Asian Journal of Electrical Sciences
ISSN: 2249-6297 (P) Vol.4 No.2, 2015, pp.29-35

DOI: https://doi.org/10.51983/ajes-2015.4.2.1948

Replacement and Maintenance Analysis of Electrical and Electronics Equipment

R.A.Jaikumar[1], R.A.Senthilkumar[2] and S.Radhika[3]
[1]Principal, Mount Zion College of Engineering for Women, Alappuzha, Kerala, India
[2]P.G.Scholar (Law), Annamalai University, Chidambaram, Tamil Nadu, India
[3]Research Scholar, St.Peter's University, Chennai, Tamil Nadu, India
E-mail: eeeccctech@gmail.com

***Abstract* - In this paper has discus about the analysis of replacement and maintenance of the Waste of Electrical and Electronics Equipments to control its problems. The major problem that the human race is facing now is the effects of the E-pollution caused by the waste of Electrical and Electronics Equipments. The rate at which the Waste of Electrical and Electronics Equipments is growing can cause serious damages in 2025. So an immediate solution has to be drawn to reuse or reduce the Waste of Electrical and Electronics Equipments and its effects on humans. An economic solution is designed to achieve an optimal source to reuse and reduce the waste of Electrical and Electronics Equipments**
***Keywords:* E-pollution, public health, environment, Backyard recycling, economic problems, Energy re-usage, Innovation.**

I.INTRODECTION

Electrical And Electronic Equipment or 'EEE' means equipment which is dependent on electric currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such currents and fields falling under the categories set out in WEEE.As per the 2012-2013 serve, United Kingdom's produces around one million tounes of Waste of Electrical and Electronic Equipment **(WEEE)** and it is suggested that this figure may two million tounes reach at 2025. Waste of Electrical and Electronic Equipment is one of the fastest growing waste streams and is increasing at a rate three times that of average municipal waste growth. The increase in disposal of the Waste of Electrical and Electronic Equipment relates to a number of factors including the general increase in use of Electronic and Electrical Equipments, the frequent upgrading of Electronic and Electrical Equipments and, in some cases, the relatively high cost of repair compared to the purchase of new Electronic and Electrical Equipments. The disposal of the Waste of Electrical and Electronic Equipment also represents the loss of large amounts of valuable resources, in particular metals and plastics. If these were to be recycled it would not only divert the waste from disposal but would also reduce the need to use virgin raw materials.

We have easily able to identify a number of environmental concerns which arise from the production and disposal of Electronic and Electrical Equipment (EEE). First, it is believed that the Environmental Impact of producing Electrical and Electronic Equipment is often greater than that used to produce other constituents of the Municipal and Hazardous wastes stream. Secondly, the increasing volumes and varied nature of Waste of Electrical and Electronic Equipment is difficult to dispose. Most of the Waste of Electrical and Electronic Equipments are discarded in landfill sites but many of these sites have limited space available in the long term. Finally, The Waste of Electrical and Electronic Equipment contain significant amounts of heavy metals and halogenated substances which, once disposed of through landfill or incineration, may present hazards to public health , environment and create the Social economic problems in the world.

II.REPLACEMENT ANALYSIS

The Waste of Electrical and Electronics Equipments or Present Equipments Replacement projects are decision problems involving the replacement of existing obsolete or worn-out assets. The contribution of operation is dependent on these assets. Failure to make an appropriate decision results in a slowdown or shutdown of the operations. The Problem often faced by management of industries are whether to replace the existing the Waste of Electrical and Electronics Equipments with new and more efficient of Electrical and Electronics Equipments or to continue to use existing WEEE equipments? And when existing Electrical and Electronics Equipments should be replaced with more efficient equipment.

III.CAUSES /REASONS FOR REPLACEMENT

The Electrical and Electronics Equipments are generally considered for replacement for the following reasons.

A. Deterioration

Deterioration is the decline in performance of Electrical and Electronics Equipments as compared to new equipment identical to the present one. It may occur due to Electrical and Electronics Equipment wear and tear and misalignment

It Causes

(i) Increases maintenance costs.
(ii) Reduces product quality
(iii) Decreases rate of production
(iv) Causes loss in operating time

(v) Increases labour costs and
(vi) Reduces efficiency of the Electrical and Electronics Equipment

B. Obsolescence

Technology is progressing rapidly; newer and better Electrical and Electronics Equipments are being developed and turned out every year. Obsolescence is due to improvement in new technology. It causes loss in value of machinery. If management of a concern does not go for a change in the Electrical and Electronics Equipment or machinery, the unwarranted manufacturing costs arising from obsolete Electrical and Electronics Equipment will

(i) Reduce profits
(ii) Seriously impair the concern's competitive position in the market.

C. Inadequacy

When existing Waste of Electrical and Electronics Equipments becomes inadequate to meet the challenge of making new products or existing product in large quantities, the question of replacement arises. For example, a milling machine may not become obsolete, but it is inadequate in producing gears on mass production. Under such conditions one may go for automatic gear cutting machines and form cutters.

D. Working Conditions

It may be thought of replacing the Waste of Electrical and Electronics Equipments and machinery which create unpleasant (i.e. smoky, noisy) and hazardous working conditions causing worker unsafely and leading to accidents.

IV. FACTORS TO BE CONSIDERED FOR WEEE

Two main factors are:

a. Technical factors
b. Financial factors

A. Technical factors

They tend to consider:

i) Whether the present Electrical and Electronics Equipment has deteriorated?
ii) Whether the present Electrical and Electronics Equipment has become obsolete?
iii) Is the present Electrical and Electronics Equipment inadequate in meeting production rate?
iv) Can the present Electrical and Electronics Equipment hold tight tolerances?
v) Can the present Electrical and Electronics Equipment better designed from a method's stand point?
vi) Is the new Electrical and Electronics Equipments providing required surface finish?
vii) Is the present Electrical and Electronics Equipments making more noise and vibrations and thus distracting the attention of the workers?
viii) Is the existing Electrical and Electronics Equipment hard on the workers?
ix) Does the existing Electrical and Electronics Equipment increase likelihood of accidents?
x) To what extent the existing Electrical and Electronics Equipment is not capable of marking use of the newer developments in the field?
xi) How often the existing Electrical and Electronics Equipment needs maintenance and repairs?

B. Financial Factors

They are

(i) The initial cost of the challenger
(ii) Operating expenses : They include

- Direct and indirect labor cost.
- Direct and indirect material cost
- Power
- Maintenance cost
- Cost of replacing parts
- Insurance, and
- Interest on invested capital.

(iii).Expected salvage value at the end of the service life of the Electrical and Electronics Equipments.

V. FAILURES

These are two types of failures, which are categorized in replacement model:

a. Gradual failure
b. Sudden failure.

A. Gradual Failure

Gradual failure is progressive in nature. It can be depicted in Electrical and Electronics Equipments, which is gradually depreciating or deteriorating with the time resulting in very high operating and maintenance costs and/or decreased residual value? It is easier to predict such type of failures and taking the corrective measures by providing a replacement policy for such Electrical and Electronics Equipments. Gradual failures results into the following:

1. Increases maintenance costs.
2. Increased operating costs.
3. Decreased productivity
4. Decreased resale value.

B. Sudden Failure

In case of sudden failure, the situation of uncertainty occurs where the prediction and control of this type of error is extremely difficult. Determining the probability distribution of failures can solve this difficulty, according to which, a suitable replacement policy could be proposed.

VI. TYPES OF REPLACEMENT PROBLEM

Replacement study can be classified into two categories:
a) Replacement of assets that deteriorate with time (replacement due to gradual failure, or wear and tear of the components of the Electrical and Electronics Equipments).

This can be further classified in to the following types.

i) Determination of Engineering Economic life of an asset

(ii)Replacement of an existing asset with a new asset

b) Simple probabilistic model for asset which fail completely (replacement due to sudden failure).

i) Determination of Economic Life of an Asset:

The cost of owning and operating an asset can be divided into three categories.
They are as follows…

a. Capital costs
b. Operating Costs
c. Total Cost

A. Capital costs

Capital costs have two components: initial investment and the salvage value at the time of disposal at the Engineering Industries. Annual Electrical and Electronics Equipments of capital costs, which is called Capital recovery cost computed from the first cost (Initial investment /purchase price) of the Electrical and Electronics Equipments. Generally speaking, as an asset becomes older at Engineering Industries, is salvage value becomes smaller. As long as the salvage value is less than the initial cost, the capital recovery cost is a decreasing function of the life of the asset. In other words, the longer we keep an asset, the lower the capital recovery cost becomes.

B. Operating Costs

The Operating costs of an asset include operating and maintenance (O&M) costs at Engineering Industries, labour costs, material costs, and energy consumption costs at Engineering Industries. O&M costs tend to increase as a function of the age of the asset. Because of increasing trend of the O&M costs, the total operating costs of an asset usually increases as the asset ages of the Electrical and Electronics Equipments. As long as the annual operating costs increase with the age of the Electrical and Electronics Equipments, the annual equivalent operating cost is an increasing function of the life of the asset.

C. Total Cost

Total cost/total annual Electrical and Electronics Equipments costs of owning and operating an asset is a summation of the capital recovery cost (average first cost/annual equivalent capital cost) and the annual equivalent operating costs of the asset. It is clear that the capital recovery cost goes on decreasing with the useful life of the Electrical and Electronics Equipment and the annual equivalent operating cost goes on increasing with the useful life of the machine. From the beginning, the total cost continues to decrease up to a particular life and then it starts increasing; the point where the total cost is minimum is called the economic life of the Electrical and Electronics Equipments. The economic service life of an asset is defined to be the period of useful life that minimizes the annual equivalent cost of owning and operating the asset. The replacement alternatives can be evaluated based on the present worth criterion and annual Electrical and Electronics Equipment criterion.

D.Replacement of Existing Asset with a New Asset

In this section, the concept of comparison of replacement of an existing Electrical and Electronics Equipments with a new Electrical and Electronics Equipments is presented. In this analysis, the annual equivalent cost of each alternative should be calculated and then, the alternative which has the least cost should be selected as the best alternative. Before discussing details, some preliminary concepts which are essential for this type of replacement analysis are presented.

VII. CAPITAL RECOVERY WITH RETURN

Consider the following data of a Electrical and Electronics Equipments. Let.

P = Purchase cost of the Equipments.
F = Salvage value at the end of Equipments life.
N = Life of the Equipments in years and
i = Interest rate compounded annually.

The equation for the annual equivalent cost is

$$AE(i) = (P - F)(A/P, i, N) + f \times i$$

This equation represents the capital recovery with return.

VIII. CONCEPT OF CHALLENGER AND DEFENDER

The terms challenger and defender are commonly used in the boxing world. In every boxing class, the current defending champion is constantly faced with a new challenger. In replacement analysis, the defender is the existing Electrical and Electronics Equipments, and the challenger is the best available replacement Electrical and Electronics Equipments. An existing piece of equipment will be removed at some further time, either when the task it performs is no longer necessary or when the task can be performed more efficiency by never and better equipment. The question is not whether the existing piece of equipment will be removed, but when it will be removed. A variation of this question is why we should replace existing equipment at this time rather than postponing replacement of the equipment by repairing or overhauling it. Another aspect of the defender – challenger comparison concerns deciding exactly which equipment is the best challenger. If the defender is to be replaced by the challenger, we would

generally want to install the very best of the possible alternatives.

IX. RELEVANT INFORMATION FOR REPLACEMENT ANALYSIS

The most common problem encountered in considering the replacement of existing Electrical and Electronics Equipment is the determination of what financial information is actually relevant to the analysis. Often a tendency to include irrelevant information in the analysis is apparent. In all defender analysis, the relevant cost is the current market value of the Electrical and Electronics Equipments. The Original cost/purchase cost, repair cost of last year, and trade –in value are irrelevant. The purchase cost of equipment three years ago and repair cost of last year are called as sunk costs. A sunk cost is any past cost unaffected by any future investment decision. In a proper Engineering Economic Analysis, only future costs should be considered; past sunk costs should be ignored. Thus, the value of defender that should be used in a replacement analysis should be its current market value, not what it cost when it was originally purchased and not the cost of repairs that have already been made on the Electrical and Electronics Equipments.

X. MAINTENANCE ANALYSIS

Maintenance is concerned with the day-to-day problem of keeping production facilities and equipment in proper operating condition. Maintenance is concerned with action taken by a user to maintain an existing facility in operating condition. The Electrical and Electronics Equipments should be continuously monitored for their efficient functioning at the Engineering Industries. Otherwise, the quality of service will be poor and the cost of operation and maintenance would increase with the passage of time.

A. Objectives of Maintenance

The following are the objectives of maintenance.

(i) To achieve minimum break –down of the Electrical and Electronics Equipments

(ii) To keep plant in good working condition at the lowest possible cost.

(iii) To keep machines at their optimum (profit making)

(iv) To ensure the availability of machines, buildings and services

(v) To achieve efficient functioning of machines.

(vi) To reduce operation and maintenance cost.

B. Functions of maintenance department

The different functions and responsibilities of the maintenance department are as follows.

i) Inspection
ii) Engineering
iii) Maintenance
iv) Repair
v) Overhaul
vi) Construction
vii) Salvage
viii) Clerical Jobs
ix) Generation and distribution of power
x) Administration and supervision of labour force in maintenance department.
xi) Providing plant protection including fire protection
xii) Insurance administration
xiii) Maintaining store of maintenance materials
xiv) House keeping

XI. TYPES OF MAINTENANCE

Maintenance activity may be classified into following categories.

a. Corrective or breakdown maintenance
b. Scheduled maintenance
c. Preventive maintenance and
d. Predictive maintenance

A. Corrective or breakdown maintenance

Corrective or breakdown maintenance implies that repairs are made after the Electrical and Electronics Equipment is out of order and it cannot perform its normal functions any longer. Under such conditions, production department calls on the maintenance department to rectify the defect. The Maintenance Engineering Department checks into the difficulty and makes the necessary repairs. After removing the fault, the Maintenance Engineers do not attend the equipment again until another failure or breakdown occurs.

B. Causes of Equipment Breakdown

(i) Failure to replace worn out parts
(ii) Lack of Lubrication
(iii) Neglected cooling system
(iv) Indifferent towards minor faults
(v) External factors such as too low or high voltage, wrong fuel.

C. Disadvantages of Breakdown Maintenance

i) Delays in production
ii) Faster plant deterioration
iii) Increased changes of accidents and less safety
iv) More spoilt material
v) Direct loss of profit.
vi) Breakdown maintenance of the Electrical and Electronics Equipments practice cannot be employed for those plant items which are regulated by statutory provisions, for example cranes, lifts, hoists and Pressure vessels.

XII. SCHEDULED MAINTENANCE

Scheduled maintenance practice incorporated (in it), inspection, repair and overhaul of certain which if neglected can result in breakdown. Inspection lubrication, servicing, of these Electrical and Electronics Equipments are included in the predetermined scheduled maintenance is a stich-in-time procedure aimed at avoiding breakdowns.

XIII. PREVENTIVE MAINTENANCE

Preventive maintenance is defined as any action performed in any action performed in an attempt to keep a Electrical and Electronics Equipments in a specified operating condition by means of systematic inspection by Engineers, detection, and prevention of incipient failures. Preventive maintenance tries to minimize the problems of breakdown maintenance. It is a stich – in- time procedure. It works on the principle of "prevention is better than cure". It locates weak spots in all Electrical and Electronics Equipments, provides them with regular inspection and minor repairs and thereby reduces the danger of un-anticipated breakdown.

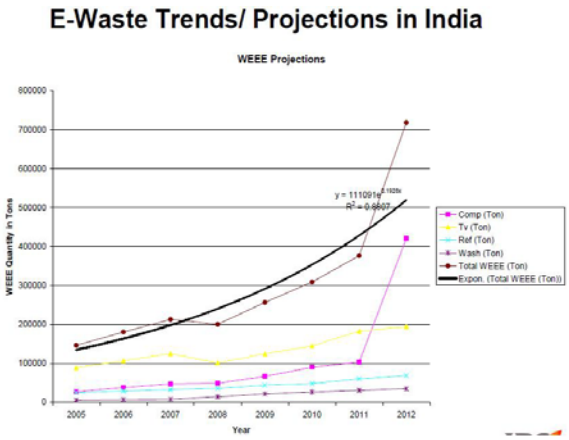

Fig.1 Growth of the Waste of Electrical and Electronics Equipment
(source:http://www.cpcb.nic.in/divisionsofheadoffice/hwmd/e-Waste.pdf).

A. Objectives of Preventive Maintenance

i) To identify small problems in Electrical and Electronics Equipment and to rectify them so that breakdown are minimized.
ii) To keep always the Electrical and Electronics Equipment available
iii) To maintain the value of the Electrical and Electronics Equipment by period inspection, repairs and overhauls.
iv) To maintain optimum production efficiency of the Electrical and Electronics Equipment.
v) To maintain the operational accuracy of the Electrical and Electronics Equipment.
vi) To ensure safety of workers.
vii) To reduce the work content of maintenance jobs.

B. Procedure of Preventive Maintenance

The preventive maintenance procedure must be tailor made for each Engineering Industry. The general preventive maintenance program contains the following steps.

i) Inspection or checkups.
ii) Lubrication
iii) Planning and scheduling
iv) Record keeping and analysis to forecast maintenance
v) Training of maintenance personnel
vi) Storage of spare parts
vii) Control and evaluation of preventive maintenance.

C.Advantages of Preventive Maintenance:

i) Reduction in production down time.
ii) Less overtime pay for maintenance personnel.
iii) Lesser number of stands –by Electrical and Electronics Equipments are needed.
iv) Lesser expenditure on repairs.
v) Greater safety to employees because of reduced breakdowns.
vi) Fewer large scale and repetitive repairs.
vii) Lower unit cost of manufacture.
viii) Better product quality and fewer rejections.
ix) Increased Electrical and Electronics Equipment.
x) Better Engineering Industrial relations as production workers do not face loss of incentives due to Breakdowns.

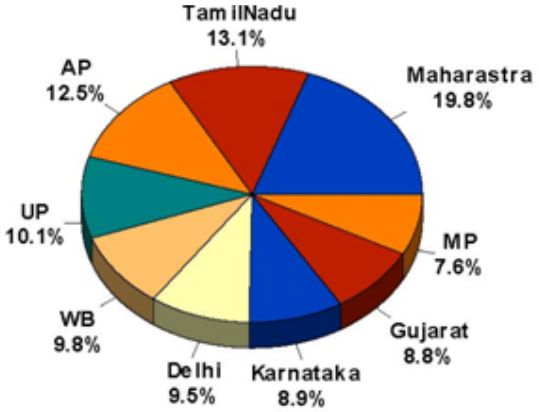

Fig.2 State wise Growth of the Waste of Electrical and Electronics Equipment in India per Annam (%)
(source: http://at http://www.ci.seattle.wa.us..)

XIV. CONCLUSION

It is comparatively a never maintenance Engineering Technique. It makes use of human senses or other sensitive instruments such as Audio gauges, Vibration analyzers, Amplitude meters, Pressure, Temperature and Resistance strain gauges and other Electrical and Electronics Equipments, to predict troubles before the Electrical and Electronics Equipments fails. Unusual sound coming out of rotating Electrical and Electronics Equipment predict a trouble. Simple hand touch can point out many unusual Electrical and Electronics Equipments (ie.Waste of Electrical and Electronics Equipments) conditions and thus predict a trouble. In predictive maintenance, Electrical and Electronics Equipment conditions are measured periodically or on a continuous basis and this enable maintenance men to take a timely action such as equipments adjustments, repair or overhaul. Predictive maintenance extends the service life of the Electrical and Electronics Equipments without fear of failure. Safe disposal of Electrical and Electronic Wastes can be done. Materials like precious metals, plastics etc., can be recovered and also can be reused. More employment opportunities can be made separately for this process. Environmental and commonly all other pollutions can be controlled to a considerable amount by this process. Economical down flow can also be controlled by using this recycling process.

REFERENCES

[1] Becker, Charles M. Indian Urbanization and Economic Growth since 1960. Baltimore: Johns Hopkins University Press, 1992.
[2] Bhattacharya, Sabyasachi (Ed.). The South Indian Economy: Agrarian Change, Industrial Structure, and State Policy, c. 1914–1947. New York: Oxford University Press, 1991.
[3] Bhattacharyya, Narendra Nath. Indian Religious Historiography. New Delhi: Munshiram Manoharlal Publishers, 1996.
[4] Brown, Judith M. Modern India: The Origins of an Asian Democracy. 2d ed. New York: Oxford University Press, 1994
[5] Cassels, Jamie. The Uncertain Promise of Law: Lessons from Bhopal. Toronto: University of Toronto Press, 1993
[6] Bhattacharya, Sabyasachi (Ed.). The South Indian Economy: Agrarian Change, Industrial Structure, and State Policy, c. 1914–1947. New York: Oxford University Press, 1991.
[7] Bhattacharya, Sabyasachi (Ed.). The South Indian Economy: Agrarian Change, Industrial Structure, and State Policy, c. 1914–1947. New York: Oxford University Press, 1991.
[8] Choudhury, R. A., Shama Gamkhar, and Aurobindo Ghose (eds.). The Indian Economy and its Performance since Independence. Delhi: Oxford University Press, 1990.
[9] Contesting the Nation: Religion, Community, and the Politics of Democracy in India. Philadelphia: University of Pennsylvania Press, 1996.
[10] Dash, Narendra Kumar. An Encyclopedic Dictionary of Indian Culture. Delhi: Agam Kala Prakashan, 1992.
[11] Diwan, Paras. Human Rights and the Law: Universal and Indian. New Delhi: Deep and Deep, 1996.
[12] Economic History of India. Mumbai (formerly Bombay): Shri Bhagavan Vedavyasa Itihasa Samshodhana Mandira (Bhishma), 1996.
[13] Encyclopedia Indica: India, Pakistan, Bangladesh. New Delhi: Anmol Publication, 1996.
[14] Encyclopedia of India and Her States. New Delhi: Deep and Deep, 1996.
[15] Gehlot, N. S. Indian Government and Politics. New Delhi: Rawat Publications, 1996
[16] Ghosh, Arun (ed.). An Encyclopedia of Indian Archaeology. New York: E. J. Brill, 1990
[17] Indian Industrialization: Structure and Policy Issues. New York: Oxford University Press, 1992.
[18] Hazarika, Joysankar. Geopolitics of North East India: A Strategical Study. New Delhi: Gyan Publishing House, 1996.
[19] Heehs, Peter. The Bomb in Bengal: The Rise of Revolutionary Terrorism in India, 1900–1910. Oxford: Oxford University Press, 1993.
[20] Jalan, Bimal. India's Economic Crisis: The Way Ahead. New York: Oxford University Press, 1991
[21] The New Cambridge History of India. New York: Cambridge University Press, 1987–1993.
[22] Bhattacharya, Sabyasachi (Ed.). The South Indian Economy: Agrarian Change, Industrial Structure, and State Policy, c. 1914–1947. New York: Oxford University Press, 1991.
[23] Becker, Charles M. Indian Urbanization and Economic Growth since 1960. Baltimore: Johns Hopkins University Press, 1992.
[24] Brown, Judith M. Modern India: The Origins of an Asian Democracy. 2d ed. New York: Oxford University Press, 1994.
[25] Tobias, Michael. A Day in the Life of India. San Francisco: Collins Publishers San Francisco, 1996.
[26] Vohra, Ranbir. The Making of India: A Historical Survey. Armonk, N.Y.: M. E. Sharp, 1997.
[27] Becker, Charles M. Indian Urbanization and Economic Growth since 1960. Baltimore: Johns Hopkins University Press, 1992.
[28] Bhattacharya, Sabyasachi (Ed.). The South Indian Economy: Agrarian Change, Industrial Structure, and State Policy, c. 1914–1947. New York: Oxford University Press, 1991.
[29] Choudhury, R. A., Shama Gamkhar, and Aurobindo Ghose (eds.). The Indian Economy and its Performance since Independence. Delhi: Oxford University Press, 1990.

[30] Economic History of India. Mumbai (formerly Bombay): Shri Bhagavan Vedavyasa Itihasa Samshodhana Mandira (Bhishma), 1996.
[31] Bhattacharya, Sabyasachi (Ed.). The South Indian Economy: Agrarian Change, Industrial Structure, and State Policy, c. 1914–1947. New York: Oxford University Press, 1991.
[32] Bhattacharya, Sabyasachi (Ed.). The South Indian Economy: Agrarian Change, Industrial Structure, and State Policy, c. 1914–1947. New York: Oxford University Press, 1991.
[33] Studdert-Kennedy, Gerald. British Christians, Indian Nationalists, and the Raj Studdert-Kennedy. New York: Oxford University Press, 1991.
[34] Tomlinson, B. R. The Economy of Modern India, 1860–1970. New York: Cambridge University Press, 1993.
[35] Tobias, Michael. A Day in the Life of India. San Francisco: Collins Publishers San Francisco, 1996.
[36] Wolpert, Stanley A. India. Berkeley: University of California Press, 1991
[37] The New Cambridge History of India. New York: Cambridge University Press, 1987–1993.
[38] http://www.eleb2b.com
[39] http://www.biologicaldiversity.org
[40] http://www.bsef.com/docs/BFR_vols_2001.doc.
[41] http://www.accessmylibrary.com.
[42] http://www.naidonline.org/.
[43] http://www.biologicaldiversity.org
[44] http://www.bsef.com/docs/BFR_vols_2001.doc.
[45] http://www.hardwarehell.com/articles/shadowram.htm
[46] http://www.cpcb.nic.in/divisionsofheadoffice/hwmd/e-Waste.pdf.
[47] http://www.ci.seattle.wa.us..