GREEN PROCUREMENT

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ACKNOWLEDGEMENT

We feel immense pleasure to express our sincere gratitude to our beloved and respectful course director, Mr. Rakesh Rajpurohit for his valuable assistance and guidance that has helped a lot in gathering various data and completing the objective of this project.

We would also like to thank Mr. Atul Gupta, SPMM for his perseverance for out of box thinking.

We would also like to give special thank to Mr. Sanjay Kumar (Dy cmm , H.Q.N.R.) for guiding us throughout the progress of our project.
SYNOPSIS

Objective

The objective of this report is to give broad perspective on Green Public Procurement (GPP) Policy, its benefit and challenges. The later part of this report focuses on developing GPP Action Plan and strategy for implementing GPP programme in Indian Railways.

INTRODUCTION

Over the years climate change has emerged as a global phenomenon entailing serious and long-term strategic implications. As a developing nation, India is confronted with compelling pressures from rapid economic development accompanied with technological advancement, population explosion as well as industrialization. Government of India is alive to challenges of climate change resulting from unsustainable consumption and production pattern. Government has formulated the National Action Plan on Climate Change to help the country adapt to and mitigate the effects of climate variability and change. The seriousness of purpose can be gauged from the fact that Government of India has voluntarily committed to reduce Green House Gas (GHG) emission intensity of its GDP by 20-25 percent, over 2005 level, by 2020.

Indian Railways Vision 2020 Statement also stresses on reducing hazardous carbon emissions that have triggered climate change and goes on to say that Indian Railways can be India's principal and foremost response to the challenge of Climate Change. Railway, as a mode of transport, is inherently environmental-friendly and plays a very visible and demonstrative role towards mitigating the adverse impact of climate change. However, in order to maintain its environmental competitive edge and contribute to realization of a sustainable development goal of India, IR needs to continuously innovate each facet of its business to ensure environmental sustainability of its operations.

Public Procurement as a Tool for Sustainable Development

In India public procurement has been estimated to constitute 30% of the Gross Domestic Products. The government being the largest buyer in national market can thus influence the market in big way affecting the consumption behavior of other sectors. In past, government across the
globe has leveraged its public procurement capacity to achieve socio-economic objectives of a country. In India too, it has been used to promote indigenous and public sector industries after independence. Certain items are still reserved to be procured only from Small Scale Industries to promote Small Scale Sector and to increase employment opportunities. Ministry of Railways has made it mandatory to purchase all requirements of linen, curtain etc. from Khadi and Handloom sector. In recent time, certain privileges have been extended to Micro and Small Enterprises (MSEs) by all central departments including Ministry of Railways to facilitate the development of MSEs in India. Thus integrating social and environmental concerns in public decision is not new to Indian Railways.

In recent past many governments, both in developing and developed countries have been using public procurement as a tool to achieve sustainability goal for a country.

There is a greater realization that procurement acts as a gatekeeper and that the choice of products and services has significant bearing on environmental impacts arising out of consumption of such products and services. Government, as a large consumers in an economy, can influence market for greener products and services and promote sustainable development agenda of nation, by procuring greener products and services that most effectively reduce negative environmental impacts over their life cycle of manufacturing, transportation, use and recycling or disposal.

**Green Public Procurement (GPP)**

Green Purchasing refers to the acquisition, selection and usage of products and services that would typically display all or some of the following characteristics like conservation of energy and water, minimized generation of waste and releases of pollutants or emissions; be recyclable or themselves be made from reused/recycled materials; alternative fuel vehicles; and use energy from renewable sources. It advocates consideration of environment concerns in addition to conventional considerations such as price and quality in purchasing decisions. This will make the reduction of the environmental impact of goods and services an element for a successful procurement contract. This will lead to paradigm shift in the national procurement and influence markets, vendors and public a large thus demonstrating Government’s commitment towards a sustainable future.

In its 2008 GPP Communication, the European Commission defines GPP as: "a process whereby public authorities seek to procure goods, services
and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured.” By using their purchasing power to choose goods and services with lower impacts on the environment, they can make an important contribution to sustainable consumption and production.

In India too, green procurement can potentially have huge benefits, both environmentally as well as economically, considering huge procurement budget. By adopting green procurement policy, Indian Railways can “lead by example” when it comes to sustainable development. Green Procurement concept is in sync with the principle of waste management, with the aim of achieving “near-zero waste”, by adopting the principle of 3 Rs – Reduction, Recycle and Reuse – that Indian Railways Vision 2020 visualizes achieving.

The Indian Railways must immediately reduce the environmental impact of the goods and services that support its passenger and freight train running operation, and promote a shift in demand toward environment-friendly goods. In order to shift demand toward environment-friendly goods, it is important to not only promote the supply of such goods, but also to prioritize the purchase of such goods. The prioritization for purchasing greener goods will help form markets for these goods and services, which in turn will promote their development and, as a result, increased purchase of environment-friendly goods. The resulting continuous improvement will create a ripple effect in the market. By adopting green procurement policy, IR can lead vast supply chains towards implementing more sustainable practices, achieving environmental, social, and economic policy objectives besides creating ‘green’ image for Railways.
INTERNATIONAL GREEN PUBLIC PROCUREMENT PRACTICES

Since the beginning of the last decade, international initiatives on GPP and SPP have flourished. Public procurement was identified at the World Summit on Sustainable Development of September 2002 as one important instrument for stimulating more environmentally sound goods and services. There has been growing realization both in developing & developed countries that integration of social and economic inspiration with environmental aims is a credible mantra for achieving national sustainability goals. The literature suggests that effective application of GPP is more urgently needed and potentially can have greater impacts in the developing world, where many countries are facing both severe constraints on the availability of resources and complicated environmental challenges.

**GPP in European Countries**

Green Public Procurement has been on the agenda in the European pioneer countries for more than two decades. The EC’s Communication ‘Public Procurement for a Better Environment’ (2006) provided guidance on using GPP to stimulate innovation in environmental technologies, products and services. It aimed at setting common GPP criteria; strengthening the process of life-cycle costing of products; and provide a target linked to indicators and future monitoring. It also set a target of 50% for green tendering by 2010 in all member states, where ‘green’ means compliant with endorsed common core GPP criteria. As per a survey conducted in 2011, 55 % of contracts for ten core product groups included green criteria. The key motivation driving the EU scheme is to provide guidance on how to reduce the environmental impact caused by public sector consumption and to use GPP to boost European competitiveness by stimulating innovation in eco-technologies and promoting eco-industries.

**GPP in China**

The Chinese public procurement system started procuring energy efficient products since 2004. In 2007, Government introduced law stipulating that governments at all levels in their procurements should give priorities to the products that are environmental friendly. Further, Government cannot procure products that do not meet environment standards. Today, Chinese Green List of products consists of 19 products, 847 suppliers and around 1,700 trademarks. In laws and notifications, the government requires relevant authorities at all levels to purchase environment-labeling products.
**GPP in Japan**

The 2000 Law on Promoting Green Purchasing makes it compulsory for government institutions to implement green procurement, while encouraging local authorities, private companies and individuals to make efforts for purchasing environmentally sound products and services. All state ministries, departments and agencies have to define procurement targets every fiscal year and make the results of green procurement efforts publicly available.

**United States**

A 2007 Executive Order integrates and updates prior practices and requirements with the goal of increasing federal purchasing of energy efficient, recycled content, biobased, and environmentally preferable products and services. Federal agencies must also ensure that at least half of renewable energy comes from new renewable sources; water consumption is reduced by 2% annually through 2015; fleet total petroleum consumption is reduced by 2% annually, use of alternative fuels is increased by 10% a year, and plug-in hybrid (PIH) vehicles are used when available at reasonable costs.

**GPP in other Developing Countries**

Green Public Procurement (GPP) was introduced in Thailand by the Ministry of Natural Resources and Environment (MNRE) in 2005. 170 organisations have participated in the GPP implementation by establishing product procurement guidelines, adoptions of product criteria of the national eco-labeling program and greening of the supply chain. Singapore is already having recycling & energy labels for electrical appliances, green vehicle incentives and material recovery facility as well as the Singapore Green Label. The Green Choice in Philippines is to guide consumers to choose products that are environmentally sound and to encourage manufacturers to adopt processes and supply products with less environmental impacts.

It is seen that in many Asian countries the roadmap towards green purchasing is already there, with many having eco-labeling and other instruments in place. However, few developing countries have programme for sustainable public procurement. The national legal frameworks for green procurement are almost non-existent at present in most of the countries. However, many agencies have been showing keen interest in its development.
LESSONS FROM INTERNATIONAL EXPERIENCES ON GPP

The good thing about Green Public Procurement is that this concept is hardly a decade old and it still evolving. A number of programmes and initiatives all aiming to support the deployment of GPP practices are currently ongoing, which provides an opportunity for countries wanting to engage in GPP to adopt successful practices while avoiding mistakes or delays in implementation that have been observed in other countries.

The international experiences on implementing Green Public Procurement show that benefits of implementing GPP is slowly becoming more widespread, while opposition is little concerning the details. Some of the compelling reasons for integrating environmental criteria in public buying are:

a. Some “greener” products and services are more cost effective over their life span as they are less costly in terms of their use, maintenance and disposal despite higher upfront investment costs.

b. The government, by virtue of being large buyer, can make a difference in environmental outcomes by choosing environmentally friendly options, as opposed to classical options.

c. The governments, by demanding greener products and services, can stimulate competition among vendors to innovate greener products and services and can influence producers to shift more rapidly to cleaner technologies. By lowering the costs of clean technologies due to scale economies, this can also help private consumers shift to environment-friendly products.

d. The government, by giving preference to greener products and services, can lead by example and raise consumer awareness about the environmental and social implications associated with different types of purchases.

Responsible sustainable public procurement is especially relevant in developing countries like India and it should form an important cornerstone of their efforts to energizes economy and should be conceived and executed in such a manner to launch nation on a new, low carbon path to green path.

Challenges for Implementing GPP

The internationals experiences in implementing GPP in various nations show that there are several barriers for implementing GPP that needs to be removed for uptake of GPP in a country. The prominent among them are:
- **Lack of vision and management support**: Without a clear vision, a dedicated strategic focus, and an organizational policy that strongly promotes GPP, in terms of time and money, the integration of environmental aspects will remain inadequate.

- **Lack of clarity on GPP policy**: Many country studies have evidenced that visionary GPP policies must be embedded in understandable legislation/executive order stipulating a clear mandate and task to the procurement functionaries in terms of implementing GPP practices.

- **Poor market for environmentally sound products**: In many countries there is a lack of products that fulfill relevant environmental criteria demanded by procurers.

- **Lack of capacity, motivation and training on GPP**: The purchasing officers in often lack the technical and legal expertise to apply green/sustainable procurement standards. Laws and policies alone are insufficient to bring about change in the traditional procurement mind-set that is based on “lowest upfront cost” rather than “the best value for money” across the project/product life-cycle—full-life costing.

- **Perceived high cost of greener products**: The higher initial cost of greener products and tight budgets are often a hurdle for implementing GPP. The greener products with higher initial cost may turn out to be cheaper if life cycle costing of product is calculated taking into account operation, maintenance and end of the life costs besides initial cost.

- **Lack of awareness, practical tools and information**: There is a low awareness among stakeholders about benefits of environmentally friendly products and services, and how to incorporate environmental criteria within procurement process. There is also insufficient information on tools for implementing GPP. Preparation of the Life Cycle Cost and Benefit Analysis of green products and services needs to be promoted.

**IMPLEMENTING GPP IN INDIAN RAILWAYS**

Indian Railways is one of the largest central departments of Government of India with procurement volume exceeding Rs. 30,000 Cr. per annum. The huge
expenditure by Indian Railways on procurement of goods alone is indicative of the kind of potential benefits that can be derived by implementing GPP in Indian Railways. Even a small shift towards green products through little tweaking in procurement policy of Indian Railways can make great impact in creating awareness among suppliers and public in general and promote sustainable development objectives. Further, the special nature of items required by Indian Railways for its rolling stocks makes it more suitable for experimenting with GPP policy and programme. With this kind of budget, Indian Railways is ideally suited to initiate GPP initiative, which can later be expanded into wider public sector programs at national level.

**Existing Procurement Framework in Indian Railways**

The Indian Contract Act (1872) and Sale of Goods Act (1930) form the legislative basis for public procurement in India. General Financial Rule (GFR) 2005, Stores Codes, Rules for Entering into Contract, CVC guidelines and various rules and regulations provide operational framework for public buying in Indian Railways. It is based on basic principles of efficiency, economy, transparency, fairness and equitability and promotion of competition in procurement. There is provision of judicial review of executive’s decision to reduce arbitrariness. However, these guidelines in their current form do not mandate public authority to incorporate environmental and social concerns in their buying decisions. Nevertheless, awareness about the need to incorporate sustainability into government decision-making has been gaining traction in recent years. Considering large volume of procurement, Indian Railways has a separate cadre of specialist procurement professionals, the Indian Railways Stores Service (IRSS).

**Current Indian Railway Approach on GPP**

In past, Railways has taken several initiatives that support procurement of environment-friendly products. Way back in 2003, Railways mandated that only low sulphur diesel would be used for running of all locomotives. Railway has taken very seriously the Integrated Energy Policy, Report of Expert Committee (August’06) issued by Planning Commission and has taken several decision like phasing out of incandescent lamp and introduction of CFL, introduction of electronic choke in place of conventional choke, mandatory compliance of Green Building Code in all new projects etc. to curb energy consumption and thereby reducing impact of its operation on environment. It has also introduced boron free coolant for diesel locomotive instead of conventional coolant in 2008, which helped reduce emission of green house gases. Further, it has
completely phased out use of M 12 gas for its air-conditioning of coaches in higher classes and office building.

In recent time, the state run transporter has initiated a slew of “green initiatives”, such as introduction of new generation electric and diesel locomotives, use of bio-diesel and procurement of minimum BEE three-star rated products with focus on saving in electricity bills.

Thus, Railways has taken ‘Triple Bottom Line’ approach to drive its corporate strategy and imbue its execution with a larger sense of purpose, encouraging economic, social and environmental dimensions. All these measures have been undertaken without any prevailing concept of green procurement in Indian Railways with prime focus on energy saving. This shows the kind of potential for reduction in carbon footprints that exists in Indian Railway. It further shows that the setting is conducive for adopting sustainable purchasing in a more structured way to harness full potentials of GPP and assist India in her current effort in mitigating climate change impacts.

**Recent Development on GPP in India**

While stakeholders in India are grappling to understand this subject and its implications, multilateral agencies such as UNEP, the German development agency GIZ and others have increased their sustainable procurement activities in the country. Their efforts, which have included workshops and seminars, have led to greater awareness among stakeholders. Moreover, in 2012, two noteworthy milestones were reached. First was the introduction of the Public Procurement Bill in Parliament stating that the environmental sustainability of a product could be adopted as one of the criteria for evaluating a tender. Second, a committee nominated by the Ministry of Environment and Forests recommended introducing legislation that encourages a shift in supplying greener products and services. These events have created some buzz around this topic among public procurers.

Despite these overwhelming challenges, sustainability champions in Indian Railways have resolved to integrate sustainability considerations into public buying. Their actions rest on the belief that although the current public procurement legislation does not explicitly mandate sustainability, it does not prevent any government agency from procuring ‘green’ products and services within the given policy framework provided it is done in transparent and equitable way.

In New Year 2013 message, the Adviser (Railway Stores), Railway Board identified
‘green’ procurement as one of the priorities for the financial year 2013-14. In order to get political support for introducing sustainability concept in public buying, the proposal to buy recycled paper was included in the Railways Budget 2013. Following passage of Railway’s budget in the Indian parliament, Indian Railway decided to buy paper made from minimum 60% recycled pulp and zonal railways were accordingly directed to buy recycled paper.

This shows that management support for GPP concept exists in Railways and the question is of getting political support for wider adoption of GPP policy in Indian Railways by enlarging the procurement basket of environmental friendly products.

**STRATEGY FOR INTRODUCING GPP IN INDIAN RAILWAYS**

Indian Railways has been pioneer in introducing e-procurement, e-auction, reverse auction etc. to increase transparency, equity and competitiveness in procurement process. The GPP policy provide yet another opportunity for Indian Railway to take leadership in integrating sustainability concept in public buying to give best value for money to its stakeholders.

Indian Railways needs to essentially follow a step-by-step approach for introducing GPP. These steps have been enumerated below:

**Political Commitment for GPP**

National laws and policies provide the all-important pre-requisites for GPP. National focus on GPP should instill emphasis on international and national standards, eco-labels and life-cycle analyses to enable procurers to take the most appropriate decision. In absence of national law and guidelines in India on GPP, Indian Railways can take leadership by announcing its intension to adopt GPP policy in upcoming Railway Budget. The inclusion of GPP policy in Railway budget would lend legitimacy to, and ensure follow up of GPP initiatives. This shall be followed up with establishing a multi-stakeholders committee to appreciate the complexities involved in GPP and draft a GPP Policy and Action Plan for GPP implementation.

**Establishment of Policy Framework for GPP**

The formulation of a GPP Policy and Action Plan would provide a sound basis on which to build a coherent, well-coordinated approach. Without these, activities may be ad-hoc and largely based on the personal efforts of individuals. There is also a need for specific green procurement regulations directing all zonal railways to do green procurement and direct them to fulfill their green procurement obligations.
However, laws and policies alone are insufficient to bring about change in the traditional procurement mindset that is based on the “best value for money” rather than the best value across the project/product life cycle. GPP implementation needs to be integrated into procurement processes through the establishment of environmental, social and economic objectives at each stage of the procurement process – establishing the need to procure, setting specifications, developing pre-qualification questionnaires, developing award criteria for evaluation tenders and making award decisions, developing contracts and monitoring contracts.

**Defining Green**

One of the recurring questions coming to mind of all stakeholders is – how do define a green product? Therefore, it is necessary to give some guidelines on what are essentials attribute of a green product. Whether a product can be considered green or otherwise would depend on the following:

- Whether the product has a substantially less potential for pollution when compared to others in the same category in terms of any stages in the life cycle, i.e., production, usage and disposal.
- Whether the product is recycled, recyclable, made from recycled products or bio-degradable. This criterion varies as per product and category as in some cases it is not easily applicable.
- The product must make a significant contribution to energy savings and non-renewable and natural resources through steps like energy efficient manufacturing practices, efficient logistics and less packing materials.
- The product must contribute to a reduction of the adverse primary criteria which has the highest environmental impact associated with the use of the product, and which will be specifically set for each of the product categories.

Besides above all products shall meet the general requirements as mentioned below:

- All products so identified shall meet relevant Indian Standards notified by the Bureau of Indian Standards (BIS). In absence of Indian Standards for particular product, International standards may be incorporated.
The product manufacturer must provide the consent clearance, as applicable, as per the provision of Water (Prevention and Control of Pollution) Act, 1974, Water (Prevention and Control of Pollution) Cess Act, 1977, and Air (Prevention and Control of Pollution) Act, 1981 respectively along with the authorization, if required under Environment (Protection) Act, 1986 and rules made there under to Bureau of Indian Standards.

The product packaging may display in brief the criteria based on which the product has been labeled as environment friendly.

The material used for product packaging shall be recyclable, reusable or biodegradable.

Where applicable, the product package or leaflet accompanying it may display instructions of proper use, storage, transport and recommend disposal guidelines after use and safe handling precautions so as the maximize product performance and minimize wastage. These could also be extended to other forms of user documentation.

Selection of Products and their Environmental Criteria

The establishment of environmental criteria for selected products is key to successful implementation of GPP Programme. The product criteria shall be put in place keeping in view supply side issues. There is no point in demanding higher performance standards from market if no vendors can currently meet them. Further, the specified criteria shall be verifiable in transparent way either through Certification or declaration from third party verification or other transparent schemes.

Given the fact that Indian Railways does not have a green procurement policy in place, it may be useful to begin with small number of products. These could be selected on the basis of the following:

- Products that are low hanging fruits (starting with products that are easier to green, requires minimal investment, etc.)
- High purchase product categories within government procurement could be looked at (High, in terms of both quantity and value)
- Products, where initiatives towards greening have already been undertaken
- Products, where technology is already established

After looking at various global frameworks for green procurement as well as the list of products commonly procured by Railways, the following product categories may be taken up in the beginning on the basis of the above mentioned factors:

1. Paper
2. Electrical Appliances (Air Conditioner/ Coolers/ Water heaters/ Fan)
3. IT equipment (Computer/ Printer/ photocopier)
4. Lighting Fixtures (Bulb/ CFL/LCD)
5. Cleaning Agent

It may be seen from above list that Indian Railways has already been using energy efficiency and environmental criteria for some of the above products.

To ensure that procurement of above products is done in smooth way across zonal railways, Indian Railways would have to draw up clear and precise technical specifications based on following factors:

- Consider environmental performances such as the use of raw materials, sustainable production methods, energy efficiency, renewable energy, emissions, waste, recyclability, hazardous chemicals, etc.
- Establish award criteria – wherein the criteria of the economically most advantageous tender is chosen, including environmental criteria
- Build upon best practices of other public authorities both within and outside India
- Use performance based or functional specifications to encourage innovative green products
- Work with vendors of identified products to improve environmental characteristics of products over a period on time.

The environmental criteria chosen shall also have test methods with appropriate accuracies/reproducibility/repeatability to verify the environmental claims and shall not rely on declarations alone. However it may not be wholly possible to always rely on testing. There are several instances wherein many programmes work on self-declaration. In such cases the requirements could be aligned in such a way that conformance could be verified with a trail of auditable documents/evidences submitted by vendors. If verification is deemed necessary to check these documents, self-audits should be conducted on a random basis, which keeps the cost manageable but still provides the required assurance. Discovery of nonconformance to self-declared criteria could be subject to harsh penalties, and provides a clear incentive for accurate and true self-declaration.

**Developing Award Criteria for Evaluation of Tenders**

Environmental requirements must also be set out at the Invitation to
Tender stage. The greater the environmental impact of procurement, the more heavily should the focus be on strong environmental criteria. It would be important to consider the costs over the life of the goods or services including environmental costs such as how much energy a product uses and the cost of disposal. The award criteria must be based on total cost of ownership of products rather than initial cost of products. This would give savings in running and maintenance costs.

The best offer will normally be determined on the basis of a number of different sub-criteria. One can use different techniques for comparing and weighing up these sub-criteria. The appropriate weightage for environmental criteria may be given in evaluation of tender based on how important environmental objectives are for the contract, relative to other consideration such as cost and general quality.

**Developing Contracts and Monitoring Contracts**

Effective contract management ensures that all commitments are met and that any problems are managed and dealt with quickly. It can also help suppliers to improve their performance in terms of sustainability. By linking managing and reviewing contracts to achieving targets, railways can ensure that suppliers take environmental concerns in their own supply chain. Using improvement targets and key performance indicators, can cover the whole range of environmental impacts from using raw materials, production, to options for managing products at the end of their life. Joint improvement targets could include:

- Ensuring that the contractor/supplier has an environment management system or environment policy
- Reducing the contract’s carbon footprint through energy efficiency
- Increasing the amount of waste recycled
- Reducing water consumption
- Ensuring that the product being purchased is made from a certain material, or contain a certain percentage of recycled content

**Capacity Building and Training**

Capacity building has emerged as an essential requirement for the efficient management and planning of GPP. Capacity building includes strengthening institutions within railways, managerial systems, and human resources, developing effective means to facilitate public participation and communication, and promoting the creation of favourable policy environments. The procurement professional and other officials need to have adequate knowledge of concept like eco-label, Life
Cycle Costing (LCC), Life Cycle Analysis (LCA), Voluntary Sustainability Standards, evaluation based on total cost of ownership, weightage if any to any criteria etc. for taking decision in the most effective and transparent way. It is imperative to develop an effective green procurement personnel management strategy and organize training for green procurement personnel on general skills, communication skills, product knowledge, thinking and analysis skills. Training activity needs to be supplemented with awareness-raising activities, including newsletters and workshops on periodical basis to build understanding on GPP. This would involve working through broad based awareness raising sessions in order to ensure that there is a common understanding amongst all officials involved in procurement activities.

The Green Public Procurement can be implemented without the active support of vendors. The railways would have to make concerted efforts to increase awareness regarding the move towards GPP among the market so that suppliers are able to prepare themselves and start sourcing green versions of products. Therefore, it is essential to constantly engage with vendors and help build capacity of vendors to facilitate innovation and development of greener products.

In the initial stage, small group of vendors identified for designated product group shall be selected to sensitize on need to produce greener products. In other words implementation of green procurement would have to be phased in accordance with product availability. This would mean that suppliers would be given time to prepare for the changes towards green procurement.

**Setting GPP Targets**

Monitoring the progress and outcome of GPP policy is considered essential to make sure that the sustainability objectives are being achieved. A simple and easy-to-use monitoring system enhancing the credibility and value of the GPP scheme could include benchmarking possibilities and tools to measure the outcomes, e.g. by cost-benefit-analysis and impact analysis tools. It may be most appropriate for Railway Board to draw up procedures/ targets for their respective green public procurement programme to zonal railways.
Clear targets are critical in order to assess progress, and to communicate these targets to all stakeholders. Targets may include:

- Overall procurement targets – e.g. a certain percentage of procurement (by value and by number of tenders) should include GPP criteria, by 2015.
- Product specific targets – At least 80% for products for which environmental criteria has been finalized by Railway Board.
- Operational targets – e.g. all procurement staff will receive GPP training by 2015

**Financial Management**

The value for money principle of procurement includes considering the full cost of the product over its full life – not its cost over one year. Budgetary mechanisms need to put in place to encourage this sort of costing. These could include – request for departments to provide a business case for what they buy, whether what they buy is priced at a premium (to encourage departments to show how the costs would be offset over the longer term) or whether they are proposing to purchasing non-green alternatives (to encourage thinking of full life costs and not simply cheapest option). These could also be built in the form of increased budgets for zonal railways to implement green procurement. In order to capture capital and running costs, the involved agencies will also have to evolve a system for capturing and maintaining requisite data.

Also, benchmarking of green against non-green products needs to be illustrated to show that green products are not always at a cost premium when considered over their full life.

Price preference already exists in India for small and village industries. There may be an option to extend this incentive further to cover the supply of green goods and services. Reductions in excise duty for specific categories of goods could also be extended. A goods and service tax might also stimulate vendors to produce products and services that are more environmentally responsible.
Communication

Highly visible communication campaigns of various examples/ best practices of green procurement would have to be run by the government. An appropriate, well-targeted and continuous communication strategy would play a significant role in increasing the acceptance of any green product or service. This implies that GPP would have to be formalized, publicized and enacted. Railways-wise targets may be established with a suitable monitoring system. In course of time, harsh decisions may also have to be taken to allow only green products for certain commodities.

A GPP website could be designed which would serve as a central point for all information on green procurement. It could be built in a manner that it provides links to a wide range of resources related to environmental issues, practical assistance and best practice examples as well as local, national and international GPP information.
Institutional Setting for Implementing GPP

The Railway administration shall increasingly stress upon the message that GPP would have to be ingrained in the culture and that everyone will need to accordingly adjust to the reality of the current environmental challenges. The implementation of GPP in railways would require setting up a designated authority “Railway Green Procurement Authority” with clear responsibility and duties. The Railways Green Procurement Authority (RGPA) would report to Railway Board and will be responsible for GPP implementation in time bound manner. The RGPA may be given following responsibility and duties:

a. Develop, communicate, implement and monitor policy on Green Public Procurement
b. Identity products to be taken under GPP Programme and establish environmental criteria for them
c. Identify and mainstream test methods with appropriate accuracies to verify the environmental claims made by firms in absence of appropriate national/internationals standards
d. Engage with third party certification body to support incorporation of voluntary sustainability standards as environmental criteria
e. Coordinate with other ministry to enhance capacity of vendors for producing greener products
f. Capacity building of stakeholders including railways officials on GPP programme and its tools
g. Set up targets for zonal railways on GPP and monitor its achievement
h. Coordinate with other ministries, academia and international organisations on GPP implementation
Carbon footprint

The total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (CO2).

In other words: When you drive a car, the engine burns fuel which creates a certain amount of CO2, depending on its fuel consumption and the driving distance. (CO2 is the chemical symbol for carbon dioxide). When you heat your house with oil, gas or coal, then you also generate CO2. Even if you heat your house with electricity, the generation of the electrical power may also have emitted a certain amount of CO2. When you buy food and goods, the production of the food and goods also emitted some quantities of CO2.

Your carbon footprint is the sum of all emissions of CO2 (carbon dioxide), which were induced by your activities in a given time frame. Usually a carbon footprint is calculated for the time period of a year.

The best way is to calculate the carbon dioxide emissions based on the fuel consumption. In the next step you can add the CO2 emission to your carbon footprint.

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<th>Total</th>
<th>Carbon Footprint(Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>Kwh</td>
<td>0.43</td>
<td>A</td>
<td>A*0.43=A’</td>
</tr>
<tr>
<td>Diesel</td>
<td>Lt.</td>
<td>2.70</td>
<td>B</td>
<td>B*2.70=B’</td>
</tr>
<tr>
<td>Fuel Oil</td>
<td>Lt.</td>
<td>2.30</td>
<td>C</td>
<td>C*2.30=C’</td>
</tr>
<tr>
<td>LPG</td>
<td>Kg</td>
<td>1.26</td>
<td>D</td>
<td>D*1.26=D’</td>
</tr>
<tr>
<td>SKO</td>
<td>Lt.</td>
<td>2.13</td>
<td>E</td>
<td>E*2.13=E’</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Lt.</td>
<td>0.002</td>
<td>F</td>
<td>F*0.002=F’</td>
</tr>
<tr>
<td>Total GHG produced (in tones )or Total Carbon Food Print</td>
<td></td>
<td></td>
<td></td>
<td>(A’+B’+C’+D’+E’+F’)/1000</td>
</tr>
</tbody>
</table>
GRIHA RATING SYSTEM

- GRIHA rating system consists of 34 criteria categorised under various sections such as site selection and site planning, conservation and efficient utilisation of resources, building operation and maintenance and innovation points.

- Eight of these 34 criterias are mandatory.

- Four are partly mandatory while rest are optional.

- Each criterion has a no. of points assigned to it.
Energy Conservation

Vision 2020 document envisages sourcing of at least 10% of energy through new and renewable energy sources and achieving 15% enhanced energy through improved energy efficiency in both traction as well as non-traction use.

In keeping with policy guidelines for promotion of renewable energy sources, about 201 number of solar panels at stations, 587 number of solar panels at level crossing gates, 4 number of solar + wind (hybrid system) for level crossing gates, 130 number of solar based street lights for colonies and training schools and 489 number of solar based water heaters in running rooms/hospitals/rest houses/canteens/base kitchens, etc. were provided during 2010-11. Approximately 14 lakh CFLs have been distributed to railway households to help reduce 0.1 million ton of carbon dioxide emissions.

10 MW wind mill has been set up at Integral Coach Factory (ICF), Chennai which is expected to earn about 20,000 CERs (Carbon Emission Reduction) per annum. Two more wind mill plants of 10.5 MW capacity have been sanctioned for Southern and North Western Railways through Public Private Participation.

New trains introduced in Mumbai suburban section with IGBT based propulsion system have been equipped with regenerative braking features which have recorded energy regeneration while braking to the tune of 30-35% of energy used for hauling these trains.

To leverage the Clean Development Mechanism framework, IR in association with World Bank, has developed a Project Design Document for registration with UNFCCC to reduce carbon dioxide emissions per annum. Ministry of Power & Bureau of Energy Efficiency have given 1st & 2nd prize for National Energy Conservation Award during 2010 to East Coast Railway and Northeast Frontier Railway respectively. Certificates of Merit were given to South Central, Southern and West Central Railways for their best efforts in implementing the energy conservation measures. The 1st and 2nd prize for
Hospital Sector under Hospital Category (Open category) at national level has been given to Railway Hospital, Kota (West Central Railway) and Bikaner (North Western Railway) respectively.

**PURCHASE DATA OF NR**

<table>
<thead>
<tr>
<th>Purchased</th>
<th>A.C</th>
<th>Desert cooler</th>
<th>FAN</th>
<th>GEYSERS</th>
<th>CHOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-10</td>
<td>35</td>
<td>260</td>
<td>915</td>
<td>302</td>
<td>1600</td>
</tr>
<tr>
<td>2010-11</td>
<td>65</td>
<td>310</td>
<td>1305</td>
<td>187</td>
<td>2100</td>
</tr>
<tr>
<td>2011-12</td>
<td>96</td>
<td>254</td>
<td>416</td>
<td>92</td>
<td>1405</td>
</tr>
<tr>
<td>2012-13</td>
<td>45</td>
<td>365</td>
<td>536</td>
<td>131</td>
<td>1315</td>
</tr>
</tbody>
</table>

**Bio toilets installed**

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of coaches</th>
<th>No of Bio-toilets installed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-13</td>
<td>120</td>
<td>400</td>
<td>AT ICF CHENNAI</td>
</tr>
<tr>
<td>2013-14</td>
<td>692</td>
<td>2230</td>
<td>AT ICF CHENNAI</td>
</tr>
<tr>
<td>2013-14</td>
<td>1257</td>
<td>1792</td>
<td>AT RCF KAPURTHALA</td>
</tr>
</tbody>
</table>
Recycled paper

Paper recycling is the process of turning waste paper into new paper products. There are two categories of paper.

1. Pre-consumer waste, and
2. Post-consumer waste.

Pre-consumer waste is material which left the paper mill but was discarded before it was ready for consumer use. Post-consumer waste is material discarded after consumer use, such as old corrugated containers (OCC), old magazines, old newspapers (ONP), office paper, and residential mixed paper (RMP). Paper suitable for recycling is called "scrap paper", often used to produce molded pulp packaging. The industrial process of removing printing ink from paper fibers of recycled paper to make deinked pulp is called deinking.
The process of paper recycling involves mixing used paper with water and chemicals to break it down. It is then chopped up and heated, which breaks it down further into strands of cellulose, a type of organic plant material; this resulting mixture is called pulp, or slurry. It is strained through screens, which remove any glue or plastic that may still be in the mixture then cleaned, de-inked, bleached, and mixed with water. Then it can be made into new paper. The same fibers can be recycled about seven times, but they get shorter every time and eventually are strained out.

**Energy Consumption**

Energy consumption is reduced by recycling. The Energy Information Administration claims a 40% reduction in energy when paper is recycled versus paper made with unrecycled pulp. While the Bureau of International Recycling (BIR) claims a 64% reduction. Some calculations show that recycling one ton of newspaper saves about 4,000 kWh (14 GJ) of electricity.

**Landfill use**

About 35% of municipal solid waste (before recycling) by weight is paper and paper products.

**Water and air pollution**

The United States Environmental Protection Agency (EPA) has found that recycling causes 35% less water pollution and 74% less air pollution than making fresh paper. Pulp mills can be sources of both air and water pollution, especially if they are producing bleached pulp. Modern mills produce considerably less pollution than those of a few decades ago. Recycling paper decreases the demand for fresh pulp and thus reduces the overall amount of air and water pollution associated with paper manufacture. Recycled pulp can be bleached with the same chemicals used to bleach fresh pulp, but hydrogen peroxide and sodium hydrosulfite are the most common bleaching agents. Recycled pulp, or paper made from it, is known as PCF (process chlorine free) if no chlorine-containing compounds were used in the recycling process.[20] However, recycling mills may have polluting by-products, such as sludge.
Statistics on paper consumption

- The average per capita paper use worldwide was 110 pounds (50 kg).
- It is estimated that 95% of business information is still stored on paper.
- Recycling 1 short ton (0.91 t) of paper saves 17 mature trees, 26 m$^3$ of water, 2.3 m$^3$ of landfill space, 2 barrels of oil (320 l), and 4,100 kilowatt-hours (15 GJ) of electricity.
- Although paper is traditionally identified with reading and writing, communications has now been replaced by packaging as the single largest category of paper use at 41% of all paper used.
- Most corrugated fiberboard boxes have over 25% recycled fibers. Some are 100% recycled fiber.

Quality of Recycled Paper

- Excellent performance
- Meets the same technical specifications as fresh papers
- Many are acid-free for archival longevity
- Successfully runs on the most demanding copiers, office machines and printing presses
- Many recycled copy papers are guaranteed to work well in copiers

Aesthetic

- High to moderate brightness levels, with pleasing light reflection
- Ranges from clean, bright whites to a wide palette of colors
- Some recycled graphic papers have specks added back in to the paper to achieve custom design effects

Availability

- Available in virtually every grade of paper
- Most printers, paper distributors, and retail outlets have some recycled paper on their shelves
- Choices are even greater if you order recycled paper ahead of time
Financial

- Many are the best buy or evenly priced with nonrecycled, especially letterhead, matching envelopes, business cards, brochures, and many coated papers
- When recycled papers cost more, price differentials are usually quite small
- Buying in larger quantities and planning ahead further reduces or eliminates price premiums on recycled paper

Environment Impact

- Saves trees, energy, water, and landfill space compared to fresh paper
- Protects forests, watersheds, ecosystems
- Produces less pollution than fresh paper production
- Offers environmental savings many times over, since fibers can be recycled repeatedly
- Needs less bleaching than fresh papers; reduces use of toxic chemicals
- Concentrates inks, chemicals and other potential hazards for responsible management, instead of releasing them as do landfilling and incineration
- Incorporates full-cycle production costs, unlike fresh paper which includes no responsibility for its eventual disposal costs

Future of Recycled Paper

- Creates strong, ongoing markets for local community recycling collection systems
- Provides the foundation of an environmentally sustainable paper production system (even when papers are tree-free, chlorine-free or produced through certified sustainable forestry)

Steps to Take in Purchasing and Using Recycled Paper

- Always specify postconsumer recycled paper, to create markets for local community recycling collection systems.
- Buy the highest postconsumer content you can, balanced against your budget and functional needs.
- Choose the right grade of paper for your job.
• Allow enough lead-time for a wider selection and better pricing.
• Use recycled paper both for "public" paper uses such as stationery, direct mail and brochures, as well as for less visible uses such as copy paper.
• Specify recycled paper use in all contracts.
• Publicize the need to buy recycled paper - to employees, customers, vendors, citizens.
• Label all printed materials, including letters, bills and publications, as printed on recycled paper so that others will see how acceptable and high quality it is.
• Solve equipment and other complaints by investigating all possible causes of the problem. Don't quit buying recycled paper.

Deal with cost issues in ways that encourage continued recycled paper purchases. Reduce paper waste to reduce costs.

**agro based and recycled paper (Date: 24/04/13) of NR**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Item description</th>
<th>Quantity</th>
<th>Values (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Printing paper Maplitho IS:1848</td>
<td>189.5 MT</td>
<td>8766696</td>
</tr>
<tr>
<td>2.</td>
<td>Paper printing offset IS:1848</td>
<td>326.640 MT</td>
<td>15141113</td>
</tr>
<tr>
<td>3.</td>
<td>Security bond paper IS:1848</td>
<td>112796 Kg</td>
<td>6474385</td>
</tr>
<tr>
<td>4.</td>
<td>Paper colour Ptg. Pink 61*86 cm IS:1848</td>
<td>630 Reams</td>
<td>570600</td>
</tr>
<tr>
<td>5.</td>
<td>Paper colour Ptg. Pink 61*85 IS:1848</td>
<td>502 Reams</td>
<td>500074</td>
</tr>
<tr>
<td>6.</td>
<td>Paper colour Ptg. Pink in reels 61 cm IS:1848</td>
<td>13354 Reams</td>
<td>847316</td>
</tr>
<tr>
<td>7.</td>
<td>Paper colour Yellow in reels 61 cm IS:1848</td>
<td>4757 Kg</td>
<td>293918</td>
</tr>
<tr>
<td>8.</td>
<td>Water mark paper in reels 43 cm IS:1848</td>
<td>10395 Kg</td>
<td>507691</td>
</tr>
</tbody>
</table>
**Introduction of Environmental Friendly Refrigerant:**

Since CFC-12 is an Ozone Depleting Substance (ODS) and India is a signatory of the Montreal Protocol that required complete phasing out of CFC-12 by 2010. Indian Railways faced the challenge of shifting from CFC-12 to more eco-friendly HFC refrigerants such as R-134a for its cooling needs.

**CONSUMPTION DATA OF LIGHTING BULB OF N.R.**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Watt</th>
<th>AAC</th>
<th>Stock position (on 15/12/13)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>40</td>
<td>2180</td>
<td>1028</td>
<td>Incandescent</td>
</tr>
<tr>
<td>2.</td>
<td>60</td>
<td>42312</td>
<td>9186</td>
<td>Incandescent</td>
</tr>
<tr>
<td>3.</td>
<td>100</td>
<td>48440</td>
<td>6123</td>
<td>Incandescent</td>
</tr>
<tr>
<td>4.</td>
<td>15</td>
<td>23032</td>
<td>2412</td>
<td>CFL</td>
</tr>
</tbody>
</table>

**CONSUMPTION DATA OF ELECTRONIC BALLAST, CFL AND CEILING FAN OF N.W.R.**

<table>
<thead>
<tr>
<th>Sl.NO.</th>
<th>Watt/SPECS.</th>
<th>Consumption detail</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2010-11 2011-12 2012-13 2013-14</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>14</td>
<td>70 0 0 0</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>20</td>
<td>0 0 0 1195</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>SWEEP SIZE 1400MM W/O REGULATOR</td>
<td>2687 4767 3408 2812</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>SWEEP SIZE 1200MM W/O REGULATOR</td>
<td>3379 3572 3551 2331</td>
<td></td>
</tr>
</tbody>
</table>
IROAF will enable Indian Railways become a responsible eco-friendly organisation through introduction of Alternate Energy, Fuel Efficient and Emission Control Technologies. It will function as a single window entity for knowledge and database on technologies, Clean Development Mechanism (CDM), suppliers, business partners and consultants.

To achieve this IROAF is working on several projects as mentioned below

Sanctioned Project of IR
<table>
<thead>
<tr>
<th>SI.No.</th>
<th>Name of Work</th>
<th>Year Of Sanction</th>
<th>Sanctioned Cost(lakh)</th>
<th>Outlay for current year(cr.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Northern Railway setting of Bio Diesel Esterifcation plants</td>
<td>2006-07</td>
<td>78.49</td>
<td>10.00</td>
</tr>
<tr>
<td>2.</td>
<td>Conversion of 100 DPC to CNG dual mode</td>
<td>2007-08</td>
<td>75.00</td>
<td>3.89</td>
</tr>
<tr>
<td>3.</td>
<td>Usages of liquidated Natural Gas in Rail Spring Karkhana</td>
<td>2012-13</td>
<td>2.51</td>
<td>1.00</td>
</tr>
<tr>
<td>4.</td>
<td>Conversion of 20 DE ALCO locomotive to dual fuel mode with LNG as substitute fuel</td>
<td>2013-14</td>
<td>105.2</td>
<td>0.0001</td>
</tr>
<tr>
<td>5.</td>
<td>Fuel cell assisted green power unit for 300 BVZI @ 4 lakh</td>
<td>2013-14</td>
<td>12</td>
<td>0.0001</td>
</tr>
<tr>
<td>6.</td>
<td>Guard comfort kit for 750 BVZI wagons @1.13 lakhs</td>
<td>2013-14</td>
<td>8.47</td>
<td>0.0001</td>
</tr>
<tr>
<td>7.</td>
<td>Provision of solar energy in DEMU coaches @ 24 lakh in 30 coaches</td>
<td>2013-14</td>
<td>7.2</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td>Total Sanctioned Cost</td>
<td></td>
<td>288.87</td>
<td></td>
</tr>
</tbody>
</table>
Four new works has been sanctioned under plan head 2100 in the year 2013-14

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Total Cost (cr)</th>
<th>Outlay(lakh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Conversion of 20 DE ALCO locomotive to dual fuel mode with LNG as substitute fuel</td>
<td>105.2</td>
<td>1000</td>
</tr>
<tr>
<td>2.</td>
<td>Fuel cell assisted green power unit for 300 BVZI @ 4 lakh</td>
<td>12</td>
<td>1000</td>
</tr>
<tr>
<td>3.</td>
<td>Guard comfort kit for 750 BVZI wagons @1.13 lakhs</td>
<td>8.475</td>
<td>1000</td>
</tr>
<tr>
<td>4.</td>
<td>Provision of solar energy in DEMU coaches @ 24 lakh in 30 coaches</td>
<td>7.20</td>
<td>1000</td>
</tr>
</tbody>
</table>
ENERGY CONSERVATION IN ECR

Energy conservation is defined as a practice for efficient use of energy. Energy conservation is not for reducing energy but for promoting its efficient use, reducing wastage, more usage of renewable source of energy for protection of climate. Energy conservation shall result in reduced energy bill, environment protection and no sacrifice on human comfort. National Energy Conservation Day is being observed on 14th Dec. since 1990. In view of the criticality and importance of energy efficiency, the Government of India had enacted the Energy Conservation Act, 2001 to provide a legal framework to enable the economy to be energy efficient. The Bureau of Energy Efficiency (BEE) which has been established under the EC Act, 2001, is entrusted with the responsibility of implementing the provisions of the Act with the active cooperation and support from all the stakeholders. Indian Railway is a designated energy consumer as per the act and had a very important role in Energy Conservation. East Central Railway is one the Railway playing an independent role in conservation of Energy. East Central Railway has identified the scope of energy conservation under three heads namely

1. Use of energy efficient appliances
2. Need base use of energy consuming appliance by use of timer/sensor
3. Promotion of renewable source of energy such as solar/wind/hydro/geo-thermal

East Central Railway consumes energy for Traction and Non-traction purpose. Consumption of Diesel energy for traction services is not considered here. Trend of traction and non-traction energy consumption over Indian Railways as compared to earnings from freight traffic and passenger services is as follows:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Traction</td>
<td>983</td>
<td>801</td>
<td>841</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Non-Traction</td>
<td>181</td>
<td>163</td>
<td>166</td>
<td></td>
</tr>
</tbody>
</table>
1) Traction Energy:

Traction energy is consumed for hauling trains. Energy measurements at locomotive and traction sub-station have been done to identify the areas for improvement. Action plan prepared and implementation started. Highlights of action plan are as follows:

a) Regeneration of Energy:

With technology advancement and availability of efficient switching devices, regenerative breaking has come into design with 3 phase GTO locos. Drives were launched for costing and efficient use of regenerative breaking. On an average, 12.5% of electric energy is regenerated. Frequent stoppages, terrain having movement of empties up the gradient and loaded trains in down gradient, frequent speed restrictions etc. makes regenerative breaking most effective. 20% holding of ECR is of G9 locomotive.

b) Energy Efficiency:

Improving energy efficiency of Transformer, Traction Motor, Smoothing Reactor, Silicon Rectifier, and Auxiliary Motors is a continuous exercise based on the technological developments. The most important one is the introduction of Static Inverter in lieu of Rotary Arno. Static inverter provides balanced 3 phase supply thus giving opportunity for reducing the frame size of the auxiliary motor. Another important feature of soft start has opened another area of energy conservation to switch off auxiliary blower motor during notch zero movement of the locomotive. Improving energy efficiency is a continuous exercise and goes along with new developments and innovations.

C) Reducing no load energy consumption

An energized locomotive even when not doing any work consumes 90kW of which 45 kW is towards blower motors. During trials of energy measurement, it is observed that considerable time is spent by locomotive at zero notches when energized or waiting at station or yard for load. Containing no load energy consumption during zero notch movement and user friendly loco shutting off system while waiting at station has provided opportunity for substantial energy saving. This is done by

i) Working trains having 1500T and less load by WAG7 locomotive with one block isolated thus saving energy equivalent to 25kW

ii) Modification in the locomotive to switch off blower motor while working on notch zero. Notch zero working is around 13%, 20% and 40% for express, freight and passenger train respectively.
iii) Lower pantograph when aware that the locomotive is likely to be detained for more than half an hour.

iv) Working of banker locomotive with one block isolation

Instructions have already been issued to divisions in this regard.

d) Reducing Traction energy consumption

Specific Energy Consumption of freight train varies widely as per the actual measurement done. One of the prominent reasons is frequent stop and start arising due to congestion in the section. Regulating the train to run at slow speed with more and more coasting instead acceleration and breaking may help in controlling traction energy without any damage on sectional capacity. With advance communication system available between control and loco pilot, this has now become possible and an exercise for the first step to be taken has started.

e) Maintenance & Testing:

Locomotive is generally kept energized during testing thus consuming approximately 45 kW power. It takes around 2 hours for testing the locomotive, of which High Tension testing does not take much time. This time goes up when repairs are also involved at the time of testing. System of external air and locomotive battery supply to test the locomotive has been introduced, thus reducing loco energized time for testing.

2.) Non-Traction Energy

Non-traction energy is consumed by East Central Railway for Illumination, Water Supply, Residential, Office and Hospital, Air conditioning, Industrial machines in workshop and sheds, Welding and compressor in Wagon and Carriage maintenance depot etc.

There is no index to measure the efficient use of energy for non-traction purpose. Energy consumed per connected load during the year is evaluated to have the idea of usage of power but not a clear indicator of energy efficiency.

Area of Energy conservation in non traction area is summarized as follows:

2.1 Illumination:

2.1.a) Energy Efficient Luminaries:
Illumination is an ever increasing need of human being. Energy conservation in the field of illumination is by use of energy efficient lamp such as T5 and CFL. In general, usage of different type of lamps standardized is as follows:

i) Incandescent Lamp: Prohibited unless required for decorative purpose or specific application. This has been implemented by stopping procurement and existing stocks freezed. Procurement of CFL in lieu of incandescent lamp has been initiated during 2008-09 and supplies started during 10-11. CFL lamps have been provided replacing GLS lamps in station premises. Excess stock of 50000 GLS lamps got generated during interim period to be disposed as obsolete item. Besides this, there is a project in advance stage for distribution of 2.6 million free CFL to employees housed in railway quarters through CDM where Railway will get free CFLs and 3% of the Carbon Revenue accruing from the project. The project has been awarded to M/s IRG, USA with M/s Philips as CFL supplier.

ii) Fluorescent Tube Light T12/T8: Being phased out by replacing with T5 and CFL. Only five star rated T8 and T/12 is being procured till all the fittings are phased out.

iii) High Pressure Sodium Vapor Lamp: Application restricted for high mast tower not falling in the vision of train movement.

v) Metal Halide: High mast tower in yards, circulating area etc.

vi) LED lamp: Use of LED lamp has been started for low wattage application such as indication board, with solar panel etc and where unit cost of electricity is very high. Street light of one Railway Colony at Mohamadganj in MGS Division & Bapudham in SPJ division has been electrified with Solar panel and LED lamps. Restricted application started on trial due to high initial cost. However, LED is future lamp with prospects of achieving efficiency level of 140 lumen/watt.
## Comparative Table of different lamps

<table>
<thead>
<tr>
<th>Sr.no.</th>
<th>Type of Lamp</th>
<th>Lumen/Watt</th>
<th>CRI</th>
<th>Avg. Life (hrs)</th>
<th>Avg. Cost</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Incandescent lamp</td>
<td>14</td>
<td>100</td>
<td>1000-2000</td>
<td>Low</td>
<td>Prohibited</td>
</tr>
<tr>
<td>2</td>
<td>FL tube T-8 , T-12</td>
<td>83-90</td>
<td>85</td>
<td>5000</td>
<td>Low</td>
<td>Phased out</td>
</tr>
<tr>
<td>3</td>
<td>FL tube T-5</td>
<td>104</td>
<td>85</td>
<td>18000</td>
<td>Medium</td>
<td>Regular</td>
</tr>
<tr>
<td>4</td>
<td>CFL 18 W - 55 W</td>
<td>62-87</td>
<td>82</td>
<td>8000 - 20000</td>
<td>Medium</td>
<td>Regular</td>
</tr>
<tr>
<td>5</td>
<td>MH, 70 W - 400 W</td>
<td>72-92</td>
<td>65 - 90</td>
<td>9000 - 2000</td>
<td>Medium</td>
<td>High Mast</td>
</tr>
<tr>
<td>6</td>
<td>HPSV, 70 W- 400 W</td>
<td>90-140</td>
<td>20-25</td>
<td>28000 - 32000</td>
<td>Medium</td>
<td>High Mast</td>
</tr>
<tr>
<td>7</td>
<td>HPMV, 70-250 W</td>
<td>50</td>
<td>70-80</td>
<td>8000-1000</td>
<td>Medium</td>
<td>Restricted</td>
</tr>
<tr>
<td>8</td>
<td>LED</td>
<td>105</td>
<td>85</td>
<td>50,000</td>
<td>High</td>
<td>Trial</td>
</tr>
</tbody>
</table>

### 2.1.b) Timer & Sensor:

Illumination is not required at uniform level throughout the night time. Timer and Sensors has been provided. Sensor helps in switching on and off the lamp depending on natural light. Timer is required to switch off part of the mast tower lights after 22 hrs or as per actual survey of train/passenger movement.

### 2.1.c) Automatic Platform Lighting:

100% light works at Railway Station when train comes to the station and only 30% during rest of the time. This is achieved automatically by taking a feed from signaling system by which 100% lights switches on when the signal is lowered for the train. A JPO has been issued vide note no. ECR/ELE/G/Policy/304 dated 26.08.08 & decided for providing at least at 10 stations in each division on trial.
2.1.d) Air Conditioning:

Air Conditioning load is having a rising trend. This is mainly for the fact that air conditioning is now being considered as an efficiency multiplier instead a luxury. Hospitals, Office Buildings, Upper Class waiting Hall, Reservation Office, Control office, etc. are being provided with air conditioned comfort. Actions taken to contain energy consumption in these areas are:

i) Use of energy efficient BEE standard star rated air conditioning machine

ii) Air sealing

iii) Temperature setting at a comfort level of 23-25\(^{0}\)C and its remote control. 3% increase in energy consumption for every 1 degree rise in temperature.

iv) Directing cool air flow towards the occupant when there are only few user

v) Use of occupancy sensor

vi) Training of office peons to switch off the air conditioners when Boss is away.

vii) Switching off supply for air conditioner load of the office building just after 15 minutes of schedule office hours.

3.0 Promotion of renewable sources of energy

East Central Railway has gone for extensive use of solar power energy at manned level crossing gates, way side stations etc. It is difficult to extend power supply at these locations; therefore, solar power at these remote locations is an attractive proposition. This application being in remote area therefore, anti-theft measures have been built in the design of the solar panel at way side stations

LED lamp is preferred with solar panel for reasons that LEDs are available in lower power ratings and battery supply can directly feed to LED lamp thus saving on inverter. LED lamp is normally justified on life costing therefore decided to design with antitheft measures and IP65 protection.
VITAL STATISTICS REGARDING ENERGY SOURCES:

- As per anticipation, the world coal reserves are likely to last over 200 years, oil reserves for 45 years and gas reserves for 65 years.

- As per an anticipation, the coal reserves in India is likely to last over 200 years, and gas reserves for 20 years.

- The Union Ministry of Power has a mission of “power for all by 2012”.

- Coal reserve in India is 8.6% to world’s total reserve, whereas USA has 25.4%, Russia 15.9% and China 11.6%.

- India has 0.5% of total oil reserves in the world.

- Per capita energy consumption in India is 4% of USA and 20% of the world average. Users of Electricity may conserve to avail the energy for those who are far from it.

- CO₂ emission/kWH varies from country to country and there is scope for improvement.

- Each tree directly absorbs 10Kg of CO₂ from air annually.

If all the ACs in India were to switch to 5 star labels

- The power saving will be equal to a power generating station feeding supply to a metropolitan like Mumbai.

- Every AC owner/user will save Rs. 500/- per month.

- Emergency services like hospitals across the country will have uninterrupted power supply throughout the year.
Photographs of Energy conservation Schemes

Street light through solar at MDJ

Street light through solar at Bapudham

LED lighting through solar at Wazirganj

LED lighting through solar at Wazirganj
T5 Tube light at DNR Station

T5 Tube light at SPJ Station

Solar Geyser at Running room JAJ
Guidelines for Loco pilots to conserve Electric Energy

1. 120 units/hours of electrical energy are consumed for auxiliary motors working on a conventional electric loco, if it is idling at a station for want of line clear or load.
2. If one RSI block, out of two, is isolated then there is saving of 30 units/hour due to switching OFF of one MVMT & one MVSI.
3. A light engine or a 8-Coach passenger train can be worked at its maximum permissible speed, even with one RSI block isolated thereby saving up to 18% of energy units.
4. An empty goods train can be worked at its maximum permissible speed, even with one RSI block isolated even on gradient of up to 1 in 200, thereby saving up to 18% energy.
5. If train is expected to be stopped for 30 minutes or more, then DJ should be switched OFF to conserve energy.
6. On light loads / empty goods trains, if worked by Multi Unit (2 Locos), trailing loco should be switched OFF.
7. Blowers should be switched OFF if line clear is expected after 15 minutes or more.
8. Idle locos at pooling point/out station/yards should be switched OFF.
9. Whenever Loco/Train is controlled/stopped for traffic block /power block, loco should be switched OFF and should be energized 10 minutes before cancellation of block.
10. Loco Pilots can monitor and conserve electricity with the help of energy meter provided on electric locomotives as well as proper use of RB and coasting using momentum of train.
**Energy Conservation Commitment, Policy & Set Up**

Make Energy Conservation a Mass Movement with involvement of all stakeholders.

- To reduce specific energy consumption in all our operations and activities, to bring down the energy cost by monitoring and controlling Energy Consumption.

- To identify locations over divisions having potential of saving of electrical energy in different areas such as train operation, Railway stations, service building, hospitals and colonies etc.

- To conduct energy audits aimed to minimize energy losses and implement the recommendations.

To achieve action plan targets given by Headquarter Office regarding energy conservation measures and energy management by regularly monitoring.

- Standardize & adopt use of appropriate energy efficient design/innovative technology.

- To promote use of renewable energy sources.

- Extensive use of energy efficient luminaries such as T-5/CFL/LED


- To create awareness & motivate all employees & their family members for energy efficiency & energy conservation initiatives by organizing seminars, painting competition on energy conservation during conservation weeks and recognize their efforts.

- Use of only 3-star & above rated product endorsed by BEE for achieving energy efficiency.
CHHAPRA JUNCTION RAILWAY STATION
N.E. RAILWAY

Station Profile

Chhapra Railway Station is a railway junction and A1 category model station in the North Eastern Railway. This is one of the biggest junctions of north Bihar, connecting north-south, east-west India.

The building has a built up area of 15640 square meters with an air conditioned area of 116.314 square metres. The total electrical connected load of the building is 265 kW and the power supply is provided by a 2x250 kVA, 11/0.4 kV transformer sub station, with a generator back up of 160 kVA & 140 kVA Diesel Generating Sets for emergency essential service.

Energy Consumption in 2011-12 & 2012-13

In 2011 - 12: Electricity consumed from the grid was 5.542 lakh kWh. Units generated through the DG sets = 3.177 lakh kWh
Total energy consumed in the year: (5.542 + 3.177) = 8.719 lakh kWh
In 2012 - 13: Electricity consumed from the grid was 4.548 lakh KWH. Units generated through the DG sets=2.901 lakh kWh
Total energy consumed in the year: (4.548 + 2.901) = 7.449 lakh kWh
**Energy conservation measures adopted**

2. Replacement of existing high wattage ceiling fans with energy efficient fans

Energy Savings achieved:-

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nos of Fans</td>
<td>Nos</td>
<td>226</td>
</tr>
<tr>
<td>Power consumption</td>
<td>Watt</td>
<td>80</td>
</tr>
<tr>
<td>Total power consumption</td>
<td>kW</td>
<td>18.08</td>
</tr>
<tr>
<td>Wattage of energy efficient fans</td>
<td>Watt</td>
<td>50</td>
</tr>
<tr>
<td>Reduction of power consumption</td>
<td>kW</td>
<td>6.78</td>
</tr>
<tr>
<td>Average working hours per day</td>
<td>hr/day</td>
<td>24</td>
</tr>
<tr>
<td>Energy saving per day</td>
<td>kWh/day</td>
<td>162.72</td>
</tr>
<tr>
<td>working days per year</td>
<td>days/yr</td>
<td>240</td>
</tr>
<tr>
<td>Energy saving per year</td>
<td>kWh/yr</td>
<td>39053</td>
</tr>
</tbody>
</table>

2. Replacement of existing 40W FTL fittings with 28W T-5 lamps

28W T-5 fittings and energy efficient fans at platform shelter

40W fluorescent tube light fittings with copper ballast were replaced by energy efficient 28W T-5 fittings having electronic ballast.
Energy savings achieved:-

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nos of FTL</td>
<td>Nos</td>
<td>154</td>
</tr>
<tr>
<td>Wattage of FTL</td>
<td>Watt</td>
<td>53</td>
</tr>
<tr>
<td>Total power consumption</td>
<td>Kw</td>
<td>8.162</td>
</tr>
<tr>
<td>Wattage of T5 fittings</td>
<td>Watt</td>
<td>28</td>
</tr>
<tr>
<td>Reduction of power consumption</td>
<td>Kw</td>
<td>3.85</td>
</tr>
<tr>
<td>Average working hours per day</td>
<td>hr/day</td>
<td>12</td>
</tr>
<tr>
<td>Energy saving per day</td>
<td>Kwh/day</td>
<td>46.2</td>
</tr>
<tr>
<td>working days per year</td>
<td>days/yr</td>
<td>365</td>
</tr>
<tr>
<td>Energy saving per year</td>
<td>Kwh/yr</td>
<td>16863</td>
</tr>
</tbody>
</table>

3. Replacement of existing 40W FTL fitting with CFL lamp.

Energy savings achieved

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nos of FTL</td>
<td>Nos</td>
<td>55</td>
</tr>
<tr>
<td>Wattage of FTL</td>
<td>Watt</td>
<td>53</td>
</tr>
<tr>
<td>Total power consumption</td>
<td>kW</td>
<td>2.915</td>
</tr>
<tr>
<td>Wattage of CFL lamp</td>
<td>Watt</td>
<td>15</td>
</tr>
<tr>
<td>Reduction of power consumption</td>
<td>Kw</td>
<td>2.09</td>
</tr>
<tr>
<td>Average working hours per day</td>
<td>hr/day</td>
<td>12</td>
</tr>
<tr>
<td>Energy saving per day</td>
<td>kWh/day</td>
<td>25.08</td>
</tr>
<tr>
<td>working days per year</td>
<td>days/yr</td>
<td>365</td>
</tr>
<tr>
<td>Energy saving per year</td>
<td>kWh/yr</td>
<td>9154.2</td>
</tr>
</tbody>
</table>

4. Control of water wastage

There was tremendous water leakage from water hydrant pipeline used for filling water in coaches and through water taps located at different locations in the station premises. A drive was launched to arrest such leakages. Defective valves and taps were got repaired along with ensuring possibility of water
supply segregation. Intensive awareness generation of water filling staff was carried out so that valves are closed when water is not needed. Also a master valve was provisioned so that at times when no train is there, then by closing this master valve any chances of water leakage through pipes are nullified. Also intensive patrolling by Railway Protection Force was carried out to ward off any outside tampering of the valves.

5. There are total 3 pumping installations having pumps of 30HP, 15HP, 15HP which supply water to the station. As a result of less water wastage these three pumps were operated for average approx. one hour less per day resulting in saving of 16425 units in a year.

5. Use of 30% & 70% segregation of lighting load

Normally, when a train is about to arrive in station then passenger rush is maximum requiring 100% lights to be operational but after about 15 mins. when the train has left and no train is about to arrive, platform is relatively empty giving us a window (about 7 hours per day) to reduce number of operational lights. This fact has been utilized to save energy. During such time 70% of lights are switched off through a centralized switch resulting in huge energy saving of 17885 kWh/yr.

Total energy saving achieved per year : 16863 +39053 +9154.2 +16425 +17885 =99380 kWh
Use of bio-diesel in diesel traction as alternative fuel of HSD oil.

Construction for 30 TPD Bio Diesel plant based on latest state of the art technology is in progress at Raipur for supply of Bio Diesel to SECR.

Bio Diesel manufacturing plant is based on algae, which is fast growing, high yielding and has no requirement of arable land. This second generation Bio Diesel plants can also use forest residue and farm residue as raw materials.
ICF, CHENNAI

ICF has carved a niche in the Indian Railway system by constantly improving the 'quality of travel' through its passenger coach design which has undergone a sea-change from the days of bye-gone era of mere 'transport of passengers'. There has been a steady growth both in the quality and quantity of its production.

As milestones in this endless travel, ICF has obtained the ISO: 9001, ISO: 14001 and ISO: 18001 certificates for the QMS, EMS and OHSAS systems respectively.

ICF goes about its motto, 'for better travel', with single-minded devotion. Comfort, speed and safety are the hallmarks of ICF built coaches. Every coach produced at ICF stands proof of ICF's commitment to live up to its motto and its pursuit of excellence. In simple words, the coaches at ICF are custom-built to delight the individual.

ICF Wind mill

ICF is the only organisation amongst all government production units to entirely source electrical energy requirement from a renewable source of energy. Seven windmills of 1.5 MVA capacities each, which ICF put-up in Tirunelveli district of Tamil Nadu, generates enough electricity to meet the entire electrical energy requirement of ICF.
<table>
<thead>
<tr>
<th>Year</th>
<th>Wind Mill Generation</th>
<th>ICF Factory Consumption</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-10</td>
<td>2.37 Crore units</td>
<td>1.99 Crore units</td>
<td>7.85 Crores</td>
</tr>
<tr>
<td>2010-11</td>
<td>2.02 Crore units</td>
<td>1.93 Crore units</td>
<td>7.66 Crores</td>
</tr>
<tr>
<td>2011-12</td>
<td>1.86 Crore units</td>
<td>1.83 Crore units</td>
<td>7.22 Crores</td>
</tr>
<tr>
<td>2012-13</td>
<td>2.24 Crore Units</td>
<td>1.69 Crore Units</td>
<td>11.03 Crores</td>
</tr>
<tr>
<td>Total</td>
<td>8.49Crore units</td>
<td>7.44 Crore units</td>
<td>33.76 Crores</td>
</tr>
</tbody>
</table>

The Project being the first of its kind in Indian Railways, this green energy project of Indian Railways assumes great importance in the wake of the growing concern of environmental pollution and global warming issues on one hand and the depletion of fossil fuels on the other hand and hence is in complete agreement with the "Go-Green" slogan propagated internationally.

Energy Efficient MRVC Rake

The state-of-the-art AC/DC EMU rakes manufactured by ICF for Mumbai Rail Vikas Corporation are with regenerative braking yielding energy saving to the tune of 30% besides unique amenities for passengers like forced ventilation system, GPS based passenger information system, etc. These 3 phase AC DC EMUs with regenerative braking has a specific energy consumption of 29.5 kWh/GTKM as against conventional DCEMU rakes having specific energy consumption of 40 kWh/ 1000GTKM. By virtue of this annual saving achieved through regenerative breaking is Rs. 100 Crores/Annuam.
Energy Conservation

The consumption for last year was $65.736 \times 10^6$ Million Joules and this year $61.092 \times 10^6$ Million Joules i.e. reduced by $4.644 \times 10^6$ Million joules.

Energy Conservation measures implemented in ICF over the years have contributed to steady decline in energy requirement for coach production. The energy required for manufacture of Equated Coach Unit (ECU) has declined from 12,012 units in 2007-08 to 7,764 units in 2012-13.
Energy conservation measures implemented in ICF

Some of the energy conservation measures implemented in ICF are enumerated below:

1. Harnessing of natural light

All the workshops in Shell and Furnishing Divisions of ICF have been provided with polycarbonate sheets and North light glazing for diffusion of sunlight. As a result, electric lamps are not switched ON during day time in ICF workshops.

2. Turbine Air Ventilators

Turbine Air Ventilators which operate on natural draft without electrical power are being installed in Workshop Roof tops to exhaust hot gas emanating from Welding operation, furnace, etc.

3. Solar water heater

Solar water heaters have been provided in Officers and Subordinate Rest House replacing electrically operated geysers. Solar water heaters are also used for Workers' Canteen to provide hot water for cooking. LED based solar street lights are being provided in ICF colonies and workshops in a phased manner. Also, ICF is planning to install 100kW Solar Panels (Order under process by Railway Board) for meeting the load requirement as part of green initiative.
4. **Timers for Air Circulators**

More than 1,000 air-circulators, which are provided in the shop floor for ventilation, are controlled by timer circuits to automatically switch off during non-working hours. Similarly, Light control panels installed in each shed to switch off non-essential lights during night time. Street lights, high mast lights, etc. are switched ON/ OFF by timer switches according to pre-set timings.

5. **Occupancy sensor**

Occupancy sensors have been provided in officer's cabin which automatically switches off Air-conditioners and room lights when there is no human presence.

6. **APFC Panel**

All 32 substations provided with Automatic Power Factor Control Panel (APFCP) and a high power factor of 0.98 achieved.

7. **Energy saver**

Energy savers, which switch OFF Arc welding machines when they are not in use for more than 3 minutes, have been provided in the Arc Welding machines in the workshop.
8. Energy efficient lighting

Energy Efficient lighting like T5, Induction lamps, CFL etc. are used in place of MH lamps & fluorescent light fitting in factory area.
Energy efficient initiatives by zonal railways

CFL Bulb

Data of SCR

<table>
<thead>
<tr>
<th>Sr .No.</th>
<th>p/nno</th>
<th>Description</th>
<th>power particulars</th>
<th>consumption in number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45150382</td>
<td>retrofit CFL</td>
<td>15 watt</td>
<td>1827</td>
</tr>
<tr>
<td>2</td>
<td>42118001</td>
<td>TUBE LIGHT 40W/230V 120MM</td>
<td>40 Watts</td>
<td>8897</td>
</tr>
</tbody>
</table>

Data of CR

<table>
<thead>
<tr>
<th>Sr .No.</th>
<th>p/nno</th>
<th>discription</th>
<th>power particulars</th>
<th>consumption in number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>42981372</td>
<td>retrofit CFL</td>
<td>15 watt</td>
<td>28517</td>
</tr>
<tr>
<td>2</td>
<td>42981384</td>
<td>retrofit CFL</td>
<td>05 Watts</td>
<td>1110</td>
</tr>
</tbody>
</table>
### Data of WR

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>pl no</th>
<th>Description</th>
<th>power particulars</th>
<th>consumption in number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>42115000</td>
<td>T-5,Tubular CFL</td>
<td>28 watt</td>
<td>72622</td>
</tr>
<tr>
<td>2</td>
<td>42114986</td>
<td>TUBULAR CFL</td>
<td>20 Watts</td>
<td>183720</td>
</tr>
<tr>
<td>3</td>
<td>42114998</td>
<td>TUBULAR CFL</td>
<td>36 Watts</td>
<td>179657</td>
</tr>
<tr>
<td>4</td>
<td>42115012</td>
<td>CFL</td>
<td>11 watts</td>
<td>154268</td>
</tr>
</tbody>
</table>

### Power consumption in IR

<table>
<thead>
<tr>
<th>Year</th>
<th>Non-traction Consumption</th>
<th>Traction Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Electricity (million kWh)</td>
<td>HSD Oil (million litres)</td>
</tr>
<tr>
<td>2000/01</td>
<td>1976</td>
<td>32.33</td>
</tr>
<tr>
<td>2001/02</td>
<td>2080</td>
<td>31.79</td>
</tr>
<tr>
<td>2003/04</td>
<td>2161</td>
<td>33.11</td>
</tr>
<tr>
<td>2004/05</td>
<td>2182</td>
<td>34.17</td>
</tr>
<tr>
<td>2005/06</td>
<td>2269</td>
<td>35.87</td>
</tr>
</tbody>
</table>
Comparison of CFL and Incandescent

<table>
<thead>
<tr>
<th></th>
<th>CFL</th>
<th>Incandescent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Input (watts)</td>
<td>13</td>
<td>60</td>
</tr>
<tr>
<td>Light Output (lumens)</td>
<td>810</td>
<td>830</td>
</tr>
<tr>
<td>Useful life (hours)</td>
<td>10000</td>
<td>1500</td>
</tr>
<tr>
<td># Bulbs for 10,000 hours</td>
<td>1</td>
<td>6.7</td>
</tr>
<tr>
<td>Bulb Costs</td>
<td>1@100=100</td>
<td>6.7@10=67</td>
</tr>
<tr>
<td>Electricity Used (kilowatt hours)</td>
<td>130</td>
<td>600</td>
</tr>
<tr>
<td>Electricity Cost (@ 5 rs per kwh)</td>
<td>650</td>
<td>3000</td>
</tr>
<tr>
<td>Total Cost (Electricity + Bulb)</td>
<td>780 Rs</td>
<td>3067 Rs</td>
</tr>
</tbody>
</table>

Saving in Monitory term

<table>
<thead>
<tr>
<th>non traction electricity consumption</th>
<th>2269 million Kwh</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of electricity consumption in lighting</td>
<td>25%</td>
</tr>
<tr>
<td>KWH ie one unit Cost</td>
<td>let 5 Rs</td>
</tr>
<tr>
<td>saving in %</td>
<td>75% aprox</td>
</tr>
<tr>
<td>saving in monetary term</td>
<td>2269<em>0.25</em>0.75*5 = Rs 2128 million</td>
</tr>
</tbody>
</table>
SOLAR PHOTOVOLTAIC PANEL

1KWh of electricity generated at thermal power station emits

1. 3015 Kcal of waste heat
2. 1 kg of CO₂
3. 0.6 Kg of no₂
4. 0.09 kg of CO
5. 0.007 kg of SO₂
6. Generates 0.201 kg of fly ash

Most parts of India receive 4-7 Kwh/m²/day of solar radiation and 250 to 300 sunny days in a year. Thus there is abundance of free solar energy available for utilization.
Challenges and Opportunities

In India, annual procurement by the government is estimated at approximately INR 2,200 billion and public sector procurement estimated at about INR 7180 billion.

Public Procurement in India is governed by the General Financial Rule (GFR), 2005 and Delegation of financial powers Rules (DFPR), 1978. The Department of Expenditure, Ministry of Finance has also issued three separate Manuals on Procurement of Goods, Services and Works as guidelines to all central government departments in the matters of procurement. Further, the Central Vigilance Commission (CVC) has also issued guidelines prescribing procurement procedure to be followed by all Central Ministries.

Although these guidelines do not stop any government agency to procure green products and services within this policy framework, they neither explicitly mandate government agency to integrate environmental concerns in their procurement decision. But in absence of such policy guidelines, GPP has remained a non-starter in India. In India too, green procurement can potentially have huge benefits, both environmentally as well as economically, considering huge procurement and consumption levels of the public sectors. The variety of experiences and approaches undertaken by pioneer countries demonstrate that implementation of GPP policy in any country is a daunting task. There are several challenges to green procurement that need to be resolved for successfully implementing green procurement in any country.

Many hurdles for implementing green procurement in India those are enlisted below.

1. These relate to absence of policy framework, regulations, internal awareness, availability and higher cost of green products and services.
2. Similarly, a dedicated legal or policy framework is critical to give legitimacy needed to break through and become embedded into the traditional thinking and financing that is commonplace in the public procurement.

3. Lack of corporate commitment: For an organization to implement a green procurement program, it must have commitment from all levels, including senior management and purchasing agents.

4. Availability: Frequently, local distributors do not stock green products, or else they stock only small quantities.

5. No acceptable alternative: Another barrier to green purchasing can be simply a lack of acceptable alternatives to the present product.

6. The critical issues with procurement professional are lack of knowledge to avoid legal and technical problems during the procurement process (inclusion, evaluation and monitoring), no knowledge & experiences of using tools such as LCC and LCA (CO₂ emission assessment), dependency on experts to define specifications and to mitigate potential financial risks due to perceived high costs of greener products.

7. Therefore, making green procurement as goal and communicating it through policy documents to all stakeholders is the first and foremost action to be taken to prepare ground for implementing GPP.

8. The Government can stimulate green market and be the game changer by giving right signal to the market of its intent to purchase environmentally preferable products and services. Simultaneously, the focus may have to be on development of environmental criteria, demonstrating relevance of green procurement on environment based on credible data; and study on cost
implication of different green products and services vis-à-vis conventional products and services.

9. This would need cooperation and collaboration of all stakeholders like Ministry of Environment and Forest, Bureau of Indian Standard (BIS), Bureau of Energy Efficiency (BEE), Ministry of Law & Justice, Ministry of Finance, major procuring ministries and not to forget various industry chambers, NGOs and the consumers.

10. Purchasing habits: 'We've always done it this way' can be a difficult mentality to overcome

**Recent Developments on Green Procurement in India**

There have been two recent developments in India on this subject that are worth mentioning here. Firstly in 2011, Ministry of Environment & Forest, Govt. of India had nominated a committee to formulate guidelines on Green Public Procurement. The committee has recommended a legislation to establish the necessary provisions and institutional arrangement for encouraging central government to procure greener products and services.

Secondly, the Cabinet has cleared Draft Public Procurement Bill-2012, which states “evaluation criteria shall relate to the subject matter of procurement and may include (a) the price; (b) the cost of operating, maintaining and repairing goods or works, the characteristics of the subject matter of procurement, such as the functional characteristics of goods or works and the **environmental characteristics of the subject matter**, …….”. This law, once enacted, would provide legitimacy to procurer’s decision of integrating environmental concerns
in public buying. These developments are certainly welcome for the cause of sustainable development in India.

The implementation of SPP in practice would require not only laws & guidelines but also change in mind-sets amongst producers & consumers. What is now urgently needed is a shift towards an understanding that spending public money is an opportunity to directly foster sustainable development and innovation. This calls for huge capacity building of all stakeholders. Equipping public buyers with the know-how on how to include sustainability requirements into their purchasing processes would be a key to successful implementation of SPP in India.
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