**International Journal of Environmental Science: Development and Monitoring (IJESDM)**
**ISSN No. 2231-1289, Volume 4 No. 3 (2013)**

# Role of technological advancements in enhancing sustainable development.

Ujjwal Raheja* and Abhinav Malik^
*Bachelor of Technology, Delhi Technological University Shahbad Daulatpur Delhi
^ Bachelor of Technology, Bhagwan Parshuram Institute of Technology, Rohini Delhi

**Abstract:**

Sustainable development today has crossed national boundaries. Today every nation raises the importance of developing technologies for sustaining our comforting lifestyles at minimal costs and load on our planet's resources. It has become a priority to develop such technology that enhances our ability to consume efficiently, reduce wastage and which can be adopted easily. Every nation is eager to share what they have developed because sustainability cannot exist at one point or nation on earth, it has to be globally adopted for better living and existence. Globally geologists are concerned about the depleting levels of liquid fuels and the increase in our dependency on them. Some also fear that is this our descend back into the Stone Age era. This makes sustainable development of utmost importance for all the world. The load on this planet can exist in many forms from a delayed existence of a disease to wrong driving habits leading to over consumption of fuels. The technology we developed for comforting our lives today puts a lot of pressure on our planet's resources and to sustain our comfortable lives with minimal changes we again look back to technology that may help us do so. It may be technologies for eradication of diseases to technologies for harnessing renewable sources of energy.

## Introduction

The world has seen many conventions, commissions, reforms and guidelines on sustainable development. Developed nations like United States of America have spent more than 100 billion USD on cancer research. Many nations have invested great amounts in biotechnology and renewable energy forms. The US Energy Information Administration in its STEO report clearly points to the increasing consumption of liquid fuels from 0.8 million bbl/d in 2012 to 0.9 million bbl/d in 2013 and is forecasted to reach up to 1.2 million bbl/d in 2014. This increase in consumption not only fastens the pace towards the end of non-renewable resources but also indicates increase in global pollution levels by greenhouse gases.

Ahmed and Stein in 2004 suggested that for sustainable development one needs to bring uniformity in technological progress, reduce poverty to new levels that all parts of the society can co-exist while following the sustainable paths and reforms laid out.

This paper covers various arenas in which vast research has yielded positive results or which are being constantly explored in order to find suitable technologies. The ongoing research in the field of biotechnology and it's ever increasing importance today has been also discussed. World communication technologies and the renewable energy sources, their advancements and extents to which they can be incorporated in our lives have been discussed.

## Biotechnology

Recent times have seen an upsurge in the investments nations are putting in the field of biotechnological research. Not only this upcoming and vast field offers problems to serious world problems but also gives an extra edge to human race in the field of medicine.

Biotechnology solved a great problem of food security. Earlier the food sources were totally dependent on natural conditions from rainfall to soil content. But today biotechnology has helped us ensure that we are able to meet our food demands even when adverse natural conditions are met. Transgenic crops are developed for imparting desirable traits to a plant and for obtaining the required useful product from it in minimal favorable conditions. Traits like pesticide tolerance and insect resistance are majorly worked upon in plants (Rastogi and Pathak, 2009).

The first transgenic crop Flavr Savr Tomato was introduced in 1994, which had an increased shelf life due to slow ripening.

In 1990s there was an increase in global crop yield due to development of Bt crops which were generated by insertion of cryAc gene obtained from B.thuringiensis. These crops were resistant to a wide range of insects as they produced toxin substances which were harmless when consumed by humans, Bt cotton being one of them (Carriere et al. 2003). Over the years Bt brinjal, Bt maize and many more crops resistant to insects were developed through this technique. Furthermore crops resistant to water scarcity were also developed to minimize the effects of famine (Thomson 2002, Zhang et al. 2004, Vinocur et al. 2005).

Another aspect of biotechnology is medicine and research. Biotechnology has provided man with tools that can be used to manipulate an organism or a disease at DNA level and provide ways to eradicate it from the root level. Yet Cancer remains undefeated. Every year the world spends billions of dollars on cancer research, some fields have shown positive results in preventing cancer to a great extent. Biotechnology has been used to explore genetic disorders and cure them thereby increasing the expected life of a human on this planet. Genetic disorder occurred because of changes in the DNA due to inheritance, lifestyle problems and environmental factors have been observed at molecular level and these interpretations have been used to cure various illness which were not pathogen associated (Bell and Beck, 2010).

## Nanotechnology

Nanotechnology has been majorly explored in the field of disease detection and in the field of electronics. Gold nanoparticles have been proposed to be used for early and accurate detection of Cancer. Oral cancer was successfully detected using gold nanoparticles by Ivan et al. 2005 due to difference in the amount of absorption of these nanoparticles by cancerous and non-cancerous cells. Bajaj et al 2009 also proposed a similar test for early detection of cancer using gold nanoparticles and fluorophores. It could differentiate between various stages of cancer. Nanoparticles are also preferred as a suitable drug delivery system for cancer drugs as they are very specific to delivery site and do no release toxic drugs at other than the affected sites. These nanoparticles are also known to cross blood brain barrier hence are able to deliver drugs to cure anomalies of central nervous system (Muldoon et al. 2006).

Nanoparticles have been used in food packaging industry for their anti-microbial properties and their thermal resistance (Holly et al. 2005, Brody et al. 2006). Nanoparticles have also found use in development of biosensors for detection of blood sugar levels using minimal amount of blood sample (Rivas et al. 2006).

## Information and communication technologies; and Artificial Intelligence

The term information and communication technology in a broader sense refers to the use of information and communication techniques in the fields of social and economic development along with fields involving human rights. It is meant to deal with resource deficit population anywhere around the world.

Kurzweil Ray suggests that the emergence of information society and new economic models along with the development of affordable and efficient information and communication techniques has given way to the contribution towards sustainable development (Kurzweil Ray, 2005).

It is believed that the people with economically privileged background would for long tend to stay in constant interaction and communication with people around the world through the means of internet, telephones, audio and video conferencing. Ray Kurzweil, adumbrates a significant increase in technologies like genetics, nanotechnology, robotics and many more. According to him ,this would leads to a technological singularity in the year 2045 and at this point the machine intelligence would be more powerful than human intelligence combined together.

The issue of realizing long term environmental and societal sustainability is a challenge for individual and collective decision making. However, certain findings in behavioral economics suggest that human decision making is biased and short sighted when it comes to sustaining healthy planet and there lies the utility of artificial intelligence for sustainability (McElroy, Mark W. 2006) , (Fisher, D. H. 2011).

Norio Shiratori and Mohammed Atiquzzaman (2004) have collectively proposed a routing schedule, named as Shaped Deficit Round Robin (SDRR). The scheme proposed by them offers better weighted throughput and improvements in packet suspension per flow. Their prime concern is to bring out the capabilities of a Label Switched Router in the presence of non real-time and real time applications wherein the non-real time applications dealt with packet loss and the real time applications dealt with packet loss.

Today information and communication technology is used across the world among people of varying ages to have access to information on various subjects and assistance in areas of their interest ranging from psychological issues , to sports , music or any sort of medical assistance. Amongst the young generation the social media and online gaming are gaining importance.

## Renewable energy for sustainable development and environment

It is believed and estimated that around the world that buildings contribute towards a large percentage of the total world's annual energy consumption. This energy is consumed for a large number of purposes. Exploiting renewable energy in buildings and agricultural greenhouse can significantly contribute towards a much lesser dependence on fossil fuels.

Renewable energy resources seem to be an alternative and a solution to preserve the natural resources and bridge an intimate relationship between the renewable energy and sustainable development. It is also essential to use energy more rationally in order to bridge a transition from fossil fuels to non -polluting fuels, and technologies such as photovoltaic (PV) cells and fuel cells (WEO, 1995).

It is estimated that worlds energy consumption is estimated to be 22billion kwh per year and about 66 billion metric ton of carbon emission are released in atmosphere to meet the energy demands (Bos et al , 1994). This demands for an approach which is essential to integrate renewable energies. However, renewable energy resources are geographically diffused and demand for one of the following two approaches (EUO, 2000):

1. The effective utilization of capture area, greater than that by community which is to be supplied.

2. Significant reduction of community's energy demands with locally available resources to a level commensurate.

Recently with new technological innovations being brought up, the advent of fuel cells is being considered as an alternative for power generation for mobile and stationary uses (Jacobson MZ, Colella WG, Golden DM (2005); Steele BCH, Heinzel A (2001)). Fuel cells of different types have been developed, some of them include: polymer electrolyte fuel cell (PEFC), molten carbonate fuel cell (MCFC) , alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC). Amongst these fuel cells PEFC is the one which has been most developed in the past 20 years and is suitable for vehicle applications which require high power density and rapid start up (Jacobson MZ, Colella WG, Golden DM (2005) ; Steele BCH, Heinzel A (2001) Borup R, et al (2007)). In comparison to the electrolytic cells that were used earlier the polymer electrolytes separate the fuels and the oxidants used effectively using a thin film of microns and thus can eliminate the problem of electrolytic leakage completely.

Thus it can be said that renewable resources if harvested sustainably can reduce the threats of air pollution, water pollution, destruction of natural habitat and problems of land degradation (Benefits of Renewable Energy Use, 1999). The reinforcement of renewable energy market and the promotion of innovative renewable applications will lead to preservation of environment by reducing emission at all levels.

## Discussion

The world today is at a stage where looking back at past we see many follies committed in haste and due to lack of knowledge. Today the requirement is to survive and preserve life as it is. When we talk about biotechnological developments and future perspectives in terms of sustainable development we mean to focus on the need of such developments that decrease the ever-increasing load on our health systems, our agricultural lands and in turn our planet. A simple example is early detection of cancer, for a patient this may lead to longer life, for the planet it

would mean a person who didn't undergo radiation therapy hence saved a lot of energy. Such small contributions mass up and contribute towards significant sustainable development.

When we discuss better communication systems we focus upon our ability to spread the knowledge to farthest of arenas so that exploitation of resources does not take place. Renewable energy perhaps is the most discussed field when it comes to sustainable development. With increasing oil prices and decreasing availability one would have to look upon the non-conventional ways of energy. Harnessing solar energy has been a project since many decades now and with each passing year we strive to develop systems which are more efficient than their predecessors to harness solar energy.

There are a number of obstacles which a new technology faces, people may not accept to incorporate it as a part of their lives for example solar heaters are being used by a fraction of population in regions where sunlight is ample. GM crops though have helped us fill the food banks are many times protested against by some organizations and members of the society (Greenpeace 1999, King and Gordon. 2001). Some oil companies claim we have enough oil for next 40 to 60 years but in the end the after all these technological developments and future prospects, we will only survive if we are prepared for the future and have gained a mass acceptance for technology that will aid us in survival.

## References

Ahmed, A. and Stein, J.A. (2004) 'Science, technology and sustainable development: a world review', World Review of Science, Technology and Sustainable Development, Vol. 1, No. 1, pp.5–24. brain barrier disruption consortium meeting. Am J Neuroradiol 27:715–721

Avinash Bajaj, Oscar R. Miranda, Ik-Bum Kim, Ronnie L. Phillips, D. Joseph Jerry, Uwe H. F. Bunz, and Vincent M. Rotelloa Detection and differentiation of normal, cancerous, and metastatic cells using nanoparticle-polymer sensor arrays Proc Natl Acad Sci U S A. 2009 July 7; 106(27): 10912–10916. Chemistry, Applied Biological Sciences

Bell, C. G. and Beck, S. (2010) The epigenomic interface between genome and environment in common complex diseases. Brief Funct Genomics 9: 477-485

Benefits of Renewable Energy Use. Union of Concerned Scientists. 1999. Retrieved 2013-01-04.

Borup R, et al (2007) Scientific aspects of polymer electrolyte fuel cell durability and degradation. Chem Rev 107:3904 –3951.

Bos, E., My, T., Vu, E. and Bulatao R. 1994. World population projection: 1994-95. Edition, published for the World Bank by the John Hopkins University Press. Baltimore and London.

Brody AL. 2006. Nano and food packaging technologies converge. Food Technol 60:92–94

Carriere, Y., C. Ellers-Kirk, M. Sisterson, L. Antilla, M. Whit-low, T. J. Dennehy, and B. E. Tabashnik. 2003.Long-term regional suppression of pink bollworm by Bacillus thuringiensis cotton. Proc. Natl. Acad. Sci. USA 100: 1519-1523

D. King and A. Gordon, "Contaminant found in taco bell taco shells," Friends of the Earth, 2001, http://www.foe.org/.

Energy use in offices (EUO). 2000. Energy Consumption Guide 19 (ECG019). Energy efficiency best practice programme. UK Government. London.

Fisher, D. H. 2011. Sustainability, Chapter 23 from Leadership in Science and Technology: A Reference Handbook, William Sims Bainbridge, ed., Sage Publications. Retrieved. From http://www.vuse.vanderbilt.edu/~dfisher/SustainLeader.final.htm

Greenpeace, "Genetically engineered food,," Greenpeace, 1999, http://www.greenpeace.org/.

Holley C. 2005. Nanotechnology and packaging. Secure protection for the future. Verpackungs-

Rundschau 56:53–56.

Ivan H. El-Sayed,Xiaohua Huang,and Mostafa A. El-Sayed Surface Plasmon Resonance Scattering and Absorption of anti-EGFR Antibody Conjugated Gold Nanoparticles in Cancer Diagnostics: Applications inOral Cancer 2005

Jacobson MZ, Colella WG, Golden DM (2005) Cleaning the air and improving health with hydrogen fuel-cell vehicles. Science 308:1901–1905.

Kurzweil, Ray (2005), The Singularity is Near, New York: Viking Books, ISBN 978-0-670-03384-3.

McElroy, Mark W. 2006. The Sustainability Code -- A Policy Model for Achieving Sustainability in Human Social Systems. Center for Sustainable Organizations, University of Groningen. Retrieved from http://www.sustainableorganizations.org/The-Sustainability-Code.pdf.

Muldoon LL, Tratnyek PG, Jacobs PM, Doolittle ND, Christoforidis GA, Frank JA, Lindau M, Lockman PR, Manninger SP, Qiang Y, Spence AM, Stupp SI, Zhang M, and Neuwelt EA. 2006. Imaging and nanomedicine for diagnosis and therapy in the central nervous system: Report of the eleventh annual blood.

Norio Shiratori (Tohoku University, Japan) and Mohammed Atiquzzaman (University of Oklahoma, USA), Telecommunication Systems 25:3,4, 169–172, 2004

Rivas GA, Miscoria SA, Desbrieres J, and Barrera GD. 2006. New biosensing platforms based on the layer-by-layer self-assembling polyelectrolytes on Nafion/carbon nanotubes-coated glassy carbon electrodes. Talanta (in press, 2006).

S. Rastogi and N. Pathak, Genetic Engineering, Oxford University Press, New Delhi, India, 2009.

Steele BCH, Heinzel A (2001) Materials for fuel-cell technologies. Nature 414:345–352.

Thomson, J. A. (2002) J. Nutr. 132, 3441S–3442S.

US Energy Information Administration Short Term Energy Outlook (STEO) July 2013

Vinocur, B. & Altman, A. (2005) Curr. Opin. Biotechnol. 16, 123–132.

World Energy Outlook (WEO). 1995. International Energy Agency. OECD Publications. 2 rue Andre Pascal. Paris. France.

Zhang, J. Z., Creelman, R. A. & Zhu, J.-K. (2004) Plant Physiol. 135, 615–621.