RESEARCH INPUTS IN SUSTAINABLE DEVELOPMENT TO OPTIMIZE TECHNOLOGICAL PROGRESS AND ITS EFFECTS OVER ENVIRONMENT

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ABSTRACT

Engineering and technological developments sustain the environmental growth. For over 150 years, the world has pursued the industrial development. This is proving more and more hazardous as this development continuously damaging the environment such as melting of glaciers, climate change, carbon tetra chloride evaporation, green house gas emission, ozone layer depletion. Due to climate change, decrease in glaciers contribute about 28% of sea level rise since 1993. Water supplies stored in the glaciers were projected to decline. What was required was to bring our energy and intellectual capacity in tandem whereby we can meet the challenge effectively without major disruption, without compromising on the livelihood of future generation of their needs. Development would have occurred without damages to the environment and major disruption, and the process of industrialization would have occurred in an innocuous manner by utilizing the resources effectively and efficiently in an environmental friendly manner. Planning and decision-making process (PDMP) of proposed projects, plans, programs and legislative actions should include the integrated consideration of technical, ethical, economical, social and environmental factors. The most important of these considerations can be referred to as “the Four Es” (engineering or technical, ethics, economics and environment) in PDMP. Prior to the enactment of International Environment Policy Acts , technical and economic factors dominated the PDMP in most of the world projects.

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Hence, sustainability of development and quality of life on earth is of utmost important. Sustainable development means industrial development should occur and must be continued without damages to the environment. Therefore, the present challenge faced by the world, lies in returning to a path of sustainable development. This article discusses research inputs put forth by the author in order to get optimized the technological progress and its effects over environment .

KEY WORDS

assessment, carbon-dioxide emission, cleaner technology, environment, global warming, impact, industries, social.

INTRODUCTION

By learning to live and exploit nature over thousand of years the human race have alienated themselves from nature itself. Industrialization and a surge in technology have given mankind the ability to know much about plant earth, and the world has now become abbreviated. But cognition level has gone down. With complete precision this has effectively eliminated, uprooted, and disconnected humans from whatever was remaining in them to be humans. The processes called development and deterioration have become synonymous. Deforestation, desertification, carbon dioxide emission, soil erosion, use of pesticides, chemical pollution , global warming , and unaccountable other factors have made the life of living beings horrendous. High industrialization and population growth coupled with polluting technologies cause increasing levels of pollutant emissions. This situation has warranted the need for cleaner and greener technologies. Cleaner technologies can be defined as technologies that can produce the same output by causing less damage to the environment. Cleaner technologies as those that are less polluting, use resources in

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a sustainable manner, recycle more of their wastes and products and handle all residues in a more environmental acceptable way than the technologies for which they are substitutes. Hence, the need is to conserve the living planet with a rational approach. It is urgently required to deal with the issues that are closely related to our surroundings, and suggested techniques preferably with local resources and know-how, to make that more sensibly habitable. This article discuss research inputs for the reduction of carbon foot print and thus reduce toxic effects on biotic environment by replacing clean technology applications and eco-friendly alternatives. It is recommended that there may be policy decision taken by the Government regulatory organizations, namely, European Commission, US Environmental Protection Agency, Royal British Commission , Indian Central Pollution Control Board etc., in order to implement cleaner and greener technologies in the hazardous industries globally to reduce carbon-dioxide emissions and thus protect from acidification of arctic ocean by corrosion.

PROBLEM FORMULATION

The Arctic Ocean is becoming acidic so quickly that it will reach corrosive levels within fifteen years. Waters around the north pole are absorbing carbon dioxide of about 100-250 mg/l (ppm). The acidity of the arctic ocean between the Norway and the north pole , pH is about 6.4 . It is by now that 5% of the arctic ocean has become corrosively acidic. The process of acidification – by which carbon dioxide emitted into the atmosphere as pollution is absorbed by water and converted into carbolic acid, is taking places in seas and oceans across the world. This level of acidification will cause immense damage to the ecosystem and the food chain particularly in the Arctic and impact on marine life. The will soon start dissolving the shells of living sea creatures.

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Hence , it is our responsibility that everyone has to immediately cut down green house gas emissions as per the given below problem solution and case studies.

PROBLEM SOLUTION

There are H-tech proposals for limiting the extent of climate change that as geo-engineering solutions to global warming such as spraying the upper atmosphere with aerosol particles that would reduce sunlight reaching the earth, mitigating the warming caused by rising levels of carbon-dioxide. But these ideas miss the point. They will still allow carbon-dioxide emissions to continue to increase- and thus the oceans to become more and more acidic. There is only one way to stop the devastation the oceans are now facing and that is to limit carbon-dioxide emissions as a mater of urgency.

CASE STUDY INVESTIGATION -1
CARBON TETRA CHLORIDE AND TRICHLORO-TRIFLOURO- ETHYLENE, TCTE) EMISSION FROM THE INDUSTRIES

Carbon tetra chloride (CTC) and Trichloro-triflouro ethylene are the cleaning solvents and carcinogenic substances which are used for wide applications in textile and metal industries, film industries , iron and steel industries , foundries, metal degreasing plants, electronics and electrical goods manufacturing industries, computer industries, electroplating, refrigeration and air-conditioning , ship yards, steel plants, fire extinguishers, service industries, oil refineries and power plants and a wide range of industries for cleaning purposes such as metals, glasses and rubber, fabrics and photographic films for removal various contaminants such as grease, oils, dust, carbon , inks and gums, stains etc. It has adverse environmental health effects on humans

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and it produces cancer diseases among the people in their vicinity and endanger various lives on earth. Occupational health exposures take place in these industries which affect the central nerve system of human health and causing dizziness, headache and vomiting. Once CTC evaporated, it rises up to the atmosphere where it destroys the ozone layer. This allows ultra violet (UV) rays to pass through the ozone chopped layer that protects our health. UV rays contribute to eye cataract and skin cancer, besides endangering plants, animals, birds and aquatic life. A Health survey conducted by the author in theses industries reveals that more than 8,00,000 people exposed (as per our rough estimate) to this occupational health hazards and potentially threat to cancers. To protect our health and environment, we need to stop using CTC and other similar substances, which destroy the ozone layer. There are eco-friendly alternatives and technological options which are available in order to alternate CTC and TCTF cleaning solvents in the above industries.

CASE STUDY INVESTIGATION -2

EXPERIMENTAL INVESTIGATIONS ON ECO-FRIENDLY REFRIGERATION AND AIR -CONDITIONING SYSTEMS

With growing environmental hazards, public awareness towards a sustainable development is increasing now. One of the series threats to the environment is the stratospheric ozone layer depletion. The demand and supply requirements of refrigeration systems are growing rapidly. Commercial chlorofluorocarbons (CFCs) and Halo chlorofluorocarbons (HFCs) are commonly used in refrigeration and air conditioning systems and they are released to the atmosphere which are carcinogenic and mutagenic substances because of their severe harmful effects on the environment. It has been documented that production, leakage and disposal of CFC and HCFC refrigerants have an adverse effect on our environment by contributing towards ozone layer

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depletion and greenhouse effect. There are specific environmental concerns about their use in air conditioning and refrigeration equipments which are related to their potential contribution to global warming and their depletion effect on the stratospheric ozone layer due to their chlorine chemical effect. Due to the fact that CFCs damages the ozone layer, environmental groups and the Montreal protocol call for halting CFC production[2]. Thus alternative refrigerants have to be investigated in order to get replaced the CFCs in refrigeration and air conditioning systems. Such alternative refrigerants should possess good thermo dynamical and physical properties, comparable cost, low toxicity and low flammability. This paper discusses use of hydrocarbons in refrigerating and air conditioning systems which offer acceptable alternative refrigerants to the CFCs, since they have good thermo dynamical properties and they are universally available at low price. This paper documents research results on an experimental study carried out for evaluating the performance parameters of a domestic refrigerator when four ratios of propane, butane and isobutene are as possible alternative replacements to the traditional R-12 refrigeran. The proposed alternative refrigerants have the advantage of being locally available, cheap and of an environmentally friendly nature. An unmodified R – 12 domestic refrigerator was charged and experimented with each of the hydrocarbon mixtures containing propane, butane, isobutene in different mixing ratios. The parameters investigated are the evaporator capacity, the compressor power, the coefficient of performance and the cooling rate characteristics. The present work shows that the hydrocarbon mixture with 50% propane; 30.3% butane ; 11.7% isobutene is the most suitable alternative refrigerant mixture with best performance among all other hydrocarbon mixtures investigated. The refrigerator has worked most satisfactorily with the proposed alternative refrigerant without the need for any modification or adjustment.

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CASE STUDY INVESTIGATION-3
POWER PLANTS OPTIMIZATION AND UTILIZATION OF RENEWABLE ENERGY POWER PLANTS

This case study aims was to investigate the potential of energy resources in the World and India and use improved technologies available for an optimal mixing use of power plants. This investigation proposes an optimal use of mixed power plants for a sustainable energy development[1]. The research work also focuses on development of new eco-friendly technologies for power plants besides modeling and analysis , zero emission technologies , pollution control system that would be a good technology transfer to the power industries and the people.

This paper elucidates database of renewable and non-renewable energy resources available in the Global and Indian energy scenario. This can give solution for the power industries to implement appropriate mixing strategies in production and maintenance of power plants. Theoretical model of 1 MW mini power plants (Renewable and non-renewable resources) and inter mixing of power plants using a mathematical modeling have been investigated. It discusses general power plant operation, maintenances and safety issues. Improved technologies available for optimum utilization of energy resources and proper mixing of various power plants have been provided for technology transfer to power industries. Theoretical concept of integrated inter mixing requirements of @ 1 MW demonstration power plants have been discussed as role models for solution to optimal mixing requirements in power industries. The percentage mixing using mathematical modeling has been given for prototype development. Procedures for inter mixing requirements of demonstration plant have also been given. The important elements which have been discussed during the power plant management are power production and quality

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management system and standards (PPMS), power plant resource planning (PPRP), power plant environmental impact assessment (PPEIA) and management plans (PPEMPs), safety by management objectives (SBMO), disaster management and mitigation, maintenance management tools, power training and software tools, ISO 9000 and ISO 14000 standards for implementation.

CASE STUDY INVESTIGATION- 4

ENVIRONMENTAL EFFECTS OF CHROME COMPOSITE LEATHER-CLAD ROLLERS USED IN COTTON ROLLER GINNING INDUSTRIES AND DESIGN OF AN ECO-FRIENDLY ALTERNATIVE

This research investigation discusses the pollution caused by chrome composite leather-clad (CCLC) rollers commonly used in cotton roller ginning mills and suggests an alternative roller material. CCLC rollers contain about 18,000 to 36,000 mg/kg (ppm) total chromium in trivalent and hexavalent forms which are toxic to human health and carcinogenic. When the seed-cotton is processed in double roller (DR) ginning machines, the lint is contaminated with chromium and chromium particles are carried into the spun yarns and cotton by-products. Specifically, due to persistent rubbing of the leather-clad roller over the stationary knife during the ginning process, the lint is contaminated of about 140 to 1,990 ppm of chromium and the spun yarns and cotton by-products contain about 100 to 200 ppm, far in excess of the standard limit of 0.1 ppm. Gin and mill workers are directly exposed to this carcinogenic substance[2]. To offset this problem, pollution-free rubberized cotton fabric (RCF) rollers have been fabricated, and tested in roller gins. The RCF roller covering is made of multiple layers of fabric bonded together using a white rubber compound which has a surface finish conducive to higher ginning efficiency. This eliminates chromium contamination and pollution during the ginning process. On the basis of the design and development of various test rollers and subsequent evaluation studies, the

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performance of pollution-free RCF rollers has been demonstrated with reference their commercial benefit and eco-friendliness in cotton ginning mills[3].

CASE STUDY INVESTIGATION- 5

ASSESSMENT OF POLLUTION LOAD FROM UNSAFE LEATHER TANNERIES

Chromium is a carcinogenic substance and acts on human in three ways, (1) Dermatitis, (2) Absorption and (3) Inhalation. Toxic effects are produced by prolonged contacts of air borne or solid borne or liquid borne chromium and its compounds even in small quantities due their carcinogenicity and mutogenecity. At present there are about 2,500 tanneries in our country, which process 7,00,000 tones quantity of hides and skins annually. About 80% of tanneries employ chrome-tanning process. The tannery processing consists of curing, soaking, liming, and unhairing, deliming-bating, deliming-washing, bating-pickling and chrome tanning. Chrome tanning process uses chromium as raw materials in the form of dichromate, sodium chromate and chromium sulphate. This process discharges copious amount of chromium bearing wastes and permanently affect ground water and soil. Out of 69,000 tons quantity of chromium applied annually in 1600 tanneries, (i) 25 to 39% spent as discharge in ground water . 45% chromate is of hexavalent chromium or Cr^{+6} salts and (ii) 61 to 75 % is usually absorbed in the leather by tanning process. Out of this about 45 % is in the form of hexavalent chromium, Cr^{+6} salts. It may be mentioned that about 90% of these leather tanneries cause severe water pollution problems in surface and ground water bodies[6]. This causes ground and surface water pollution with toxic hexavalent chromium. Hence the present investigation characterizes and assesses chromium pollution load from leather tanneries in India[6].

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CASE STUDY INVESTIGATION-6
IMPORTANCE OF ENVIRONMENTAL MANAGEMENT SYSTEMS, ENVIRONMENTAL TRAINING AND AWARENESS PROGRAMMES IN INDUSTRIES

The growing global sensitization about environment and pollution has imposed pressure on industry and business world to implement environmental management system (EMS) in their business establishments. International Organization for Standardization (ISO) -14000 series of standards were developed to assist organizations in achieving environmental and economic gains. They are very helpful not only for improved environmental performance, but also for prevention of pollution, reduction in waste, enhancing internal management systems, optimum utilization of resources and anticipating regulatory/legal requirements[2]. EMS is a continual cycle of planning, implementing, reviewing and improving activities, which an organization does to meet its environmental obligations[2]. ISO-14000 standards focuses on environmental management of all sorts of organizations /industries. It defines the features of an EMS that need to be in place to ensure that organizations identify and focus on improving areas where they have significant environmental impacts. Awareness, training and competence play a significant role in encouraging and enhancing people's participation in activities aimed at conservation, protection and management of the environment, essential for achieving sustainable development. Effective training programs, including those that raise the environmental awareness levels of all people in the organization, are a critically important element in implementing and maintaining the EMS. Depending on the nature of the operations, it may be necessary to raise the level of awareness of the facility's users. Internal staff may be trained to educate the users of the facility. Training must be approached systematically.

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The environmental awareness training should be aimed at educating employees on how they can make a contribution to the EMS and to the facility's environment performance. Identified environmental training needs should include the needs of each person whose work has existing or potential control over these impacts. Each of these individuals must meet a competency standard (developed by the organization) to be achieved through education, training or practical experience. Hence education, training and are the key to the success of an EMS.

CONCLUSION

In the past two decades , environmental concerns have been growing and the protection of environment has become a global issue. High industrialization and population growth coupled with polluting technologies cause increasing levels of pollutant emissions such as greenhouse gases including carbon tetrachloride and chloro floro carbon emissions. This situation warranted the need for cleaner and greener technologies. Cleaner technologies can be defined as technologies that can produce the same output by causing less damage to the environment. The cleaner technologies are those that are less polluting, use resources in a sustainable manner, recycle more of their wastes and products and handle all residual wastes in a more ecologically acceptable way . The appropriate case studies and cleaner technologies are discussed in this article for possible commercial exploitation in the industries.

Planning and decision-making process (PDMP) of proposed projects, plans, programs and legislative actions should include the integrated consideration of technical, ethical, economical, social and environmental factors. The most important of these considerations can be referred to as "the Four Es" (engineering or technical, ethics, economics and environment) in PDMP. Prior to the enactment of National Environment Policy Act, 1970 in USA, technical and economic factors dominated the PDMP in most of the world projects.

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This article discuss research inputs for the reduction of carbon foot print and thus reduce toxic effects on biotic environment by replacing clean technology applications and eco-friendly alternatives. It is recommended that there may be policy decision taken by the Government regulatory organizations, namely, European Commission, US Environmental Protection Agency, Royal British Commission , Indian Central Pollution Control Board etc., in order to implement cleaner and greener technologies in the above referred hazardous industries globally to reduce carbon-dioxide emissions and thus protect from acidification of arctic ocean by corrosion.

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