

Energy Management for a Sustainable Industry: Their Challenges and Scope

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Abstract

Background/Objectives: The paper aims to study the development of sustainable industry at present with the challenges occurring at their every step. **Methods/Statistical Analysis:** The paper has undergone desk research and has come out with the scope and challenges of a sustainable industry. **Findings:** The energy driver is an important element of sustainability. The highly contaminated water is also a severe problem for the unsustainability of the industrial belt which has to be taken for further research. **Applications/Improvements:** The paper is original and claims to cover the sustainable industry which is an essential need for the planet.

Keywords: Challenges, Industry, Scope, Sustainability

1. Introduction

With time India has moved towards the period of industrialization where the population is dependent on the industries for their basic or luxurious needs one or the other way. Today every industry is associated with the natural resources and affects the ecosystem. The Indian Industries constitutes of labour, raw materials, ownership, source of raw materials and some other miscellaneous industries. Indian industries have been classified into sub industries¹ (Figure 1).

Industries in the present era are approaching towards sustainability. The indicators of sustainability has been in use in rural areas since past in Australia and has become an industry in itself. These indicators have been identified by several frameworks². The sustainable indicator for an industry is the quality as well as quantity of the product, government policy, awareness about the research and technology, consumers' preference and access to information as well as research and technology³. The energy driver is an important element of sustainability which leads to economic, social and environmental development. The three energy drivers are accessibility, availability and acceptability⁴ (Figure 2).

1.1 Accessibility

The energy services must be provided at affordable prices for the industry to attain sustainability. Efficient operations in industry can be made through proper access of energy services.

1.2 Availability

This aspect involves adequate and timely supply of the energy services by the industry.

1.3 Acceptability

Clean sustainable technologies must be accepted by the industries in order to attain sustainability.

The green products constitutes of three environmental drivers namely energy minimization, optimum utilization of materials and prevention of pollution which are known as the life cycle of the products⁵.

Besides the three energy drivers sustainability should be perceived as sustainable consumption and sustainable production. According to Brundtland commission sustainability is defined as to meet the needs of the present without affecting the future. Sustainability comprises

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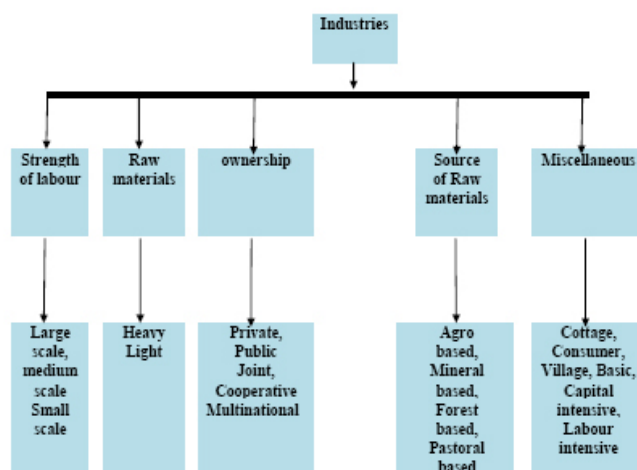


Figure 1. Classification of Industries.

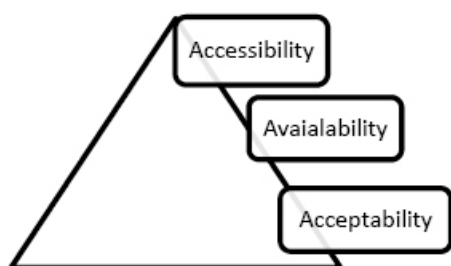


Figure 2. 3 A's energy sustainability.

of three most important parameters namely economic, environment and social aspects⁶. (Figure 3)

2. Development of Sustainability

Sustainability development came into recognition through the first publication called Our Common Future by the World commission on Environment and Development in 1987. The sustainable development of any industry comprises of three important constituents, namely economic, environmental and social dimensions (Table 1).

According to Truncer et al., 2008 there are six approaches of industries moving towards sustainability namely.

2.1 Focusing at the Triple Bottom Line

In reality any business focuses only on economic and environmental issues and do not stress on social issues for sustainability.

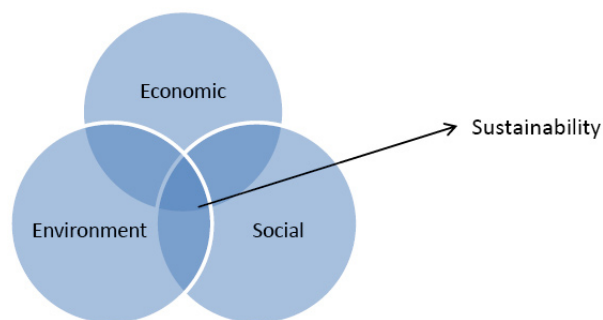


Figure 3. Three parameters of sustainability.

Table 1. Dimensions for the development of sustainability in industries

Dimension of Sustainability of Industry	Constituents of Sustainability of Industry
Economic	It focuses on efficient technologies to survive in the competition ⁷ , innovations ⁸ , aggregate demand, consumptions and savings ⁹ .
Environmental	The prime objective of this constituent is to minimize the nonrenewable resources conservative of ecosystem ¹⁰ and reduction of greenhouse gases
Social	This focuses on education, high employment, income and benefits to the society ¹¹ .

2.2 Concrete Procedures for Effective Management

The organizational and institutional features of environment entrepreneurs are weak. Marketing with the poor involves great experience to work.

2.3 Empowerment of Poor

The business sector can help the poor by creating opportunities for them to become more secure, healthy and economic.

2.4 Fostering Partnership Model

Creating values for the poor through market must be made either through partnership or through developing agencies.

2.5 Encouraging Sustainable Consumption

Sustainable consumption pattern involves such factors like infrastructures, technology, products and services which enables or constrains consumer choice.

2.6 Supporting Public Policy Efforts

According to UNEP et al 2005 the governments have a limited capacity to address the issues of the poor. High transaction costs and lack of adoption of local property acts as barriers for any business activity.

3. Status of Industries in Terms of Energy Management for Sustainability

Only 6% of the total material flow ends up in consumer products while the remaining goes to the environment in the form of harmful gasses and wastes¹². Every year over one billion tons of wastes are generated from the industries. The companies have been launching green products that are sustainable and environment friendly which have reached their number up to one thousand five hundred and seventy¹³.

3.1 Cement Industry

The product from the cement industry is responsible for a huge emission of greenhouse gases and wastage of energy.

3.2 Concrete Industry

The consumption of sand and rock is about 10 billion tones and mixed water about 1 billion tons annually. The practices in the industries are not sustainable¹⁴. In the cement industry the high speed in construction is responsible for excessive cracking problems in the cement. These cracks and losses are traced out later which is a sign of unsustainability. Table 2 depicts the role of energy management in sustaining practices in different industries.

4. Scope

Development of a sustainable industry can be made by minimizing the use of energy. The process of sustainable development by practicing minimum energy consumption can lead to reduce the amount of wastes produced.

This will perhaps result in conserving the scarcity of the resources and limiting the damages due to wastes flows²². For a construction industry the following parameters must be fulfilled for attaining sustainability (Figure 4).

4.1 Raw materials use

This is the prime and important parameter for attaining sustainability. The raw materials act as the important source for attaining sustainable practices in any industry. The use of raw materials must focus on economic, social and environmental aspects of sustainability.

4.2 Location where the raw materials are used

The raw materials location also affects the sustainability of industries one or the other way. Every industry is dependent on the raw materials one or the other way. Therefore the source as well as the flow of materials acts as the main base for any industry. The systematic flow of the materials depends upon the location of the raw materials. Since most of the cost is consumed by the transportation source which disturbs the economic sustainability of the industry.

4.3 Methods involved for the management of raw materials

The management of raw materials includes several methods which leads the industry to move towards sustainability. The transformation of raw materials into final products comprises of several methods and it is very essential for the methods to be sustainable.

4.4 Design, lifecycle, recycling, reuse and planning of the facilities involved

The process of product design, product life cycle and the process of reuse as well as recycle affects the sustainable practices of the industry. The planning of the facilities leads to the practices approaching towards sustainability.

As a part of sustainable development, various initiatives have been taken to come over economic, social and Environmental issues in India. Eco industrial park (EIP) is one of the sustainable solutions to industrial pollution, widely fostering in various regions of India. The transformation of Industrial clusters into Eco industrial parks by integrating environment, energy and climate issues at

Table 2. Role of energy management in sustaining practices in different industry

S. No.	Industry	Sustainable Practices
1	Procter & Gamble	This industry explored the amount of energy utilized by their products and found that a lot of energy is wasted in using their detergents by washing through hot water. This led to the increase in the electricity budget in every house. Thinking this in terms of sustainability P&G introduced a cold water detergent for washing as tide cold water in united states and aerial cool in Europe in the year 2005. Today the P&G has introduced a lot of cold water products for serving energy leading to a sustainable approach ¹⁵ .
2	Clorox	This was the first company to introduce non synthetic green consumer products in the year 2008. In 2009, biodegradable cleaning wipes were introduced by the company for designing sustainable products ¹⁵ .
3	Calera	Calera in California has developed technology in order to extract carbon dioxide emissions from industries and this carbon dioxide was bubbled into the sea water which led to the manufacture of cement ¹⁵ .
4	Electricity	The electricity sector is the largest contributor of emissions of greenhouse gases since it is dependent on coal, gases and fossil fuels ¹⁶ .
5	C21 steering Company	The steering company at Singapore has changed from dirty, dangerous and demanding industry to a professional, productive and progressive one ¹⁷ .
6	Basix	It was established in 1996 and acts as a helping hand for the poors by providing them loan for rural business. The services provided are approaching towards sustainability. It has tried to raise the income and business of the rural people by fostering their innovative ideas for the economic development. It has also structured insurances like insurance due to rainfall problems, due to crop loss or due to income loss for the poor by indulging with various insurance companies
7	Cosmos	It has used the technologies in such a way that it was founded as the first company to bring solar light emitting diode lighting. It has led to the development of mighty light which has helped many rural households who often face the problems of electricity. The solar power LED lamp has led to economic, social and environmental sustainability by replacing kerosene lamps with LED lamps ¹⁸ .
8	ITC	ITC company are well known for their FMCG, paperboard, agribusiness, hotels and information technology. It is reusing the used papers for paper manufacturing. It helps in minimization of greenhouse gases, solid wastes and water wastes. Its process of reusing the products one or the other way leads to sustainability ¹⁸ .
9	L&T	It was founded in 1938 as an engineering, construction, electrical, machinery, industrial products, information technology and engineering services. In order to maintain sustainability it has widen its scope of environmental policy, adapted new technologies and has assessed carbon footprints for different locations. It has built a waste management system, rain water harvesting has identified green concept in buildings and has switched to minimization of energy use ¹⁸ .
10	TCS	It was established in 1968 and has been known as an environment friendly company. Its operation has led to minimization of greenhouse gas emissions, energy saving, reduced water wastes and has reduced carbon footprint ¹⁸ .
11	MIM Holding Limited	It is a processing company and mines gold, copper, iron ore, coal and coke. It follows sustainable strategies to minimize the loss of water, greenhouse gases, recycling of the wastes and ultimately increases the energy efficiency ¹⁹ .
12	Rio Tinto	It is a processing company and mines gold, copper, iron ore, coal, aluminum and coke. They have made a contribution to sustainability by developing the mineral resources at local level in such a manner that after the mining industry ceases economic activity, education, public health and reclaimed land remains ¹⁹ .
13	Toronto based Rio Algom Ltd	It is the largest steel and aluminum industry. It has developed an environment and a safety policy ²⁰ .
14	Placer Dome Inc.	It is a gold mining company and contributes in sustainability by improving environmental performance ²⁰ .
15	General Electric	It has focused on the environmental issues for developing a low carbon economy ²¹ .
16	HP	This company has recycled about twenty percent of the equipment by teaming with Sony, Braun and Electrolux ²¹ .
17	Cargil and Unilever	They have worked in the development of technologies for sustaining the practices in the agriculture sector by working with the farmers ²¹ .

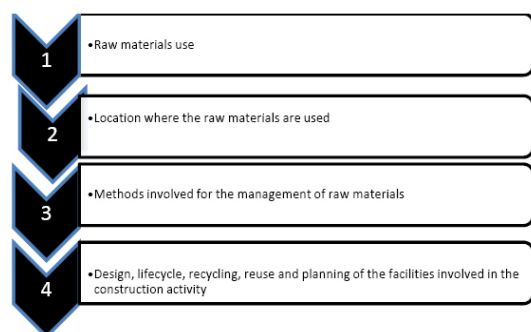


Figure 4. Scope of Sustainable Industry.

macro level, micro level and through industrial symbiosis. The objectives of EIP's are to achieve higher resource efficiency in raw materials, energy, water and transportation with the cost savings. It also focuses on cleaner production through various process improvements and use of renewable energy and material as a substitute to fossil fuels. When it comes to the infrastructure it demands restoration of existing buildings to higher energy and environmental standards and use of green architecture and engineering. It also calls for ecological site planning and utilization based upon clear understanding of the carrying capacity of Environmental factors²³.

5. Case Study of Naroda Industrial Estate of Gujarat approaching towards Energy Management for Sustainability

On the path of development of sustainable industry or industrial cluster, various industry wide initiatives have been taken at Naroda Industrial Estate of Gujarat. Ceramic industries have come up with innovative ceramic thermal insulation which could save up to 33% of kiln car energy cost. The industry installed Ultralight, a unique lightweight refractory material that has excellent thermal insulation property and various other economic, environmental and social benefits. This led to improved manual drying by installing Manglam dryer, which could save 40% of the time and reduction in the manpower. The industry also switchover to Piped Natural Gas from Light Diesel Oil as a Eco-friendly fuel with the savings of around Rs. 7 Lacs/Annum. Chemical industries have installed timers for highly energy intensive operations like centrifuge in dyes & dye intermediates sector for energy conservation. Use of the new technology for filtration, to

avoid high filtration loss in dyes and dye intermediates products. Agitated Nutsche filter is used for filtration; it offers an economic operation where maximum percentage of liquid in slurry is separated mechanically and savings in energy cost of Rs. 65000/year. Also as a more sustainable option they are going for solar a dryer which is at pilot plant stage now. A comprehensive treatment plant of 1000m³/day capacity have been established for the treatment of spend acid (H₂SO₄). It is collected from nearby different industrial estates like Naroda, Vatva and Odhav to produce ferrous sulphate (FeSO₄), which is sold to cement industry. This waste exchange benefited to more than 100 industries in that region. Most of the industries in Naroda use iron powder as a reducing agent. In this process large amount of iron oxide sludge generates, which is hazardous and need to send to common hazardous waste storage treatment and disposal facility for landfilling. By adopting efficient technology of catalytic hydrogenation in the place of reduction process eliminates the use of iron powder and subsequent problem of sludge disposal. Naroda also developed a renewable energy biogas plant to generate Electricity. The bio degradable waste generated by member units of GIDC Naroda estate is collected and through a 85 m³/day capacity digester they are producing methane. With 80% methane and 20% diesel they are generating approximately 12-130 units of power for illuminating lights of Naroda CETP during the night time. The industry also generates bio-fertilizer almost 700 kg/day; it is being used for gardening²⁴.

6. Challenges

The industrial practices and economy development are not sustainable in the present era²⁵. The tremendous rise in population, use of technology, choice of technologies and the impact of the overall performance of industry towards sustainability is still a topic of concern. The use of technology in industries is still limited which has resulted into deposition of the raw materials directly to the environment in the form of harmful gasses and solid liquid wastes. Only 6% of the total material flow ends up in consumer products while the remaining goes to the environment in the form of harmful gasses and wastes²⁶. The cement and concrete industries are the largest contributors to unsustainability problems²⁶. Large amount of wastes and pollution have been generated from the industries. The major challenge is that the

green products cannot be supplied in the market because manufacture of green products involves several new equipments and techniques for attaining sustainability. These techniques are not adopted by the industries due to several reasons one of being that the industries are habituated of using the machines and processes that they do not try for a change as it may involve risks. The technologies and processes can only be implemented if the industries get well aware of the term sustainability²⁷. The major challenges involved in the sustainability of industries are: Application of technologies, increasing the efficiency, human skills involved, knowledge, operations and development of sustainable sources are some of the innovative, central and competency challenges that industries have to face for moving towards sustainability. The biggest challenge in sustainability is faced by the electricity sector (I.E.A, 2011). This is mainly due to the rising population, increased urbanization and increasing number of industries. The construction industries face several challenges and problems in their effectiveness and to support sustainability²⁷. The major problem is the lack of resources which acts as a barrier in the sustainability of construction industries. The highly contaminated water is also a severe problem for the unsustainability of the industrial belt which has to be taken under further research²⁸.

7. Research Imperatives

The need for sustainable practices in industries means new challenges for researchers and practitioners focusing on important issues:

- How can the consumption of energy in the industries be reduced? What are the methods for optimum use of the energy from industry?
- What opportunities has energy management opened for the industries which are practicing sustainable techniques? What factors contribute to their success?

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