

## 12. Brief write up on Southern Railway.

### I. Unit Profile

Southern Railway was formed on 14<sup>th</sup> April 1951 by merging the Railway system administered by the erstwhile Madras and Southern Mahratha, South Indian and Mysore State Railways. Subsequently in 1966, with the formation of South Central Railway, a portion of Southern Railway was transferred to South Central Railway. Again in 2003, South Western Railway was formed transferring two divisions from Southern Railway.

Now Southern Railway serves the entire States of Tamilnadu, Kerala, Pondicherry and a small part of Andhra pradesh.

The Electrical Branch of Southern Railway is responsible for the operation and maintenance of the following assets, as well as construction activities involving electrical installations.

- Electrical Rolling Stock
- Traction Distribution installations
- Train lighting and air conditioning equipment in coaches.
- General Electrical Services – HT & LT distribution, lighting, ventilating, air-conditioning, pumping in Railway stations, offices, workshops, residential areas, hospitals, passenger reservation systems etc.

Southern Railway has 5155 route kilometers RKM. Out of this 1692 Rkm is electrified on 25 kV AC. Southern Railway holds 265 electric locomotives and 416 Diesel locomotives.

This Railway has a 105177 strong workforce and 6 divisions Headquartered at Chennai, Palghat, Trivandrum, Tiruchchirappalli, Madurai and Salem. Periodical overhauls are done at the following workshops

1. Coaches – Carriage works Perambur & Golden Rock shops
2. Loco – Loco Workshops Perambur
3. EMU – EMU car shed Avadi, Tambaram and Velachery.

Though the major traffic on this Railway is of passenger services substantial amount of freight services are also run. The status of passenger movement and freight over the past 6 years are given below :

### ***III. Energy Conservation Commitment, Policy and Organizational set up.***

#### ***Commitment :***

This Railway is strongly committed to minimize energy consumption to the extent possible without making any compromise on quality and quantity of output and services with a view to (i) make electrical energy available to all (ii) conserve energy for use by future generation (iii) preserve fossil fuels and last but not the least (iv) to economize expenditure. The energy utilizing departments i.e Electrical, Mechanical are always engaged in implementing various energy conservation measures as well as process techniques for saving energy and thus achieving savings in energy consumption. The department heads of Electrical and Mechanical are closely monitoring the energy consumption and initiate timely action on various energy saving measures.

#### **Energy Policy :**

Attached as Annexure D.

### ***IV. Energy conservation achievements***

#### ***Non Traction area***

The following Energy conservation measures have been implemented in Southern Railway during the year 2007-08

##### ***➤ Segregation of station lighting:***

The lighting load of Railway stations has been segregated into two circuits one with 20% of lightings which will be "ON" for the entire night (1800 hrs to 6 am) and the other circuit with 80% lighting will be switched "ON" based on arrival / departure of trains manually at big junctions and timers at way side stations. This arrangement of segregation has been implemented in all the 725 electrified stations in Southern Railway.

With this arrangement energy saved to a tune of 8% of station consumption achieved.

##### ***➤ Provision of Automatic Switch Off Timers in way side stations***

Electronics static timers having fine and coarse settings have been provided at 85 stations. These timers can be switched ON only by manually but they switch OFF automatically after lapse of preset time of 30 minute. Once these timers are provided in lighting circuits containing 80% of the circuit in wayside stations. These Timers manually switched ON 15 minutes before the arrival of train, they switched OFF automatically after 30 min, thus avoiding unnecessary lighting on totally vacant platforms for entire night.

An average of 8% of Electrical energy is being saved with the provision of these timers.

➤ **Provision of Energy Efficient Fluorescent lamps :**

18340 Nos of Energy Efficient T 5 - 28 W Fluorescent lamps with electronic ballast have been provided in replacement of conventional 40 W Fluorescent lamps with copper magnetic ballast.

With this arrangement energy saved to a tune of 17.67 lakhs of units per annum.

➤ **Provision of Energy Efficient Compact Fluorescent lamps :**

1982 Nos of Energy Efficient Compact Fluorescent lamps have been provided in replacement of conventional 40 W /60 W incandescent lamps. .

With this arrangement energy saved to a tune of 1.62 lakhs of units per annum.

➤ **Provision of Energy Efficient fans :**

12114 Nos of Energy Efficient 60 W fans have been provided in replacement of old 90 W fans.

With this arrangement energy saved to a tune of 10.61 lakhs of units per annum.

➤ **Provision of Electronic ballast :**

4125 Nos of Electronic ballast have been provided in replacement of conventional copper magnetic ballast.

With this arrangement energy saved to a tune of 1.81 lakhs of units per annum.

➤ **Provision of Solar Water Heaters :**

25 Nos of Solar Water heaters have been provided in replacement of electric geysers.

With this arrangement energy saved to a tune of 1.37 lakhs of units per annum.

➤ **Provision of Solar Lighting Panel for LC gates :**

8 Nos of Solar Lighting panel have been provided in LC gates lodges. .

With this arrangement energy saved to a tune of 0.03 lakhs of units per annum.

➤ **Provision of VVVF control for Lifts :**

15 Nos of lifts have been provided with VVVF control for Lifts. .

With this arrangement energy saved to a tune of 1.81 lakhs of units per annum.

➤ **Provision of High Pressure Mercury Vapour Lamps in place Sodium vapour lamps :**

730 Nos of High Pressure Mercury vapour lamps in place of High Pressure Sodium vapour lamps.

With this arrangement energy saved to a tune of 3.20 lakhs of units per annum.

## ***TRACTION***

The following energy conservation measures have been implemented in Southern Railway during the year 2007-08.

**i). Provision of 21.6MVA transformer in place of 12.5 MVA at 1 traction substations.**

No load losses in 13.5 MVA (ONAN) transformer and 21.6 MVA (ONAN) transformer are 9 kW. The load losses in 12.5 MVA are about 60 kW at Full Load. 21.6 MVA transformer, which has 85 kW load losses at its full load, will have load losses as 37 kW at 12.5 MVA which is less by 23 kW (i.e. 38%) than in 12.5 MVA. The difference in load losses will be more pronounced at higher load i.e 201480 kwh/year. Thus an average saving of Rs. 5.8 Lakhs per transformer per year has been achieved.

## ii) Provision of Low loss Air cored series reactors for capacitor bank.

During the initial stage of electrification Conventional air cored series reactor having 13 – 18 kW power loss was provided. Series reactors are in service for 24 hrs per day and 365 days per year. Total power loss will be 1,57,680 kWh/year. With Southern Railway initiative, low loss series reactor of 5 kW was developed during 1999. Total power loss in low loss series reactor will be 43,800 kWh per year. During the year 2005 –06 one number of series reactor have been provided at Perinad Traction Substation in Trivandrum Division.

$$\begin{aligned} \text{Energy saving per annum } & (1,57,680 - 43,800) \\ & = 1,13,880 \text{ kWh} \end{aligned}$$

$$\begin{aligned} \text{Saving in energy charges/TSS at Rs.4.59/kwh} & = 1,13,880 \times 2.90 \\ & = \text{Rs. 3.3 Lakhs per year.} \end{aligned}$$

## Saving due to provision of capacitor bank at Traction Substation

Southern Railway is availing power supply for electric traction at 110 kV/ 32 kV through 27 Traction Substations from TNEB/KSEB/ APTransco. For maintaining power factor above the stipulated value of 0.90 lag Railways have provided adequately rated shunt capacitor banks at all the Traction Substations and maintaining the average power factor above the stipulated value. If the power factor falls below the stipulated value, low power factor surcharge has to be paid at the rates prescribed by SEBs. If the power factor is maintained above a specified value high power factor incentive at such rates will be paid by SEBs as provided for by the respective Electricity Regulatory Commission.

Kerala State Electricity Regulatory Commission (KSERC), after hearing Southern Railway's views presented in the specific hearings organized, has ordered a rebate for maintaining high power factor at the rate of 0.15% of Energy charges for every 0.01 increase in the PF above 0.90. Southern Railway, by way of maintaining the PF above 0.90 by providing capacitor banks in at 8 traction substations, have thus saved Rs. 30.65 Lakhs during the year 2007 – 2008.

## ***V. Energy Conservation Plans and Targets***

Energy Conservation plans is proposed to adopt the following Energy Conservation Policies during the year 2008-09 to conserve Electrical Energy on continual basis.

- ❖ To reduce non traction energy consumption from 129 million units in 2007-08 to 120 million units in 2008-09
- ❖ Star rated products 3-star labeled and above are being procured for which Bureau of Energy Efficiency has authorized labeling based on energy consumption.
- ❖ All future procurement of new fluorescent tube lights will be only T 5 energy efficient fluorescent light fittings with electronic ballast.
- ❖ Progressive replacement of existing T12/T8 FL lamps with magnetic ballast by T5 energy efficient retrofit assembly kits with electronic ballast.
- ❖ Energy consuming incandescent lamps, mercury vapour lamps and magnetic ballast have been discontinued..
- ❖ Complete switch over to Compact Fluorescent lamps in place of IC lamps for all applications including office buildings, railway stations railway quarters, hospitals, rest houses, workshops etc.
- ❖ Station name boards to be with LED lamps only as against neon lamps containing the switch on lights in.
- ❖ Timers for circulating area and street lights
- ❖ 3 colonies to be exclusively provided with solar panel for lighting to begin with and proposed to extend the same to more colonies.
- ❖ 6 stations to be provided with solar panels for lighting to begin with and proposed to extend the same to more stations.
- ❖ Provision of occupancy sensors to start with in officers chamber, VIP lounges waiting halls, meeting room etc to avoid wastage of electrical energy.
- ❖ Provision of Automatic switch off timer for all way side stations.
- ❖ Provision of Common Meter Reading Instrument (CMRI) for down loadable receptors for one colony to begin with and proposed to extent the same for more colonies.

❖ In addition to the above, following works aimed at improving energy efficiency and energy conservation measures have been sanctioned.

1. Provision of green building features at MAS Central and MAS Egmore station at a cost of Rs.50 lakhs each.
2. Complete elimination of electric geysers by provision of solar water heaters.
3. Switch over to LED signages.
4. Dynamic reactive compensation.

➤ **Energy Auditing by Accredited Energy Auditors**

Energy Auditing has been conducted by Accredited Energy Auditors at 7 major locations to identify potential for energy saving by detecting areas of energy wastage, inefficient energy utilization, unproductive consumption etc. Medium term measures recommended by energy auditors which are applicable to all locations have immediately been implemented over the Southern Railway as detailed below.

- ❖ Replacement of copper choke by Electronic choke
- ❖ Replace 40 W fluorescent lamp with 28 W T 5 Lamp
- ❖ Replace fluorescent tube/ lamps with CFL
- ❖ Replace fluorescent tube/ lamps with LED lamps
- ❖ Provide timers in street lights and tower light circuits for automatic switching ON/ OFF
- ❖ Replace high wattage lamps with energy efficient lamps say 250 W HPMV by 150 W MH lamps
- ❖ Install capacitors to improve power factor
- ❖ Setting up of optimum voltage of 205-210 V for lighting circuit against 230/240V to same energy.

Details of auditors, load center-wise has been furnished in item 10 of BEE's questionnaire.

## **VI. Environment and safety**

### **Environment**

For providing Clean Environment following actions have been taken.

- Cleanliness Contract has been awarded to external agencies for maintenance of cleanliness and hygiene in major and important stations. Officers and supervisors have been provided with imprest for engaging external agencies for maintaining cleanliness at other stations.
- Replacement of harmful R-12 refrigerant of AC coaches with Eco friendly R134a refrigerant. Southern Railway has modified 78 old type Air Conditioned coaches to work with R134 Refrigerant entirely by Departmentally.
- Undertaking modification works at two major stations viz Chennai Central and Chennai Egmore to provide Green-building features.
- Providing DG sets with acoustic enclosures to limit the carbon emission
- Keeping station in pleasant atmosphere surrounded by trees

### **Safety**

The Safety performance is constantly monitored at the highest level. An exclusive Safety department headed by a joint secretary level officer (CHIEF SAFETY OFFICER) assisted by seven officers at Dy secretary level is functioning to ensure safety. The trend of train accidents is reviewed regularly and corrective measures adopted.

With a view to identify system failures, bi monthly joint two-day safety audits by an SAG level multi disciplinary team of officers are being conducted. The following are the joint audits safety audits conducted for the year 2007-08

Sl.No	Section	Date of Safety Audit conducted
1	Trichur – Shoranur	26.04.07 & 27.04.07
2	Tiruchchirappalli – Lalgudi	31.07.07 & 01.08.07
3	Milavitan – Tuticorin	18.09.07 & 19.09.07
4	Calicut Station only	14.12.07 & 15.12.07
5	Gummidipoondi – Sulerpet	07.02.08 & 08.02.08

Safety camps are organized periodically to inculcate Safety awareness amongst the staff and to discuss day-to-day practical problems in an informal environment and evolve solutions for safer working.

Safety propaganda is conducted at regular intervals through media such as TV, Radio and Newspaper. The hazards of fire in trains and perils of non-observance of rules by road users at level crossings are carried to the masses.

Road users are educated through interaction display of Safety posters and by distributing handouts, various functions and propaganda campaigns are organized to high light the importance of Railway safety. These activities include street dramas, folk dances etc as a medium to take the message to the masses.

#### **Efforts to improve the Diesel Consumption:**

- A. DEMU's have been introduced in routes where the number of coaches hauled is less with short lead
- B. The locos running with conventional Turbo are identified and the repair of defective turbo is being expedited to provide high efficiency turbo in all fuel efficient locos.
- C. Monitoring loco wise fuel consumption is being done to take corrective action during schedules.
- D. Shutting down of idling locos and shutting down of rear locos in MU operation when the load hauled is less.
- E. Monitoring the periodical review of trip fuel ration is being followed. Wherever excessive trip ration is noticed suitable corrective action is taken.
- F. Checking the fuel account at the installations and fueling more quantity of fuel at the installation where the overall cost is less being done.

2007-08

- 1. Running of fuel efficient locos
- 2. Introduction of DEMUs in routes where number of coach hauled is less.
- 3. Retro fitment of microprocessor control system and micro process based governor.

## **1. Provision of microprocessor based energy cum speed monitoring system.**

During the year, 195 number of micro processor based energy cum speed monitoring system have been provided in the locomotives and Electrical Multiple Units running over various sections of Southern Railway. The cost of each system is Rs.2.43 lakhs. Thus there has been an investment of Rs.473.85 lakhs in this system during last year. So far Southern Railway has provided this system in 272 EMU/Locomotives. Thus the total investment is about 660.96 lakhs in this system. Using this system, energy consumed by every loco pilot/motorman can be ascertained for the train run by him. Based on trials, bench marks have been formed for specific energy consumption for each service and train in various sections of Southern Railway. All those loco pilot/motorman consuming energy more than the bench mark energy levels are counselled by loco inspectors with a view to improve their driving technique. At the same time, drivers not showing signs of improvement are made to improve their driving skills on the driving simulator, duly monitored by one instructor. In this way, Southern Railway has been able to reduce energy consumption in traction area by properly monitoring loco pilot / motorman. This has resulted in a saving of about 11.04 lakhs units of energy and Rs.50.55 lakhs last year.

## **2. Provision of static invertors in the locomotives**

Southern Railway has provided 30 static invertors (SIV) in the locomotives. The cost of each static inverter is 33.65 lakhs. There has been an investment of Rs.1009.5 lakhs on this account. So far Southern Railway has provided this system in 58 locomotives. Thus the total investment is about 1951.7 lakhs in this system. Earlier we were using Arno Converter costing about 2 lakhs. Thus there is incremental cost of 1835.7 lakhs. This system is provided in the locomotive for converting the single phase supply available as output from the auxiliary winding of the locomotive transformer to 3 phase supply to feed the auxiliary motors in the locomotives. Earlier for this purpose Arno converter was used. This arno converter was comparatively less energy efficient compared to SIV and there was a wide variation of output voltage depending on the input voltage and load. During trials it has been observed that when all auxiliaries are made to work, the locomotives with arno converter will consume 100 units in 1 hour whereas the locomotives provided with SIV will consume only about 5- units when the locomotive is in stationary state. Thus, there is a saving of 50 units per hour per locomotive used. There are about 240 locomotives in service over Southern Railway in mail / express, passenger and other goods train services. Provision of 30 SIV during this year and 28 in previous year have resulted in a saving of about Rs.0.95 lakhs kWh of energy and Rs.4.25 lakhs during the last year.

### **3. Use of 3 phase locomotives having regenerative braking and unity power factor feature over Southern Railway**

the latest generation of electric locomotives in use on the Indian Railways use 3 phase squirrel case Induction motors as traction motors instead of the traditional DC series motor. On these locomotives, a GTO based converter converts the single phase supply available from the OHE to a variable voltage variable frequency 3 phase supply after stepping down the voltage with the help of a transformer. With the use of these converters, it is now possible to resort to regenerative braking while negotiating falling gradients, which was not possible in the conventional electric locomotive. The energy regenerated by using these locomotives in typical section is found to be around 30% of the energy consumed during powering. At the same time with the use of pulse width modulation to control the single phase bridge in the power converter and using it in step up chopper mode, it is possible to work the locomotive always at unity power factor.

The cost of 3 phase locomotive is about Rs.1500 lakhs and can start and haul a goods train of 5067 t on 1 in 200 rising gradient. The cost of earlier version locomotive which does not have the feature of regenerative braking and unity power factor is 700 lakhs. Hence there is incremental cost of Rs.800 lakhs in this locomotive. On trial it is noticed that there is about 10% saving in energy consumption due to regenerative braking. On an average for the use of 3 locomotives over Southern Railway, this works out to be 3.29 lakhs units of energy and Rs.14.7 lakhs for the last year.

At present the number of such locomotives worked on this system is only about 1 to 2%. It is planned to increase the number of 3 phase locomotives used to 15% by Dec. 2009 and 30% by Dec.2010. with 30% of energy consumed being regenerated on the 3 phase locomotives and due to the unity power factor in all loads on these locomotives, it is expected that the energy bill of Southern Railway in electric traction will be reduced progressively by 2.5% in 2009-10 and by 5% in 2010-2011.