THE ENVIRONMENT MANAGEMENT

Indian Institute of Environment Management
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From Director's Desk

In current scenario Environment Management for Sustainable Development is a pertinent issue that needs focus from the perspective of economic development and conservation of natural resources. For an environmentally sustainable future, India needs to value its natural resources, and ecosystem services to better inform policy and decision-making. Compared to developed nations, India is much more vulnerable to the effects of climate change due to its low capacity to adapt and its disproportionate dependency on natural resources for welfare. On the other hand, a grim scenario is looming large with the depletion of resources and increasing pollution. Management of urban solid waste, drinking and waste water is becoming difficult task that needs sustainable interventions. In industrial ecosystem strict environment health and safety norms are in a very nascent stage in India. Faced with such imminent threat, there is a growing realization that rational utilization of environmental endowments of life support systems and strict regulatory affairs are must for sustainable development. We are bringing out current issue of 'The Environment Management' on 'World Environment Day 2016' with emphasis on cross cutting areas of environment management and sustainable development.

Dr. Seema Mishra

Poaching of the Pride

Sunil Belvekar
Goldfinch Engineering Systems Pvt. Ltd.
Email: sunileagleeye@yahoo.co.in

The largest member of the felid family, The Tiger, The Pride of India has been struggling to survive in the wild since recent decades. Among various reasons like habitat loss, climate change and human-wildlife conflict, poaching is the prime cause of decline in their population and putting the tiger under 'Endangered' category. Traditional Chinese Medicines have made tiger poaching a profitable business particularly in China and Southeast Asia. Tiger is valued for all of its body parts due to long history of believing that it has restorative and supernatural powers. The rising demands for tiger parts have become an irresistible incentive to poachers.

Using the Tiger products and medicine has become a symbol of high status and wealth. Some remedies include tiger parts as one of the major ingredient. In many places in China, tiger parts are a delicacy that is served at private banquets. Skin, teeth and claws is given special importance as it is considered as a status symbol of the buyer. Tiger bone wine is thought to impart the tiger's great strength and vigour.

Due to immense population of India, inadequate anti-poaching efforts and a huge demand of animal parts by neighbouring countries the exact number of tigers and other wildlife killed is difficult to determine. Also the judicial system is overburdened, penalties are light, and wildlife crime sits low on the list of priorities. However, number of initiatives, programmes and agreements has been made aiming for conservation of tigers. *Project Tiger* is one of the initiatives taken by Government of India in 1973. It covers 47 tiger reserves in 18 tiger range states. Project Tiger has also established the Tiger Protection Force with the aim of catching poachers and stopping the killing. This initiative has been instrumental in relocating about 2,00,000 villagers in the rural areas so that they are no longer living within the natural habitat of the tigers. This reduces the risk of tiger attacks on humans (which often leads to the killing of the tiger for the safety of the villagers). The National Tiger Conservation Authority is a statutory body under the Ministry of Environment, Forest and Climate Change for strengthening tiger conservation. After a century of constant decline, the number of wild tigers is increasing! According to the most recent data, at least 3,890 tigers now exist in the wild in 13 range countries. At present India is home to about 70 % of world's tiger population and we should be proud of it.

Tiger plays a pivotal role in maintaining health and diversity of an ecosystem. It is a top predator at the apex of the food chain that maintains balance between herbivores and vegetation. Tiger's presence in forest signifies well being of the ecosystem and therefore we need to take more effective measures towards conservation of this beautiful species.

Tortoise Trade in India

Devayani Savant
SIES Indian Institute of Environment Management, Nerul, Navi Mumbai
Email: devayanis@sies.edu.in

Indian Star tortoise (*Geochelone elegans*) is famous for the star like radiating patterns of yellow, intermixed with black spots in the pyramidal scrutes of its shell. This patterning makes it a popular pet to collectors around the world. Presence of tortoise in house is considered as a good omen. In addition, they are openly kept at religious temples for spiritual purposes. It is believed to represent incarnation of the Hindu God "Vishnu".

Indian star tortoise is a relatively small and adaptable terrestrial species primarily found in scrub forests, grasslands and some coastal scrublands of arid and semi arid regions. Nesting seasons coincide with the monsoons.

The thorn scrub forests located on the borders of Southern Andhra Pradesh, Karnataka, Tamil Nadu and the Sourashtra and Kutch regions of Gujrat are associated with sourcing of the animals and are considered as the "Trade Hubs". The animals are often wrapped in cloth and packed in suitcases. However, to avoid detection by enforcement agencies, some are also placed into boxes filled with a top layer mask of other legal produce such as fruits, vegetables, crustaceans and fish. The animals are then exported to Thailand, China, Malaysia and the Middle East. The price of one animal ranges between 1000-3000 Indian rupees. It is estimated that about 10000 to 20000 individuals are being poached from the wild in India each year.

Illegal capture, handling and overcrowding of the animals may cause physical injury and stress which may further lead to disease or death of the traded animals. Privately owned captive animals may also show detrimental behavioural changes such as hyperactivity, lethargy and anorexia. The trade of animals can have severe negative impact on the wildlife populations too, leading to biodiversity loss, introduction of invasive species and diseases. Hence, this species has received protection as a Schedule IV List Species of the Wildlife Protection Act 1972 for over 40 year. Since 1975, this species has also been included in Appendix II of the Convention on International trade in endangered species of Wild Fauna and Flora (CITES) that regulates all commercial trade of animals.

More research is necessary to understand the attitude and behaviour of the consumers and the impact of the trade on the wild population and a multifaceted approach is necessary to reduce the illegal trade by introducing new legislation, increased enforcement effort and creating public awareness.

Reclaimed Water Can Be the Answer for PM's Dream

S.V.Viswanathan, Jt. Hon. Sec.,
South Indian Education Society, Mumbai
Email:viswanathansv@sies.edu.in

About 70% of the earth's surface is covered with water of which 97% of the water is salt water. Salt water is filled with salt and other minerals, and humans cannot drink this water. Although the salt can be removed, it is a difficult and expensive process. 2% of the water on earth is glacier ice at the North and South Poles. This ice is fresh water and could be melted; however not possible to transport across the globe. About 0.7 % of all the water on earth is fresh water that we can actually use. We use this small amount of water for drinking, transportation, heating and cooling, industry, and many other purposes. We need much more water to meet the requirements of our rapidly growing population. Reclamation is the only solution to this problem and possible answer to our **Prime Minister Modi's dream of bringing water to dry fields.**

The pressure is on mankind to find various ways of Reclaimed water- be it in the world or more particularly in India. Reclaimed water is generally waste or sewage water that is treated in a wastewater treatment facility meeting certain water quality standards and compliances generally eliminating solid wastes, impurities and can be used at least one more time before it passes back into the natural water cycle. However these may have high levels of minerals or nutrients as well as human pathogens.

These are used for sustainable landscaping irrigation, parks, golf courses and cricket grounds. They are useful for recharge of groundwater aquifers, to meet commercial/industrial water needs and drinking. They can be used for washing cars, flushing toilets, cooling water for power plants, concrete mixing and artificial lakes. Water is passed through high level purification systems such as membrane filtration, reverse osmosis & ozonation to achieve a quality which is necessary for its safe application for other purposes.

US Environmental Protection agency guidelines which are at par with International standards and guidelines talk of reclaimed water usage in Urban Reuse, Restricted-Access-Area Irrigation, Agriculture Reuse, Recreational Impoundments, Landscape Impoundments, Construction Uses, Industrial Reuse, Groundwater Recharge and Indirect Potable Reuse. Disinfected, Tertiary Treated Effluent can be used in all of these applications. Benefits of agriculture reuse include high concentrations of nutrients. They may eliminate need for fertilizer, long-term soil enrichment, decreases demand on potable water supply. Disadvantage of agriculture reuse includes health risk from associated pathogens, health risk from other contaminants such as metals, chemicals, pharmaceuticals, decrease in soil quality from accumulation of metals and acidification and infiltration of groundwater.

Urban waste water after secondary treatment should be futher treated for reuse in different areas such as irrigation of public parks, schools, road medians, any landscaped areas, golf courses, commercial - vehicle washing facilities, laundry facilities, window washing, mixing pesticides and herbicides, construction - dust control, concrete production, toilet and urinal flushing, fire

protection and in some cities drinking water such as in Australia.

Urban waste water reuse includes **a reclaimed water system** consisting of:

- Water reclamation facility - provides treatment in addition to secondary treatment
- Distribution system - includes pipelines, storage facilities, pumping facilities

As world population requires both more clean water and better ways to dispose of wastewater, the demand for water reclamation is expected to rise in near future. However, its success will depend on whether this can be achieved without adverse effects on human health and environment. The use of reclaimed water is also useful to the environment as it decreases the pollution sent to sensitive environments. It can also enhance wetlands, which benefit the wildlife depending upon the ecosystem. It also helps to stop the chances of drought as recycling of water reduces the use.

In Singapore having a population of 5 million residing on less than 750 square kilometers of land with a very strong economy, lacks the most essential asset --- water. Reclaimed water, known as NEWater, has become cleaner than the government issued tap water. Water security is a national priority in Singapore as half of its current water supplies are imported from neighboring Malaysia. They are preparing for the day when they should be ready to fulfill their own needs internally by reusing reclaimed water,"

Singapore's strategy for a hydrated nation includes desalination plants, efficient catchment of rainwater and recycling of sewage. Rainwater is collected through a network of drains, canals, rivers, storm water, collection ponds and reservoirs with the aim to catch water across two-thirds of the country.

Reclaimed water known as 'NEWater' is filtered through membranes and treated by the country's public utilities board. Through a four-step series of barriers and membranes, wastewater is made free of solids, microorganisms, and contaminants resulting in potable water supplies for use by humans and industry. Water is used three times before letting into the drain. This meets 30 percent of Singapore's water needs, with plans to triple volumes by 2060. The demand by industry is being further met by collaboration with Meiden- a Japanese firm that supplies factories with recycled industrial water. For this a large size pool viz., one and a half Olympic-sized swimming pools of water are currently filtered and treated every day. The plan is to develop a cost-effective industrial waste treatment and make citizens accept the reclaimed water.

The question is if Singapore can do it **what prevents India from doing it**?

Readers' corner

Many thanks for sharing 'The Environment Management' E Newsletter. I read through it with great interest and found very informative and well documented!

Aman Singh, Founder/Chief Coordinator,KRAPAVIS (Krishi Avam Paristhitiki Vikas Sansthan) Alwar, Rajasthan, India

Panacea for Municipal Solid Waste Management in India

Dr A K Agnihotri, Ex-GM (Chem.), CHSE, ONGC, Delhi
E mail: anilagn@gmail.com

India is one of the fastest growing urban settlements having approximately 1.25 billion people. The daily generation of municipal solid waste is enormous.

Presently, there is a lot of media coverage about the municipal garbage disposal issue in New Delhi, Bengaluru, Mumbai and many other metro cities and other cities as well for wrong reasons. It requires careful sceintific planning and implementation.

With fast pace of urbanisation especially in metro cities the issue of sustainable management and ultimate disposal of MSW deserves the attention of all the stake holders of the society and this can be achieved.

First and the foremost important issue, regarding the MSW management, is that these projects should be planned based on negative pricing basis.

It is pertinent to mention at this juncture that what is the negative pricing externality

A negative pricing externality occurs when an individual or firm making a decision does not have to pay the full cost of the decision. If a good has a negative externality, then the cost to society is greater than the cost consumer is paying for it.

A common example of a negative externality is pollution. For example, a polluting industry might pump pollutants into the air. While the industry has to pay for electricity, materials, etc., the individuals living around the industry will pay for the pollution since it will cause them to have higher medical expenses, poorer quality of life, reduced aesthetic appeal of the air, etc. Thus the production of product by the firm has a negative cost to the people surrounding the industry --a cost that the industry doesn't have to pay.

MSW Rules 2016, India

The latest legislation on MSW has just come into effect which has certain very good provisions like:

Dairy waste, which is major polluter of the rivers, has been covered under said legislation.

First time, Biomethanation has been emphasised for the treatment of Indian MSW because our waste is rich in organics with high moisture content and low calorific content.

Biomethanation is proven technology which can treat fresh MSW and hence there is no need to dump the entire garbage in landfills; only partly it will go to land fill where the same can be recycled.

Very recently in compliance with Hon'ble National Green Tribunal order dated 5th February 2015 in the matter of OA No. 199 of 2014, Govt. of India has come out with *Suggestive/Indicative "Action Plan for management of Municpal Solid Waste"*

The action plan emphasised the urgent need for regular quantification of MSW and assessing its composition as prescribed in the Manual of CPHEEO, MoUD, 2000.

Keeping in view the facts mentioned above, I have some suggestions to address the MSW management and disposal in India, which can be easily achieved provided we adhere to business model of MSW management, as prevalent globally wherein all stake holders get some benefit.

- My first and foremost suggestion is that for MSW management and disposal projects, the economic evaluation should be done on Negative pricing mode.

- Secondly, we should not forget that Indian Garbage has different composition than that of developed nations. Our garbage is rich in organics and moisture content and have very low calorific contents while the garbage from developed countries has reverse values. Therefore, prevailing technologies for MSW management may not be applicable in the Indian context..

- The other very vital issue is the fiscal aspect. These projects need huge investments and regular operation of the utility etc., which needs capital expenses. If we provide these incentives/fee to operators, these projects are bound to run successfully. There are two main players in such projects, one is the **garbage collector** and the other is **utility operator** (May be RDF Plant, Land fill, Incinerator or composting operator etc.).
- These projects should have minimum government intervention in the form of ULB's, municipalities or municipal corporations, that too limited to inviting expression of interests from the entrepreneurs in respect of garbage collection Garbage collector) and ultimate disposal (Utility company) conforming the prevailing statutory environmental norms.
- ***Regarding project economics, it is worth mentioning that since these projects are to be built on negative pricing concept, hence need consistent financial support from the government (Tipping fee/Gate fee). Keeping in view the environmental economics, the cumulative financial losses we incur due to mismanagement of MSW, are more than what we have to actually pay for sustainable MSW management.***

- Looking at the hazards involved in this sector with the growing population and stress on per capita availability of the urban space, money should not be the issue because in our countries we have number of subsidized services, viz. postal, water, energy, transportation, food and health etc., then why not this sector and I am of the firm opinion that if we do the proper economic analysis of the industry, the pay back will be very fast with added advantage of becoming clean nation and healthier nation.

Way Forward :

1. Ensure the financial commitment based on the present data on MSW.
2. Open this sector to private sector.
3. Invitation of expression of interest by the respective agencies for the MSW collection and its scientific disposal, keeping in mind the negative pricing concept which is prevalent all over the world in such

projects, conforming to the prevalent statutory standards.

4. Develop various concessional agreements pertaining to such projects with implicit roles and responsibilities of each stake holder along with the administrative mechanism to ensure the effective implementation of said concessional agreements with clear administrative accountability provisions.
5. Provisioning for the performance guarantee and strict monitoring of the said projects right form construction to the implementation of the said projects.
6. Provisioning for the stake holder participation and open to visit such facilities to ensure that all due care is taken about the environment by the project executer. This is quite common practice in developed world.

Disaster Education for the Children and Youth of India

Ranit Chatterjee,
Monbukagakusho Doctoral Scholar, Kyoto University, Kyoto, Japan
Email: ranit13@gmail.com

In a time when the disaster risk of the coastal cities are increasing due to complex urban development and change in climate, the children and youth participation in managing disasters is not significant in India. Case studies from the past disasters point out that children and youth are treated as passive victims with no role in communicating risks or preventing and responding to disasters. The Sendai Framework of Action for Disaster Risk Reduction (SFDRR) envisions the children and youth as agents of change and encourages them to contribute to disaster risk reduction, by involving in legislation, national practice and educational curricula.

India has the highest children and youth population in world between the age of 10 to 24 as per the United Nations. A good number of them are the student population in schools, universities and other training and vocational institutions who would be targeted for disaster education. Past studies underlines the effectiveness of disaster education for children and youth as learning for lifetime, which is in turn transferred to family and community.

The disaster education can be classified under three heads namely formal, informal and non-formal. Formal education corresponds to a systematic, organized education model; structured and administered according to a given set of laws and norms. Non-formal education is one where one of defined set of parameters of formal education is missing and informal education is a more public oriented educational approach, which does not necessarily include objectives and subjects usually encompassed by the traditional curricula like visit to museum, listening to radio, etc.

Disaster education has been introduced in India for Secondary, University and professional courses. The Central Board of Secondary Education (CBSE) has introduced disaster management as a part of the formal education system but most state boards are yet to include it in their curricula. There have been distance learning programs and masters and PhD courses on disaster management in India. Having said that, it is felt that need for basic and applied research to understand hazard, risks and vulnerabilities is utmost important at the national and local level. The university students mainly in post graduate and doctoral studies would need to be envisioned to add to the future researches. On the other hand, state and local disaster management authorities are doing their part to add on to informal disaster education through awareness and training programs for various stakeholders.

To build a robust disaster education system focusing on the children and youth, formal disaster education should be introduced at various levels of education to create a generation, which is more aware and risk sensitive. Non-formal disaster education for specially abled children and youth would help in reaching out to more people. Involving students in disaster education will bridge the gap of current need for domain experts in the field of disaster management and that will lead also to application of the scientific knowledge and research findings into policy planning and practice. For doing this, more investment is

required on research and knowledge management. Educational institutions should simultaneously involve students in various disaster risk reduction activities like plan preparation, drills and training. This will make India disaster resilient in future.

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SIES INDIAN INSTITUTE OF ENVIRONMENT MANAGEMENT
Plot 1- E, Sri Chandrasekarendra Saraswathi Vidyapuram
Sector V, Nerul, Navi Mumbai 400 706
Phone: (91) (22) 6119 6454/55/56
Website:www.siesiiem.net

Post Graduate Diploma in Sustainable Environment Management (PGDSEM)

Environmental management techniques are integral to conservation, agriculture, forestry, industry and countryside planning. This part time course is designed for people already in environment-related employment, who wish to develop their careers by updating their knowledge and skills. It aims to satisfy an industrial and public sector demand for science and engineering qualified environmental management personnel.

Eligibility: Professionals from industries, consultancy and NGO working in field of environment.

Duration: One year- Part Time

COURSE HIGHLIGHTS

* **Industry centered curriculum with emphasis on applications**
* **Industrial visits and seminars**
* **Focus on improving individual skills**
* **Highly dedicated faculty**
* **High faculty/student ratio**

Sustainability Journey of Mahindra Sanyo

R. S. Rane, Senior General Manager, Mahindra Sanyo Steel Pvt. Ltd.
Email: rane.ramchandra@mahindra.com
Website: www.mahindrasanyo.com

Mahindra Sanyo is a joint venture company between Mahindra & Mahindra, Sanyo & Mitsui of Japan. Our turnover for the F 16 is $ 135 million and we are in the manufacturing and sales of long special steel products, i.e., bars & billets. Our customers are spread across various industry sectors like auto, bearing, engineering, mining, oil & gas application and railways etc.

Sustainability: The concept of people, planet and profit is of significant importance to us because as a steel manufacturing company we tend to use a lot of natural resources. However, unlike mother earth blast furnace manufacturing, we manufacture our steel through scrap route. *This impacts our carbon footprint on a positive note*. However, we are depending heavily on the use of electricity and thus sustainability is of significant importance to us.

We have a well identified roadmap on the pillars and sub identified aspects to work with the pre-determined or targeted goals in the course of five years. This is a five year rolling roadmap based on Ceres framework of sustainability.

On note of aspiration, we have sustainability goals known as BHAG targets (Big Hairy Audacious Goals)

At Mahindra Sanyo, Sustainability activities and initiatives are carried under four pillars. These are environmental initiatives, social initiatives, enablers and emerging initiatives. In all there are 19 teams working under these pillars. The environmental pillar has teams progressing towards energy efficiency (electricity & oil), water efficiency, resource intensity & recycled input, circular economy & waste reduction, GHG emission & pollution control, green supply chain and biodiversity. Social pillar has aspects ranging from safety, succession planning and skill development, CSR & social life cycle assessment. Enabler pillar has aspects that act as catalyst for all pillars. These are materiality and stakeholder engagement, Environment life cycle assessment and management accountability. The emerging pillar as the name suggests has aspects where Mahindra Sanyo as company is picking up like renewable energy, green building & product responsibility.

The aspects and their targets are achieved by a team specially formed for it. These teams are inter-departmental, cross functional and across the hierarchy selected employees who are experts in their respective departments and areas of operations.

Sustainability journey has begun at Mahindra Sanyo in 2013 under the visionary leadership of Mr. Uday Gupta [Managing

Director] and since then there is no looking back. We have over the period of these three years made significant achievements. To name a few are 10 % reduction in energy consumption, 70 % reduction in water intake, plantation of more than 50,000 saplings etc…

In the year 2015, we have been awarded as the "Most Energy Efficient Unit" and "Best Presentation" (audience choice award) by CII across the country in the mines and metals sector. Also at the Mahindra group level, the company has bagged two significant awards "Mahindra Innovation Award" & "Mahindra Game changer Award".

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SIES – Indian Institute of Environment Management
Sri. Chandrasekarendra Saraswaty Vidyapuram
Plot No. 1 - E, Sector V, Nerul, Navi Mumbai – 400 706
Contact: 022 6119 6454/ 55 / 56 /57
E mail: iiemoffice@sies.edu.in; Website: http://www.siesiiem.net

Environment, Health & Safety and its Role in Current Scenario

K. C. Nath,
SM (S & F), GSFC Ltd., Jamnagar
Email: kcnath_yahoo.co.in

There are deaths of 6300 people everyday as a result of occupational diseases or work-related accidents resulting into more than 2.3 million deaths per year. About 317 million accidents occur on the job annually, many of these accidents debarred them from work for unlimited days. The above figure is compiled by International Labour Organization (ILO) which can startle you if you think in a global prospective.

In current scenario, the awareness level of public on EHS is so high that the organisations can't ignore the impact of their activities on adjoining communities. In meeting their environment, health & safety responsibilities, businesses have been keeping a balance between conflicting interests. When a firm puts forward a safety recommendation, its stakeholders now want to know the cost of implementing it, while employees are asking how many illnesses, injuries or deaths it is likely to prevent each year. The objective for Environment, Health & Safety (EHS) is to care for people's health and safety by ensuring that risks in the changing workplace are properly taken care of. The approach may be different and the message may be wide-spreading but the core objective is essentially the same.

The three most important EHS roles in current scenario are: 1. National & Environmental Policy and Legislation, 2. Creating Awareness, 3. Development of Infrastructure and Competence

National & Environmental Policy and Legislation

National Policy on Environment, Health & Safety (EHS) at work places provides general guidelines perpetually for all stakeholders to develop a safety culture and environment in work places. Workers' Unions, NGOs and other agencies are now influencing policymakers to accelerate the issue.

Environmental Policy puts every organization on a course that achieves the goal of sustainable use where the environmental impacts of society are in harmony with natural ecological cycles of renewal. To achieve this, sustainable development ascertains that the direction of investments, the orientation of technological developments and institutional mechanisms work hand-in-hand towards the goal of sustainable use.

Creating Awareness

EHS awareness is being created among all stakeholders such as lawmakers, employers, employees, contractors and the general public. EHS is being included in educational curriculum at all levels of school, university and technical education. Public awareness is being created through mass media about the health hazards of environmental pollution, diseases caused by exposure to harmful substances, etc. The need of EHS training and effective awareness campaigns in unorganized sector is being explored.

The attitude of workers and employers is transformed slowly through EHS education. Specific codes of practices on EHS issues such as noise, dust, chemical handling, construction work, etc., have been prepared

and published by selected industries for information and sharing of knowledge. To escalate the trend, video films, manuals, skits and booklets are being prepared and distributed by the industries.

Development of Infrastructure and Competence

There is a great shortage of occupational health professionals in World. In addition to, occupational health physicians and industrial hygienists are in high demand in the organized sectors as well. To balance the shortfall, the majority of medical practitioners are continuously being trained in occupational health and consequently the diagnosing skill being developed to prevent occupational diseases.

There is a need of independent, national & international accreditation agency to establish national standards on EHS. EHS audit is being implemented for assessing the effectiveness of EHS in industries, ports, construction works, mines, etc.

Conclusion

EHS will have to be considered as a 'Critical Business Activity' to achieve Sustainable Development. In addition, if a strategy of zero incidents, zero injuries, zero fatalities, zero illness, zero waste and zero emissions is pursued, it could result in a scenario of a healthy and content employee when she or he retires.

Methodology for Waste Thermocol Volume Reduction

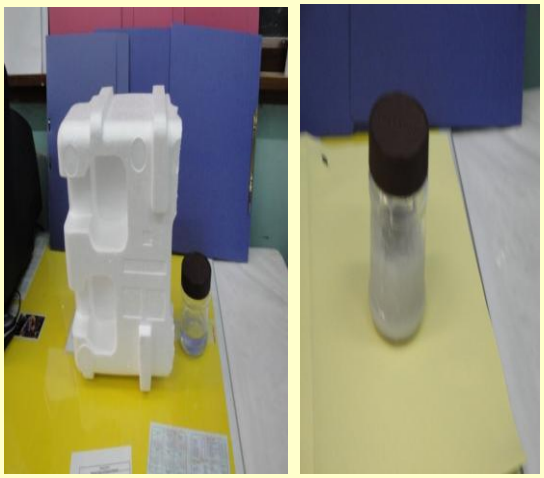
Dr. D.B. Naik
Radiation & Photochemistry Division, Bhabha Atomic Research Centre
Trombay, Mumbai 400 085
Email: dbnaik@barc.gov.in

Introduction

In recent years, large quantities of solid waste are generated in residential buildings, office premises and it is becoming increasingly difficult for civic authorities to properly manage waste. Thermocol is one of the components in the solid waste. Large amount of thermocol is used in various applications such as packaging, insulation, crockery items such as cups, plates and decorations, etc. Thermocol (Styrofoam) is expanded polystyrene with more than 97-98 % air trapped in it. Thermocol is not often recycled due to its light weight (hence large volume), and thus has low scrap value. Also, there is lack of consumer awareness regarding suitable recycling facilities and collection methods. Used thermocol is found at garbage points, roadsides, and finds its way into ponds and the sea. It also chokes water drains. Discarded polystyrene does not biodegrade and is resistant to photolysis. If polystyrene is properly incinerated at high temperatures, the only chemicals generated are water, carbon dioxide, some volatile compounds, and carbon soot. When burned without enough oxygen, polycyclic aromatic hydrocarbons, carbon black and carbon monoxide, as well as styrene monomers are generated which are harmful

Methodology developed

Thermocol when exposed to acetone collapses and there is large reduction in volume as thermocol essentially contains more than 97% air. A process has been developed to reduce volume of thermocol extensively. Depending on the type of thermocol easily ~97-98 % volume reduction is achievable when optimum use of acetone is made. Acetone is taken in a wide mouthed bottle with air-tight cap as given in Fig. 1. Thermocol pieces are inserted through the wide mouth of bottle. Initially thermocol collapses quite fast till the time free acetone is present and a jelly like paste is formed. Depending on type of thermocol, thermocol equivalent to easily 50-60 times volume of acetone is taken up in a few minutes. Then onwards, in the paste so formed, one can insert thermocol pieces in the bottle and keep it tightly closed. It is observed that within a few minutes these pieces are collapsed. This process is continued till the material in the bottle becomes like dough. At this time, one can give any required shape to it.



a **b**

Fig. 1 a. Thermocol chunk and Acetone ~ 60 ml b. Condensed material

Dough like material sticks to wooden or cement surface. So, shapes to objects can be given on a glass surface and then kept on a cotton cloth. One can give variety of shapes such as Lord Ganesh, trays, bowls, leaves, alphabets, numerals, etc. or any other shape as given in Fig. 2.

Fig. 2 Display of objects made from material obtained by condensing used thermocol

Material becomes quite hard after leaving it for 5-6 hours. Hardening process can be made faster by giving large surface area to the condensed material before giving the final shape. Thus, in about 100 ml of acetone, about 12,000 cm^3 of thermocol can be collapsed to get approximately 230-240 g of recycled polystyrene.

Apart from making various objects from condensed material, the main purpose of this methodology is reduce the volume of waste thermocol to the extent of 97-98 % which can save the landfill space and also nuisance of waste at many places. Condensed material which is mainly polystyrene can be used for the purposes where polystyrene finds application.

All previous issues of 'The Environment Management' can be viewed at: http:// www.siesiiem.net

Case Study on Initiatives Taken to "Reduce Electricity Costs"

C. V. Gopalakrishnan
Purchase Director, South Indian Education Society
Email: cvgopalakrishnan@sies.edu.in

Abstract

This case demonstrates effects of passionate leadership and innovative approach towards continuous improvement undertaken to reduce electricity costs. Most of the improvement efforts involve performance of what is called as Small Group Activities (SGA), wherein small groups drawn from related departments are made to work together during a stipulated time through PDCA based improvement methodology. The group made use of various productivity and quality improvement tools & techniques like Theory of constraints, Pareto analysis, GEMBA and PDCA. The group also gets involved in implementation of solutions derived by them. One of such SGA activities has been documented in this case study.

Our efforts have been recognised by National Centre for Quality Management and we have been awarded the First prize in 10th BEST EDUCATIONAL QUALITY ENHANCEMENT (BEQET) PRESIDENT AWARD 2015. Our project initiative has been published in the Jan-March 2016 newsletter of NCQM.

Introduction

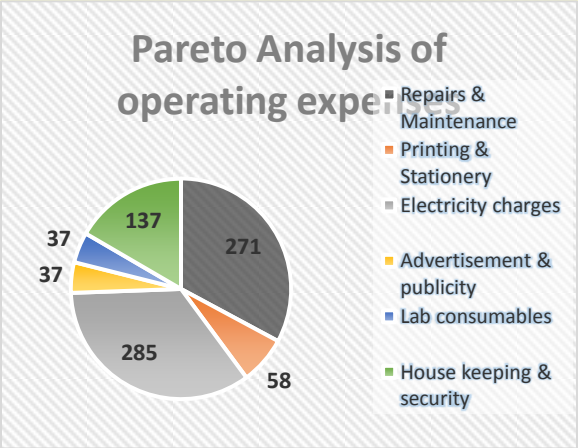
The South Indian Education Society (SIES) is one of the oldest educational societies in Mumbai and was pioneered in year 1932.What started with a strength of six students has now become a conglomerate of various institutions with nearly 25000 students under its wing. SIES has established a high school, science & commerce colleges with academic and other institutions of higher learning.

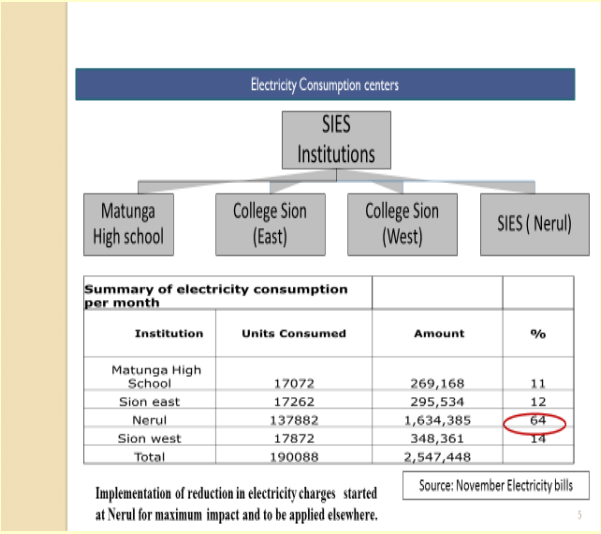
This includes establishments of Centre for Excellence in Management Research & Development (CEMRD), SIES School of Packaging, SIES Indian Institute of Environment Management, Graduate School of Technology (an Engineering Institute), SIES Senior's home and SIES Sri Chandrasekarendra Saraswathi Veda Vidya Pitha are the latest initiatives of SIES. Education blends with tradition at SIES, which in turn reflects on individual and personal growth. This has achieved through the foresight, wisdom and dedication of the founders with strong emphasis on high standards of academic, professional and societal performance. Our institutions are located at Sion (East), Sion (West), Matunga and Nerul.

Analysis of problem

Electricity charges is one of the major expenditure for our organization and for the financial year 2014-15 we had spent Rs 2,85,22,899/ on electricity alone. With a view to control reduce electricity charges a team was constituted to study the existing system and suggest ways & means to improve the same. The values given below are in Rs Lacs

The team analysed the electricity consumption for the specific month and the report is as detailed below.





In order to achieve maximum impact we decided to study the electric power consumption at Nerul which contributes to nearly 65-70% of total consumption.

On analysing the electricity bills of Nerul it was observed that the power factor was observed to be 0.918 - 0.922 which was very low and in the month of June 2015, we had paid penalty of Rs 62000/ as the power factor was below 0.90.

In addition to issue of power factor some of the meters were exceeding the contract demand thereby incurring the penalty for over loads. It was also observed that in some compared to the contract demand.

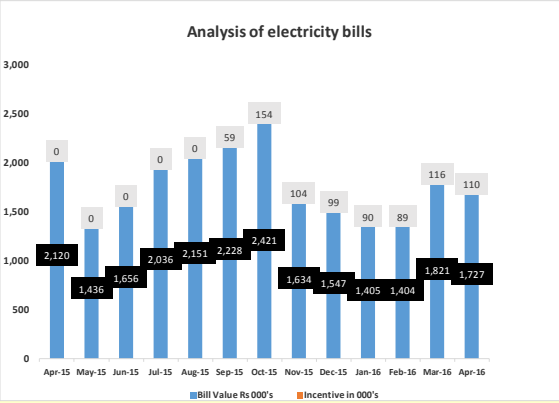
Development of solutions

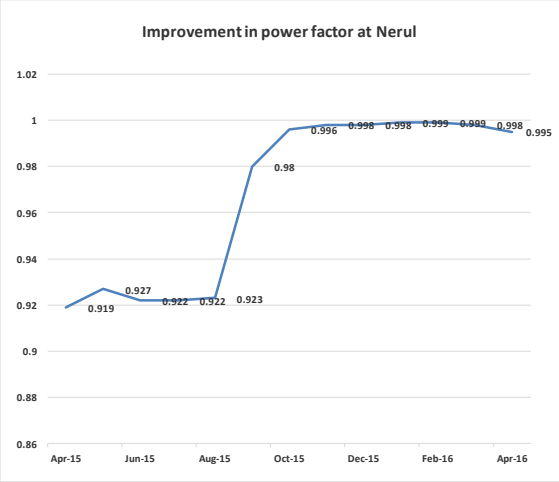
We decided to enlist the services of two consultants to separately evaluate the reason for such low power factor. We had already installed adequate capacitor banks of capacity 300KVAR & 250 KVAR respectively. The contractors were instructed to check each capacitor in the bank and it was observed that in 250 KVAR all the capacitors were defunct and in the 300KVAR the capacitors were functioning well but the contactors had burnt off. In addition theoretical studies on the design of the capacitors were undertaken with the help of our Engineering College and based on their studies and recommendation, optimum capacitor requirement were derived.

We installed new capacitors and burnt contactors were changed. In the month of September 2015 we were able to improve the power factor to 0.98 resulting in incentive of Rs 58,697/. Even after installing new capacitors and change of contactors we were not reaching the desired power factor of unity and we were reaching the values of 0.98. Further technical discussions were held with the consultants and it was decided to install additional KVAR's to compensate the reactive load of the transformers of capacity 1000KVA & 625 KVA. Additional capacitors of 25KVAR rating were connected to each transformer. Eventually in the month of October 2015 we were able to obtain the power factor of unity and incentive of Rs 1,54,264/.

Currently, we are getting the power factor of unity with manual intervention of capacitor banks due to reduced load in the evening and automation is still pending. The reactive load of transformers are still to be optimised and we have to undertake analysis of load using power analyser. This we propose to carry out when there is maximum load on transformers and is scheduled in the month of May 2016. Subsequent to the study the

optimum capacity of capacitors required for the transformers will be calculated and same will be connected to the transformers. We have spent an amount less than Rs 2 lacs in this initiative.

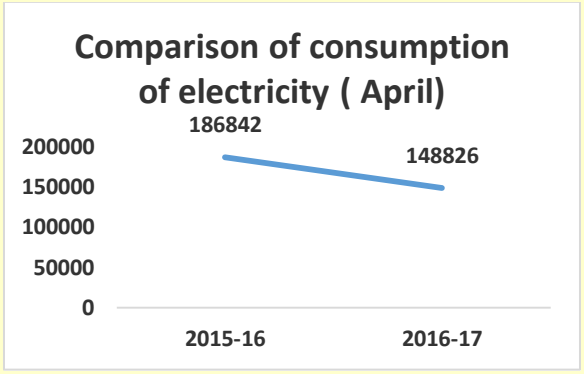




Additional Initiatives

In addition we are installing individual KWH meters in all institutions to measure the consumption and give the institutions targets for reduction in electricity charges. We have been able to improve the awareness of electricity consumption within the institutes and for the month of April 2016 we have consumed considerably less units comparing same month previous year.

We are scaling up the initiative of saving the electricity on the demand side by reducing the utilisation during peak hours, resetting the temperature of air conditioners to 25˚C and other proven measures. We are planning to hold a conference on "***conservation of energy***" in the month of December 2016 to convey the message of conservation of electricity across the institutions and get the support of all in the institutions and achieve the objective of reduced electricity charges.



Improvement in Savings in electricity

Improvement in savings in electricity at High School Matunga			
Consumer No	Parameter	Oct-15	Apr-16
202-030-153	Power factor	0.969	0.973
	Incentive	2,028	1,620
202-000-206	Power factor	0.969	0.99
	Incentive	486	814
202-020-083	Power factor	0.952	0.985
	Incentive	0	4,260
Total		2,514	6,694

Comparison of Electricity Consumption 2014-15 and 2015-16.

We are giving below the comparative statement of electricity consumption year to year.

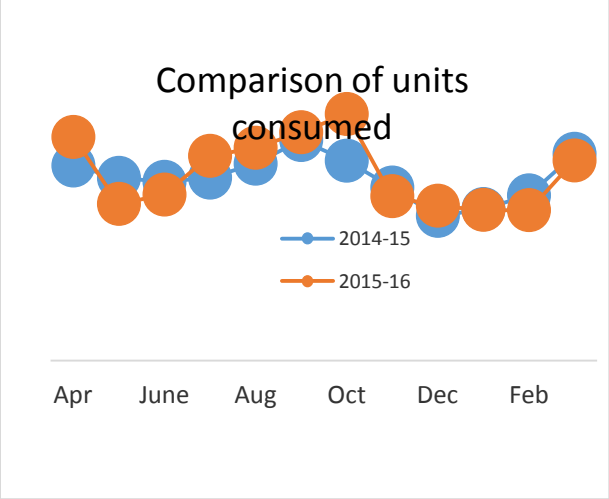
In the year 2015-16, we have consumed more electricity resulting in an increase of 51357 units , whereas there is reduction in bill value by Rs 6,53,015/. We have achieved the above savings with the help of

improved Power factor. In case we take into account increased consumption of electricity, the savings would be much better.

Comparison of Electricity Consumption

Year	2014-15	2015-16	Variance
Total units Consumed(KWH)	1,836,188	1,887,545	*51,357*
Total bill value in Rupees	22,511,833	21,858,818	*(6,53,015)*

The graphical comparison of electricity year to year



Effective January 2016, the electricity consumption is showing reduction comparing same month last year. This may be due to the generation of electricity from solar plant.

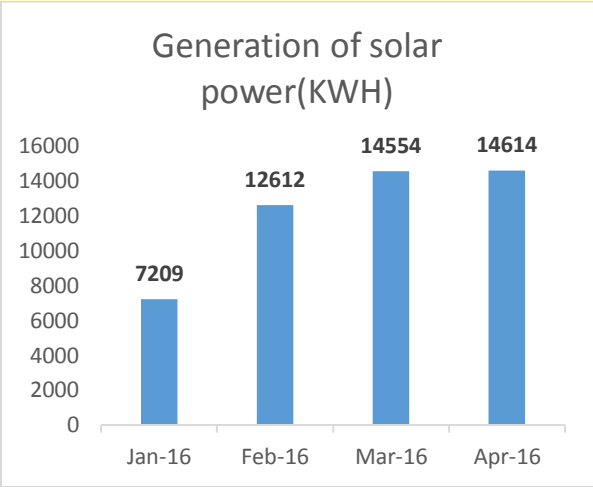
Installation of solar power

As a long term measure to reduce electricity cost, we have decided to install a 100KWp solar power plant. We started the pilot project in the month of November 2015 and the solar power plant was inaugurated on 12/01/2016 and currently generating 13500 units monthly. We will be saving around Rs 16 Lacs annually on electricity charges with this installation.

Photograph of solar plant installed at SIES Nerul

Report of Electricity generated through solar power for Week 3 May 2016

Date	Energy [kWh]			
	Total system	Inv No.1 - 34.2kWp (# 1)	Inv No.3 - 33.3kWp (# 1)	Inv No.2 - 34.2kWp (# 2)
	100800 Wp	34200 Wp	34200 Wp	32400 Wp
	kWh	kWh	kWh	kWh
16.05.2016	**475.0723**	162.6222	164.9014	147.5487
17.05.2016	**483.7266**	165.9557	168.1605	149.6103
18.05.2016	**475.2296**	163.2095	166.3349	145.6852
19.05.2016	**467.3040**	160.2128	162.9375	144.1538
20.05.2016	**409.4493**	140.8155	143.1286	125.5052
21.05.2016	**400.0059**	139.0734	138.5272	122.4053
22.05.2016	**532.3219**	184.0034	186.5521	161.7664
	3,243.1096	**1,115.8925**	**1,130.5422**	**996.6749**



Balancing of loads

In addition to issue of power factor and we had issue of meters exceeding the contract demand thereby incurring the penalty for over load. We have to study the existing loading pattern and availability of capacity in other meters and increase the capacity of fuses, contactors etc. Currently we have balanced the loads in all meters and we hope to realise the benefits which will reflect in all future electricity bills.

Improvement in electricity savings at Sion east			
Consumer No	Parameter	Oct-15	Apr-16
202-030-359-9	Power factor	0.886	0.943
	Incentive/ penalty	(284.61)	0
202-002-979-9	Power factor	0.989	0.997
	Incentive	4,279	8,403
Total		995	8,403

Conclusions

Tangible benefits for the year 2015-16

Action	Investment in INR	Payback period	Savings in INR
Improvement in Power factor	174,273	2 months	711,000
Balancing of loads	12,616	1 month	88,000
Installation of solar power	6,600,000	6 years	292,875
Total			**1,091,875**

Intangible benefits

- Reduction in Power Consumption – Improved Energy Efficiency
- Extra KVA available from existing supply
- Reduction in Voltage drop in cables
- Reduced heating of cables & Electrical Components

Sustainability

- Continued benefits will be reaped from implementation of the solution across all the campuses
- Continuously monitored by central Improvement team
- Cleaning of PV modules carried out for improved efficiency
- Automatic loading of capacitor banks
- Annual Maintenance Contract given for inspection of all the control panels and maintenance carried out once in an year
- Savings to be utilised for further expansions

- Cleaner environment by using solar energy

Bench Marking

We had made a study of management of electricity by other educational institutions within Mumbai and our report is as follows.

Factors	SIES	College 1	College 2
Month	Jan-16	Jan-16	Dec-15
Power factor	0.999	1	0.994
Units	125901	7448	153984

Awards and Recognition

Our efforts have been recognised by National Centre for Quality Management and we have been awarded the First prize in 10th BEST EDUCATIONAL QUALITY ENHANCEMENT (BEQET) PRESIDENT AWARD 2015.

SIES IIEM DEDICATED TO ENVIRONMENT MANAGEMENT THROUGH R & D AND OUTREACH ACTIVITIES

ABOUT SIES IIEM

- SIES IIEM was established in 1999. It has been contributing in the fields of R&D activities and Academics in the areas of Environment Management and Biotechnology.
- IIEM is recognized by Department of Scientific and Industrial Research for research activities and has successfully completed various research projects with funding from DST, BRNS, DBT, ICMR, MOEFCC, MMREIS and several other agencies.
- IIEM also conducts consultancy services, organizing seminars, workshop and providing community service through research and creating awareness.




INFRASTRUCTURE AND FACILITIES

State of Art Facilities to conduct R & D and consultancy in the areas of Environmental Science and Management. Laboratories are equipped with the advanced equipments (HPLC, AAS, GC, HVS etc.)

CONSULTANCY SERVICES

GREEN MANAGEMENT

Environmental Monitoring and Analysis

- Water, Soil, Air, Waste
- Eco-toxicity studies

Conservation of Resources and Biodiversity

- Eco restoration of Resources
- Biodiversity mapping and indexing

Waste Management

- Wastewater management for zero discharge
- Solid waste management
- Industrial sludge management
- E- waste management

Expertise in:

- Advanced oxidation processes
- Aerobic and anaerobic processes
- Bio- and phyto- remediation

EIA and Sustainability Solutions for Mitigation of Climate Change Vulnerability

GIS based Environmental Planning and Management

- Natural resource mapping
- Groundwater recharge study
- Site selection
- Database management

GREEN COMMUNICATION

Providing CSR Solutions for Environment and Society

- Environmental Education
- Training and Awareness programme
- Water audit and energy audit
- Carbon footprint mapping
- Capacity building
- R&D proposals and report writing
- Events – workshops, seminars and conferences

Areas of Research	Specific Areas
1. Total Water Management	1. Purification of drinking water by using low cost techniques. 2. Management of nitrite contaminated wastewater 3. Textile wastewater management. 4. Phytoremediation. 5. Oil spill management by biosurfactants. 6. Management of brine generated from water purification technologies. 7. Assessment and management of marine pollution
2. Solid Waste Management	1. Management of industrial waste. 2. Management of MSW and other solid wastes. 3. Management of agro- residue.
3. Applied Biotechnology	1. Utilization of biofertilizers and biopesticides in soil fertility management and agriculture. 2. Exploitation of beneficial microorganisms in remediation of heavy metals, oil pollution etc.
3. Management of Natural Resources	1. Pollution monitoring and management 2. Ecorestoration. 3. Studies on Climate Change. 4. Biodiversity Studies. 5. GIS & Remote Sensing

MAJOR FUNDING AGENCIES

- Ministry of Environment Forest and Climate Change
- Department of Science and Technology
- Department of Biotechnology
- Board of Research in Nuclear Sciences
- Indian Council of Medical Research
- Mumbai- Metropolitan Region- Environment Improvement Society

OUTREACH ACTIVITIES

Plastic Waste Management

C. Srinivas
SIES Indian Institute of Environment Management, Nerul, Navi Mumbai
Email: srinivasc@sies.edu.in

Plastics are usually synthetic, most commonly derived from petrochemicals. The world's first *fully synthetic* plastic is Bakelite, invented in New York in 1907 by Leo Baekeland who coined the term plastics. Nobel Laureate Chemist Hermann Staudinger is called the father of polymer chemistry.

Wide spread use of different plastics has led to the generation of huge amounts of plastic waste.

India generates 56 lakh tonnes of plastic waste annually according to a recent CPCB report. Mumbai generates 689 tonnes a day. Plastic waste constitutes about 9% of the total municipal solid waste generated in our country.

Plastic waste is of special concern because it is not naturally bio-degradable and lasts for thousands of years in the environment. It means that almost every piece of plastic ever made still exists today. Plastic waste contains harmful additives such as bisphenol A and phthalates that are added into the plastics during the manufacturing process, for making them more flexible, durable and transparent. They can leach out of the plastics into the environment and enter food, water and bodies.

Despite growing mistrust, plastics are critical to modern life and have a valuable place in our lives. To make plastics safer, scientists are working on environmentally-friendly bioplastics made of plant crops instead of fossil fuels. Research is also in progress to make biodegradable plastics.

Besides, technologies are continually evolving to manage the plastic waste.

One plastic waste management option is **recycling**. Total plastic waste which is collected and recycled in our country is estimated to be 9205 tonnes per day (approximately 60%). India's rate of recycling is highest in the world (USA recycles 2-3%). Uncollected and littered plastic waste per day in our country is 6,137 tonnes. Mostly, thermo plastics, PE and PET are recycled depending on the demand. Recycling is a physical process involving melting and pelletization after pre-treatment Thermosetting plastics like PUF and Bakelite cannot be recycled in the same manner because they are thermally stable and tend to char on heating to high temperatures instead of melting. They constitute about 20% of the total plastic waste generated. Chemical processes for plastic waste management include incineration, pyrolytic conversion to liquid fuel, plasma pyrolysis technique.

Incineration is exothermic oxidation reaction to carbon dioxide and water in the presence of oxygen at high temperatures. It is a dirty process unless carefully controlled and leads to emission of carcinogens into air and is sparingly used globally.

Pyrolysis i.e., thermal decomposition in the absence of oxygen, of plastics at 400-700^{o}C

under carefully controlled conditions tend to break the long polymeric chains of the plastic into different smaller carbon chain containing reaction products. Depending on the number of carbon atoms in the molecule, the reaction products exist in gas, liquid and solid states under ambient conditions. Aim and challenge of pyrolysis of plastic waste is to cleanly convert the *difficult-to-burn* solid plastic fuel predominantly into *easy-to-burn* liquid fuel of composition similar to diesel or petrol avoiding/minimizing generation of char, gaseous hydrocarbons and air pollutants. It is a radical chain reaction involving complex chemistry. Both catalytic and non-catalytic methods are under investigation. Fluid cracking catalysts employed in petroleum industry are also being investigated for this application. In view of the huge quantities of plastic waste generation, this option could be immensely attractive as an energy source.

In the **plasma pyrolysis** technology, the plastic waste is heated to extremely high temperatures (20,000^{o}K) using plasma torch in oxygen starved environment. The pyrolysis gases are combusted into carbon dioxide, water, etc. It is emerging as a clean alternative to incineration and it can destroy wide variety of plastics including non-recyclable ones, medical waste and other combustible solid wastes with energy recovery possibility. Further, there is an advantage that plasma pyrolysis system can be installed at hill stations, tourist places etc. to demonstrate decentralized disposal of plastic waste.

In conclusion, simultaneous to the development of more eco-friendly plastics, the need of the times is to develop technologies to harness wealth from plastic waste.

Best Compliments from

F. B. Dhondy

Enka Civil Constructions Pvt. Ltd.

20 – G, Navshir Bharucha Marg

Mumbai 400 007

Tel.: 2380 3431, 2381 1432

Sustainable Waste Management: Need for the Environment

Dr. Ashish Polkade
Vision Ecologica, Pune www.visionecologica.in
Email: apolkade@gmail.com

As per definition of OECD "*Waste refers to materials that are not prime products (i.e. products produced for market) for which the generator has no further use or for own purpose of production, transformation or consumption, and which he discards, or intends or is required to discard... Excluded from the definition are: residuals directly recycled or reused at the place of generation (i.e. establishment); waste materials that are directly discharged into ambient environment".*

We as a team of Vision Ecologica believe that waste is not waste until we have thought so. Waste is generated once we stop thinking on it. We can, for example, convert organic waste into energy. Vision Ecologica is ready to share this vision towards waste.

Severity of an issue:

India is generating around 0.14 million tons of waste daily which is more than 3% of the total garbage generated in the world. This waste is ultimately contributing to the increase in level of pollution in air, water and soil which finally creates a load on the health of the environment. Domestic & commercial waste management has become an urgent need with the growing population - to control all types of pollution; to stop the spread of infectious diseases and to conserve environmental resources, including forest, mineral and water.

Solutions on waste management:

Waste management is all those activities and actions required to manage waste from its inception to its final disposal. This includes amongst other things, collection, transport, treatment and disposal of waste together with monitoring and regulation. Combined efforts at individual, society, government and corporate level are key for success towards Clean India Movement. (Fig 1)

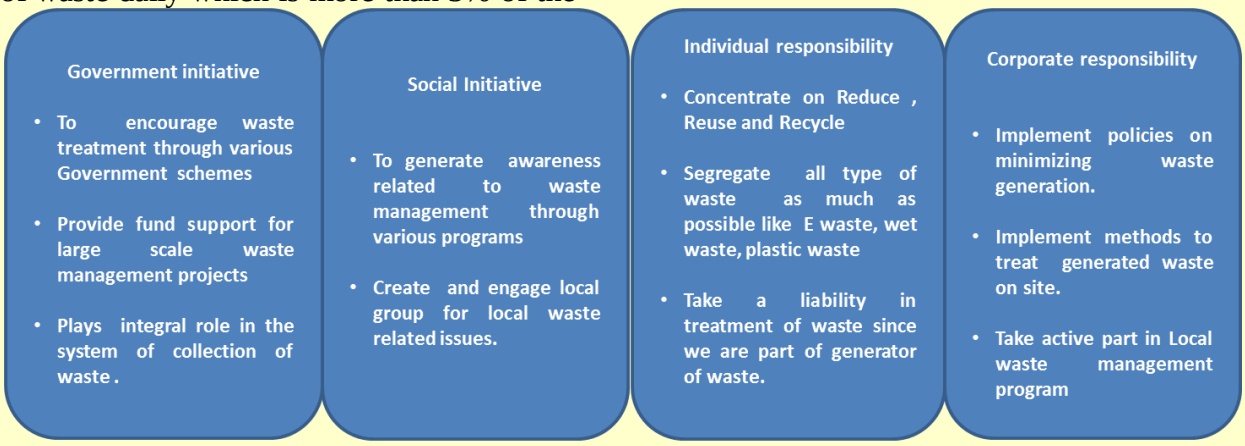


Fig 1: Combine approach to move towards Clean India

Reduce, Reuse and Recycle are three essential 'R's in waste management.

Reduce

To reduce is a process that involves reducing the amount of waste produced in society and helps to eliminate the generation of wastes, supporting the efforts to promote a more sustainable society. The primary focus of most of the waste management strategies should be waste minimization. Proper waste management requires a significant amount of time, thinking and resources; therefore, it is important to understand the benefits of waste minimization and how it can be implemented in all sectors of the economy, in an effective, safe and sustainable manner.

Recycle/ reuse

The biggest beneficial impact that waste management has on the environment is the effort to recycle materials. Recycling not only means that what was once waste material gets used again in a productive manner, but that it also means less resources to be taken from the surrounding environment in order to make the same products. Recycling also means that there is less waste disposal in landfills which, obviously, is better for the environment as a whole.

One of the offshoots of recycling is that it has become a substantial business opportunity for those who can recycle materials and make many new items from them. Over the past couple of decades, recycling has taken on a whole new meaning for commercial endeavors who have added new customers because of their efforts. This process had generated different vendors in various waste sectors like wet waste, e – waste, plastic waste, dry waste, paper waste etc.

Process/ Treatment

If the above 'R's are not possible, then finally it has to be treated or processed without any environmental impact.

Treatment of the generated waste involves various processes depending on the type and volume of the waste to be treated. Some routinely used processes for agricultural and domestic wastes are Composting, Biogas generation, Incineration etc. Composting can reduce the waste to 20% to 30% of the original quantity. Traditional composting methods take very long time (4 to 6 weeks) and demands manual involvement. Currently compost machines are used to expedite process.

In conclusion, waste management practices should follow Reduce,Recycle and Reuse principle and reduce the burden on the environment.

India Renewables

Bhagyalakshmi Nair,
Lead Engineer, Consumer Engineering, Tata Power
Email: bhagyalakshmi.nair@tatapower.com

We are living in the 21st century, where India is considered to be one of the major emerging economies. However, an insight into its power sector shows a different picture. India's power sector was one of the most ignored sectorS in Indian economy. Every third person in rural India remains without power even today, as against only 6% of the urban population. India has a per capita consumption of 1000 kWh compared to the global average which is 3000 kWh in 2014-2015.Our energy production was 1193 billion kWh in 2013 as compared to the global average of 23,342 kWh. The power shortages translate into massive power cuts and intermittent supply issues, which in turn affect all segments of the Indian economy. A key reason for this is the country's inability to generate more power. With depleting natural resources, renewables can offer some respite from this ever-increasing deficiency which adversely affects the country's economy. This will also help us in achieving "sustainability". Available renewables include solar, wind, tidal, geothermal and biomass.

India's present day capacity of renewable energy resources is around 34GW, and the aim is to reach the target of close to 50GW of manufacturing and EPC facilities for solar and wind.

Under "Make in India" campaign, close to 300 companies have committed to generate 266GW of solar, wind, mini-hydro-electric and biomass based power in India within the next ten years. According to the ministry of new and renewable energy, 293 firms have shown interest in setting up renewable energy plants in India.

India has seen 157% increase in solar power capacity since 2014 which is 4132MW and highest ever addition of wind energy of 3423MW in 2015-16.

This increase in use of renewable energy resources is primarily because of their:

- High Potential
- Perennial nature
- Lower reliance on imported fossil fuels
- Lower CO_2 emissions
- Faster recovery of investments

Roof top solar and mini-hydro power plants have recently gained importance because they can be easily installed and their payback is also faster. Government is funding such projects and relaxation on tariffs is also being provided. Solar potential of India is estimated to be 15,00,000 MW. The strategic geographical location of India enables it to have long and sunny days for the major part of the year. Hence solar energy can be the practical solution to generate electricity for the mass of Indian population.

Although there is a great potential for renewable energy resources, there exist a few challenges, like:

- Ageing main grid
- Inability to integrate renewable energy with the main grid due to its unreliability and unavailability when required
- Growing demands
- Absence of intelligent storage systems

The challenge to store this energy still remains due to cost and size of storage cells. However, this problem is being tackled by various manufacturers, and a working solution is not far from becoming a reality.

It is hoped that demand management along with energy efficient solutions will ensure better and far-fetched results.

Disclaimer:

Editors have taken utmost care to provide quality in this compilation. However, they are not responsible for the representation of facts, adaptation of material, and the personal views of the authors with respect to their compilation.

Environment in News Headlines

CPCB has set guidelines for processing of non recyclable plastic waste

On the directions of the principal bench of the National Green Tribunal, the CPCB has brought out guidelines to manage plastic waste generated from thermoset plastic that cannot be remoulded or recycled. The committee has also said that alternative to thermoset, polycarbonate should be identified that could also be recyclable. Co-processing of thermoset polymer waste in cement plants is a more environment friendly and sustainable method of disposal compared to landfilling and incineration. This reduces emissions and leaves no residue after treatment. In this method, the plastic waste is used as a raw material to recover energy and material from them. Due to high temperature and long residence time in cement kiln, all types of wastes can be effectively disposed without any harmful emissions.

DNA, New Delhi, Friday May 27, 2016

Protection of dead trees vital for cavity nesting birds

Even dead trees play a vital part in maintaining a region's biosphere, say ornithologists. According to them, dead trees are usually preferred for setting up nests by certain bird species like the woodpecker and mayna. They make cavities in tree trunks for nesting. The same nest is reused by a host of other bird species during breeding. Removal of dead trees to plant new ones or for firewood can have a serious impact on the biosphere.

TOI, Coimbatore, May 26, 2016

Portugal Ditched Fossil Fuels for 4 Days. Can We Go Longer?

Portugal became the latest country to coast solely on renewable energy this month, going without fossil-fuel power for four days straight. Denmark, Germany, and others recently have declared similar feats. But are these temporary clean-power surges a mark of real change, and if so, how far can that go?

“This is definitely signalling a shift in terms of the energy mix,” says Luca De Lorenzo, project manager at Sweden’s nonprofit research group Stockholm Environment Institute.

Overall, renewable energy is gaining ground on the world’s electric grids, accounting for nearly 60 percent of the world’s new electric capacity, according to the renewable energy research network REN21.

National Geographic May 27, 2016

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Forthcoming Events

International Conference on Environment Management and Sustainability (ICEMS-2017) in January 2017

Articles, photos etc. are invited for next issue (July - September 2016) of ‘The Environment Management’ on the theme “Water Treatment Technologies”

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SIES - Indian Institute of Environment Management,
Sri. Chandrasekarendra Saraswathi Vidyapuram
Plot 1 E, Sector V, Nerul(E), Navi Mumbai 400 706
Tel.: 022 6119 6454 / 55/ 56 ; FAX: 022 27708360
E- mail:iiemoffice@sies.edu.in; Website:http://siesiiem.net