ENERGY AND SUSTAINABLE DEVELOPMENT

Railway is the most fuel efficient mode of transport and committed to make efforts to improve energy efficiency and adopt environment friendly technologies in manufacture, maintenance & operation activities, reduce electricity charges and in better fuel management in diesel locomotives. Focus during the XI Plan is to improve overall productivity, fully exploit the additional capacity created in rolling assets through innovative operations and maintenance practices and undertake strategic low-cost investments with short gestation lags. The XI Plan projections for freight and passenger traffic are as under:

2.0 XI FIVE YEAR PLAN PROJECTION FOR FREIGHT & PASSENGER TRAFFIC

	2006-07	2011-12	% increase (per annum)
Originating Freight (Million Tonnes)	726	1100	10.3
Originating Passenger (Million)	6242	8400	6.9
Passenger Kms (Billions)	700	880	12.9

To cater to the growth in traffic during the XI Plan period, number of capacity enhancement projects like new lines, gauge conversion, doubling, electrification, metropolitan transport project and new terminal facilities are to be created which would require additional use of energy both electrical and diesel fuel.

2.1 ELECTRICAL ENERGY CONSUMPTION IN TRACTION DURING X PLAN.

YEAR	2002-03	2003-04	2004-05	2005-06	2006-07	Growth Percentage (per annum)
Electrical Energy consumed in billion Kwhrs.	8.99	9.48	10.13	10.4	11.03	5.25%

2.2 ELECTRICAL ENERGY CONSUMPTION IN NON-TRACTION DURING X PLAN.

Year	2002-03	2003-04	2004-05	2005-06	2006-07	Growth Percentage (per annum)
Total electrical energy consumed in billion Kwhrs	2.36	2.22	2.43	2.31	2.32	(-) 0.25%

2.3 HSD QUANTITIES CONSUMED DURING X PLAN.

Year	2002-03	2003-04	2004-05	2005-06	2006-07	Growth Percentage (per annum)
Total HSD consumed in billion Liters	1.99	2.05	2.07	2.07	NA	0.98%

2.4 The anticipated requirement of energy at the end of XI Plan is expected to be as under.

	2006-07	2011-12	% increase (per annum)
Electrical Energy (Billion Kwhrs)	13.3	17.15	5.5%
Diesel Oil (Billion liters)	2.08	2.23	1.5%

The traffic growth is pegged as 8% but electrical energy need will only grow as 5.5% per annum if Indian Railways undertakes various Energy Conservation initiatives which are covered in para 4.0 to 6.0.

2.5 The peak load requirement at present for traction and non-traction use is 2500 MW. In the business as usual scenario (BAUs) and the projecting demand at the end of XIth Plan will be 3250 MW. The additional projected power requirement for dedicated freight corridor will be 400 MW and additional projected power requirement for 17 world class station will be 500 MW.

In high growth scenario (HGs) projected power requirement after XIth Plan will be in range of 4000-4200 MW.

3.0 Steps taken by Railways to reduce electricity price (tariff).

Energy constitutes 24% of working expenses of Indian Railways and containing energy prices will play an important role in improving bottomline of Indian Railways. With the enactment of Electricity Act 2003, Indian Railways can explore various short term and long term options for containing electrical energy prices. Some of these are as under;

Indian Railways spend about Rs. 5011 crore annually for purchase of electricity for traction purpose from Distribution Companies (DISCOMs) in 18 States and from 3 power companies. In order to reduce electrical energy bill, the following Schemes/Projects have been initiated/implemented on Indian Railways:

3.1 Reduction in electric traction tariff through continuous presentation of Railways case with Regulatory commissions:

During the decade 1990-2000 a very sharp increase in electric tariff was enforced by various State Electricity Boards (SEBs) and DISCOMs from Rs. 1.20 – 1.50 per unit to Rs. 4 – 5 per unit. As such increases where not reasonable, efforts were made to reverse the trends since 2000. With the ongoing reforms in the power sector, Railways are making representations before various State Electricity Regulatory Commissions (SERCs) regarding unreasonable tariff being charged for electric traction and have been requesting for fixing the tariff on the basis of the cost to serve and progressively eliminate cross subsidies. With these efforts further increase was arrested and in some cases the tariff was reduced as well. The average unit rate of electricity purchased for traction purpose stabilized in the last few years and also reduced as shown in the table below:

(Figure in paisa per unit (kwhr)

2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
427	428	428	421	422	428	429

3.2 Availing Direct Power Supply from NTPC using Railways own transmission lines:

(i) Indian Railways avail direct power supply from NTPC Limited for traction in the following sections:

(a) Traction Power Supply has been taken from, Dadri and Auraiya power plants of NTPC for Ghaziabad-Kanpur section of North Central Railway since 2000. The project has been completed @ Rs. 63 crore and saving achieved in electricity bill are as under**:**

(figures in crore Rs.)

Year	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Saving	60.50	90.62	121.67	120.22	80.17	49.49	25.65

(b) From NTPC supply in Delhi area since 28.7.05. This results in recurring annual saving of over Rs. 1 crore.

(ii) Two more schemes for availing direct power supply from NTPC have been sanctioned:

a) Direct power supply from NTPC in Bilaspur division of South East Central Railway at a cost of Rs. 205.93 crore. Ministry of Power has already allocated 80 MW power to Railways from NTPC's Sipat power plant being constructed near Bilaspur. This will result in an estimated saving of Rs. 50 crore per annum.

b) Availing direct power supply from NTPC in Kanpur-Allahabad section of North Central Railway at a cost of Rs. 152.85 crore. This will result in an estimated saving of Rs. 42 crore per annum.

3.3 Setting up of Captive Power Plant in Joint Venture with NTPC Limited:

Indian Railways has established a captive power plant of 1000 MW capacity at Nabinagar, Bihar with NTPC. The joint venture company named as Bhartiya Rail Bijlee Company Ltd.(BRBCL) has been formed on 22.11.2007. The company has authorized capital of Rs. 1605.75 crore. The estimated cost of project is Rs. 5352 crore with mega status. The project is financed through 70% debt and 30% equity. The equity participation of NTPC is Rs. 1188.26 crore (74%) & of Railways is Rs. 417.5 crore (26%). Bhartiya Rail Bijlee Ltd has already awarded a contract to M/s BHEL for erection and commissioning of Boiler & Turbine Generator on 22.01.2008. This plant will have four units of 250 MW capacity and plant will be expected to be operational by the beginning of 12th Five Year Plan. After operation of this plant Railways will save Rs. 400-600 crore per anum in their energy bill. This plant will supply 90% of its power to 164 substations of IR located in Eastern and Western region

The Joint Venture Agreement has been signed between Railways and NTPC on 06.11.2007. The estimated cost of generation of electricity from this project will be 213 paisa per unit. The estimated charges for wheeling and transmission of electricity to Railway's load centers from captive power plant will be 125 paisa to 150 paisa per unit. This will result in saving of Rs. 400-600 crore at present level of electricity consumption at 164 traction substations of Railways in Eastern and Western region.

3.4 Exploring possibilities for purchase of Power from Independent Power Producers (IPPs)/Power Trading Companies (PTCs).

After enactment of the Electricity Act 2003, it has become possible for the consumer to purchase electricity from other than the distribution licensee for that area under "Open Access". Under this provision, the existing transmission and distribution network of the Central/State Transmission Utilities and Distribution Licensee can be used on payment of transmission and wheeling charges and surcharge.

Indian Railways has already explored possibility of power purchase agreement with private parties as suggested by Planning Commission for traction substations located in Northern and Southern regions. It has been found that this option is not viable at present as cross subsidy surcharge applicable to traction tariff is very high. In addition to high cross subsidy surcharge, Railways have to pay high demand charges and wheeling and banking charges for ensuring uninterrupted power supply to Railways for traction application. The option of availing power from IPPs/PTCs will be pursued in future when open access charges are rationalized.

3.5 Setting up of Captive Wind Mills in Wind Rich areas:

Indian Railways has commissioned 10.5 MW wind mills for ICF, Chennai at the cost of Rs. 66 crores. It wil save Rs. 7.47 crore per annum and there will be additional revenue generated of Rs. 1.47 crore as carbon credit.

3.6 Power requirement at the end of XIth Plan

Power requirement	Distribution companies	NTPC and other IPPs	Captive Power Plant	Wind energy
3250 MW	2950 MW	200 MW	-	100MW
4000 MW	3700 MW	200 MW	-	100 MW

------ **BAUs** ------- **HGs**

4.0 Major initiatives planned by Indian Railway for energy conservation

4.1 Traction

4.1.1 Electric Locomotives

- **New Generation Electric Locomotives** - Enhanced vehicle efficiency has been achieved by adoption of 3 phase technology for electric locomotives which facilitates regeneration of 14%- 15% of energy consumed by utilizing the braking energy for traction purposes, which is likely to fetch Carbon Credits under CDM .

- 259 nos. 3-phase electric locos, which regenerate about 15% of the energy consumed, have been inducted on IR .

Period	IX plan	X plan	XI plan (upto July 09)	Total
No. of 3-phase locos inducted	67	116	114	297

- It is further planned to completely switchover the production of electric locos at CLW to 3-phase locos only by the year 2013-14.
- All high horse power locomotives acquired by Railway in future will have three phase technology which will have regenerative features.

- **Improved driving technique through simulators**:

- **Driver advice system**

  Driver Advice system will be installed to ensure energy efficient technique by loco pilots. This will also helpful in ensuring safety and for improving energy efficient drive

4.1.2 Electrical Multiple Units (EMU) OR MEMU

- **New Generation Electrical Multiple Units (EMUs)**

  Adoption of 3-phase technology under Railway Board/MRVC contract for suburban transportation is resulting in 25-30% energy regeneration by way of utilizing the braking energy in the frequently stopping suburban services in Mumbai. It is further planned to progressively switch over to IGBT based technology for MEMUs and EMUs stock on Indian Railway.

- **Rolling Stocks (Emus) For Metro Kolkata**

  It has been decided that all future rolling stocks for Metro Kolkata will be provided with IGBT based 3-phase technology to improve energy efficiency.

- **Long Distance And Intercity Highspeed Travel**

  Railway will break 150 Kmph speed barrier by acquiring train set for enabling overnight journeys between major cities. These train sets will have world class facilities and will also be energy efficient

- **High Speed Super Rail Cargo**

  EMU type high speed for carrying container and other air-conditioned cargos will be introduced like Japan. This train will be air conditioned parcel train carrying premium freight cargos at high speed of 130 kmph. These cargos shall be suitable for transporting perishable and other agri products.

4.1.3 Traction Distribution

- **Power Factor Correction Device**

  IR will use latest technology to achieve nearest to unity power factor on traction**.**

- **Introduction Of 2 X 25 Kv System For High Density Network**

  2 x 25 KV system will be adopted on high density and newly freight corridor. This system will reduce line losses and will be useful for high density traffic.

4.1.4 Energy Efficiency In Passenger Cars

- **LED Lights**

  The decision has been taken to provide LED lights in 80 AC coaches. Based on the performance of these coaches action to switch over 100% LED lights on the coaches will be taken. This enables 80% saving of energy.

- **Head On Generation**

  In future, on board power in long distance train will be drawn from locomotive by providing separate inverter for catering hotel load. These will be provided on major Rajdhani/ Shatabdi and other mail/ express trains. It has been decided to manufacture Rajdhani/ conventional coaches with HOG Scheme. This will improve considerable energy efficiency for hotel load.

5.0 Energy Conservation Measures In Non-Traction Use:

5.1.1 Bench Marking Of Electrical Use For Non Traction Area

An elaborate action plan has been issued to Zonal Railways and PUs to implementing the same and targets for energy conservations has been set.

5.1.2 Improvement in Lighting at Platforms, Circulating Area & Concourse :

This is achieved by using energy efficient fittings without increasing the energy consumption. Energy management system shall be installed at stations to reduce energy consumption.

5.1.3 Use of energy efficient luminaries

T-5 tube lights are also good replacement for ordinary tube lights. A policy decision has been taken to progressively replace all T-8 40 Watt tube lights with three years.

5.1.4 Use of energy efficient CFL

About 63% less energy is consumed by CFLs compared to conventional GLS lamps. A policy decision has been taken to eliminate incandescent (GLS) and adopt compact fluorescent lamps , (CFL) in service building, production units and residential colonies.

5.1.5 LED lights

LED based lights are energy efficient and have high burning hours life. LED based signage station name will be provided on all A/A-1 class of stations. Provision of LED based lights will be introduced in beginning.

5.1.6 Use of 3-star and above rated products

5.1.7 Energy Audit Of Major Work Centers

5.1.8 ECBC Code And Green Building

Construction of new building to comply with Energy Conservation Building Code (ECBC) 2007 from March 2008 has been mandatory. Indian Railways will construct all new buildings as green buildings.

5.1.9 IT based energy monitoring system

Indian railways will use IT in big way to monitor, control in traction and non-traction applications.

6.0 Use of Renewable Energy Source

In order to show commitment to policy issued by PMO on National Action Plan on Climate Change, IR will source 10% of its power for Renewable Energy source.

6.1 Use of grid connected solar panel in offices/workshops/station building

6.2 Solar Power House

Railway will also set up grid connected solar power installation of 10 MW in follow up of National Mission on solar mission unveiled by Prime Minister' Office.

6.3 Renewable Energy source for stations

Railway will also use renewable energy source as standby in lieu of DG sets at small and medium stations where electric supply is unreliable

6.4 Use of solar street lights & solar water heaters

6.5 Use of wind energy in Railways

Indian Railway has commissioned 10.5 MW capacity wind mill for ICF, Chennai at Trinvelli district of Tamil Nadu. IR will sanction more projects in Rajasthan, Gujarat, Maharashtra, Andhra Pradesh and Tamil Nadu. It will increase Indian Railways green image.

7.0 Enabling IT in power systems: IT based solutions for Power Network of Railways.

An integrated Energy Management System shall be developed to optimize the use of fuel and electrical energy. Intelligent IT infrastructure will be created which will help in substation automation, smart metering using Automatic Metering Infrastructure on traction substations, General service substations, residential quarters, rolling stocks (MEMUs, Locomotives, EMUs) etc. and distribution automation of load management at buildings, various uses. Advanced Energy Management System will be developed which will support communication media like PLCC, GPRS and optical fibre line. This system will also be utilized to monitor various parameters of rolling stocks, building management and demand supply management. This system also will help in developing driver advice system to implement energy efficient driving. This system will be introduced in XIth Plan & XIIth Plan and will be continuously upgraded.