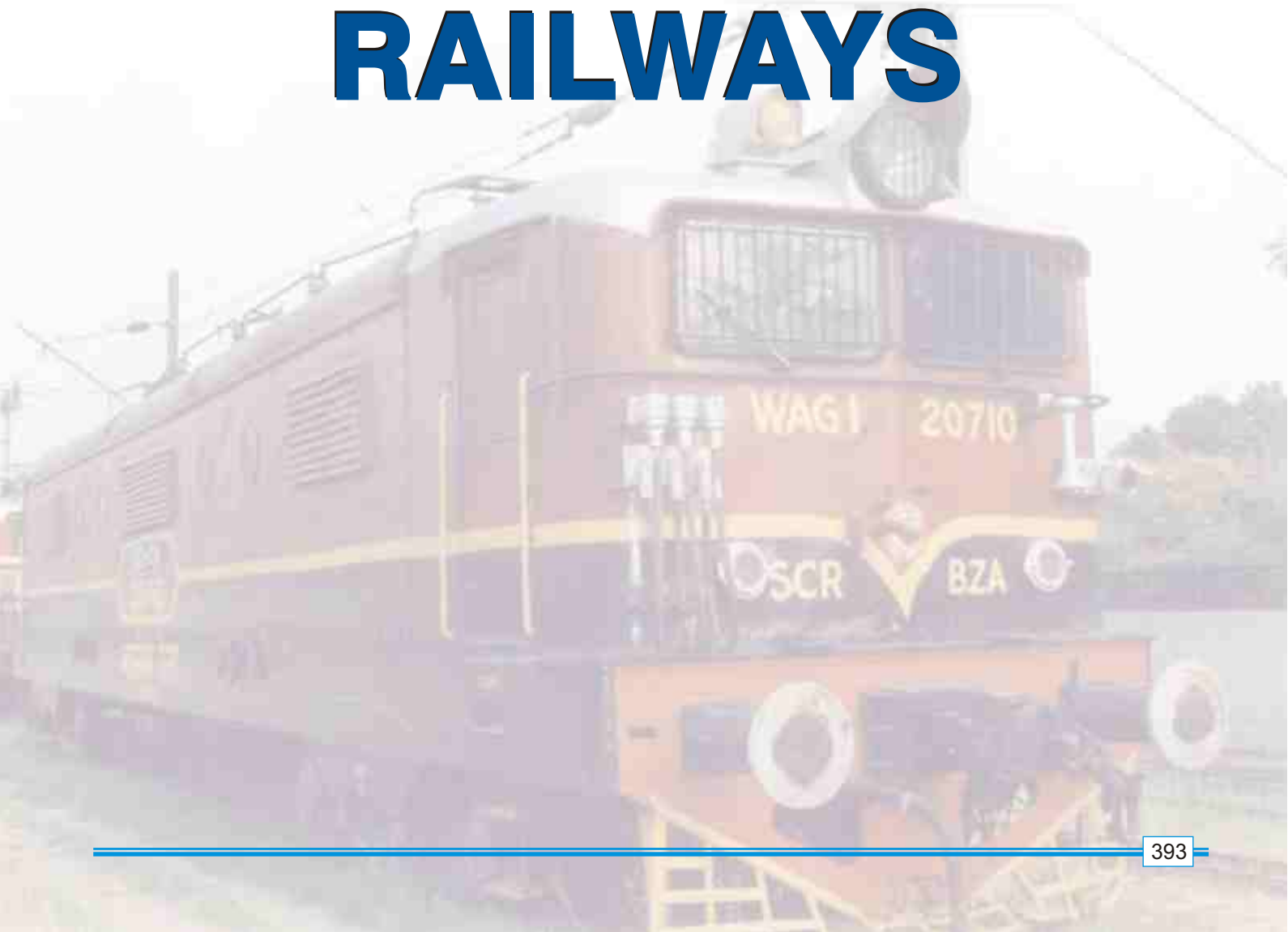
ZONAL RAILWAYS



SOUTH EAST CENTRAL RAILWAY

Bilaspur (Chhattisgarh)

Profile

South East Central Railway figures among major railway zones of Indian Railway. It is termed as one of the youngest zones belonging to Indian Railway. South East Railway zone became functional from 20th September, 1998. Later, it was dedicated to the nation on 5th April, 2003. There are 3 open line divisions functional under South East Central Railway. These are known as:

- Nagpur Division
- Bilaspur Division
- Raipur Division

South East Central Railway is the most techno-savvy and developed railway zone of the Indian Railway. The zone witnesses huge passenger and freight traffic round the year. With its improved and technologically advanced signalling system, a good number of passengers amenities and neat and clean stations, South East Central Railway holds respectable place among all the zones of the Indian Railway.

Energy Consumption

1.	TRACTION (Electric)	2007-08
(i)	% SEC reduction during 2007-08 for (Goods) with respect to Preceding Year.	30.59
2.	TRACTION (DIESEL)	
(i)	% SFC reduction during 2007-08 for (Goods) with respect to Preceding year.	31.32
3.	ANNUAL ENERGY SAVINGS	
(i)	Total annual electric energy saving (Lakhs kWh/Year)	681.14
(ii)	Total annual electric energy saving achieved (Lakhs Rs./Year)	2928.90
(iii)	Total annual Diesel saving (Kilo Liters/Year)	7032.56
(iv)	Total annual Diesel saving achieved (Lakhs Rs./Year)	2253.63

Energy Conservation Achievements

1. Solar based lighting system for Electrification of Manned Level crossing gates over South East Central Railway

Non-conventional energy source (Sun light) is being effectively utilized in SECR, by providing solar lighting system at LC gates.

Annual Savings:3200 kWh/ year (Rs.15,000/ year)

2. Solar based water heating system (Geyser) for Running Rooms and Rest Houses

Non-conventional energy source (Sun light) is being effectively utilized in SECR, by providing solar geysers system at Running Rooms & Officers Rest Houses in SECR. During 07-08, SECR has replaced 44 nos. conventional electric geysers by solar geyser of capacity of 500/1000/3000/5000 LPD in Running Rooms & Officers Rest Houses.

Annual Savings : 85,000 kWh/year (Rs.4.06 lakhs/ year)

3. Provision of additional capacitor bank provided through Maximum Demand Controller

Traction load is variable and it changes very frequently depending on the train movement in the jurisdiction of a particular TSS. With such a variable load, it is very difficult to maintain a uniform power factor with a fixed capacitor bank. At light loads the power factor goes to leading side while at heavy loads it goes to lagging. Power meter has been installed at Traction sub-stations to control the penalty due to bursting of Contract Demands. Using two spare interlocks of the same power meter, a trial was conducted to switch ON additional capacitor banks with increase in current above certain limit and switch OFF with its decrease.

Improvement In Power Factor Achieved

S. No.	TSS	2006-07	2007-08
1.	Raigarh	0.90	0.91
2.	Kharsia	0.88	0.90
3.	Bilaspur	0.92	0.93
4.	Belgahana	0.88	0.90
5.	Pendra	0.90	0.90
6.	Udalkachhar	0.91	0.91
7.	Bhatapara	0.90	0.91

4. Various Steps undertaken to reduce electricity loss

Steps for reducing electricity loss during acceleration

1. Ensure complete release of brakes after application and before taking notch.
2. Keep pressing ‘BPSW’ switch till Air flow indicator returns to its nominal value.
3. Never start train before return of Air flow needle as above.

Steps for reducing loss during braking.

1. Good road knowledge is essential to reduce possible non essential braking.
2. Landmarks where brake application to be initiated, to avoid repeated notching.
3. Keep pressing ‘BPSW’ switch for sufficient time after brake application (*till Air flow indicator returns to nominal value)* to ensure quickest possible and complete brake release in trailing stock, during train control.
4. Use DBR’s to maximum and Plan controlling using *terrain/landmarks*.

Steps for reducing Losses in Power Equipments

1. Use coasting to maximum possible limit to reduce unnecessary power consumption and also losses in Transformer, TM and SL.
2. Shut Down rear loco if trailing load is light.
3. Switching off of TM blowers in case of idling more than 20 min.

Steps for reducing Losses in Auxiliaries

1. Use of static Inverter in place of Arno.
2. Use of Twin Beam Halogen Lamp Head Light.
3. Use of LED Based Marker and Flasher.
4. 100% use of FTL for train lighting in MEMU Coaches.

Operation of WAG-9 Locos

- Regenerative braking to return electrical energy back to OHE.
- *Constant speed operation through 'BPCS''* Automatically controls energy flow to/from OHE without intervention of Loco Pilot.
- Soft starting feature for starting auxiliary motors.
- Temperature controlled operation of Oil Cooling Blower.

5. Use of Simulator for improving driving technique of Loco Pilots

Loco pilots contribute the maximum on traction energy conservation. All loco pilots are imparted training on simulator to improve their engine man ship resulting in saving of traction energy.

Electric Loco Simulator works on accurate modeling of track-train dynamics and locomotive behavior, for imparting training to locomotive driver. Through realistic simulation it is able to replicate real life situation but in safe environment. The Simulator uses the most advanced concept of CGI (Computer generated images) of the track items, with options to create different conditions of the track for training of loco pilots. The 'motion system' of the simulator gives actual feeling of loco/train driving to the trainees.

SOUTH CENTRAL RAILWAY

Secunderabad (Andhra Pradesh)

Profile

One of the 16 zones of railway in India, the **South Central Railway** was inaugurated in the year 1966, on the second day of the month of October. The important divisions of Hubli and Vijayawada, which belonged to the Southern railways, were clubbed with the Solapur division and the Secunderabad division of the Central railway to create a new railway zone, the South Central Railway.

The South Central Railway of India has been serving since 42 years. Over all these years South Central Railway has grown into a modern transportation network, which has succeeded in fulfilling the passengers aspirations and demands.

South Central Railway consists of 6 Divisions i.e. Secunderabad, Vijayawada, Guntakal, Guntur, Hyderabad & Nanded with route kms.of BG 4914 kms. and MG 838 kms. South Central Railway covers 5 states in Andhra Pradesh, Maharashtra, Karnataka, Madhya Pradesh and Tamilnadu. The Zonal Headquarters of South Central Railway is at Secunderabad.

There are 358 Electric locomotives, 387 diesel locomotives, 101 Mainline Electric Multiple Units (26 motor coaches & 75 trailer coaches), 60 Electric Multiple Units (20 motor coaches and 40 trailer coaches), 335 Air-conditioned coaches and 2974 passenger coaches on this Railway. The annual consumption of energy for traction was 11158.55 lakh units, for non-traction use was 1347.37 lakh units in 2007-08.

Energy Consumption

South Central Railway is in fore front in energy conservation, both in traction and non traction. The salient features have been listed below:

Electric Energy Consumption – Traction:

S.No	General Description	2005-06	2006-07	2007-08
1	**Energy consumed** in Lakh KWhr/year	10021.19	10293.87	11158.55
2	**SEC – Goods** in KWhr per 1000 GTKM	8.60	7.93	7.44
3	**SEC – Passenger** in KWhr per 1000 GTKM	18.9	18.8	18.8

Electric Energy Consumption – Non-Traction:

S.No.	General Description	2005-06	2006-07	2007-08
1	**Energy consumed** in Lakh KWhr/year	1302.40	1320.70	1347.30
2	**Electricity Bill paid** in Rs.Lakhs/year	6184	6450	6729
3	**Unit Rate** Rs./ KWhr	4.75	4.88	4.99

Energy Conservation Measures Implemented

Achievements in 2007- 08:	
A)	**Non-Traction:**
1	22428 nos. of energy efficient T-5 tube lights of 28 W have been provided at stations and service buildings replacing 40/36 W tube lights.
2	1021 Nos. of CFLs have been provided in service buildings & stations replacing place of incandescent & FL fittings lamps
3	**Innovative Measure for use of CFLs :** With a view to encourage use of CFLs by employees in railway colonies , a scheme has been launched in Secunderabad division to issue 900 Nos. of CFLs to staff and recover cost in 3 (three) installments. **This measure is first of its kind in IR.**
4	Manned Non -electrified gate No 117 between GTU-PRLI has been electrified with non-conventional energy sources. On this gate hybrid technology (Solar + Wind Mill) is used. In this system 450 Watts wind mill and 5 Nos of Solar panel of 38 Wp have been used. The energy generated by both the non conventional means (Wind & Solar) is being stored in the batteries of 3 Nos of 12V, 26 AH SMF. The complete LC gate has been electrified with LED lights which will consume less power and give more illumination. This is the first of its kind on this Railway and probably on Indian Railways.
5	Solar water heaters have been provided at 8 locations of 2200 – 2500 LPD each at running rooms and retiring rooms of SC, BZA, GTL divisions. Solar home light system has been provided at 20 locations with PV module 1 x 74WP each in Nanded division. Solar street lights have been provided at 20 locations with PV module 1 x 74WP each in Nanded division.
6	At Parli Vaijnath Station on platform No.1 Infra Red Sensors has been provided and connected to the Train Time lighting circuit for operation and control of 70% of lights during arrival and departure of trains to conserve the electrical energy.
7	Eight energy audits are conducted by professional agencies during the year in major consumption units 1) Rail Nilayam (HYB division), 2) Sanchalan Bhavan (SC division), 3) Vijayawada Railway station, 4) Krishna river pumping (BZA Division) 5) GTL Diesel loco shed (GTL division 6) DRM office of GNT and 7) DRM office of NED divisions 8) Traction Substation at KCC (BZA Division).
8	150 Nos of occupancy sensors have been provided in head quarters, divisional offices and VIP lounges. The sensors control switching on and off both lights and air conditioners.
9	18 nos of energy efficient pump sets have been provided.
B)	**Traction (Electric): Apart from conventional methods:**
1	Saving the transformer no load losses by switching off standby transformers in all traction sub-stations on the Railway. Cold transformer standby.
2	Using of shunt capacitor banks for traction sub-stations to control power factor and to reduce MD and over head line losses. At 5 traction substations capacitor banks upgraded to 2400kVAR from 1500kVAR capacity SKZR , RDM,PGU, JMKT, KCC
3	Switching off blowers during idling in stations & yards where detention is more than 15minutes.
4	Energy Savings to the extent of 12.5% (Regeneration / Consumption) is achieved by regenerative braking on WAG9 Loco on gradient sections on Secunderabad Division.
5	Energy cum Speed Monitoring System (ESMONS) has been commissioned in all Electric Locomotives and Motor coaches of EMU/MEMU on this railway. SEC of Electric traction has been reduced by 5.86% in 07- 08 over the previous year.

C)	**Traction (Diesel):**
	Consumption of diesel for traction purposes is being monitored by adopting following conservation measures:
1	Providing fuel efficient Kits and Micro processor Governor on Diesel locomotives. Electro-Hydraulic Governors have been replaced with Microprocessor based Governors which controls the consumption of HSD oil minutely as per the demand. Excess burning of oil is minimized.
2	The handling loss at the time of decanting HSD Oil from Road Tankers/Rail Tank Wagons and at HSD fuelling points is fixed at 0.1%. S.C.Rly has achieved an average of 0.004% which is well within the target fixed and the net saving is to the tune of 230KLs per annum valued at Rs.73.3 lakhs.

Extensive Energy Conservation Works on S C Railway During the year 2007-08

1) Non-Conventional Source of Energy

	
2000 Ltrs/day solar heater at eight Running Rooms on SCR commissioned during the year.	Infrared Sensors at Parli Vijanath Station on SC division controlling platform lighting.

2) LED Lighting at LC Gates and at Running Rooms

	
LED lighting at LC Gate	LED based reading light and a mobile charger at Running Room.

3) Prepaid energy meter

Pre paid energy meter at a fruit stall on Secunderabad station

4) Extensive T 5 lighting in stations on SCR

T-5 Fittings on Platform No:1 at Secunderabad station

Secunderabad concourse T5 lighting

5) Electrification of LC Gate by using Hybrid (Wind mill + Solar) Technology

450 watt wind mill

Hybrid (wind mill + Solar) LED lighting at LC gate

Second Prize *Zonal Railways*

DELHI METRO RAIL CORPORATION

New Delhi

Profile

Delhi Metro Rail Corporation (DMRC) Limited registered on 3rd May, 1995 under the Companies Act, 1956 for implementation and operation of Delhi Mass Rapid Transit system (MRTS), has equal equity participation from the Government of India and the Government of National Capital Territory of Delhi.

DMRC has a mission to cover the whole of Delhi with a Metro Network by the year 2021 and to operate on sound commercial lines obviating the need for Government support.

Delhi Metro Rail Corporation has already commissioned three lines comprising of 65.10 Kms route with 59 stations with an average inter-station distance of 1.1 km in Phase – I and construction of 121 Kms of Phase – 2 with 78 metro stations is in progress, which is scheduled to be completed by October 2010.

Metro trains are energy intensive by its inherent service requirement of start, accelerate fast, attain maximum speed and stop at every station a km apart, within 85 – 90 seconds. For the existing network, DMRC has 6 nos. 220kV/33/25kV and 66kV/33/25 kV receiving substations and 72 nos. of 33kV/ 0.415 kV auxiliary substations, with total contract demand of 52 MVA and the annual energy consumption of around 200 million units. With the completion of phase – 2, the contract demand is expected to rise to 150 MVA and with the annual energy consumption of around 600 million units.

Delhi Metro is member of NOVA an elite group of international metros and is the only metro in the world to have been approved for Carbon Credits for the regenerative braking in traction system.

Energy Consumption

The consumption of electrical energy is nearly equally divided between Traction (49%) and station auxiliary (non – traction) (51%). The underground stations being air-conditioned & with higher lighting requirements consume higher electrical energy, as compared to elevated stations. The operation of Delhi Metro is it the running of trains, air-conditioning of underground stations, lighting of stations, lifts, escalators, etc. involves electric energy consumption of 200 million units / Year, which constitutes around 25 % of the total operation cost.

Delhi Metro had adopted energy conservation measures right from the design stage by judicious evaluation on selection of system and technology. This has left limited scope for achieving further Energy conservations / saving in operations.

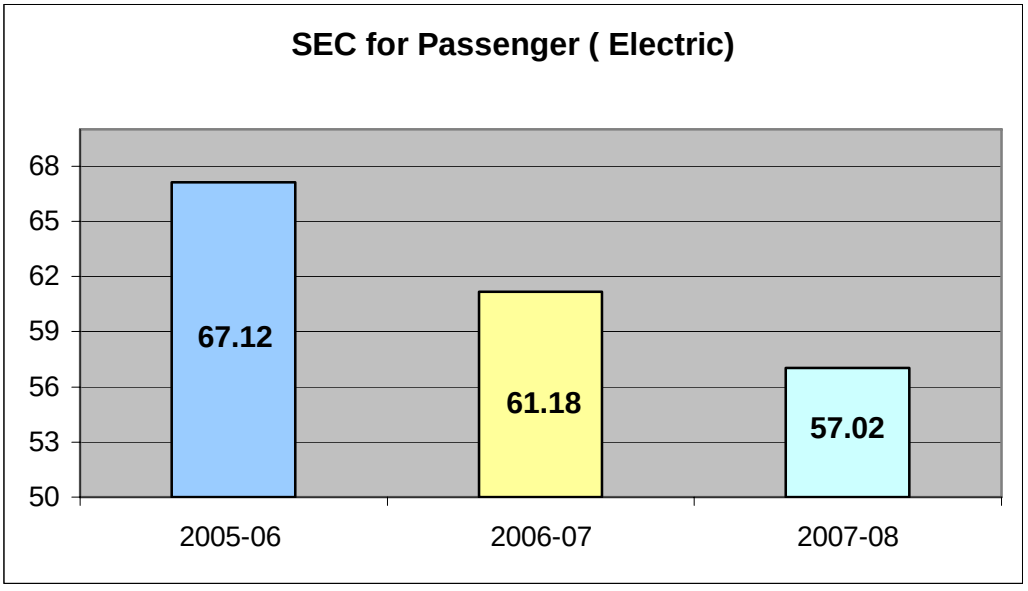
Discoms are metering the power supplied to DMRC on kVAh basis, therefore technology is so selected that the power factor of the traction and auxiliary supply system is being maintained close to unity.

Specific Energy Consumption Reduction

(a) Electric Traction

	2005 – 06	**2006 – 07**	**2007 – 08**
Electric Units Consumed (Lakhs kVAh)	592.20	880.97	970.70
GTKM for Passenger	882275526	1440046730	1702270254
SEC for Passenger (kVAh / 1000 GTKM)	67.12	61.18	57.02
% SEC reduction during 2006 – 07 & 2007 – 08 for Passenger w.r.t. preceding year	**-------**	**- 8.86%**	**- 6.79%**

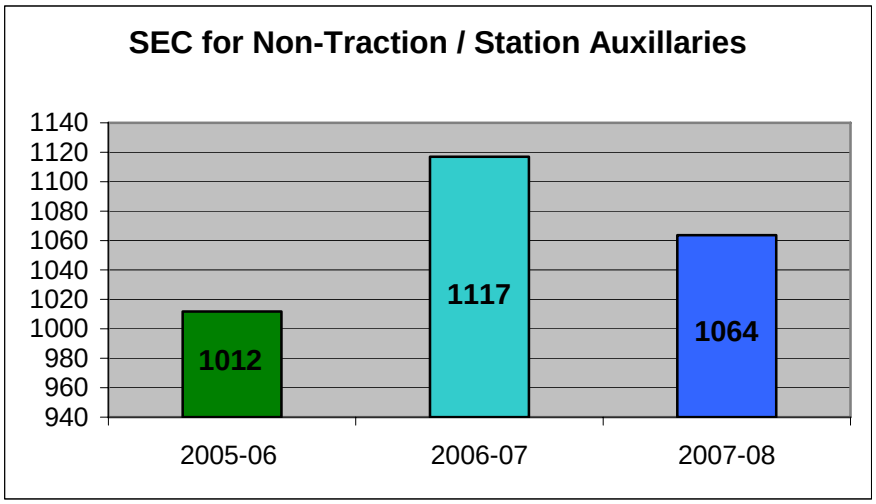
Graphical Representation



(b) Non – Traction / Station Auxiliaries Electric Energy.

	2005 – 06	2006 – 07	2007 – 08
Electric Units Consumed (Million kVAh)	60.7	107.68	102.54
Connected Load in MW	60	96.4	96.4
SEC (kVAh / kW)	1012	1117	1064
% SEC reduction during 2006 – 07 & 2007 – 08 for Passenger w.r.t. preceding year	-------	**10.41 %**	**- 4.77 %**

Graphical Representation



Energy Conservation Commitment, Policy and Organizational Set up

Delhi Metro is committed to strive for providing a clean and environment friendly public transport network of international standard to the capital of the country and to set the bench-mark in India for operating a metro on sound commercial lines, which can be achieved only by ensuring an Energy efficient system at design stage and to make constant endeavour to operate in the most energy efficient manner.

DMRC has Energy Conservation Policy and an Energy Conservation Cell headed by General Manager / Maintenance.

Energy Conservation Achievements

Major activities implemented to reduce Energy Consumption:-

S. No.	ACTIVITY	ACTION TAKEN
1	Energy Saving by management of Light.	DMRC is operating "4-coach" trains while the system is designed for "8-coach" trains. Therefore, scheme was prepared to reduce the number of lights being switched ON in unoccupied area and save energy. This scheme was implemented at various stations of DMRC in Dwarka sub city, Vidhan Sabha and Civil Lines stations.
2	Switching – off of Lights in Tunnel during Revenue hours.	In the tunnels Lights have been provided for facilitating maintenance, which were kept ON for 24 hours. It was decided to Switch – OFF these lights during revenue hours to conserve energy. This in-turn has improved visibility for train drivers.
3	Solar Lights in Tagore Garden and Patel Chowk	Solar power parking lights have been installed at Tagore Garden and Patel Chowk Metro Stations. Each 70 W Pole mounted light Fixture has been replaced with solar light of 14 W.
4	Modification in Train Air-conditioning	Air –conditioning Temperature set points were increased from 24^{o}C to 25^{o}C.

In addition to above the saving in Energy requirement for Traction has been achieved by better utilization of assets and by improving the driving techniques.

Solar Lights in Station Parking areas

Tunnel Lights

Energy Conservation Plans and Targets

S. No.	ACTIVITY	ACTION TO BE TAKEN
1	Providing of UVC Tube Emitters at AHU of Rajeev Chowk Metro Station	UVC emitter is the latest technology to reduce growth of algae on cooling coils of AHUs, in turn achieve better heat transfer from Air to cooling coils. DMRC has implemented it on experimental basis at four of its AHUs at Rajeev Chowk metro station in the current year 2008 – 09.
2	Replacement of all the 36 Watt Tube lights with retrofit type T-5 lights at Chawri Bazar Metro Station	Replacement of all the 36 Watts Tube lights with retrofit type T-5 lights at Chawri Bazar Metro Station through Energy service company is in progress.
3	Energy saving by providing sun film on windows	It was observed that in equipment rooms with high air-conditioning loads, large glass panes result in substantial solar heat gains. Sun films are being provided to achieve Energy savings.
4	Replacement of various building lights with LED based light sources.	
5	Energy audit to identify new areas for energy conservation.	

Environment and Safety

(a) The Environment Management System of Delhi Metro Rail Corporation has been awarded ISO 14001:2004 since 22.12.2005, and which is valid up to 28.08.2011.

(b) The Occupational Health and Safety Management System of Delhi Metro Rail Corporation has been awarded BS OHSAS 18001 since 22.12.2005, and which is valid up to 28.08.2011.

(c) Delhi Metro is the first Railway project in the world to be registered by the United Nations under the Clean Development Mechanism (CDM), which will enable it to claim carbon credits. The Project has been registered on 29 December 2007 with the Project number 1351 with the title ***"Installation of Low Green House Gases (GHG) emitting rolling stock cars in metro system"*** and with credit period of 10 years up to 28.12.2017.

Under the project, DMRC will earn Certified Emission Reductions (CERs) for the using regenerative braking system in its rolling stock (trains). This is the first time in the world that the United Nations Framework Convention on Climate Change (UNFCCC) has registered a project based on regenerative braking.

Under the regenerative braking system, whenever a train applies brakes, the kinetic energy released starts a converter-inverter, which supplies electrical energy back to the Over Head Electricity (OHE) lines. This electrical energy is used by other accelerating trains in the same service line, resulting in 30 % saving of electricity requirement of the system.

DMRC can now claim 400,000 CERs for a 10-year crediting period beginning December 2007 when the project was registered by the UNFCCC. This translates to Rs 1.2 crore per year for 10 years.