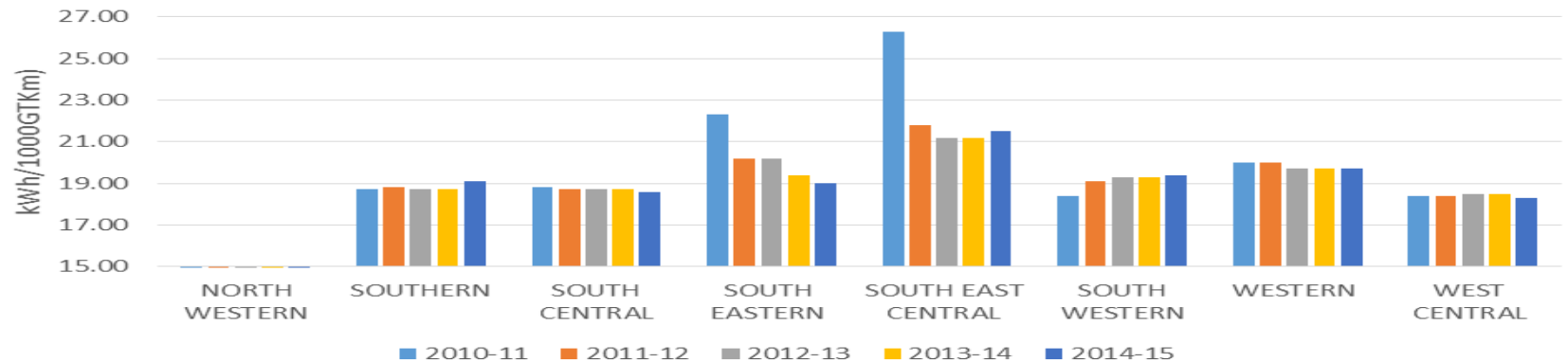


Zone wise Energy Consumption

Specific Fuel Consumption (Passenger, Electrical)



Specific Fuel Consumption (Passenger, Electrical)



Baseline Fixation and Target Setting Methodology

PAT Cycles Baseline Fixation

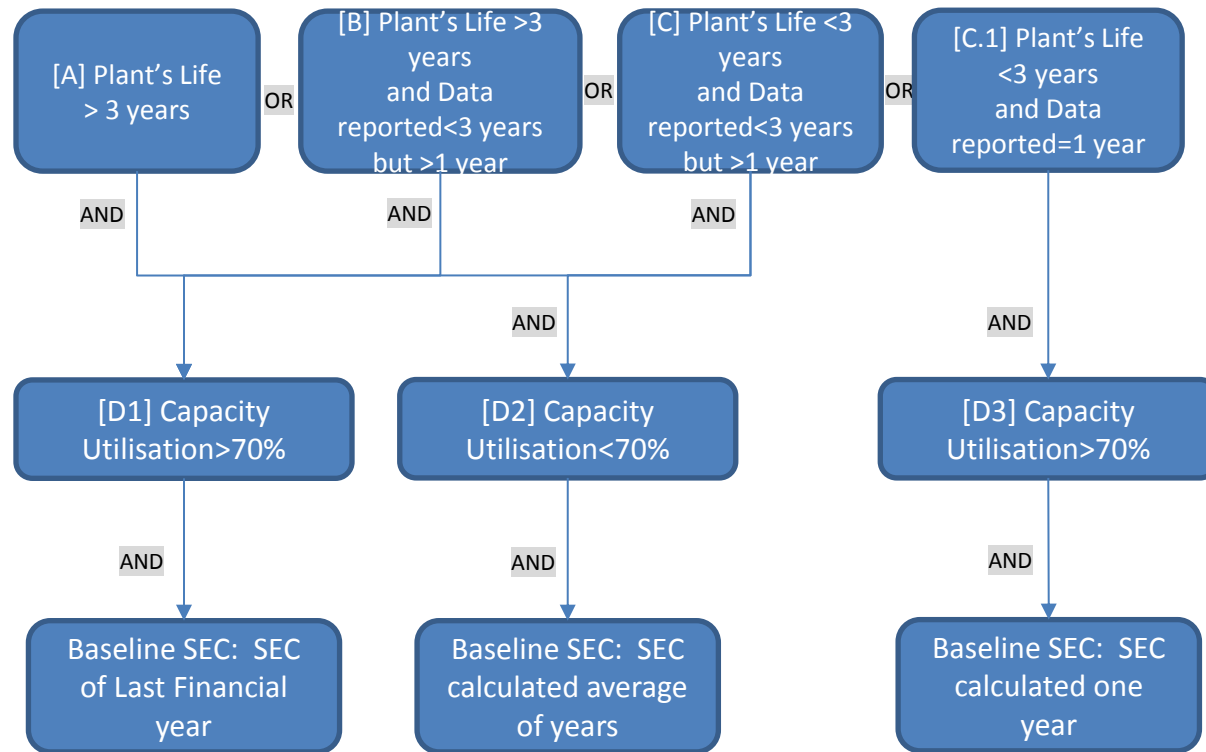
Sr No	Item	PAT Cycle I		PAT Cycle II	
		478 DCs	Existing DCs 478 Nos	New DCs in Existing Sector	New DCs in New Sector
1	Data Reporting	Five Years (2005-10)	One Year (2014-15)	Three Years (2012-15)	Three Years (2012-15)
2	Baseline Year	Average of three years (2007-10)	One year (2014-15)	One year (2014-15)	One year (2014-15)
3	Pro-forma	Through Form I and Pro-forma	Through developed Form I and Pro-forma	Through developed Form I and Pro-forma	Pro-forma development under final stage through Form I and Pro-forma
4	Data Verification	Baseline Energy Audit	M&V	Baseline Data Verification through pro-forma	Baseline Data Verification through pro-forma
5	Data Fixation	Baseline Energy Audit In Assessment year	M&V with certain changes in Formulae of Product and Power mix in AY data	Baseline data Verification Report	Baseline data Verification Report

Type of DCs for PAT Cycle II

- Existing DCs in existing 8 sectors
- New DCs in existing 8 sectors
- New DCs in new Sectors

Baseline Fixation-New DCs in existing and new sector

Baseline SEC Calculation- Based on Last financial year data



[E] Baseline SEC Fixation Condition

- Baseline Specific Energy Consumption will be calculated based on the last financial year data, if any conditions mentioned in (A) or (B) or (C) and condition mentioned in (D) are satisfied for the last financial year.
- In case, conditions are not satisfied for the last financial year, average of all those year where above mentioned conditions are satisfied shall be considered for calculating baseline specific energy consumption

Last financial year of three year reported data will be considered as the Baseline year for the new DCs in PAT Cycle II (Majority of the DCs)

Target Setting Methodology

▶ (I) Average rate of reduction

- in specific energy consumption across the designated consumers sectors'

▶ (II) **Policy objectives**

- of keeping the target of reducing the specific energy consumption a few percentage points above the average rate of reduction

Target Setting

Proposed to be based

- **Average rate of reduction in specific energy consumption (SEC) across all the designated consumers sectors + Policy objectives of keeping the target of reducing the specific energy consumption a few percentage points above the average rate of reduction**

Target Setting

(II) 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 %

(II) Policy Objective

Target Setting

- % rate of reduction per year as per policy objective (Energy Conservation)= 2.3% per year
- Net ESCerts available in PAT Cycle II will be over 2 mtoe
- **Total Saving Required: $19.6 + 2 = 21.6$ mtoe**

Global best DC Sector

Differentiation between Global best and other sector

•*The target for the global best sector(s)*

•*The target for other sector*

SEC Targets For all Zones (Traction)

Sr.No	ZONE	FUEL	SERVICE	CONSUMPTION/1000GT Km		Target (Assessment Year : 18-19)
				Units	2014-15	
1	CENTRAL	Diesel	Passenger	litres/1000 GTKm	4.12	4.01
			Goods		2.59	2.54
		Electrical	Passenger	Kwh/1000GTK m	18.50	18.30
			Goods		7.94	7.65
2	EASTERN	Diesel	Passenger	litres/1000 GTKm	3.88	3.78
			Goods		2.24	2.20
		Electrical	Passenger	Kwh/1000GTK m	16.10	15.93
			Goods		6.39	6.16
3	EAST CENTRAL	Diesel	Passenger	litres/1000 GTKm	3.21	3.12
			Goods		1.97	1.93
		Electrical	Passenger	Kwh/1000GTK m	20.00	19.79
			Goods		10.40	10.02
4	EAST COAST	Diesel	Passenger	litres/1000 GTKm	3.85	3.75
			Goods		1.82	1.79
		Electrical	Passenger	Kwh/1000GTK m	25.30	25.03
			Goods		6.99	6.74

SEC Targets For all Zones (Traction)

5	NORTHERN	Diesel	Passenger	litres/1000 GTKm	3.45	3.36
			Goods		1.85	1.82
		Electrical	Passenger	Kwh/1000GT Km	18.50	18.30
			Goods		4.95	4.77
6	NORTH CENTRAL	Diesel	Passenger	litres/1000 GTKm	3.95	3.84
			Goods		1.97	1.93
		Electrical	Passenger	Kwh/1000GT Km	18.50	18.30
			Goods		5.38	5.19
7	NORTH EASTERN	Diesel	Passenger	litres/1000 GTKm	3.83	3.73
			Goods		2.03	1.99
		Electrical	Passenger	Kwh/1000GT Km	0.00	0.00
			Goods		0.00	0.00
8	NORTH EAST FRONTIER	Diesel	Passenger	litres/1000 GTKm	4.49	4.37
			Goods		1.68	1.65
		Electrical	Passenger	Kwh/1000GT Km	0.00	0.00
			Goods		0.00	0.00
9	NORTH WESTERN	Diesel	Passenger	litres/1000 GTKm	4.01	3.90
			Goods		2.01	1.97
		Electrical	Passenger	Kwh/1000GT Km	0.00	0.00
			Goods		0.00	0.00
10	SOUTHERN	Diesel	Passenger	litres/1000 GTKm	4.19	4.08
			Goods		2.18	2.14
		Electrical	Passenger	Kwh/1000GT Km	19.10	18.90
			Goods		6.67	6.43

SEC Targets For all Zones (Traction)

11	SOUTH CENTRAL	Diesel	Passenger	litres/1000 GTKm	4.49	4.37
			Goods		2.24	2.20
		Electrical	Passenger	Kwh/1000GT Km	18.60	18.40
			Goods		6.10	5.88
12	SOUTH EASTERN	Diesel	Passenger	litres/1000 GTKm	3.15	3.07
			Goods		1.90	1.86
		Electrical	Passenger	Kwh/1000GT Km	19.00	18.80
			Goods		6.46	6.23
13	SOUTH EAST CENTRAL	Diesel	Passenger	litres/1000 GTKm	3.53	3.44
			Goods		1.88	1.85
		Electrical	Passenger	Kwh/1000GT Km	21.50	21.27
			Goods		6.00	5.78
14	SOUTH WESTERN	Diesel	Passenger	litres/1000 GTKm	3.93	3.82
			Goods		2.75	2.70
		Electrical	Passenger	Kwh/1000GT Km	19.40	19.19
			Goods		10.60	10.22
15	WESTERN	Diesel	Passenger	litres/1000 GTKm	3.25	3.16
			Goods		2.10	2.06
		Electrical	Passenger	Kwh/1000GT Km	19.70	19.49
			Goods		6.48	6.25
16	WEST CENTRAL	Diesel	Passenger	litres/1000 GTKm	3.10	3.02
			Goods		2.45	2.40
		Electrical	Passenger	Kwh/1000GT Km	18.30	18.11
			Goods		8.04	7.75

SEC Targets for Production Units

S.No	PRODUCTION UNIT	Output	Units Produced (14-15)	Energy Consumption (2014-15) (Toe)	SEC (Kgoe/No of units produced)	
					2014-15	Target
1	Chittaranjan Locomotive Works	Locomotive	260	4505.5	17328.85	16294.31
2	Diesel Locomotive Works	Locomotive	266	910	3421.05	3216.82
3	Diesel Modernization Works	Locomotive (rebuilding and manufacturing)	306	1040.34	3399.80	3196.84
4	Integral Coach factory	Coach	1704	1702.67	999.22	939.57
5	Rail Wheel Factory	Wheel	175175	23079.56	131.75	123.89
6	Rail Coach Factory (Kapurthala)	Coach (Equalized)	2042	2749.59	1346.52	1266.13

Major Obligations for DCs

- **EC Act schedule provides list of 15 energy intensive industries and other establishments to be notified as designated consumers (DC).**
- **DCs to appoint or designate energy managers who shall be in charge of activities for efficient use of energy and its conservation (clause 14(I)).**
- **The information with regard to energy consumed (clause 14(a)) in Form 1**
- **Get energy audits conducted by accredited energy auditors**
- **Implement techno-economic viable recommendations**
- **Comply with norms of specific energy consumption**
- **Submit report on steps taken**

Thank You