

In the Universe, the earth, a tiny speck of cosmic creation incapsulated in a space has an environment to let live any form of life on. The civilisation regarded earth, fire, water, air and space as mutually interactive to support the life. The civilisation has moved from hunting to farming to industrialisation to urbanisation and now to an artificial intelligence era & research for enhancing the biological life transition cycle duration.

Energy in all its forms is central to prosperity, well being and comfort. Energy sources are plentiful but their regional endowment and pace of conversion & distribution demands enlightened business initiatives to ride over the barriers (social and trans-boundary) for its growth. World's path of energy development into sustainable trajectory is set to encounter low carbon technologies, changes in capital stock, institutional reforms and business modules crossing the physical boundaries of individual countries. Energy security & equitable distribution are being debated world over. The industrialisation process, commencing with steam driven motive power has served humanity in long run but with concerns for global warming now. The energy conversion by burning fossil fuel (mainly coal) into steam has been key driver to economy along with widening manufacturing industry base for over two hundred years. This beginning of steam motive energy from coal was followed by oil & gas usage leading to era of mobility, motoring, aviation and outer space exploration. Concurrently we ventured into hydro power and nuclear energy as well.

Twentieth Century encountered two world wars, liberation of many countries (India, Burma, Indonesia, South Africa, others in West Asia, Africa & South Americas) from colonial era. Twentieth Century also witnessed consolidation (East & West Germany), disintegration of USSR into CIS, East European transition economies, consolidation of social order through United Nations, internal conflicts within liberated countries. People fought for securing physical boundaries ownership and autonomy for Governance just a few decades ago. Today in this fast changing world order the prominence of physical boundaries in respect of life support needs, technologies ingress is weakening in an evolving global market place; further weakening will emerge from the initiatives for having the liveable environment while maintaining the sovereign rights of various countries on harnessing their respective natural resources.

The drive of humanity in the lifestyle evolution process has led to an excessive drawl of natural resources, its conversion, utilisation and waste generation. All these steps are getting justified in the name of techno-economic viability, global market acceptability and so called sustainability. Capacity of natural ecosystem to cope up with the damages imposed by the human activities mainly from waste, deforestation and the developmental projects is facing challenges on many counts. Another critical aspect is that the natural ecosystems once destructed are hardly recovered / restored to their original form. The fundamental problem derives from the excess intensification of the anthropic activities compared with the finite limits of natural ecosystem on the earth.

Earth Resources (International / National Rivers & other water bodies), Forest Resources (Textile, Paper, Wood, Non-woody forest products), Ocean Resources (Oil & Gas, Fish, Shipping, Coastal cities, Mangroves,), Land Resources (Solid fuel & other mine able, urbanisation, surface transport,), Water in motion, Air Resources (Breathe, Aviation, Wind mills,) coupled with the Space drawing solar energy and other outer space applications make it difficult to converge on a well defined globally acceptable scientific baseline as all of them are embryonic. The dynamic treatment of technologies for harnessing, conversion, utilisation, waste creation / processing of natural resources has many voids from ecological sustainability point of view. Though the environmentalist are gaining recognition world over; the nature lovers are finding back seat thereby pushing ecological sustainability aspects into hibernation. This is the first step from where the ZerO2Nature track begins its path to usher an era of eco-sustainability and not just sustainability.

The scientists, technologists, engineers and all stakeholders evolved the humanities lifestyle energised mainly through fossil fuel for over three hundred years and reached a milestone in the last decade of twentieth century to study the global warming; the two hundred years of oil & gas exploration is likely to make us reach in a couple of decades another milestone of after effects of oil &

gas exploration at the time when its reserves shall near exhaustion and thereafter one hundred years of renewal energy harnessing could bring in another milestone in twenty second century for conducting the research on its after effects under the umbrella of environmental concerns. From preceding three years to fifty years the environmental concerns addressed the current situation and may be a couple of generations ahead. But the ecological sustainability concept is an environmental concern that aims to view the Nature naturally so that the liveable environment is maintained for the countless generations to come. With that in view; a multi disciplinary team of matured competency professionals comprising a Doctoral research scholar cum chemical engineer, a civil engineer, a mechanical engineer, an electrical engineer, physics professor and an international business expert are steering the ZerO2Nature apolitical professional platform for holistic engineering services.

June 05, 1972 UN conference in Stockholm declared twenty six principles and formed United Nations Environment Program (UNEP) just six months later to improve people's quality of life without compromising that of future generations. Since then UNEP has drawn road map for international environmental law through over one hundred multilateral agreements besides bringing awareness on environmental concerns world over. To make these draft conventions pass through vital political acceptance and pass through the individual country parliaments is end of pipe dream in many cases. Individual countries therefore prefer to have non-binding agreements. Nevertheless UNEP has helped growth of environmental jurisprudence in many developing countries during last over three decades for co-existence of development & sound ecosystems. In addition to UNEP, a dozen of UN agencies, the secretariats of treaties & conventions, multi-lateral development banks, regional political groups, individual country initiatives are putting efforts to combat environmental degradation & climate change impacts. More than nine hundred legal instruments have emerged since Stockholm UN declaration thereby making congestion in many counts. UNEP has contributed in Nations realise the value of self regulation but the external incentives remain a necessity for developing countries in particular. UNEP though has promoted creation of international environmental law its image is more of scientific and technical body. It took 25 years for political will to culminate into Kyoto Protocol in 1997, a legally bound framework of commitments with milestone set for achievement within next 15 years i.e. by 2012. Though on the technical aspects substantial work got done through IPCC, UNFCCC, the diffusion of political will and dominance of business as usual market forces coupled with the slow pace of penetration of new technologies having prohibitive cost led to crash of CER prices for GHG reduction. The pace of penetration of technologies & investments in energy efficiency, aimed at maintaining green house gases emission below 1990 levels by 2008 – 2012, has been lower than required. There has been increase of cleaner production in industrialised countries and energy efficiency projects got boost in the developing countries / transition economies. But the combined political will under Kyoto Protocol got into fragmented multi directional efforts. These include NAMA and NDC and the separate initiatives by World Bank, Asian Development Bank, Emission Trading, Green Climate Fund, Joint Crediting Mechanisms and many more. Majority of these had the basis of "Polluter Pay Principle" and "Common but differentiated responsibility", "specific technologies driven" concepts on the backbone. Kyoto Protocol offered algebra for commoditising pollution for exchange at global scale by CDM, JI and emission trading. However the global market place found it difficult to accept a non asset based mechanism of trading GHG on the basis of common but differentiated responsibility.

The Policies per se needs to be equitable Worldwide to find its global acceptance. The equity on inter – country, inter – generation, intra – generation are quite complex issues on the political agenda. Currently one third of World population are resourceful, mainly living in cold countries enjoying technology leadership, energy intensive lifestyle and are quite concerned on the environmental issues as well. Another one third in the countries like China, India, Brazil, South Africa and many more having higher GDP growth are ambitious to opting more energy usage in their life style and seen contributing increase in GHG. Balance one third of World populations are awaiting access to the commercial energy at an affordable cost. This one third, majority living outside the domain of digitised world, causing deforestation and making improper land use, throws higher challenges to the technologists / scientists and micro finance tools. To find single window solution to this one third syndrome is an end of pipe dream for the humanity.

Currently there are varied levels of environmental concerns of different countries, economic buying power of various local currencies, pace of penetration of new technologies in an upcoming global market. The power plants reacts, operates and generates power differently under varied load curves, grid conditions and quality of inputs thereby cost of generated power varies. A proficient electrical engineer can very well assess, monitor, verify and take corrective actions suiting to specific conditions. However the assessment, monitoring, verification of ecological distortion and corrective actions for its restoration demands multidisciplinary expertise and is a more complex matter to be dealt with .

In the twenty first century there is a shift from fossil fuel energy to renewable sources, manufacturing base to service industry. Sweden declaring to free its dependence on fossil fuel by 2020 and Denmark harnessing 23% of energy from wind are bench marks that promise the target of 35% of entire commercial energy drawl from renewable sources by 2050. However it would be premature to state that these endeavours shall be free from any adverse impact on the Climate Change during upcoming decades like fossil fuel. Technologies face many challenges and its ingress followed with impacts are encountered over decades so are the challenges for evolving the liveable environment at global scale. Here again the concern for ecological sustainability deserves considerations in the overall developmental process steered by the technologists amidst one third syndrome. Under the prevailing one third syndrome; the project promoters find it difficult to choose the path that leads them to make their project viable within the given constraints without diluting the concerns for eco-sustainability. Sometimes the project promoters; under economic pressures opt out to pay for the penalties for pollution instead of taking mitigation actions considering the cost benefit analysis and taking advantage of weak environmental jurisprudence. There have been a number of approaches like “Zero discharge” i.e. zero effluent discharge in the water bodies from any of the industrial / other projects. Zero emission i.e. by removing the pollutants from the air discharge through the chimneys and many more. A number of countries brought environment protection acts that are very stringent in some cases and others weak. This also led to phenomena of shifting of polluting industries from high environment concern countries to low environment concern countries for economic considerations.

The environmentalists are raising voice of polluting 215 international and huge number of domestic rivers, sea shores receiving contaminations in the ocean rim countries, about 4000 million ha of forests facing deforestation world over, urban waste creating hosts of issues on its segregation, collection, transport, landfills and waste to energy and many more concerns throwing challenges to the liveable world. But the environmentalists normally do not hold the levers of economic power. Media too is bringing in awareness for market dynamics to finds prudent ways of mitigation of environmental concerns through internalisation of environmental costs.

The research topics that are in agenda of ZerO2Nature include the following:

1. Waste to resources : Key technologies : development of diseconomy projects - green field, brownfield, in-situ modifications and non-asset based avenues.
2. Industrial Processes : Assessment of Water Balance, Gas Balance, Material Balance, Energy Balance and its impacts on the Biodiversity / ecological systems.
3. Clustering of industries based on output - analysis and possible methodologies.
4. Energy efficiency avenues
5. Regional optimisation and assessment for alternative approaches to the national development.

For example ZerO2Nature research initiatives can leads to mushroom cultivation on beer brewery waste, pig farming by using spent mushroom beds, methane gas production from pig waste digestion, waste heat recovery from the hot gases going to the chimneys and using it for air-conditioning of control rooms in metallurgical industries, optimising the flaring of gases in oil & gas and other industries and many more.

The metallurgical industries; iron & steel in particular has been at the backbone of industrialisation process. Per capita steel consumption has be an important index of socio - economic development and living standard. Steel has been the most recycled commodity thus could be regarded as envi-

ronmental friendly as finished product. But for one ton of steel making about 2.7 ton of input material mainly iron ore, coking coal, flux gets through conversion process. The entire process has multi-disciplinary engineering involvement, generates large pollution of CO, SO₂, NO_x, CO₂ and dust particulates goes in the air, almost 3 cum of waste water containing pollutants, suspended solids, oil, ammoniacal nitrogen, phenols, cyanides going into liquid discharges and over 400 kgs. of slag plus dust, sludges, rolling mills scales, refractory and other solid wastes come out of the iron & steel making process. During the preceding five decades the steel production has crossed the 1000 million ton / year production levels thus pushing in huge amounts of pollution in air, water and solid waste through the conversions process of about 2700 million tons / year of inputs going into the iron & steel making. There have been remarkable developments in the technologies / process options for enrichment of input raw materials and solid waste management, up gradation of drives and controls for improving the operational process, energy efficiency, harnessing of waste heat from the by-product gases and optimisation of power consumption. From the project promoters perspectives; iron & steel sector has been highly effected by the environmental concerns thereby causing its closures, relocations and turning into ailing sector for the banking institutions. The steel industry emitting about 5% of the World's CO₂ emissions, contributes to about 27% of total industrial emissions with uneven performances per region & countries and between the plants within countries. Nine countries & regions ; namely China, Russia, India, Ukraine, The EU, The United States, Japan, Brazil and South Korea dominate the world steel production.

For industrial sectors of such large magnitudes there are research institutions available to the project promoters to get the suitable technologies that optimises the following:

- Water Balance
- Gas Balance
- Material Balance
- Energy Balance
- Biodiversity / Ecological - distortion / restoration avenues

As we get along with concept of eco-sustainability; the major barrier that is encountered is internalisation of environmental costs. This varies for same project depending upon the project location, quality of inputs, competitiveness of human resources and the technology selection. Here comes the competence of the professionals to assess the environmental prudence and pursue the developmental projects. Currently there are many avenues open to have funding support for achieving the economic viability of the projects. These include CDM, Green Climate Funds, Joint Crediting Mechanisms, Emission Trading Systems, Multi-lateral funding institutions, Grant agencies, UN-FCCC channels for adaption and mitigation and many more. There is a visible trend amongst consumers to pay a bit higher for the green products as well. The key driver of all these is to have reduction in the GHG that is causing global warming. The key drivers in case of ZerO₂Nature are eco-sustainability and creating a framework that helps cleaning the planet.

The ZerO₂Nature platform is available for the project promoters to:

1. Take up energy efficiency & other in situ projects through intricate schemes and innovative solutions that goes beyond the core businesses with the aim of promoting eco-sustainability.
2. Have an institutional motivation through capacity building / mentoring of human resources to make an extra effort towards ZerO₂Nature concepts.
3. Find support for development of viable schemes on shared savings / performance linked models for extra revenue generation.
4. Get involved in the DTU Coins domain for sustaining / enhancing your business on ZerO₂Nature road map.
5. Be a part of humanity aspirations of life style evolution met by the dynamic treatment of technologies that view Nature naturally in maintaining the liveable environment for the countless generations to come.

The World truly shares a common fate through the voice to hopes, aspirations and vital needs beginning with ignorant, tolerant & most voiceless people in villages accounting close to one third of

World population. The human spirit, truly indomitable, gives us hope, confidence & compassion to make it happen. People's unswerving commitment & tireless leadership creates trustworthy institutions to sustain the needs of ever changing World around us. World has the practical knowledge, tools and means; the will & actions are to be steered. Welcome to cycle on the ZerO2Nature track to develop diseconomy projects, earn and trade DTU coins to enhance the profitability and / or achieve techno-economic viability of your projects and harness the fruits of epiconomy.

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