2017
ANNUAL
CONFERENCE

THE CLUB OF ROME | INDIAN NATIONAL ASSOCIATION

Towards a Resource Resilient India

Security of Natural Resources for All

The Critical Need for Coherence in Policies and Action

A Report to The Club of Rome

Indian National Association


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Foreword

The focus of the Annual Conference of the Indian National Association for the Club of Rome was "Towards a Resource Resilient India: Security of Natural Resources for All - The Critical Need for Coherence in Policies and Action". Understanding the interdependence of Food-Water-Land and Energy is essential to plan for both present and future populations within the ethical, ecological, societal and economic criteria.

The Club of Rome in India evaluated the critical elements of the new security agenda that include Food and Nutritional Security (2014), Water Security (2015) and Forests, Land and Soil security (2016). Then last year we reflected upon the security of energy, natural resources and green economy that encompasses resource security, resource inclusivity (access), resource use impact and a way forward for resource efficiency. This has led to a greater understanding of coherence in such policies, guiding us towards recommendations for change in policy directives.

Existing environment-based policies have remained dormant in real practice and, therefore, it is crucial we persuade agencies, institutions and the establishment to recognise the significance of fresh and healthy food, water, forests, land and air for all and materials security, now and in the future.

The primary need now, is to bring on board enough representatives from the government – that includes both the concerned ministries and the elected representatives - for endorsing and advocating energy and resource efficiency policies. We hope to capture their attention and engage them in the new security agenda with the help of recommendations from the conferences.

We were privileged to hear valuable propositions from some of the most outstanding people having policy expertise and practical experience on these crucial themes. We are confident that the purpose of Conference 2017 to explore the various facets of "Towards a Resource Resilient India", particularly in the context of equitable access to renewable resources, over consumption and rapid use of non-renewable resources, development of new materials and use of newer cleaner technologies has been reasonably addressed. Our aim now is to facilitate the crafting of a strategic roadmap that is required to make a resource resilient model for 'Make in India'.

Dr S. Ramadorai
Chairman, Club of Rome - India

Mr Ranjit Barthakur
Secretary General, Club of Rome - India

Message from the Trustee, Club of Rome

Dear Colleagues,

Transforming fundamental social and economic paradigms is both a challenge as well as an opportunity. With a population of 1.2 billion people and growing, accounting for 17 percent of the global population, living on only 2.4 percent of the world's surface, India faces deep impediments to achieving the kind of secure and sustainable access to the natural resources and its future generations need for the prosperity and wellbeing they legitimately aspire to.

Though not yet as widely recognised as other global threats we face such as climate change or species extinction, resource issues are now becoming increasingly visible through their impacts on economic production, trade, and environment – witness the growing scarcity and consequent price shocks constraining the use of energy, water and once abundant building materials such as sand.

These also have larger economic, social, political and environmental consequences, including particularly the burden borne disproportionately by the poor and vulnerable, both within and among nations.

India's extraction of primary raw materials increased by around 420% from 1970 to 2010. The country's consumption, at 5 billion tonnes, made it the third largest consumer after China and the United States, using about 7.2% of the resources extracted in the world. Till the 1970s-80s, biomass constituted the predominant share of resources consumed, but by 2010, the share of abiotic materials has climbed to nearly 50%. Despite high aggregate consumption levels, per capita consumption in India remains lower than the world average.

Our concerns regarding natural resources, then, are:

(i) How can the economy get the maximum benefit for all citizens from the Earth's resource endowments? and

(ii) What technology, economic and lifestyles choices would enable us to maximise human wellbeing and minimise ecological damage?

India now needs to pursue a "circular economy" path based on efficiency, greater use of renewable and secondary resources and waste minimisation (the 3Rs – reduce, reuse, recycle) – and of course, sufficiency. The 2017 Annual Conference was therefore titled "Towards a Resource Resilient India", to explore how Government's policies, Industry's practices and Consumers' behaviour can lead to a more resource secure national future.

Ashok Khosla
Chairman, Development Alternatives
Trustee, Club of Rome - India

Acknowledgment

The Annual Conference of the Indian National Association for the Club of Rome on 'Towards a Resource Resilient India' conducted on 16-17 Nov 2018 achieved its stated objectives. The deliberations over two days addressed issues related to resource security and inclusivity, technological prescriptive for exploiting secondary raw materials for transitioning towards a circular economy. It also highlighted policy gaps and increased awareness in the younger generation. The success was due to the galaxy of luminaries that took out time to be with us to share their valuable inputs and the unstinted support of associated leading policy Think Tanks, Corporates, Institutions and NGOs.

On behalf of the Governing Body of the Association may I place on record our gratitude to each and every one of them for their contribution and we shall continue to seek their support in our future endeavours. We thank Vice Admiral, Girish Luthra, PVSM, AVSM, VSM, ADC- Flag Officer Commanding-in- Chief, Western Naval Command, Indian Navy, for accepting to be the Chief Guest and for a thought-provoking opening address. We are indebted to Mr. Ashish Chauhan, Managing Director, CEO, Bombay Stock Exchange and his team for the venue and support rendered for the smooth conduct of the conference. We are also thankful to the thematic experts and communication staff from Development Alternatives, the Balipara Foundation, EU-REI, Tata Institute of Social Sciences and other academic institutions for their strong support at the conference. The contribution of Globally Managed Services India Pvt. Ltd. (GMS), Eco Ventures Pvt. Ltd. (EVPL) and Ardek Consultants is greatly appreciated. The effort of Ms. Indira Mansingh in composing and editing the conference report is highly appreciated. The members and the staff of the Club of Rome, namely, Vishal and Surabhi, were undoubtedly the backbone of the conference.

The Club of Rome acknowledges the prominent contribution of our sponsors, namely, The European Union, EU-REI, ONGC, Tata Steel, Tata Consultancy Services, Government of West Bengal [West Bengal Accelerated Development of Minor Irrigation Project (WBADMIP)], Tata Chemicals and Hindustan Unilever Limited. They not only supported the conference but also shared their weighted industry perspectives for enhancing the recommendations of the conference.

The Club acknowledges the contribution of Mr Baldev Raj, Director, National Institute of Advanced Studies, Bengaluru who played an important part in promoting energy alternatives and sadly passed away in January 2018.

I am confident that the deliberations and recommendations of the conference will in a humble way contribute towards a resource efficient India.

Lt Gen Arun K Sahni PVSM, UYSM, SM, VSM
Former General Officer Commanding in Chief, Indian Army and
Director General, Indian National Association for the Club of Rome

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Section 1
Executive Summary

Few today would argue that the social and economic paradigms underlying our current development policies and practice have resulted in rather gross mismanagement of natural resources across the globe. Unsustainable levels of resource use and waste generation have already led to humanity exceeding four of the nine planetary boundaries, bringing much of the global life support systems to critically dangerous levels. The evidence of possible runaway climate change, accelerating mass extinction of plant and animal species, the growing scarcity of resources as wide ranging as water, phosphates and sand and the acidification of oceans and the consequent bleaching of corals are all early indicators of serious imbalance between humans and nature. The life support systems of our planet are in trouble.

Sustainable Consumption and Production was identified as a stand-alone goal (SDG 12) and as a central component of many of goals and targets adopted by the UN. Member states of the UN have called for urgent action through many multilateral environmental agreements, including the Climate Accord, Convention on Biological Diversity (CBD) commitments and the Sustainable Development Goals (SDGs) framework to address these concerns.

The World Economic Forum now defines the Circular Economy as a new *industrial system* that is restorative or regenerative by design; replaces the concept of end-of-life with restoration; is sustained by renewable energy; eliminates the use of toxic chemicals; and designs out waste through the improved design of materials, product systems and business models (World Economic Forum, 2014).

The Government of India has also recently moved a step forward towards this agenda. On November 30, 2017, NITI Aayog released the Strategy on Resource Efficiency in collaboration with the European Union Delegation to India. This strategy document is the first policy document to emphasise resource productivity in the country. However, even in the presence of such an exhaustive document public consultations are still needed for a plan of action - core and medium term - and for its implementation. The Indian National Association for the Club of Rome (CoR) has contributed to the strategy and the agenda.

With a deep concern for biotic and abiotic resources of India and issues of sustainable growth on a global scale - its search for ecological solutions aimed at human wellbeing, for all, the CoR provides a platform for those who share these concerns and to help identify development strategies that are best suited to the demography, aspirations and resource endowments of India. Since 2014 onwards, the Club has had a series of Annual Conferences; to examine and analyse how India manages its key resources and the related issues of policy coherence.

The world's economy has certainly grown considerably over the past couple of centuries – at rates unprecedented in history – and this growth has brought greatly increased prosperity and human wellbeing. But a large part of this achievement has been at the cost of highly intensive and often inefficient use of resources. Given the stresses now becoming visible on our resource base, it is becoming imperative that we reorient our development models to create more with less, delivering greater value with less input, using resources in a sustainable way and, minimising their impact on the environment. Thus greater coherence and rationalisation of the policies and practices governments businesses becomes essential meeting the challenges we face in protecting the health and productivity of our natural resources and ecosystem.

The thematic focus of the 4th Annual Conference was, therefore, on transitioning "Towards a Resource Resilient India - Security of Natural Resources for All: The Critical Need for Coherence in Policies and Action". The conference was held at the Bombay Stock Exchange (BSE), Mumbai from November 16th - 17th, 2017, with the participation of distinguished experts from various fields as an insightful multi-stakeholder dialogue.

The conference recognised that the country needs to move beyond GDP and growth as the primary indicator of progress. Urgent attention must also be given to joblessness, community vulnerability, resource depletion and environmental destruction. The two themes that emerged from the conference deliberations after intense debates were *Resource Security* and *Inclusivity*. The conclusion was that a strategic understanding of critical mineral, food, water and land resources was a key factor in managing resource productivity if the country was to have resource security in the long run. Diversification was seen to be a major strategy for the economy to avoid the negative consequences of volatility so often observed in resource prices. Equitable access to resources ("resource inclusivity") was just as necessary to ensure the ability of citizens to create livelihoods and to reduce the vulnerability of the poor as well as women, children and the elderly.

The Club of Rome conference determined that Resource Efficiency and Sufficiency can be attained by using the limited natural capital in a sustainable manner while minimising impacts on the environment, thereby creating more with less and delivering greater value. It also called for changing consumption values and practices and adopting new lifestyles that are less energy and resource intensive. Finally, it highlighted the importance of the first three R's, 'refuse, reduce and reuse' as a first step to rational resource management, to be supplemented by innovations that lead to the remaining R's, such as 'recycling, refurbishing and remanufacturing". Thus, balancing availability of natural resources with demand for them was the challenge and the policy requirements for achieving this were spelt out.

The conference was designed to address the following issues and provide recommendations that could support new policies and achieve greater congruence in implementing those policies:

- The Fundamental Role of Resources in the Economy
- Materials Security for Efficient "Make in India"
- Energy Security for All
- Equitable access to India's Natural Resources - Water and Terrestrial Ecosystem for All
- Price Volatility of Resources - a challenge: Towards Minimising and Mitigating the Price Volatility of Essential Commodities
- Importance of Natural Resource Efficiency in Corporate Education and Curriculum
- Circular Economy and Material Recycling (Secondary Raw Material Use) – Business's Responsibility Towards Material Security

The discourse over two days led to the following findings and analysis suggesting a new approach to address scarcity of virgin resources and significantly minimise waste generation.

There was consensus on a need for a holistic lens of security, inclusivity, efficiency and sufficiency while looking at resources; ensuring economic and social benefits and livelihoods for all, along with material resource efficiency; developing the Rural Futures concept for ensuring equitable distribution of

resources and by creating livelihood opportunities in rural areas; redefining waste as a leading resource and a secondary raw material; considering natural capital as a "trust fund"; encouraging private sector to practice stewardship, adding value to resource efficiency; performance of a company to be reviewed from both economic output and ecological footprint; encouraging industrial symbiosis and synergy; and, finally, in general and business education programmes, to promote development of systems thinking skills, which help create relevant and where needed, disruptive solutions.

Recommendations

Resource Security - Efficiency and Sufficiency

- Urgent need to go from the traditional linear economic model of Take, Make, Use and Dispose to alternative models like the Circular Economy, which are designed to aim for zero emissions and zero waste
- The circular economy while being 'restorative and regenerative' must follow systems thinking in terms of connectivity, relationships and the environment
- It is essential that innovation and policies create methods to convert waste into a value adding resource and a secondary raw material
- The design of products that use waste and reduce energy consumption needs to be complemented by product design to minimize waste and maximize recyclability
- Disruptive technologies such as Factor Five technologies have to be encouraged to reduce current resource consumption pattern to at least 1/5th
- Attention to resource productivity provides opportunities for business, particularly MSMEs, to practice stewardship, adding value to resource efficiency
- Financial balance sheets of corporations should be supplemented by natural capital balance sheets
- The new world of design with zero waste and manufacture of products from waste calls for new skills with the corollary of new livelihoods
- Collaboration with informal sector to be stepped up as resources should be looked at through the lens of security, inclusivity, efficiency and sufficiency along with profit
- Material resource efficiency has to go hand in hand with economic and social benefits and livelihoods for all must be guaranteed
- The *Rural Futures Framework* ensures equitable distribution of resources and creation of livelihood opportunities in rural areas and should be developed and scaled up
- Youth must be part of this movement for securing their future and co-opting them is possible by inculcating a reflex hunger for knowledge and a desire to make a difference in the environment.
- Educating the young in systems thinking and processes in waste management is a priority and job streams for young professionals designed for the environment

Policy Perspectives and Suggested Action by Government for:

Sustainability

- Introduce a Policy framework promoting use of waste as secondary resource material
- Ensure that Policies promote sustainable development, not just economic growth
- Redesign indicators of growth from GDP to SDGs and SDG plus
- Create a favourable policy environment wherein technology, economic and capacity concerns are dealt with to motivate use of innovative and sustainable materials
- Develop national level inventory of resources used in the country across sectors and value-chains
- Build capacity to promote corporate and academic responsiveness to sustainability issues
- Push resource efficiency as a part of the college and business curricula
- Establish GPP (Green Public Procurement Policies)
- Policy support for greening the ocean economy and reducing marine pollution

Energy

- Programmes promoting shared economy – for example, develop and execute and encourage use of mass transit systems
- Government initiatives for inspiring hybrid solutions for renewable and non-renewables
- Policy to provide space and opportunity for private sector in energy
- Commercial mechanisms for purchase of renewable power and financing of energy storage to be put in place
- Fiscal incentives to be provided for business to takeover energy based projects
- Policy recommendations for the Photo Voltaic and Storage Technology Missions

Urban Local Bodies

- Build capacity of ULB (Urban Local Bodies) to establish and implement green public procurement policies
- Green dimension to be included in all aspects of governance frameworks for ULBs
- Urban local bodies to employ environmental engineers

Business

- Government to initiate long term strategic planning and investment in consultation and coordination with private sector
- Multi-level governance that includes partnerships for product design, manufacturing and capacity building for green entrepreneurs to be practised
- Extended Producer Responsibility (EPR) – for product design, consumption and thereafter to be established
- Promotion of dialogue encouraging resource mapping and innovators workshops
- Support for Construction & Demolition (C&D) waste use as part of the circular economy

All these recommendations clearly make a case for an alternative consumption and production model, i.e. the circular economy model. Resource Efficiency and Circular Economy are important goals and central principles for achieving sustainable development. However, with respect to the already emerging technological advancements in manufacturing, India could risk falling behind its global counterparts. The circular economy is a simple yet powerful lens for designing development strategies. It questions the soundness and practicality of the business-as-usual approach, exposing how waste lies at the core of the conventional business model; not merely wasted resources or rubbish, but underutilised assets and short product lifecycles. While many leading advocates are excited about the potential of the circular economy approach, emerging economies and developing countries must position this opportunity within the broader principle of sustainable development, in particular the issues of equity and inclusiveness.

Encouragingly, the next generation of Industry, green and social entrepreneurs are beginning to emerge in Indian industry. Moreover, they are offering progressive new business models that arguably foster inclusive growth. However, this new breed of innovators needs continuous support for a while at-least with respect to finance, technology, market and capacity building in order to upscale their green business activity and to ensure employment generation in the country.

The Way Forward

India's level of engagement with the circular economy is nascent. It needs to develop a more coherent policy and strategy towards realising this approach. Additionally, policy-makers should be aware of how the circular economy can deliver new opportunities and models for economic growth. At the highest public policy level, Indian policy makers will need to give deeper consideration to this concept. It is currently not adequately seen as a fundamentally new industrial model, which could have implications far beyond promoting innovation and best practices in waste management and resource efficiency. Importantly, the development of policies and initiatives towards realising the circular economy must be positioned in the context of the principle of sustainable development to ensure that the human and community dimensions are not neglected.

While it is important for government to set the overall policy direction, innovation lies at the heart of this transition. Multi-level governance must be directed at fostering India's new breed of Industry; i.e. green entrepreneurs. Complementary measures should be directed at encouraging research collaboration between the private and public sectors, as well as academia. The international community has to play an important parallel role in supporting these initiatives. The NGO community and civil society sector has an significant complementary role in popularising circular economy discourse; changing existing consumer preferences from brand new to brand renewed; reminding them of India's cultural history in the circular economy which should be preserved; as well as spreading broad-based enthusiasm for the circular economy emerging as a digital revolution, which the consumer can be a part of.

Unless we urgently change course and adopt more sustainable development pathways, the long gestation periods for many resources to recover their productivity, the dead-end path we are currently on could become irreversible. The future of India, and the wellbeing and prosperity of our descendants depends critically on altering the direction and the principles of today's development trajectory.

Introduction

For more than four decades, the Club of Rome has been dealing with issues of sustainable growth on a global scale. The Indian National Association for the Club of Rome was established in 2011 to define a distinct Indian paradigm to address the most pressing concerns of India, and the world, such as food security, the challenge of water and the need to generate 'green jobs' and 'green skills'.

The Indian National Association for the Club of Rome has a deep concern for biotic and abiotic resources of India. Therefore, 2014 onwards, the Club has begun a five-year series of Annual Conferences; to examine and analyse the issues of policy coherence in how India manages its key resources. This series was designed to cover the following issues:

- 2014 - "Securing Food for All"
- 2015 - "Securing Water for All"
- 2016 - "Securing the Forests, Land and Soils for All"
- 2017 - "Securing Materials and Energy for All "

The thematic focus of the 4th Annual Conference was, therefore, on transitioning "Towards a Resource Resilient India - Security of Natural Resources for All: The Critical Need for Coherence in Policies and Action". The conference was held at the Bombay Stock Exchange (BSE), Mumbai from November 16th - 17th, 2017.

Natural resources are enormous blessings of our planet earth that organisms use for their survival. They can be either biotic (forests and wildlife) or abiotic (water, soil, air and minerals). However, these resources are spread unevenly, which creates pressure on nations. Previous patterns of the world's growth have brought increased prosperity, but through intensive and often inefficient use of resources. It is needed to create more with less, delivering greater value with less input, using resources in a sustainable way to minimising their impact on the environment. Therefore, the need for coherence and rationalisation of the policies of the state and central governments becomes critical in the context of challenges to natural resources, human resources and ecosystem protection. The conference was structured with the following sessions:

- The Fundamental Role of Resources in the Economy
- Materials Security for Efficient "Make in India"
- Energy Security for All
- Equitable access to India's Natural Resources - Water and Terrestrial Ecosystem for All
- Price Volatility of Resources- a challenge: Towards Minimising and Mitigating the Price Volatility of Essential Commodities
- Importance of Natural Resource Efficiency in Corporate Education and Curriculum
- Circular Economy and Material Recycling (Secondary Raw Material Use) – Business's Responsibility Towards Material Security

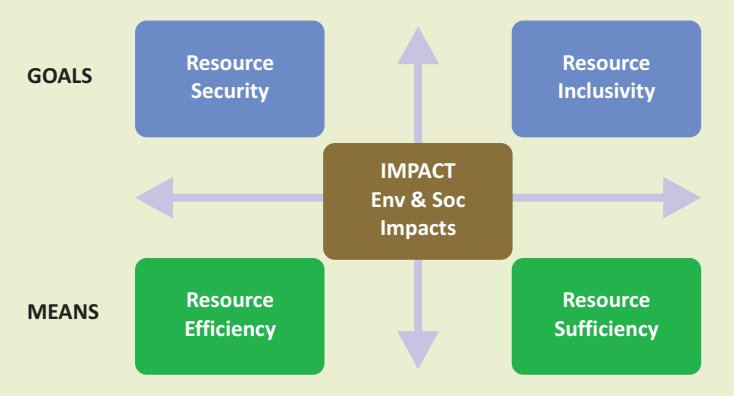
Context Paper for the Conference

Towards a Resource Resilient India

Security of Natural Resources for All: The Critical Need for Coherence in Policies and Actions

Natural Resources - Goals and Means - and Impacts

Over 4.5 billion years of evolution and sustenance, Nature has successfully provided its vast and abundant bounty of resources for a growing complexity of living organisms on our common planet. For the first time in that long history, over less than one century, one species – human beings – have created stresses and scarcities that threaten the survival, let along the wellbeing, of all those living organisms.



The human population is increasing rapidly and needs are also growing, demand of resources has increased drastically; eventually there is a great pressure on the existing finite resources and they are being over exploited. Structural changes in a society also lead to transformations in consumption patterns and lifestyles, which then impact resource consumption patterns.

Security of natural resources is embedded under four themes in the present context for countries like India - Resource Efficiency, Resource Inclusivity, Resource Security and Resource Use Impact.

Goal 1: Resource Security

All agricultural and manufacturing activities need natural resources, as do construction, transportation and day-to-day living and India's manufacturing sector is primarily natural resource-driven. Metals, chemicals, textiles and food contribute about 60 per cent of manufacturing. The Indian economy requires more materials per output than many other economies. To avoid the negative impacts of resource scarcity on India's economic future, considerable policy foresight is needed to ensure continuing security of minerals along with food, water, forest and biodiversity, land and soil.

Goal 2: Resource Inclusivity

Perversely, the worst development outcomes -- measured in poverty, inequality, and deprivation--are often found in those countries with the greatest natural resource endowments. Often, development that is heavily dependent on resources induces displacement and related loss of livelihoods, particularly among the poor. Women, children, the elderly and those vulnerable to natural disasters have less access to resources which increases their marginalisation.

Means 1: Resource Efficiency

Resource efficiency means using the Earth's limited resources in a sustainable manner while minimising

the impact on the environment. It allows us to create more with less and deliver greater value with lesser input. Its directly available tools are the Six R's (Reduce, Reuse, Recyle, Refurbish, Remanufacture and Refuse) and the most effective long term strategies are miniaturization, durability and sharing of physical products and assets.

Means 2: Resource Sufficiency

Resource sufficiency is achieved by simply adopting lifestyles and consumption patterns that are neither more nor less than what is needed for everyone to have a decent, healthy and prosperous life. While this is a necessity more among affluent societies, it applies to all whose basic needs are met.

Impact: Resource Use Impact

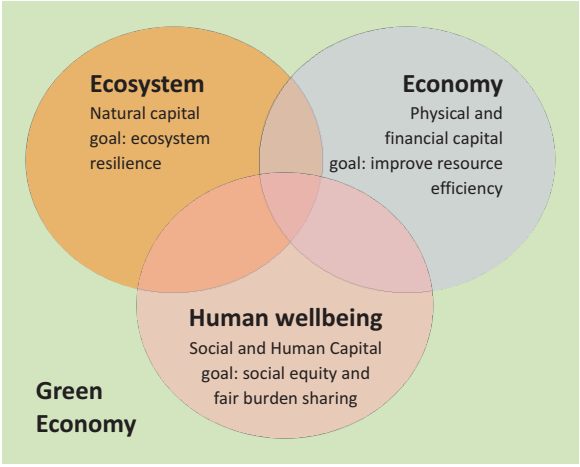
The positive impacts of resource use on society, environment and the economy have to be maximised and the negative ones must be reduced to the minimum.

The Debate Needed Today

The three different dimensions - ecological, economical and ethnological (i.e. social or cultural) - are associated with natural resources. If a natural resource is required to be used, its use must be physically possible, economically viable and culturally acceptable.

Economic benefits - Prosperity

A Resource Resilient approach has the potential to improve resource availability that is critical to the growth of industries, which translates into reduced price spikes because of supply constraints or disruptions. By using resources more efficiently, or by using secondary resources, industries can improve competitiveness and profitability, since material cost is typically the largest cost for the manufacturing sector.



Social benefits - Human Wellbeing

Reduced extraction pressures from adoption of Resource Resilient approaches have the potential to lessen conflict and displacement and improve human wellbeing. This can increase affordability and access to resources critical for removing poverty and raising human potential. A resource resilient approach has enormous potential for job creation, not only in the recycling sectors, but also high skilled jobs in innovative design and manufacturing.

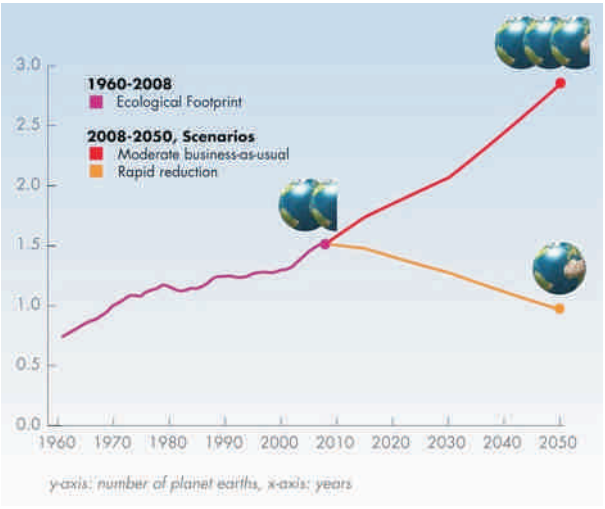
Ecosystems - Environmental Benefits

Lowering extraction pressures through Resource Resilient approaches helps in reducing ecological degradation and other risks, and leads to opportunities for landscape restoration and regeneration of degraded areas. Reduced contamination of water, air and soils can lead to healthier and more productive assets for agriculture, manufacturing and habitation.

Targets – Examples

1. Materials and Minerals: Optimise use of minerals, conserve and recycle materials in manufacturing and infrastructures, secure critical minerals, tackle challenges of fluctuating commodity markets and introduce efficient innovations in resource extraction, etc.

2. Water and Marine Resources: 'Fewer Drops for More Crops', prevent flooding and drought by fighting climate change, protect water qualiity, regulate use of surface water and groundwater, etc.



Source: Global Footprint Network

3. Croplands and Grazing Lands: Protect fertile land from diversion to other uses, remediate contaminated sites, redesign policies for land use, etc.

4. Soils: prevent soil damage, mitigate infrastructure impact, restore organic matter contents, avoid chemical pollution, etc.

5. Ecosystems and Biodiversity: Reduce acidification, avoid ecosystem damage and maintain biodiversity.

6. Energy: Regular and adequate supply of energy, less waste and losses of electricity, less energy losses, effective distribution network and SMART grids, minimise demand and supply gap of energy, effective asset management, etc.

7. Wastes: Reduce consumption, develop new materials, use newer cleaner technologies, use more abundant resources, reuse and recycle; promote circular economy, thinking beyond 'take, make, dispose,' and design an economy that restores and regenerates.

Towards a Resource Resilient India - The Critical Need for Coherence in Policies and Actions

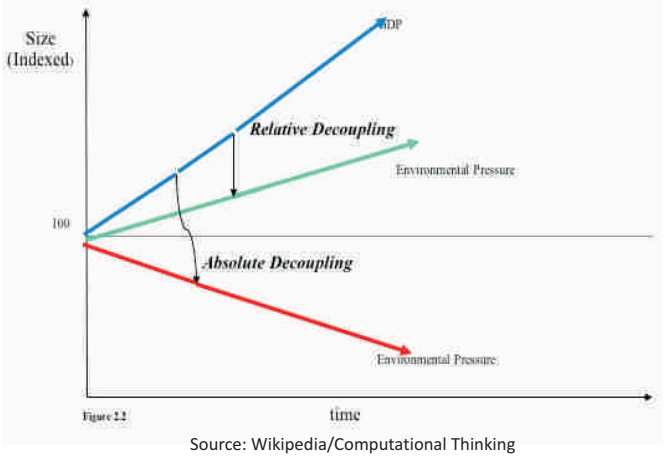
THE OBSTACLES: OBJECTIVES TOO NARROW, TIME HORIZONS TOO SHORT

With today's production systems – industrial, agricultural, extractive or service-based - there are very large opportunities for raising efficiency. From simple housekeeping or technological measures to logistical and systemic ones, great increases in efficiency can be won at very little marginal cost and even

improved overall economic performance to enable producers and consumers to get much more with much less. Resource efficiency is thus a "good", delivering "triple win" outcomes for the economy and for society and the environment. Given the general convergence of self-interest and the broad area of common purpose among participants in international negotiations, the push for efficiency is a "low hanging fruit" to be pursued.

The need for sufficiency ("raising the floor", "at least enough for survival") at the lower end of the economy (where the poor and marginalised live) is self-evident for any society that aims at being socially just. The need for sufficiency ("lowering the ceiling", "enough is enough") at the upper end of the economy may be less self-comfortable for those in the wealthier social strata, but needs to be recognised – as was already clear to Mahatma Gandhi many decades ago - as a logical consequence of a finite natural resource base and planetary boundaries.

The Global South typically wants relative decoupling, and the North should aim at absolute decoupling



Source: Wikipedia/Computational Thinking

Policy makers who wish to deal with these difficult choices are confronted by factors that further obfuscate their decisions: growing complexity, rapid change and significant uncertainty in the system – political, social, economic or technological – that they must deal with daily. Often the short-term takes inordinate precedence over longer time horizons (which are themselves shortening by the day).

Adopting leaded petrol for automobile efficiency, Freons (CFCs) for air conditioners and foams, DDT for malaria control were all well-intentioned policies, which led to unintended consequences that were so negative that use of these 'miracle' substances is no longer permissible. The promise of plastics has led to the mass murder of marine life and widespread deterioration of terrestrial ecosystems, making it another material headed for oblivion. The convenience of fossil fuel use has led to the ultimate threat to life on Earth - Global Warming.

The introduction of the 'Green Revolution' in the mid-1960s enabled Punjab and other states in India to literally save the nation from starvation, but within 50 years, it has left these states with poisoned soils and water bodies, loss of soil fertility and declining crop productivity, explosion of cancer and other diseases, rampant unemployment and drug use and a general breakdown of social systems.

Every day, we see the conflict between different sets of otherwise desirable social objectives where policies designed to solve immediate problems end up creating bigger problems later. Free electricity for farmers leading to over-irrigation and unnecessary contamination of aquifers; building of ill-planned overpasses leading to even greater traffic congestion; promotion of biofuels leading to competition with food crops, irrigation water and forests – these are all common examples of counter-intuitive and countervailing impacts of well-intentioned but narrowly conceived decisions.

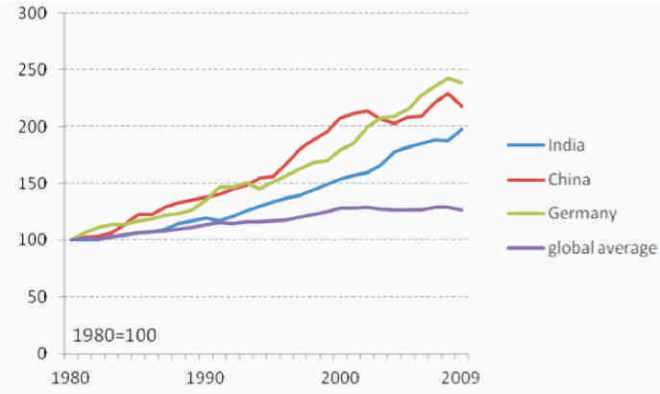
REDEFINING PROGRESS: BEYOND GDP AND GROWTH

Despite several decades of advocacy for alternative economic models, global and most national economies are still ruled by a virtual total reliance on the paradigms of GDP and economic growth. All

measurement, analysis, tracking and subsequent communication is based on the flawed and highly limited index of gross production and the bulk of subsequent policy formulation is aimed at how to accelerate its growth.

Under these circumstances, it is no wonder that even fundamental issues such as growth of joblessness, resource depletion, environmental destruction or community vulnerability hardly figure in national policies.

Domestic Material Consumption (DMC) Per Unit GDP



Source: Wikipedia/Computational Thinking

Policies to promote GDP growth tend automatically to focus the minds of policy makers on increasing investments and providing incentives to industry, urban and other infrastructure, mining and resource extraction – implicitly promoting increased resource use and producing more waste and pollution i.e. encouraging more of the 'bads' that actually need to be reduced.

Globalisation in the sense of international economic integration has brought with it many goods and bads of its own. Growing trade, transfer of technology, movement of skilled professionals and the exchange of knowledge have all contributed to improving the lives of people in many countries. At the same time, rising inequity, lopsided accumulation of wealth and the concentration of economic and political power that comes with it, has now started to limit how much integration will be tolerated, either by the poor or the rich.

Mechanisation and digitalisation, including robotics, artificial intelligence while delivering great improvements in lives and opportunities are now threatening jobs, making it necessary to question the future of work and accelerating the need for alternative sources of taxation.

The major guzzlers of material resources are construction, infrastructure, transportation, industry and energy production. Together, these account for the bulk of the major raw materials used in the economy: steel, cement, aluminium, copper, sand, clay, etc. Agriculture is a major consumer of fresh water, energy, phosphorous, and other minerals. It has now become apparent that the goods and services provided by these sectors could with improved technologies and logistical systems, be provided with far lower inputs than they do at present, thus resulting in far less geophysical damage and also producing much fewer wastes and pollution. The cumulative impact of doing so on maintaining biodiversity is a huge additional bonus.

Thus, while GDP and other conventional indicators of economic progress will no doubt continue to be important inputs for decision-making, we now also need to incorporate measures of other social and environmental outcomes of economic activities to obtain a better understanding of what is the degree of genuine human progress. This, science, often termed 'full-cost accounting' is still in its infancy and needs to be rapidly advanced if costly, possibly irreversible changes in the biosphere that sustains us are to be avoided.

CURE OR PREVENTION?

Despite received wisdom, we continue to think of implementing end-of-pipe solutions rather than mitigating causal factors.

Systems thinking provides policy makers the framework and a toolkit to understand seemingly disconnected effects of actions; and why for example, solutions in the short term (such as focusing only on cash crops) in later years exacerbate the very problems (farmers' financial security) they were designed to solve. We urgently need to strengthen our nation's ability to build the skills of our policy makers, planners and programme implementation personnel. In summary,

- Deep linkages exist across sectors, geographies, social and institutional systems.
- Ignoring these inter-linkages leads to outcomes that diminish the value of development interventions.
- Frameworks for policies, laws and regulations and implementation processes must be designed to generate synergies among these components, minimise trade-offs and reinforce sustainability.
- A systems view is essential for promoting resource and energy efficiencies, healthy local economies and equitable and fulfilled societies over the long term.
- To achieve this, requires a paradigm shift in mental maps of our development planners and implementers, which needs Systems Thinking Skills Systems Modelling Ability.

The new paradigm thinking that is based on Systems Thinking for Sustainable Development compels users to seek direct-indirect, spatial, temporal, sectoral and hierarchical linkages in policy strategies and solutions. It widens perspectives and induces decision makers to look critically at the indicators of development beyond the traditional economic and growth measures of GDP. These are the areas that the Development Alternatives Group and the Club of Rome seek to explore and implement.

Q1: What are examples of major policy conflicts, policy requirements relating to Material Resources, within these sectors and in other sectors that impact these resources?

Q2: What structural changes are needed in governance to ensure that policies in different sectors and domains that effect Material and Natural Resources are coherent, convergent and mutually reinforcing?

Q3: What are the knowledge gaps or other barriers that prevent rational policy formulation for these resources?

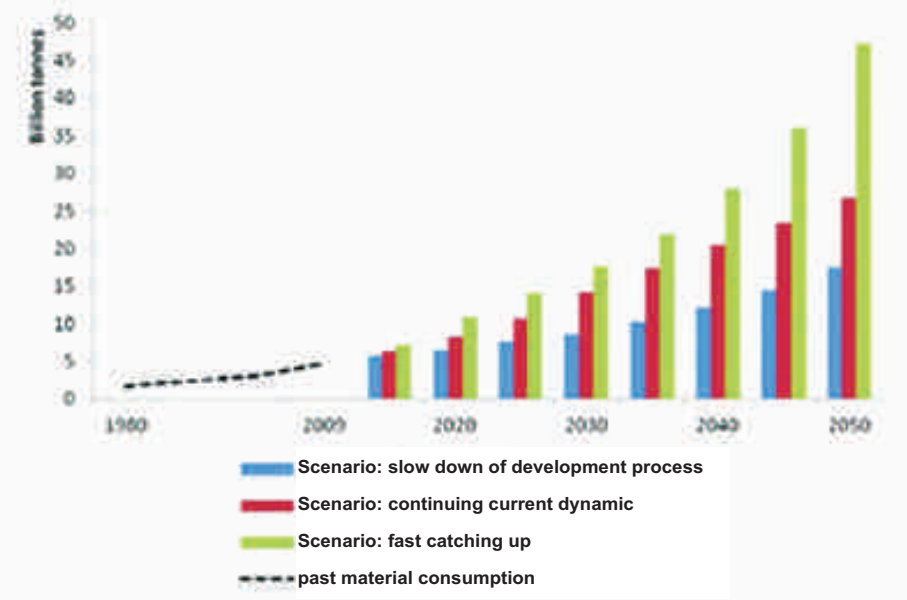
Plenary 1 Issue: Materials Security for Efficient Make in India

India is on a path of 'Make in India' with a focus on 25 sectors, most of which directly use natural resources as raw materials.

India's population and economy, which are both among the largest and most rapidly growing in the world, require large amounts of material resources. Although the per capita use of resources is very low, the nation's aggregate of 5 billion tonnes per year is already straining their availability for essential development needs. For its own future and as a leader and role model for other developing countries, India needs urgently to become more resource efficient and thus resource resilient.

Earth's capacity to continue to provide resources for human population in the immediate and more distant future is of critical importance. This was recognised more than 50 years ago in the ground-breaking report 'Scarcity and Growth, from Resources for the Future' (Barnett and Morse, 1965[1]). The report concluded that innovation and technology had largely stabilised or reduced the costs of

resources, but that environmental endowments were not as amenable to such innovation. It warned that environmental scarcity would ensue if the environmental market externalities were not efficiently internalised.



India's Past Material Demand and Future Material Consumption (IGEP, 2013)

The extraction of both biomass and fossil fuels has doubled, while the extraction of metal ores has tripled and the extraction of non-metal minerals has nearly quadrupled during the period. Since countries of Asia are growing very fast, the extraction of primary materials is more than quintupled within the 40 years.

No doubt India is rich in natural resources but its rate of consumption of these is a major cause for concern for future resource security..

While extraction of biotic materials increased only by a factor of 2.4, the extraction of abiotic materials, particularly of non-metallic minerals, showed a remarkable increase, primarily for the construction, infrastructure and transport sectors.

Compared to extraction, India's exports and imports are still small in terms of quantity. However, both have grown significantly. Exports continue to be dominated by metal ores, particularly iron and steel; while imports are dominated by energy-carriers, particularly petroleum and coal.

Therefore, there is a need to address the following questions:

Q1: What are the existing means and policies available to support materials security in India? Do these policies need changes or revision?

Q2: What policy changes are needed to ensure adequate material availability at least environmental cost to fulfil the aims of the 'Make in India' goals?

Q3: What changes in policies and corporate practice are needed to promote resource efficiency and use of secondary/renewable materials?

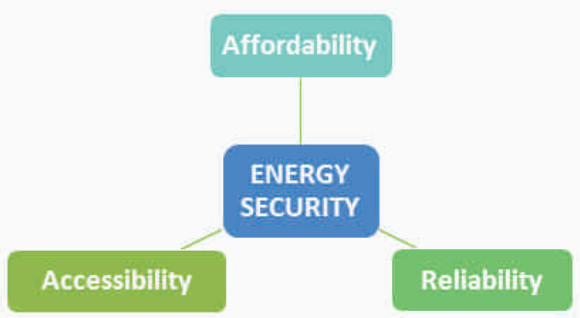
Q4: Can Corporate Sector, Government and Civil Society Organisations contribute jointly to solve the issues of material security in India at large?

Plenary 2 Issue: Energy Security for All

Often energy security is considered as the uninterrupted availability of energy sources at an affordable price. This covers all major aspects of affordability, accessibility and reliability at a National and Global context.

Energy security is deeply correlated to Economic Security. Equitable accessibility of energy at lower or affordable costs is essential for the economy to function properly. The world's economic growth is derived by the primary energy and final source of energy.

With limited petroleum and natural gas resources, India faces a major challenge to meet the energy needs of the nation without transgressing its commitments to carbon emission reduction. In 2015 India consumed 882 million tonnes of oil equivalent energy, out of which 290 million tonnes of oil equivalent energy were imported from other countries. Until it can generate sufficient energy from renewable sources such as the sun, wind and biomass, its energy security is highly dependent on external sources of energy.



India's power generation capacity is around 315 GW, well below that of China and USA. Around 69% of India's power comes from thermal (non-renewable) and 29% from renewable resources. The latent demand and supply is around 20 times the actual power generated in India.

The Government is committed to provide 24×7 reliable supply of electricity to all the citizens of the country in the next 5 years. In order to achieve this objective several targeted programmes have already been launched by the Government of India which include: (1) Deen Dayal Upadhyaya Gram Jyoti Yojana with an investment of US$ 7 billion, (2) Integrated Power Development Scheme that covers 5,000 towns with an investment of US$ 6 billion, (3) North Eastern Regional Power System Improvement Project (NERPSIP) with an investment of US$ 1 billion, (4) New RE Program with a target of 175 GW by 2022 and investment commitment of US$ 260 billion, (5) 100 Smart Cities and Rejuvenation of 500 towns where smart grids will provide clean and sustainable energy, (6) National Mission on Electric Mobility with a target of 6-7 lakh electric vehicles by 2022; and (7) National Smart Grid Mission (NSGM) that will take up development of smart grids on fast track in coordination with the above programmes.

Emerging Challenges in Power Sector

Power generation, transmission, distribution and consumption are linked to each other and this cycle must function properly. The current technical and institutional systems have not been able to deliver power of adequate quanitity and quality to the people, farmers, businesses and industries of the country. However, current policies and initiatives aim at improving the situation, and the Conference is invited to evaluate their potential contribution:

- Renewable energy and non-renewable energy
- Power Grids, Smart Grids and Policies
- Decentralised energy: Challenges and Possibilities
- Nuclear Energy

The conference would try to capture the following questions:

Q1: What roles do digitalisation, management information systems, and smart grid management have and what policies can enhance these?

Q2: What innovations or regulations can improve economic viability, reduce transmission loss, and enhance reliability at National or SMART Grids?

Q3: What structural changes such as business or community participation can help improve the economics and universality of energy networks?

Q4: What measures can promote spread of renewable energy, and can it cater to 100% of India's needs?

Q5: What suggestions could help improve:

a. Quality of power in the rural areas
b. Erratic and unreliable supply
c. The pump storage capacity
d. Nuclear Energy and nuclear waste

Plenary 3 Issue: Equitable Access to India's Natural Resources - Water and Terrestrial Ecosystems for All

Issues of lack of natural resources, such as, water, land, soils, and forests – and of lack of equitable access to these by all – are now becoming commonplace and are in some areas reaching dangerous levels. What was once the pride and unique wealth of India, its biotic and abiotic resources, are now suffering from massive degradation and loss.

Today India needs some 1.7 Indias to sustain itself, up from the 0.3 or so Indias it needed at the time of independence. The generous wealth endowed to us by Mother Nature, like a spendthrift's bank balance, is rapidly disappearing, as the gap between withdrawals and deposits keeps growing.

This session will review the recommendations of earlier Annual Conferences and current government actions and policies, and discuss how think tanks can support policymakers to evolve more pragmatic and easy to apply recommendations. Some of the issues to be covered are:

Climate Change and Water Security

- Impacts
- Adaptation
- Mitigation

- System Dynamics of Pollution, Exploitation and Encroachment of Rivers
  Global and National Politics for Coherence in Water Policy
- Counterintuitive Policies in Water Security
- Environment And Resources Issues In Water Security
- Creating Policy Successes in River Conservation and Water Security
- Best Practices in Water Management for a Water-Secure Future

This plenary session will address the questions such as the following, with a view to drawing out the synergies and trade-offs among the different concerns:

Q1: How effective are the existing policies and practices in maintaining the productivity and health of our water resources?

Q2: What are the major barriers and hurdles to enabling local communities to act as guardians of their local natural resources?

Q3: What is the current knowledge base on the minimum water flows, particularly in our rivers and streams, which is needed to maintain basic ecological services and what research is required to be conducted?

Q4: How can multi sector involvement and financial inclusion be encouraged so as to maintain natural resources and ensure equitable access for all?

Plenary 4 Issue: Price Volatility of Resources - An Economic and Geopolitical Challenge

The future commodity prices and availability of resources like minerals, water and land may often be similarly out of line with the future reality. Repeatedly, the focus of price volatility on energy and power sectors in policy domains is more prominent, as it has a direct impact on the consumer. However, the cost of resources is also equally important.

One of the greatest challenges facing humanity today is to maintain the healthy growth necessary to lift the world's one billion people out of absolute poverty and manage the natural resources required for the well-being of nine billion people by 2050 – all while keeping environmental impacts within acceptable limits and sustaining life's natural support system.

Improving the rate of resource productivity, doing more with less, faster than the economic growth rate is the notion behind decoupling, to the extent of actually using less resources.

The worldwide use of natural resources has accelerated, causing severe environmental damage and depletion of these resources.

Annual material extraction grew by a factor of eight through the twentieth century. At the same time, the use of resources, such as freshwater, land, sand and soil has transgressed sustainable levels.

This explosion in demand is set to accelerate as population growth and the increase in incomes continue to rise. More than 3 billion people are expected to enjoy "middle class" income levels in the next twenty years, compared to 1.8 billion today.

A global economy, based on the current consumption models, is not sustainable and carries significant economic consequences. Price volatility and supply shocks of resources have already been observed across a range of key materials and commodities. The volatility of food prices, for example, increased to 22.4 per cent in 2000-2012 compared to 7.7 per cent in the previous decade.

A high level of leadership is obviously needed in the public and private sectors to overcome the resistance that is commonly faced by such deep policy changes and to promote the needed policy action.

However, reducing investment uncertainty and political lock-in, and changing unhelpful public decision making structures, increasing innovation capacity, adjusting government pricing instruments to align market resource prices with decoupling and creating new and effective market structures are always helpful for mitigating the price volatility.

Indian policies are quite strengthened, which is why, in 2015, India was one of the fastest growing economies in the world. However it remains one of the few countries that have been able to overcome the challenges posed by the sluggish global economy. Sustaining such growth is a necessary, if not sufficient, condition to ensure that the living standards of hundreds of millions of people living in absolute poverty are improved.

This session will address the following questions:

Q1: What are the current trends in the central government and provincial government to cope up with price volatility and restricted availability of resources? What India is doing to control price volatility of resources?

Q2: How to ensure economic visible technology and mechanism to link with supply chains – internationally and nationally?

Q3: How can India be more self-reliant on material resources without destroying the land and fresh water resources?

Q4: What type of role private sector and government can play to strengthen each other?

Plenary 5 Issue: Education for Internalising Natural Resource Efficiency in Corporate Performance

Today's economic systems are complex, rapidly changing and vulnerable to external perturbations of many kinds, ranging from natural disasters to hostile trade-related actions to changing fashions.

Many businesses that were iconic five decades ago no longer exist. Many businesses that did not exist five decades ago are among the largest corporations today. Every decade, a completely new business model becomes the dominant paradigm, only to be replaced by another, often after an unexpected and sometimes catastrophic collapse of the market.

Appropriate skills, knowledge and attitudes are essential for conducting a successful business in the modern economy. And because of the fluidity of business requirements, the ability to let go of old skills and quickly learn new ones becomes more important for retaining jobs than ever before.

Moreover, single-minded focus on the bottom line (or even top line) is no longer acceptable, given the broader landscape of stakeholders that today's businesses have to operate in. Sustainability issues dictate that the least number of bottom lines a business must pay attention to now is three – financial, social and environmental.

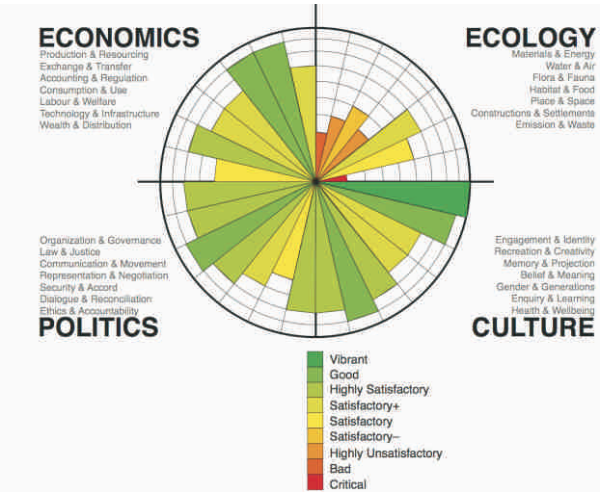
Fifty years ago, a professional with a freshly minted degree in a specific subject could spend an entire working life without any further need for study. Today, technology and markets are changing so rapidly that a professional may well change specialisations three or four times within his or her working life. In many cases, because of changing demand patterns, obsolescence, mechanisation or other reasons, jobs simply disappear and no new ones with similar skill requirements take their place.

But the need for specific skills for specific tasks is no longer the primary issue. A professional now needs to bring many other unfamiliar considerations into the domain of work: external market changes, environmental requirements, longer-term product impacts and other issues that are now becoming just as important as the basic engineering or management concerns.

The impacts of natural resource availability, price behavior and vulnerability of supply to external factors

beyond a resource user's control can be very large. The tightening of supply of rare earth minerals when China introduced export quotas led to a decade of disruptions in the computer hardware sector, a factor that can lead to significant economic losses. Business professionals needed to be very nimble in finding solutions that kept their companies operational and profitable.

As new environmental, economic and other vulnerabilities become apparent, quick adjustments of technology, processes, supply chains and markets will have to be introduced, sometimes very quickly and these need flexibility of thinking rather than the rigid mindsets nurtured by conventional MBA-type training.



Circles of Sustainability

Source: Wikipedia

The institutions for tomorrow's business needs do not exist at the moment and one of the most urgent needs of the economy is for curricula that "educate" professional to think systemically and holistically, directly in contradiction to the conventional, legacy educational systems based on rigid, compartmentalised disciplines and sectors.

The future will belong to those who master systems thinking and learn to apply it to generate a wide variety of business solutions:

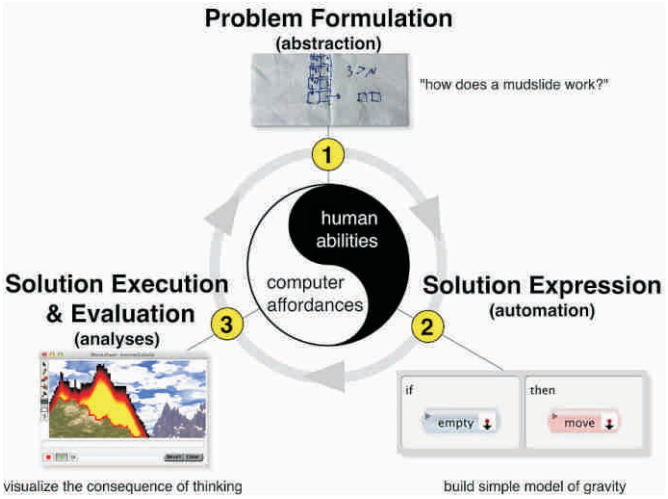
Q1: What changes are needed in the school, college and MBA curricula?

Q2. How can the Systems Dynamics learning be made available at all levels of education?

Q3: What incentives can be given to MBA programmes to include the issues of sustainability and ethical business?

Plenary 6 Issue: Circular Economy and Material Recycle - Business Scope for the Use of Secondary Raw Materials in India

An enormous quantity of waste is generated by industrial activity, right from extraction of raw materials till the end product disposal stage. Once the waste is produced, money, manpower and additional materials must be spent to manage it. The best and least expensive means of waste management is to reduce the amount generated at the source itself. However, low awareness among communities on the depletion of resources



Source: Wikipedia

due to waste and lack of appropriate infrastructure for managing end of life of complex products are the main causes of high waste of resources in India. To deal with this issue the economy needs to focus on recycling and reusing of waste material, using them as secondary raw material and converting them into productive or usable material. Recycling and reuse, is the process of removing a substance from a waste and returning it to productive use. However, identification, prevention of waste, its reuse and safe disposal, etc. are required to maintain natural resource efficiency.

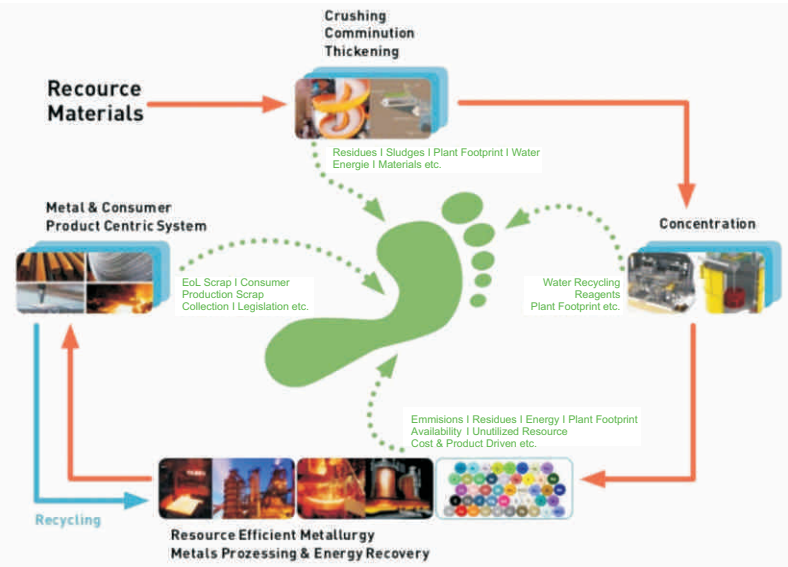
The increasing demand for metals in the course of the last century, putting permanent pressure on natural resources, has revealed that metals are a priority area for decoupling economic growth from resource use and environmental degradation. Recycling the waste is more resourceful and cost-efficient than just throwing away the resources and starting all over again. A considerable quantity of iron and copper, is now embodied in products and structures that one of the least costly way to extract these resources is from “urban mining”.

The imperative of decoupling will become even more pressing in the future with a global demand for metals on the rise. As a result of rapid industrialisation in developing countries and in developed countries due to modern, metal intensive technologies that are crucial especially for the transformation towards green technologies. Ensuring appropriate levels of supply while reducing the negative environmental footprints will therefore be essential on our way towards a global green economy.

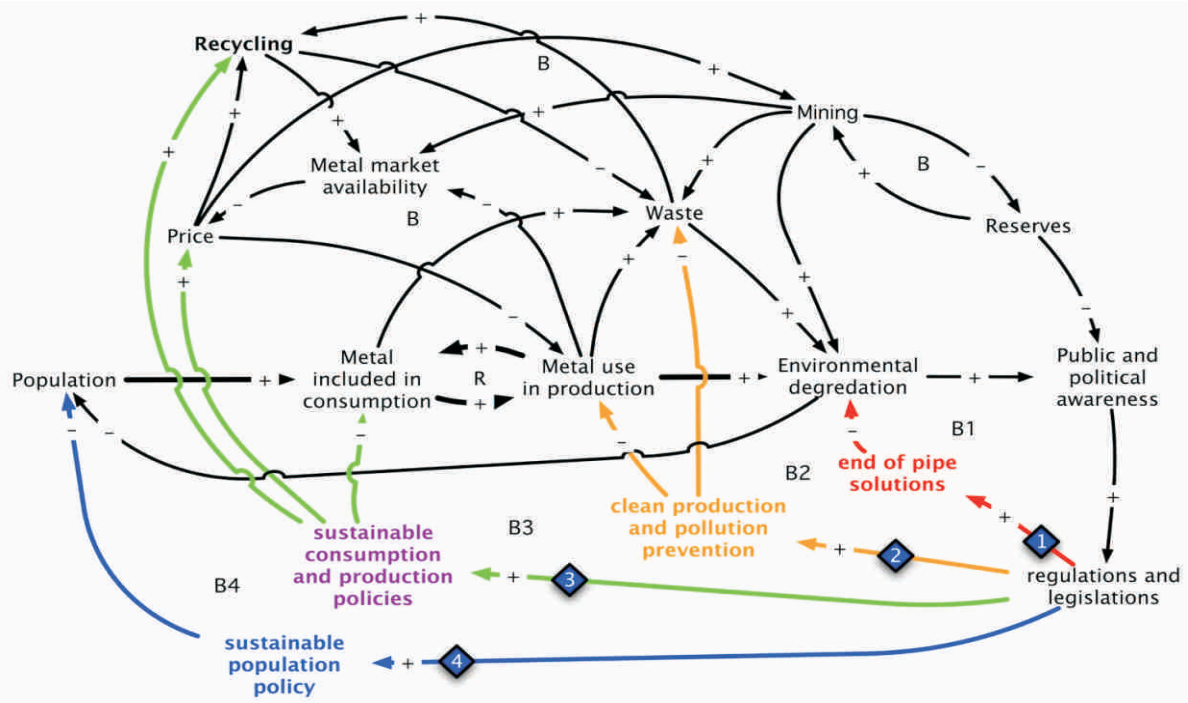
In this regard, recycling and thus resource efficiency plays a crucial role, as it decreases the necessity to fulfil the demand by exploiting our natural resources further. The basic assumption of recycling is that the value of the recovered (and other materials) has to pay for all collection, dismantling, sorting and other recycling activities. The economics of such recycling is based on estimating the true value of recyclables from the best recovery of refined metals, alloys and compounds.

Using secondary resources temporarily locked up in so-called “urban mines” decreases not only the environmental impacts associated with mining, but also decreases the release of – partly toxic – wastes into the environment. Taking into account that most modern technologies rely on ‘critical’ elements, which are not abundant in nature, it is of crucial importance to preserve and reuse them as much as possible.

India produces over 1000 million tonnes of solid waste from agriculture, mining, industrial and domestic activities. Some of these waste are hazardous and have the potential to harm human beings or other organisms because of their toxic, corrosive, flammable, explosive, reactive, or pathological nature and ultimately create a harmful effect on environment and ecology. However, much of the waste produced can be transformed into a secondary resource by recycling and reusing such solid waste again in industry.



Source: UNEP Report on Metal Recycling – Opportunities, Limits, Infrastructure -2013



Source: UNEP

Government policy can have a very significant impact on increasing recycling. It can:

- Influence the economics of any part of the recycling chain, changing the economic viability of the whole chain or of any part of it.
- Provide the incentives and means for stakeholders in the recycling chain to exchange information and cooperate to increase recycling.
- Act as a stakeholder in the chain – public organisations (often local authorities) are frequently part of the recycling industry – providing waste-collection services and recycling or disposal infrastructure.
- Set framework conditions that enhance quality of recycling, such as setting certified standards.

India needs effective secondary raw material policy to promote effective waste management. Therefore, this plenary session will address the following questions:

Q1: How can national self-sufficiency in raw material resources be achieved? Renewables? Secondary raw materials?

Q2: What are the possibilities of adopting renewables and secondary raw materials?

Q3: How can innovations in extraction and use of secondary raw materials be effectively encouraged?

Q4: How much can infrastructure and construction convert to wastes from demolition, mining or industry into useful resources?

Highlights of the Conference

Day I: Inaugural Session: Setting the Context

The Role of Natural Resources in the Economy

Speakers in the inaugural session set the context of the conference by highlighting the dangerous trends in today's profligate and runaway consumption of nature's resources, for our economic, social and environmental future. They spoke emphatically on the need for the world to look beyond just consumption as the main driver of the economy, and rather evolve a new direction towards an economy that encourages eco-innovations so as to improve resource and energy security.

Some of the significant observations and recommendations include ideas such as the growing recognition of the need for an "exchange" for natural resources like the exchanges we have for financial stocks; as much as there is a need to price resources to reflect their true cost, the need to price wastes to account for the damage caused by disposal or the opportunity cost of not using them as a resource for other benefits; corporate balance sheets need to factor in not only financial capital but also natural capital. Several of these issues are, happily, being understood by the next generation, many of whom have much higher commitments to a healthy environment than their predecessors.

In his introductory remarks, Mr Ranjit Barthakur, Secretary General, Club of Rome- India, called for a candid assessment of the damage we are causing to our resources. There was a need to go back to basics and support the rural population, which protects natural resources and shift the focus to rural development. Therefore, the necessity for a Rural Futures Framework through which a balance between human aspirations and natural assets may be achieved.

He pointed out that waste is a critical resource with enormous economic value which is current underutilised and, therefore, much needs to be done in the space of policy development for a waste management policy. It may then be possible to create an ecosystem that nurtures the interdependence between humans and nature in a regenerative way.

Mr S Ramadorai, Chairman, India National Association for Club of Rome, affirmed the need for security of natural resource for all, leading to a resourceful and resilient India. He emphasised that innovation in material extraction technology is important, but, its judicious use and recycling was even more so.

While the objective of the conference seemed ambitious, the Chairman observed that the challenge can be answered with discussions leading to answers that ensure a wide, systemic approach based on substantial understanding of the industrial and economic factors driving recycling. The circular economy path, he proposed, is one of the potential solutions that can bring more benefits to society, particularly to address the serious issues being raised at this conference.

Mr Kirit S. Parikh, Former Member, Planning Commission, Chairman, IRADe, India, in his special address, made the proposition that we require efficiency, frugal use of water, recycling, minimising waste and successful R&D to support a resource resilient India. He stressed on the need for tough policy actions by the government in the given scenario.

Vice Admiral, Girish Luthra, PVSM, AVSM, VSM, ADC- Flag Officer Commanding - in - Chief, Western Naval Command, Indian Navy and Chief Guest, in his opening remarks, appealed for the need for greening the blue economy, that is, seas and oceans. While accepting the need for economic development for the growth and prosperity of India's masses, and especially for poverty-alleviation of about 1/5th of our population, he raised the equally important need for economic prosperity not to be an irreversible cost of resource security and resource inclusivity.

The need to create an ecosystem that is environmentally sound and resource resilient, Vice Admiral Luthra signalled, must be on top of all agendas. This was possible only through collective action of governments, industry and citizens alike, in the formulation of robust and coherent policies and their speedy implementation and adherence.

Setting the agenda for an India where every citizen has equal rights to live a healthy and fulfilling life, **Dr Ashok Khosla, Trustee, Club of Rome – India**, reminded the conference of the inferences made in the landmark 1972 study, the 'Limits to Growth', which used dynamic computer modelling to predict that the global system would ultimately collapse if business-as-usual continued. The implication was that economic growth must respect its planetary boundaries.

He highlighted the prime of objective of the conference - to identify structural changes that we need in the governance of our sectors and our resources to bring about a convergence and mutual reinforcement of different policies. This can then bring about a better resourced future by identifying the knowledge gaps or other barriers that restrict the formulation of a rational policy on resources. Dr Khosla invited consultations for specific initiatives that the government can take including legislation, regulations and new programmes as well as influencing the policy makers with the ultimate aim of developing a supportive ecosystem for resource resilience.

This conference would, therefore seek answers for:

1. What are examples of major policy conflicts, policy requirements relating to Material Resources, within these sectors and in other sectors that impact these resources?
2. What structural changes are needed in governance to ensure that policies in different sectors and domains that effect Material and natural resources are coherent, convergent and mutually reinforcing?
3. What are the knowledge gaps or other barriers that prevent rational policy formulation for these resources?

Quotes

"The circular economy path can bring more benefits; nonetheless,
to continue our growth we still need a resource efficient and a resource resilient India"

"…create an ecosystem that emphasises the inter-dependence between humans
and nature in a regenerative way"

"…need to decouple economic growth from natural resource use, thereby reducing
the divide between India and Bharat"

Plenary 1:
Materials Security for Efficient Make in India

India is on a path of 'Make in India' with a focus on 25 sectors, most of which directly use natural resources as raw materials. In the given scenario, the country urgently needs to become more resource efficient and thus resource resilient. Therefore, it is essential that the following questions are addressed:

- What are the existing means and policies available to support materials security in India? Do these policies need changes or revision?
- What policy changes are needed to ensure adequate material availability at least environmental cost to fulfil the aims of the 'Make in India' goals?
- What changes in policies and corporate practice are needed to promote resource efficiency and use of secondary/renewable materials?
- Can Corporate Sector, Government and Civil Society organizations contribute jointly to solve the issues of material security in India at large?

As Chairman of the session, Mr Nitin Desai, Former Under-Secretary-General for Economic and Social Affairs of the United Nations, set the stage by stating that the phenomenal expansion in consumption of material intensive goods as witnessed in the 2nd phase of the twentieth century has pushed us into the middle of an emergency. The problem, he observed, does not lie with finding material sources, but minimising the impact of what such sourcing is doing to the environment.

Dr Ashok Khosla, Trustee, Club of Rome – India, reminded the conference that the dialogue should not be limited to the efficiency of resources; rather these dialogues should facilitate talk on the implications of resource efficiency in both the richer and poorer sections of our people, as India has both a consumption society and subsistence society. He marked the issue of exactly how to decouple economic growth, prosperity and wellbeing from resources as being the most compelling concern. Dr Khosla introduced the notion of urban mining and pointed out the potential opportunity to reuse, recycle and remanufacture much more cheaply.

On, the question of Make in India goals, Ms Henriette Faergemann, Counsellor - Environment, Energy, Climate Change, Delegation of the European Union to India underscored working together at the global level and signalled the potential for joint efforts towards addressing the issues of resource efficiency between the European Union and the Government of India. She cited the example of EU-India Summit of October 2017 where resource efficiency and the circular economy became the two critical aspects of the summit.

Ms Faergemann expressed her concerns over the waste production in the Make in India drive and pushed for ways of manufacture that makes it easy to recycle to minimise later effects. On similar lines, Mr Cesare Saccani, ICMQ India – MD, EPD India – Director, suggested that there is need to look at the end of life of a product and pushed for the introduction of standards, labels and testing the environmental performance of products in all the sectors.

While the discussion focussed mainly on the relevance of material efficiency, Mr Anirban Ghosh, Chief Sustainability Officer, Mahindra Group, categorically called for moving away from scavenging if we want to continue to live our lives the way we are currently doing so. Making the proposition that scarcity is indeed a trigger for innovation, he appealed for finding ways of using alternative materials, less materials or recycled materials. Mr Ghosh affirmed the potential for bringing in innovative solutions to address these issues by illustrating various such practices of the Mahindra Group.

Material security is not just a question of efficiency, but also of inclusivity underlined Mr Nitin Desai in his concluding remarks. He clearly indicated that one consolidated resource policy might not be sufficient in the case of India, as there are different groups of population with varied needs.

Quotes

"Scarcity is indeed a trigger for innovation"

"Material security is not just a question of efficiency, but also of inclusivity"

"Need to look at the end of life of a product".

Plenary 2:
Energy Security for All

Energy security is often considered as the uninterrupted availability of energy sources at an affordable price; however this covers all major aspects of affordability, accessibility and reliability at a national and global context. In the light of this fact, the focus of this session was on following the questions:

- What roles do digitalisation, management information systems, and smart grid management have and what policies can enhance these?
- What innovations or regulations could improve economic viability, reduce transmission loss, and enhance reliability at National or SMART Grids?
- What structural changes such as business or community participation could help improve the economics and universality of energy networks?
- What measures could promote spread of renewable energy and can it cater to 100% of India's needs?
- What suggestions could help improve:
    a. Quality of power in the rural areas
    b. Erratic and unreliable supply
    c. The pump storage capacity
    d. Nuclear Energy and nuclear waste

As the Chair of the session, Mr Anil Kakodkar, President, National Academy of Sciences, India, established energy as a critical resource for improving India's HDI score. He further highlighted the prominence of solar energy as a viable source of future energy needs in his remarks, but appealed for more importance to be given to solar thermal. Mr Kakodkar pointed out the access to energy gap that needs to be filled, where solar might have limitations in meeting the entire energy need.

While Mr Kakodkar suggested looking at alternatives, Mr Baldev Raj, Director, National Institute of Advance Studies, Bengaluru, made a proposition that nuclear is the best alternative source to improve energy access and resource efficiency. However, scale is important and the damage by radiation is probably much less than is predicted. He projected nuclear as the most sustainable energy solution.

While finding alternative energy sources was the key discussion point in this session, Mr Anand Rao, IIT Bombay, Mumbai defined the acronym "ACCESS" as - abundant, clean and effective energy systems for sustainability. He flagged the fact that a large set of the Indian population does not have access to electricity and clean cooking fuel. Acknowledging the targeted schemes, like UJWALA, he observed that the LPG has not penetrated sufficiently because of stacking, saving for emergencies and affordability issues. Long term concerns for electricity must include energy security and GHG emissions.

Following Mr Rao's remarks, Mr Rahul Tongia, Fellow, Brookings Institute, Bengaluru, called for energy security for the poor. However, the need for access to meaningful electrification without load shedding for others is also a priority. Mr Tongia also identified DISCOMs as the weakest link in the country in terms of electricity and made a proposition that electricity cannot be handled without DISCOMs.

On the subject of electric vehicles, he suggested they be re-termed as Emission Elsewhere Vehicles as the manufacturing emissions have not been factored in. His recommendation was that only a portfolio of energy sources can meet India's energy needs.

While a portfolio of energy sources and the need for improving the access to energy particularly for rural population were mutually agreed areas for intervention, Mr Hari Sharan, DESI Power, pushed for co-generation based power stations and highlighted the role of coal to meet the future energy needs of our country. He categorically declared that smart grids are slow and do not have a network to reach out to different parts and thus solar thermal and biogas based power units are the most likely solution to village energy needs.

The discussions during this session focused on either access or alternative sources. However, Mr Rahul Goswami, Managing Director, Greenstone Energy Advisory, talked about the financial limitations of the energy generation plants. Financing is not a problem was his contention, but finding good projects is the primary concern. Although he appreciated recent government moves that support the solar power sector in the country, Mr Goswami proposed the need for right policy shifts that will encourage the sector to grow.

While concluding the session, the Chair Mr Kakodkar made a recommendation that energy management and efficiency are extremely important subjects; nonetheless, they need to be addressed separately instead of aggregating the two. He suggested hybridisation of technology as a solution to the energy concerns.

Quotes

"Nuclear is the best circular cycle"

"ACCESS - abundant, clean and effective energy systems for sustainability"

"Hybridisation of technology for fulfilling energy needs"

Plenary 3:

Equitable access to India's Natural Resources - Water and Terrestrial Ecosystem for All

Issues of lack of natural resources, such as, water, land, soils, and forests – and of lack of equitable access to these by all – are now becoming commonplace and are in some areas reaching dangerous levels. India's biotic and abiotic resources are suffering from massive degradation and loss and this session thus put focus on the following questions:

- How effective are the existing policies and practices in maintaining the productivity and health of our water resources?
- What are the major barriers and hurdles to enabling local communities to act as guardians of their local natural resources?
- What is the current knowledge base on the minimum water flows, particularly in our rivers and streams, which is needed to maintain basic ecological services and what research is required to be conducted?
- How can multi sector involvement and financial inclusion be encouraged so as to maintain natural resources and ensure equitable access for all?

As the Chair of the session, Lt Gen Arun Kumar Sahni, Director General, Club of Rome –India, laid out the scenario of how rapid population growth and transformation of technology and innovation in the twentieth century has increased productivity, but on the other hand it has had serious negative impacts on the ecosystems. India, home to 18% of worlds' population, actually has only 4% share of freshwater and this he noted has severe implications on India's water needs and in particular, on the agricultural sector, which is the means of sustenance for a relatively large group of India's population. Accordingly, he cautioned that we need to develop policy solutions, which can ensure that the ecosystem that exists around a particular resource is balanced and potentially available to all people.

Following Lt. Gen Sahni, Mr Anish Andheria, President and CEO, Wildlife Conservation Trust further elaborated on the issue of water scarcity and remarked that two-thirds of the world's population currently lives in the area of water scarcity. He concluded that due to neglect in quantifying and pricing of natural resources, we have taken our natural resources for granted; under-pricing them has led to market failures. He also pointed out as a result of the tragedy of commons – the shared pool of resources; people have ended up consuming more than their requirements.

Mr Pankaj Pachauri, Editor in Chief, Go News, highlighted the increasing water stress prevailing in our country, which has been exacerbated by rising exports of water-intensive goods. He suggested that the problems of sustainability for resource resilience can be solved by solutions that encourage a bottom up approach on the lines of various government initiatives including AADHAR, Direct Benefit Transfer and MGNREGA.

Unlike the other speakers in the session, Mr Parasuraman, Director, Tata Institute of Social Sciences, identified capitalism as the major cause of the prevailing resource crisis, and stated that the rising population was not to blame. His premise was that India is already loaded with policies and probably

does not need another policy, rather we need to strengthen the implementation of the existing polices as that can ensure more equitable resource distribution.

Though the majority of the discussion centred on the urban systems, Ms Mansi Parikh, Balipara Foundation, India, on the other hand offered a framework of the Rural Futures concept for making certain equitable distribution of resources and by creating livelihood opportunities in rural areas. She suggested a human- centric approach towards enhancing knowledge and innovative solutions for conservation issues. Rather than putting the onus on the communities to protect the natural ecosystems, the practice should be increased community participation, through ecosystem based services. This can bring about stewardship behaviour that makes the community stakeholders owners of their natural assets.

While concluding the session, the speakers agreed that a framework that leads to livelihoods is the minimum need that must be met. A natural resource cannot be protected in isolation; rather an ecosystem approach has to be established that has a role for communities, individuals, government and businesses and all of them need to come together to overcome the resource stress issues.

"Under-pricing natural resources has led to market failures"

"Rural Futures Framework for equitable distribution of resources and livelihood opportunities in rural areas"

Day 2
Debriefing

Mr Ranjit Barthakur, Secretary General, Club of Rome- India, opened the discussion on Day 2 of the 2017 annual conference with a brief recap of Day 1. Appreciating the dialogue of the previous day as rich and insightful, he maintained that participative management is essential to ensure equitable resource distribution and sustainable resource utilisation. Mr Barthakur analysed the highpoints of the deliberations, categorising them under:

- Resource security and efficiency;
- Prospective technologies for adaptation and mitigation; and
- Policy gaps and required actions.

A special guest, Dr Asokan Pappu (CSIR) Advanced Materials and Processes Research Institute (AMPRI), thereafter made a captivating presentation and demonstrated various innovative products that have been developed using waste as a key resource. The practical recycled gadgets validated the call for reuse and recycling.

Plenary 4:

Price volatility of Resources - A challenge: Towards minimising and mitigating the price volatility of essential commodities

Future commodity prices and availability of resources like minerals, water and land may often be out of line with the future reality. The focus of price volatility on energy and power sectors in policy domains is becoming more prominent as it has a direct impact on the consumer. However, the cost of resources cannot afford to be neglected. Therefore, there is a demand for addressing the following questions:

- What are the current trends in the central government and provincial government to cope up with price volatility and restricted availability of resources? What India is doing to control price volatility of resources?
- How to ensure economic visible technology and mechanism to link with supply chains – internationally and nationally?
- How can India be more self-reliant on material resources without destroying the land and fresh water resources?
- What type of role private sector and government can play to strengthen each other?

As Chairman of the session, Ms. Henriette Faergemann, Counselor - Environment, Energy, Climate Change, Delegation of the European Union to India, prepared the speakers and the conference by outlining the questions the session was committed to find solutions to.

Mr Sanjeev Paul, Vice President, Tata Steel Ltd., initiated the consultations with a brief introduction about the subject of price volatility and its relationship with various key economic variables including GDP, Balance of Payment, unemployment, inflation rates etc. He clarified that increased frequency of volatility leads to instability, which complicates financial planning and, therefore, impacts sustainable development. Mr Paul pinpointed the consolidation and cooperation between multinational traders that is responsible for the loss of market power of many countries, which have a low returns and high risks. The steel sector, he declared was at the receiving end of this. However, he acknowledged that there is no silver bullet to correct the situation.

Following him, Mr Perses Bilimoria, Founder & CEO - Earthsoul Bio Products / Earthsoul India Private Limited, spoke about the relevance of pricing natural capital bringing to the attention of the conference, the absence of built in costs of natural capital in the balance sheet of the economic activity. But, Mr Bilimoria revealed that there might be a slight change in the trend; big companies like Coke are now making commitments on replenishing natural capital.

Bittu Sahgal, Environmental activist and writer and founding editor of Sanctuary Asia, on the other hand elucidated the technique of pricing. He made a proposition that rather than fixing the price of a resource, the emphasis should be on fixing a price for where the generated waste will be kept. Humans, he remarked, are the only creatures who believe that they can generate infinite waste on a finite planet.

Prof Ramprasad Sengupta, former Distinguished Fellow of India Development Foundation and former Honorary Professor of NIPFP recognised that there is unnecessary resource waste. He also pointed out

that product output does not currently account for the role of natural and material resources and the services of environmental stocks. Prof Sengupta identified the two broad types of eco services that nature provides the economy – one- supply or flow of resources and two- absorption of waste rising from production and consumption processes. On the other hand, the waste absorption service has limited capacity and correspondingly, the finiteness of the ecosystems becomes crucial.

While concluding the session Dr Ashok Khosla, elaborated on a nature bound economy that also ensures an equitable and dignified life for all the citizens. He declared that a large corpus with the government to solve the issues of climate change might not be sufficient; rather the responsibility has to be borne equally between various stakeholders.

Quotes

"Increased frequency of volatility leads to instability, complicating financial planning and sustainable development"

"Humans are the only creatures who believe that they can generate infinite waste on a finite planet"

"Build in costs of natural capital in the balance sheet of the economic activity"

"Rather than the price of a resource, fix a price for storage of generated waste"

Plenary 5:

Importance of Natural Resource Efficiency in Corporate Education and the Curriculum

Today's economic systems are complex, rapidly changing and vulnerable to external perturbations of many kinds, ranging from natural disasters to hostile trade-related actions to changing fashions. Therefore, appropriate skills, knowledge and attitudes are essential for conducting a successful business in the modern economy. And because of the fluidity of business requirements, more than ever before, the ability to let go of old skills and quickly learn new ones become critical for retaining jobs. Consequently, the following questions need to be addressed:

- What changes are needed in the school, college and MBA curricula?
- How can Systems Dynamics learning be made available at all levels of education?
- What incentives can be given to MBA programmes to include the issues of sustainability and ethical business?

As Chairman of the session, Dr Amita Bhide, Dean, Tata Institute of Social Sciences, started the discussions with a remark that we are aware and recognise the finiteness of the planet; but in real life, practical implementation for careful use of resources is the problem. Highlighting 'The Bombay Plan' as an example of prime stewardship of the corporate sector, she pointed out that private sector is not only responsible for implementation of state policies but also needs to be a steward in framing better curricula. In the light of these observations, she opened the floor for probing the role of private sector, academia and policy makers to better engage on the issues of sustainability.

Following Dr Bhide, Prof Chari Kumanduri, BIMTECH, illustrated various waste minimisation options based on their research activities that the corporate sector can take-over and scale up. He was confident that waste generation could be avoided with better technology and product design. Prof Kumanduri offered various suggestions on how waste from one activity can become a resource for another activity. He confirmed that the research of an academic institution can support carrying out business run production activities more efficiently.

While Prof Chari pinpointed the ways to be resource efficient, Mr Chandrakant Puri, Chair Professor, Rajiv Gandhi Centre for Contemporary Studies, affirmed the need for holistic thinking to ensure equitable resource distribution across various sets of stakeholders. Academia and corporate must work together for the development of people and the gap between industrial needs and students' skills minimised. He referred to Gadhchiroli, Mandalekha as a good example of industrial linkages with resources.

Significantly, Dr Anindita Roy Saha, Coordinator, Centre for Earth Studies, Indraprastha College, DU, recognised that human capital formation is the prime activity of educators and called for a curriculum that interests students and generates enthusiasm. Citing the example of the eco-club which engages student interest, she raised the need to strategise and rethink the environmental curriculum; improve teacher training; and enhance interface, internships and entrepreneurship with the corporate sector in order to bring plausible environmental, social and economic returns.

Like other speakers, Mr Amar Nath, CEE, India, also highlighted the lack of broad based understanding of sustainability among the actors, the presence of fragmented understanding and incomplete details of the social and environmental aspects as major roadblocks. He urged for systems thinking to resolve the prevailing sustainability issues and the need for corporate sector to be more engaged to include social, environmental and other aspects.

The session concluded with a clear need to promote environment as a core discipline; adequate measures including designing of curriculum for environmentalists and environmental engineers should be taken; enough incentives to be provided to make this discipline attractive for students to pursue and finally, the market to take the lead in stewardship to bring these tangible changes to the system.

Quotes

"Private sector needs to be a steward in framing better curricula"

"Waste from one activity can become a resource for another activity"

"Systems thinking to resolve prevailing sustainability issues"

Plenary 6:

Circular Economy and Material Recycling (secondary raw material use) - Business Scope towards Material Security

An enormous quantity of waste is generated by industrial activity, right from extraction of raw materials till the end product disposal stage. Once the waste is produced, money, manpower and additional materials must be spent to manage it. To deal with this issue, the economy needs to focus on recycling and reusing of waste material, using them as secondary raw material and converting them into productive or usable material. However, identification, prevention of waste, its reuse and safe disposal, etc. are required to maintain natural resource efficiency, therefore, the need to address the following questions:

- How can national self-sufficiency in raw material resources be achieved? Renewables? Secondary raw materials?
- What are the possibilities of adopting renewable and secondary raw materials?
- How can innovations in extraction and use of secondary raw materials be effectively encouraged?
- How much can infrastructure and construction convert to wastes from demolition, mining or industry into useful resources?

As Chairman of the session, Dr Ashok Khosla, Trustee, Club of Rome – India, Co-Chair, International Resources Panel and Chairman, Development Alternatives, opened the debate reminding the panellists and the audience to share strategic inputs on the above mentioned questions.

Mr Mukesh Gulati, Senior Advisor, Foundation for MSME Clusters, started the discussions by indicating the 10 highly resource intensive MSME sectors and the enterprises in these sectors. These, he revealed, use both primary and secondary materials and the processes have a wide scope for improvement in terms of efficiency. The use of waste can potentially make the final product cheaper, however, the lack of bank–linkages with respect to investment support, lack of awareness on the use of waste and lack of incentives for the stakeholders involved, make the sector appear unattractive.

Following Mr Gulati, Ms Indrani Malkani, Managing Trustee, V Citizens Action Network (VCAN), joined the discussion by putting the spotlight on the immense wealth and business opportunities that lie in waste, if looked on as a resource. Integration of city managers and citizens efforts can only bring solutions to the system as the absence of a holistic policy design creates hurdles in the actual and effective implementation. Ms Malkani commented that the value of the waste and its disposal gets affected by the way it is handled.

Ms Shilpi Kapur, TERI, raised some fundamental questions at the session when she highlighted the lack of effective know-how on the recovery of by-products of the products that are being explored. She brought forward the technological constraints prevailing in the country and the dearth of initiatives on applying technology due to inadequate funding opportunities.

Like other panellists, Mr Rene Van Berkel, UNIDO Representative, Regional Office India, underscored the urgency for improving the material efficiencies of different economic sectors. It was crucial that

measures be taken for estimating the direct and indirect requirement of raw material for manufacturing different products and conducting significant R&D to find their substitutes. Mr Van Berkel enumerated the five business models, which are: circular supply, product as a service, resource recovery, product life extension and a sharing platform significant for inclusive and sustainable development.

The session concluded with a short presentation by Mr Adrian, Griffiths, CEO, Recycling Technologies illustrating the potential use of plastic as material and how innovative technology can recycle plastic materials and brought to reuse. He made a proposition that almost 90% of the world plastic can be recycled both mechanically and chemically and solve the rising plastic waste concern of the world.

Quotes

"The use of waste can potentially make the final product cheaper"

"The value of the waste and its disposal gets affected by the way it is handled"

"Almost 90% of the world plastic can be recycled both mechanically and chemically"

Valedictory Session

Valedictory Address – Mr. Ashish Kumar Chauhan, MD & CEO

Mr Ashish Kumar Chauhan, MD & CEO, made an inspirational and insightful speech on India's energy future in his valedictory address. While he acknowledged that India faces an energy crisis, he also declared that India is on its way to become a global economic powerhouse, his premise being that India can benefit from the technology driven revolution in the energy sector unfolding around the world. Mr Chauhan called for developing a technology ecosystem across the energy sector that will comprise innovation and research, technology services, local manufacturing and customer support for innovation.

He highlighted the efforts of the Bombay Stock Exchange towards this direction citing the stock market indices namely S&P BSE Greenex (assesses the energy efficiency of firms) and S&P BSE Carbonex (measures company's ability to address climate change risk and opportunity) and other similar initiatives catering to eco-friendly investment philosophies.

Dr Khosla recognised and appreciated the efforts of the financial sector and welcomed the initiatives the sector is innovating to create metrics and practices in measurements to evaluate how companies are performing in the field of environment management.

Closing Event

In his concluding remarks, Mr S Ramadorai, Chairman, India National Association for Club of Rome observed that the consultations had most certainly demonstrated the compelling need for collaboration amongst various stakeholders if we were to move towards a resource resilient future. He championed the approach for measuring performance from a broader lens - economy plus the ecological footprint - rather than mere economic performance of the respective stakeholder.

The circular economy, Mr Ramdorai advocated, must be across the entire spectrum of economic development. This would mean that preserving energy, water, waste recreation, reduction of landfills and such steps are the way forward to sustain the growth rate of 7% per annum for next two decades.

Dr Ashok Khosla, Trustee, Club of Rome – India, signalled the need to maintain the productivity of the resource base to sustain a good life for future generations. Spreading awareness and co-opting other stakeholders including corporate, government, civil society, media, academic and similar institutions was thus the imperative.

Lt Gen Arun Kumar Sahni, Director General, Club of Rome–India concluded the session and brought the annual conference to an end with a short sum-up of the entire discussion during the two day conference. The key takeaway, he highlighted, was a plan of action centred on the circular economy and utilisation of secondary raw material to improve resource efficiency and progress towards sustainable development.

Lt Gen Sahni summarised the discussions within a broad set of analyses and recommendations. The first covered measures on how we can become more resource efficient and this is where we look at the circular economy, using secondary raw materials to enhance resource efficiency. The second referred to

the prevailing policy gaps specifically, the example of GST levied on the use of secondary material, which needs to be flagged to the concerned authorities. The third was the aspect of awareness. Acknowledging the work of academic and other institutions in this domain, he highlighted the need for strategic actions by both government and the corporate sector in order make these domains attractive to the younger population to sustain resources for future needs. The fourth area was about technological prescriptions and disruptive technology where innovative thinking in the designing of a product can significantly reduce waste creation. This will improve productivity, resource resilience and ensure sustainable development.

Recommendations

The major recommendations that emerged from the conference are fall under three distinct categories:

- Resource Security - Efficiency and Sufficiency
- Possibility for Disruptive Technology: Innovation and Improvisation
- Suggestive Policy Action

Resource Security - Efficiency and Sufficiency

Circular Economy

- India needs to pursue alternative models like the Circular Economy designed as a zero waste model in contrast to the traditional linear economic model of - Take, Make, Use and Dispose
- The circular economy while being 'restorative and regenerative' by design must also follow systems thinking and innovation in terms of connectivity, relationships and the environment
- Resources should be looked at through the lens of security, inclusivity, efficiency and sufficiency.
- An understanding about the relationship between scarcity and choice must be developed, as it is crucial to assessing the value of a resource
- It is essential that waste is designated as a leading resource and a secondary raw material
- The use of alternatives for virgin raw materials to be encouraged
- Valuation of marine resources is critical

Livelihoods

- Along with material resource efficiency, economic and social benefits and livelihoods for all must be ensured
- The Rural Futures Framework that makes certain equitable distribution of resources and creation of livelihood opportunities in rural areas should be developed and scaled up

Business

- The private sector needs to practice stewardship, adding value to resource efficiency
- Increase the involvement of the private sector in achieving the universal sustainability goal

Possibility for Disruptive Technology: Innovation and Improvisation

- Encourage disruptive technologies such as Factor Five technologies (technologies promising five times more resource efficiency than their counterparts) that lead to reduced energy consumption, using 1/5th of the current resource consumption pattern

- Scarcity acts as a trigger for innovation; hence continuous research is needed for improving the productivity and efficiency of high-resource intensive sectors
- Promote co-generation technology like burning biomass and coal to produce electricity and contribute sustainable resource utilisation
- Biomass and bio gas plants need to be scaled-up in India considering the large base of village populations without access to electricity
- Hybrid green composition has the potential for generating opportunities for new enterprises. Hybrid material composition can address rising waste by generating green products and jobless growth by creating employment
- More innovative thinking needed on design of product as that can significantly minimise waste generation.

Suggestive Policy Action

A. Change of Approach for the Government for:

Sustainability

- Policy framework promoting use of waste as secondary resource material to be developed
- Government programmes to be established for incentivising valuation of ecosystem services and users to encourage conservation
- Policy to be based on indicators for inclusive development, rather than growth
- Reimaging of indicators of growth from GDP to SDGs and SDG plus to be undertaken
- Hybrid products need regulatory support to encourage their utilisation. Two broad regulatory requirements can include approval under the BIS standard and a reduced GST rate
- Create a favourable policy environment wherein technology, economic and capacity concerns are dealt with to motivate the use of innovative and sustainable materials
- Provide technical support to new entrepreneurs in sustainable materials
- Develop a national level inventory of resources used in the country across sectors and value-chains
- Build capacity on Corporate and Academic responsiveness through sustainability education
- Resource efficiency as a part of the curriculum to be pushed as a single point agenda through a policy directive
- Establish GPP (Green Public Procurement Policies)
- Policy support required for greening the ocean economy and reducing marine pollution

Recycling

- Policy on solar panels for ensuring end of life recycling and reuse should be developed

- Mechanisms supporting tough action for frugal use of water, recycling and focus on R&D to be put in place

Energy

- Programmes promoting shared economy – for example, instead of material intensive electric vehicles, develop and execute and encourage use of mass transit systems,
- Government initiatives needed for inspiring hybrid solutions for renewable and non-renewables; systemic thinking for solar and wind models are the opportunities
- Promote a larger number of decentralised power plants with micro grids
- Policy should provide space and opportunity for investment as the utility scale of role of private investment is now self-sufficient in energy
- Commercial mechanisms for purchase of renewable power and financing of energy storage to be put in place
- Fiscal incentives to be provided to encourage business to takeover energy based projects as rural markets relatively slow
- Fiscal incentives like minimal GST or no GST should be levied on use of secondary material for production
- Policy makers to work with companies, technology vendors and research organisations to establish common data standards for smart meters and smart grid devices
- Policy recommendations for two Technology Missions – Photo Voltaic and Storage

Urban Local Bodies

- Build capacity of ULB (Urban Local Bodies) to establish and implement green public procurement policies
- Green dimension should be included in all aspects of governance frameworks for ULBs
- Urban local bodies to employ environmental engineers for systems planning and execution

Business

- Multi-level governance that includes partnerships for product design partnerships for product design, manufacturing and capacity building for green entrepreneurs to be practised
- Government to initiate long term strategic planning and investment in consultation and coordination with private sector
- Promote dialogue encouraging resource mapping and innovators workshops
- Support C&D (Construction & Demolition) activities and industries (circular economy)

- Rent or royalty to be paid for units of extraction - accumulated funds to be used for investing in renewables
- Extended Producer Responsibility (EPR) – for the product design, consumption and thereafter
- Access to institutional finance as a big driver: Training of existing bankers and performance systems that support project based financing and not asset based
- Linkages with the Global value chain/ markets and benchmark enterprises: Policy Support and Capacity Building
- Need for a more stringent enforcement of laws: Special studies that track progress over time

B. Change of Approach for the Corporate Sector

- Factor of Natural Capital is critical for corporate and balance sheet as Nature is demanding a balance sheet
- Encourage industrial symbiosis: optimising water and energy use and reuse between companies in industrial production and using secondary resources in industries
- Waste has to be recognised as a secondary resource for a circular economy
- Address waste by recognising its usefulness, features; strengths and positives
- Need for creation of a market for secondary raw materials
- There is a need to price 'where will you keep the waste', rather than only pricing resources
- Price volatility can be mitigated, but there is no silver bullet Different economies and different solutions possible
- Encourage poly-silicon manufacturing capability to reduce dependence on imported solar panels
- Promote the scope for CSR opportunities in waste management
- Collaboration with informal sector to be stepped up
- Undertake integrated initiatives for acknowledgement of different and innovative schemes

C. Approach For Co-opting the Young

- Inculcate a reflex hunger for knowledge in the young and a desire to make a difference in the environment
- Educate the young on waste management
- Education to acknowledge systems thinking processes that think of solutions, which are disruptive not just incremental
- Systems dynamic thinking should be incorporated from KG to PG
- Design job streams for the environment for young professionals

Conclusion

The discussions and dialogue over the two days focussed on concepts and practical applicability of resource efficiency, energy security, circular economy, waste and use of secondary raw material that can help in transition to a resource resilient India. The event was fortunate to have active participation from a diverse set of stakeholders including business, civil society, academia, students, media and legal professionals and government. Some of the prominent speakers expressed their deep concern regarding the state and trends in the sphere of natural resources and the immediate need for developing a resource resilient future for the country. Much of the focus of the discussion was on technological, economic and lifestyle changes for transformative action and the policies that are needed to encourage these changes.

While, there was a larger framework of questions, the discussants did not confine themselves to it and discussed several more issues. The presentations and discussions at the conference yielded a rich and diverse set of specific suggestions and recommendations. There emerged a common understanding and consensus that we are hurtling towards harming our planet - mother earth - and there is a compelling need to urgently regulate our ongoing activities for sustainable development. A circular economy and resource efficiency were clear alternatives to carry on production and consumption for sustainable future.

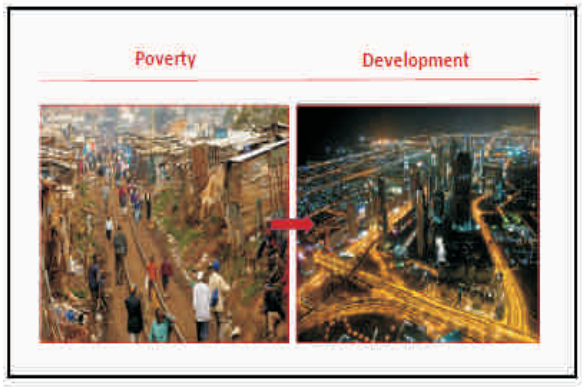
Apart from developing a coherent policy and strategy towards realising the circular economy, India needs to prepare for encouraging and aiding resource resilience. Essentially, policy-makers need to become aware and knowledgeable of how circular economy can deliver new opportunities and models for economic growth. The development of overarching policies and supporting initiatives must take place within the broader framework of the principle of sustainable development.

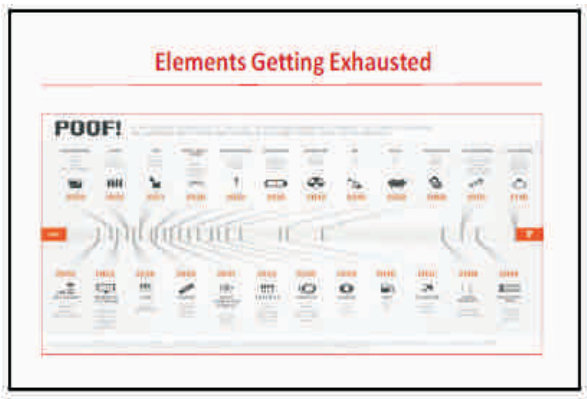
While it is important for government to set the overall policy direction, innovation lies at the heart of this transition. Multi-level governance must be directed at fostering India's new breed of innovative green entrepreneurs. Complementary measures should be directed at encouraging research collaborations between the private and public sectors, as well as academia. The international community has an important parallel role to play in supporting these initiatives, while the NGO and civil society will be important in disseminating the prospects and opportunities for creating a circular economy to the broader community to galvanise support and optimism towards this transition.

Annex 1

Presentations
Plenary 1:
Materials Security for Efficient Make in India

Anirban Ghosh, Chief Sustainability Officer, Mahindra Group




Elements Getting Exhausted
POOF!


Scavenging
Preservation

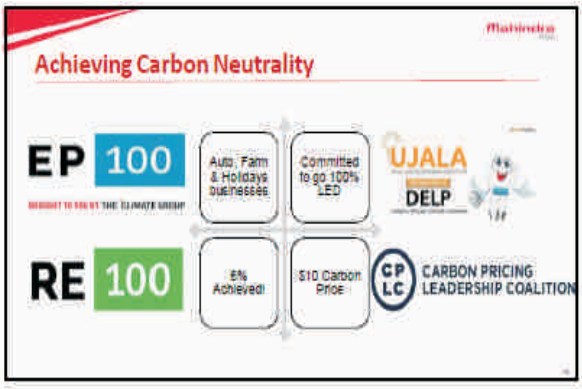

The Mahindra Group


Rise
Mahindra Sustainability Framework
Building enduring businesses by rejuvenating the environment and enabling stakeholders to Rise
People
Planet
Profit
Partnering. Learning. Sharing.
Giving back more than we take.


How are we becoming Resource Efficient?

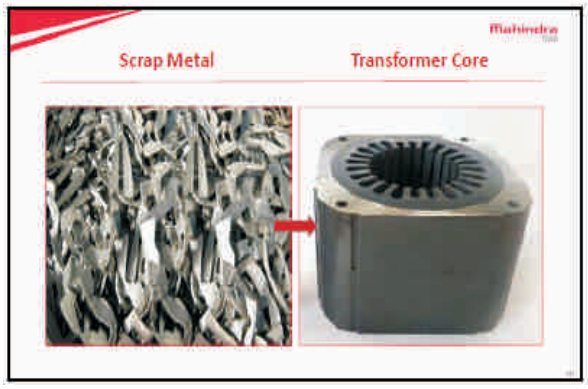

Lighter
Weight has been reduced by 100 kg in less than 50 HP models in last 3 years.
Saving of 5000 tons of vital raw materials and resources


Even Lighter
Mahindra ELECTRIC


Achieving Carbon Neutrality
EP 100
RE 100
Auto, Farm & Holidays businesses
Committed to go 100% LED
UJALA
DELP
8% Achieved!
$10 Carbon Price
CP LC
CARBON PRICING LEADERSHIP COALITION


Becoming Water Positive
FIN-DRIP
Integrated Watershed Management: 2.35X increase in income for 20,000; 12% of water consumption harnessed by Mahindra
Saving 30-40% Water for Irrigation


Soiled Gloves
Fancy Carpet

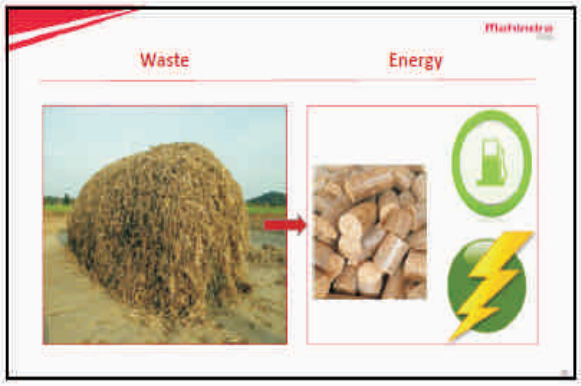

Scrap Metal
Transformer Core

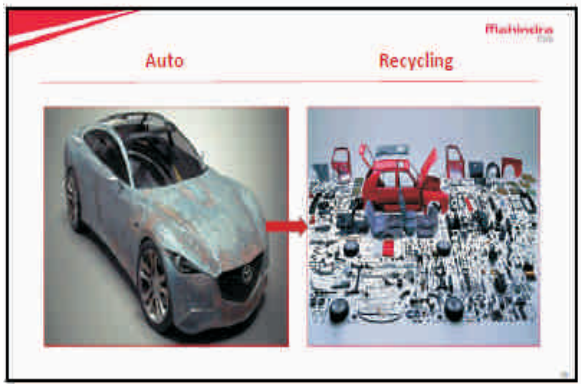

Foundry Waste Sand
River Sand


22 Factories
Managing Waste

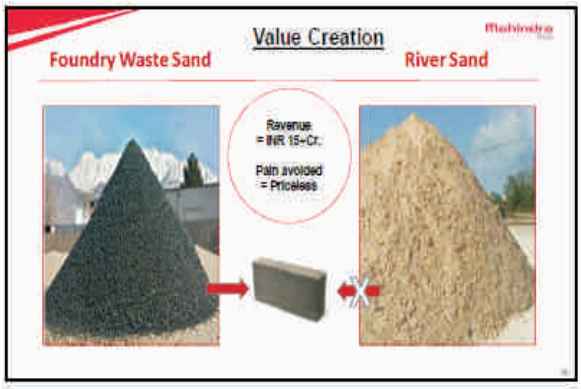

India's 1st Certified Zero Waste to Landfill Factory
CERTIFICATE
INR 1.5 Cr. ($0.25million) annual value creation
19% reduction of total waste
28.5% reduction of hazardous waste


Kitchen Waste
Fertilizers


Waste
Energy

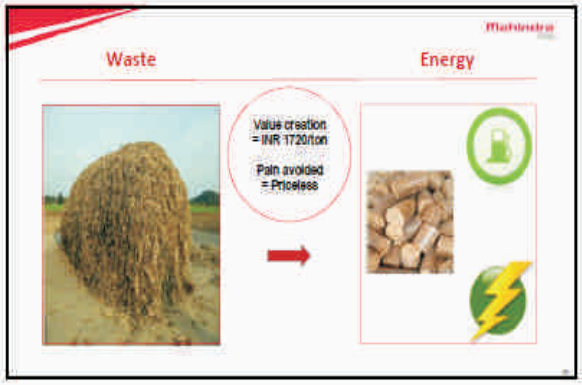

Auto
Recycling

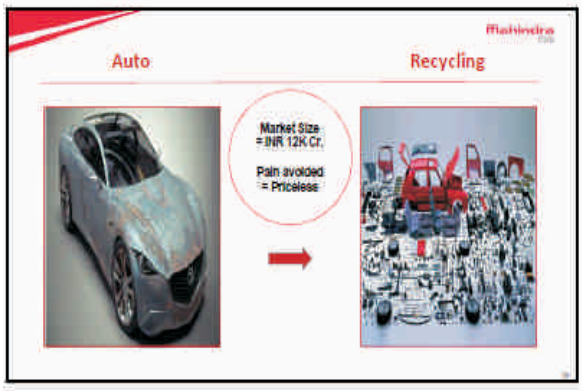

Paint Sludge
Cement Plant

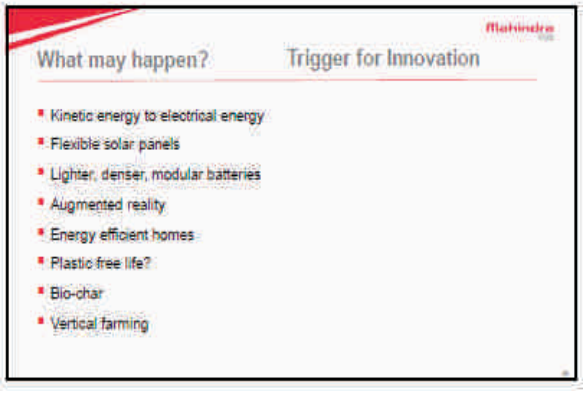

Value Creation
Foundry Waste Sand
River Sand
Revenue = INR 15+Cr.
Pain avoided = Priceless


22 Factories
Managing Waste
~ Revenue = INR 39 Cr./Yr.
Pain avoided = Priceless

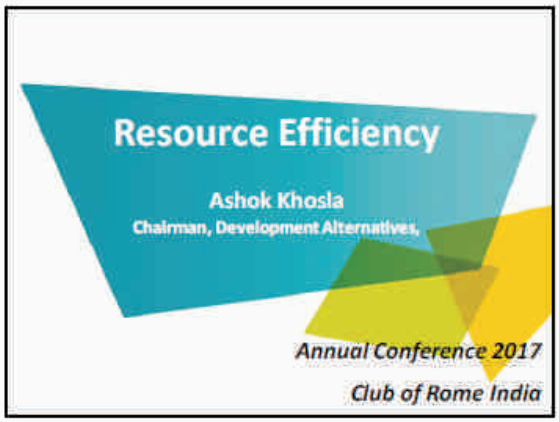

Kitchen Waste
Fertilizers
India Saves = INR 10,000Cr.
Pain avoided = Priceless

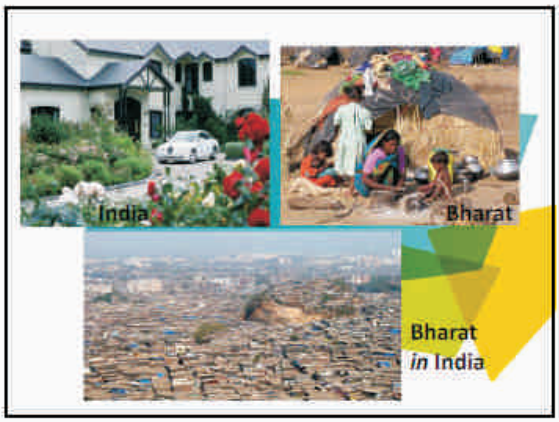

Waste
Energy
Value creation = INR 1720/ton
Pain avoided = Priceless

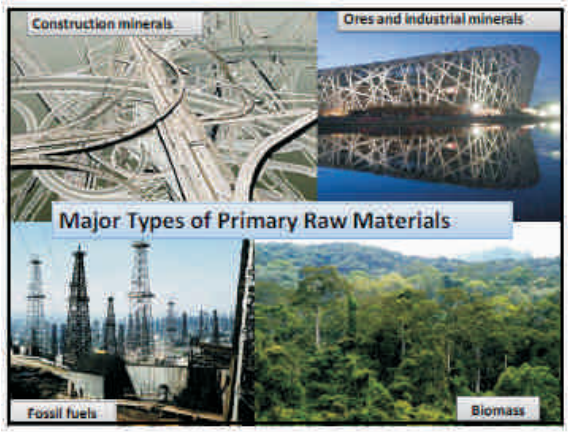

Auto
Recycling
Market Size = INR 12K Cr.
Pain avoided = Priceless


What may happen?
Trigger for Innovation
Kinetic energy to electrical energy
Flexible solar panels
Lighter, denser, modular batteries
Augmented reality
Energy efficient homes
Plastic free life?
Bio-char
Vertical farming

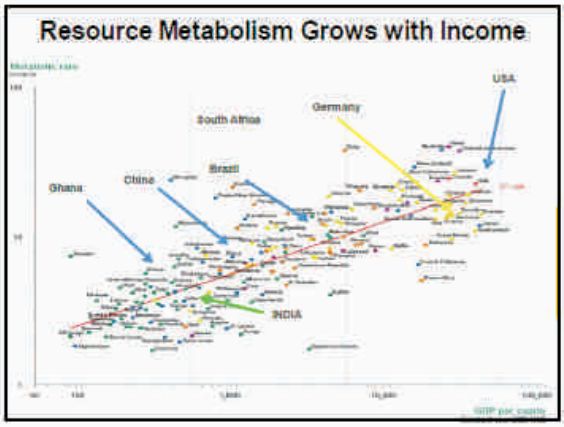
Ashok Khosla, Trustee, Club of Rome – India, Co-Chair
International Resources Panel and Chairman, Development Alternatives

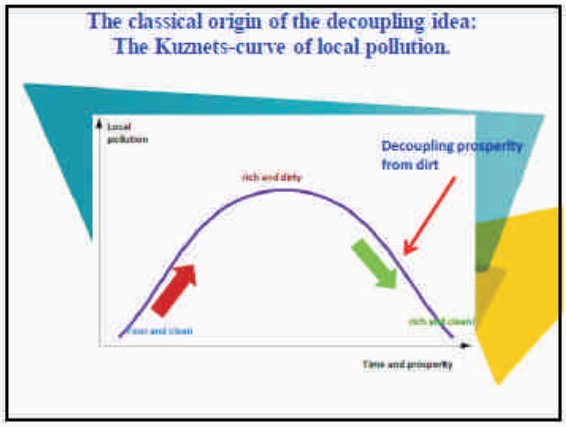


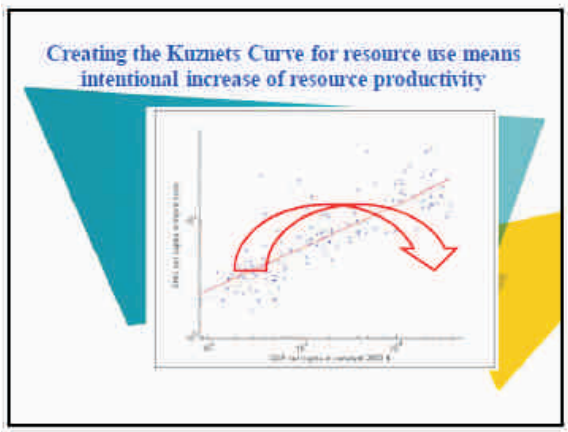


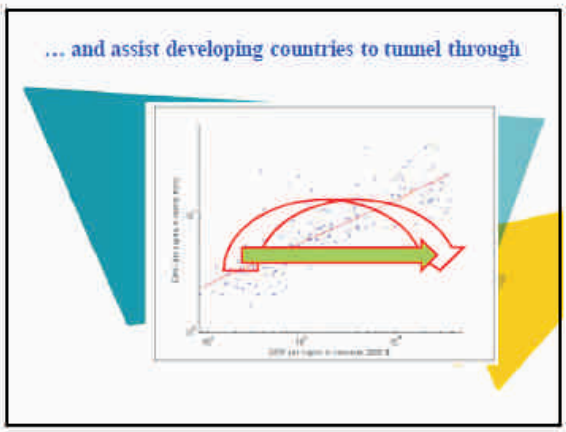

Construction minerals
Ores and industrial minerals
Major Types of Primary Raw Materials
Fossil fuels
Biomass

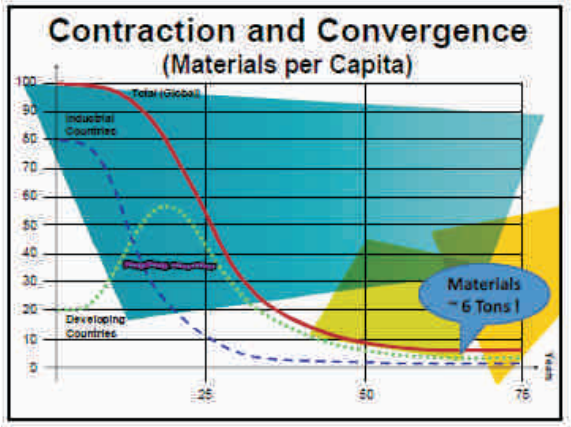

Material Consumption by Region
SERI

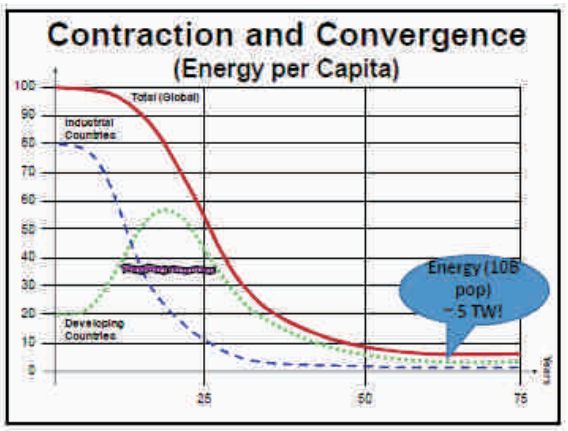

Resource Metabolism Grows with Income
USA
Germany
South Africa
Brazil
China
Ghana
INDIA

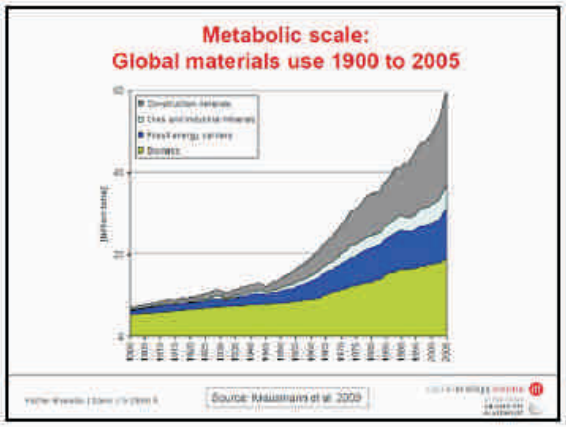

The classical origin of the decoupling idea:
The Kuznets-curve of local pollution.
Local pollution
Decoupling prosperity from dirt
rich and dirty
poor and clean
rich and clean
Time and prosperity

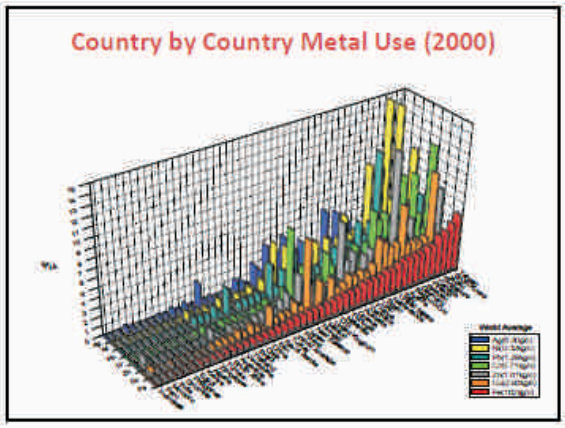

Creating the Kuznets Curve for resource use means intentional increase of resource productivity

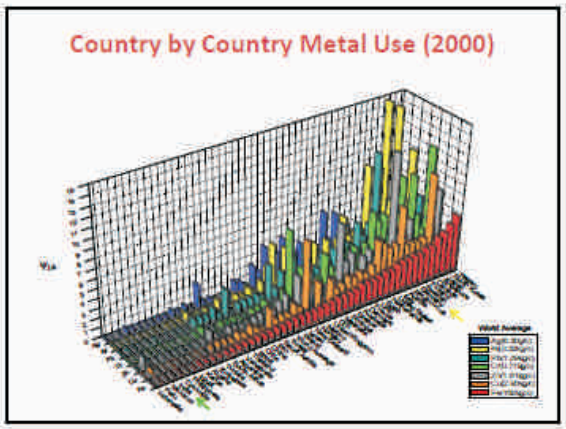

... and assist developing countries to tunnel through

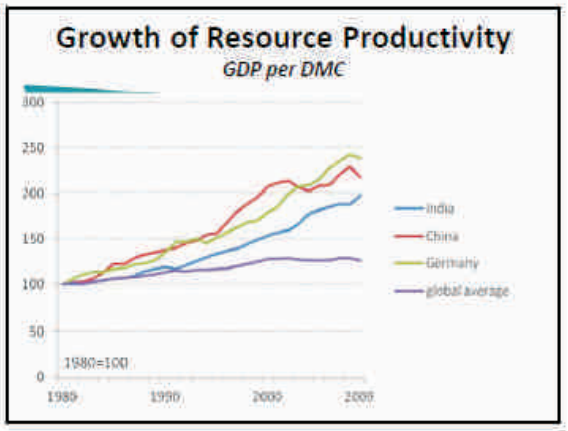

Contraction and Convergence
(Materials per Capita)
Total (Global)
Industrial Countries
Developing Countries
Materials ~ 6 Tons !
Years

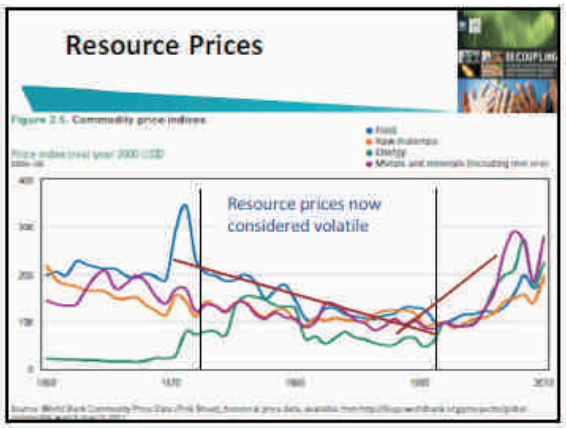

Contraction and Convergence
(Energy per Capita)
Total (Global)
Industrial Countries
Developing Countries
Energy (10B pop) ~ 5 TW!
Years

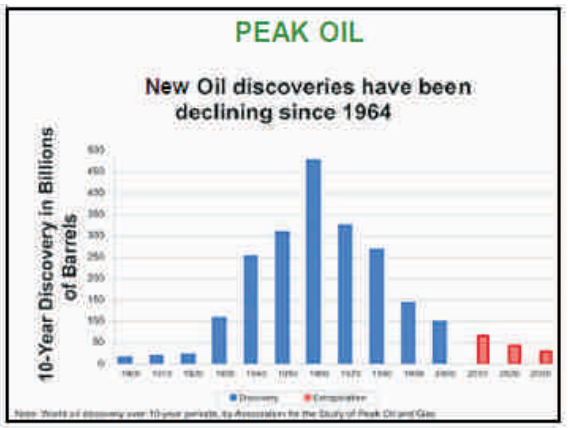

Metabolic scale:
Global materials use 1900 to 2005

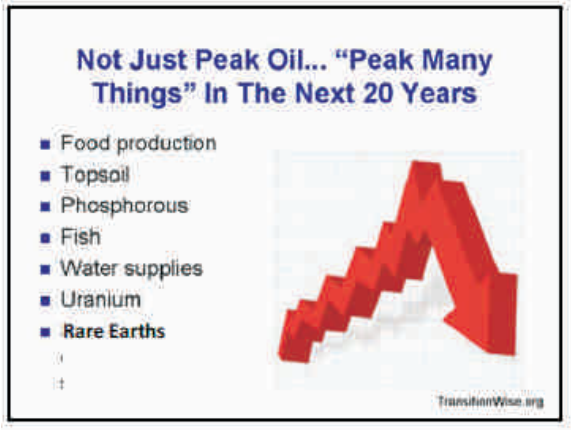

Country by Country Metal Use (2000)

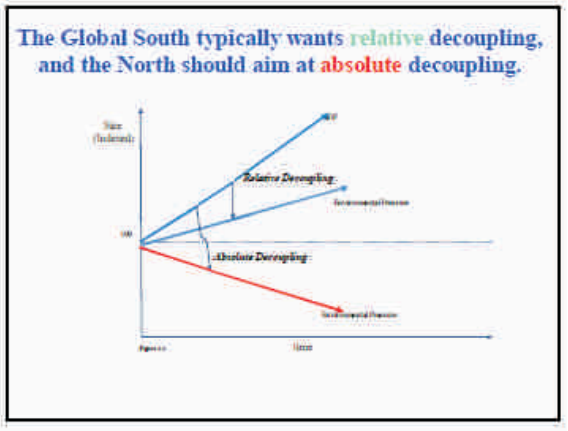

Country by Country Metal Use (2000)

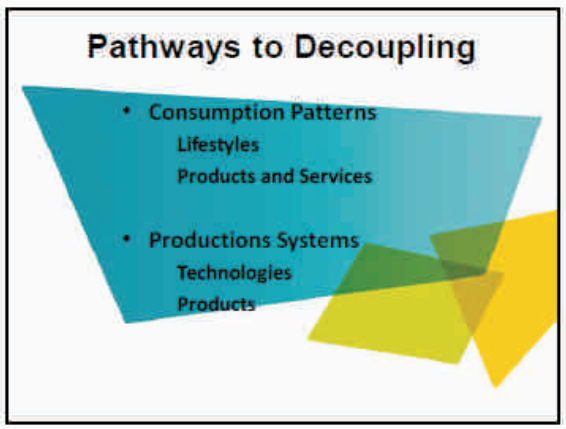

Growth of Resource Productivity
GDP per DMC
India
China
Germany
global average
1980=100

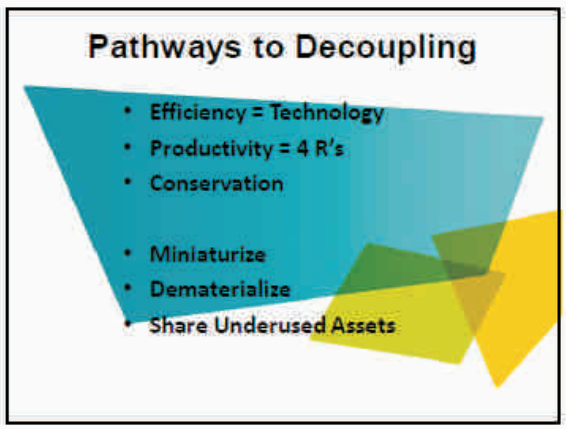

Resource Prices
Resource prices now considered volatile

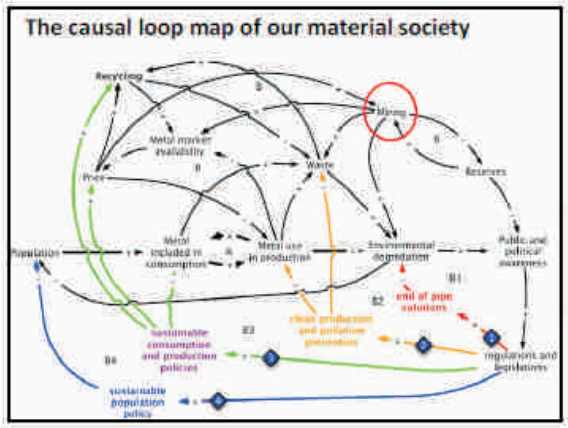

PEAK OIL
New Oil discoveries have been declining since 1964
10-Year Discovery in Billions of Barrels

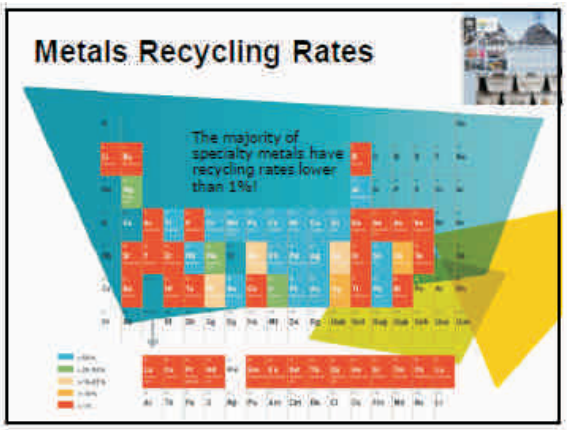

Not Just Peak Oil... "Peak Many Things" In The Next 20 Years
Food production
Topsoil
Phosphorous
Fish
Water supplies
Uranium
Rare Earths
TransitionWise.org


The Global South typically wants relative decoupling, and the North should aim at absolute decoupling.
Relative Decoupling
Absolute Decoupling


Pathways to Decoupling
Consumption Patterns
Lifestyles
Products and Services
Productions Systems
Technologies
Products

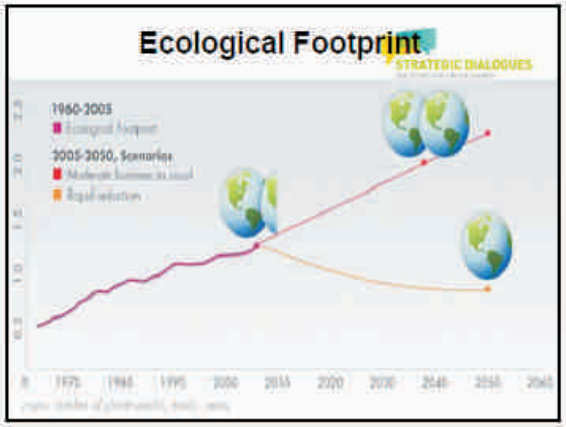

Pathways to Decoupling
Efficiency = Technology
Productivity = 4 R's
Conservation
Miniaturize
Dematerialize
Share Underused Assets


The causal loop map of our material society
Recycling
Mining
Metal market availability
Price
Waste
Reserves
Population
Metal included in consumption
Metal use in production
Environmental degradation
Public and political awareness
end of pipe solutions
clean production and pollution prevention
sustainable consumption and production policies
regulations and legislations
sustainable population policy

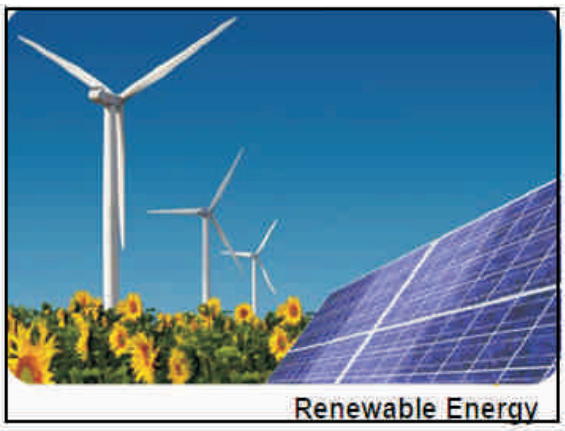

Metals Recycling Rates
The majority of specialty metals have recycling rates lower than 1%!

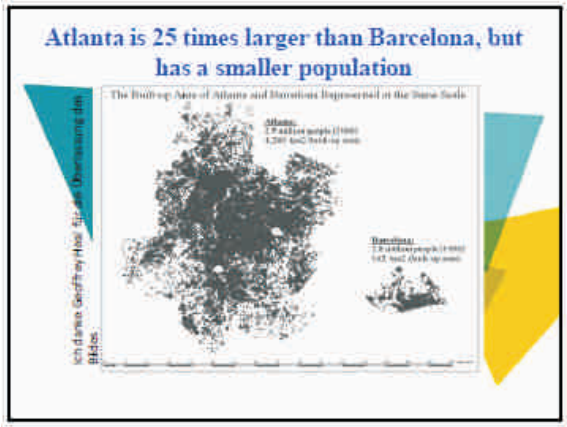

urban
mining
MINING
URBAN


The Ecological Footprint
CARBON footprint
FISHING grounds


Ecological Footprint
STRATEGIC DIALOGUES
1960-2005
2005-2050, Scenarios

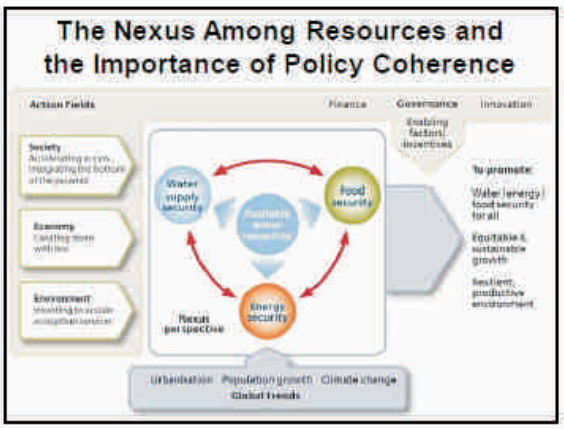

FACTOR FIVE
A Few Examples of Factor Five Technologies . . .

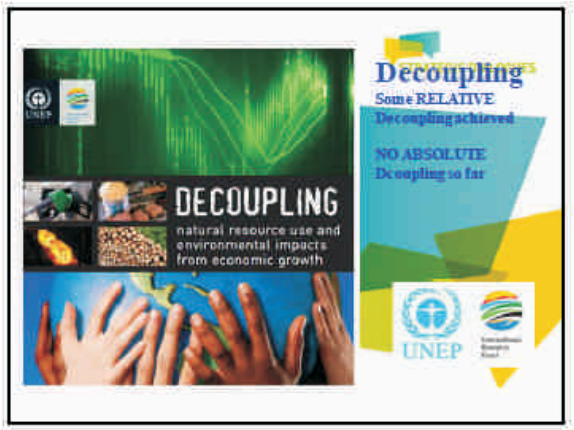

Renewable Energy

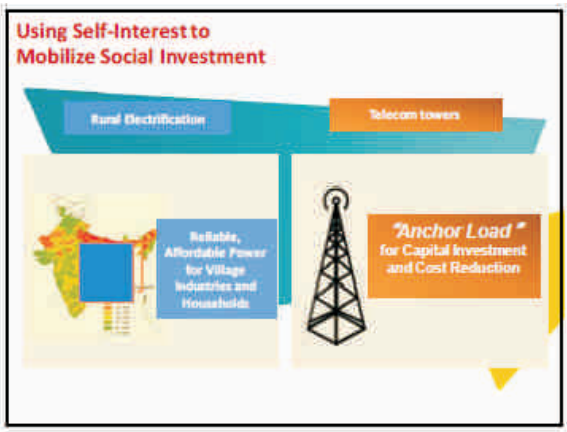

Atlanta is 25 times larger than Barcelona, but has a smaller population


From 12 lane highways to bicycle centered cities
Atlanta
Barcelona

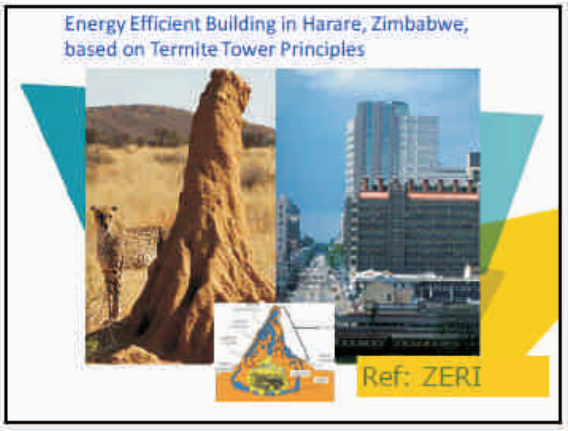

Copenhagen


The Nexus Among Resources and the Importance of Policy Coherence


DECOUPLING
natural resource use and environmental impacts from economic growth
Decoupling
Some RELATIVE Decoupling achieved
NO ABSOLUTE Decoupling so far
UNEP

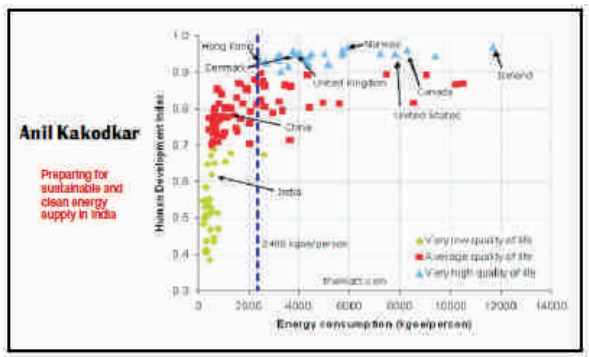

Using Self-Interest to Mobilize Social Investment
Rural Electrification
Telecom towers
Reliable, Affordable Power for Village Industries and Households
"Anchor Load" for Capital Investment and Cost Reduction

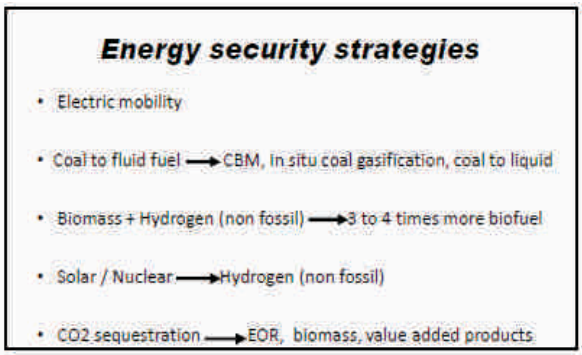

DESI Power Unit

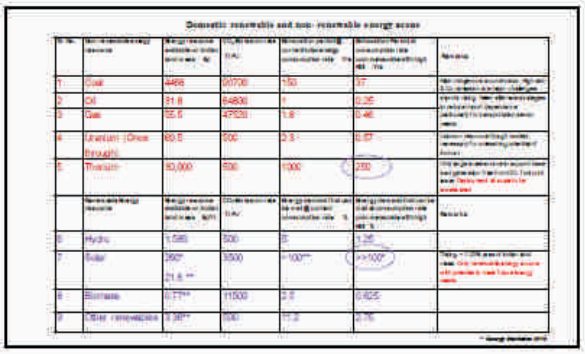

Energy Efficient Building in Harare, Zimbabwe, based on Termite Tower Principles
Ref: ZERI

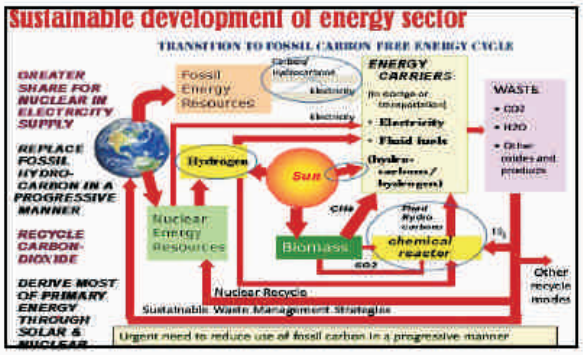
Plenary 2: Energy Security for All

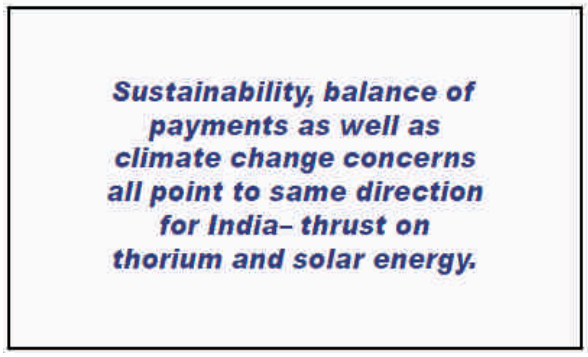
Anil Kakodkar, President, National Academy of Sciences, India

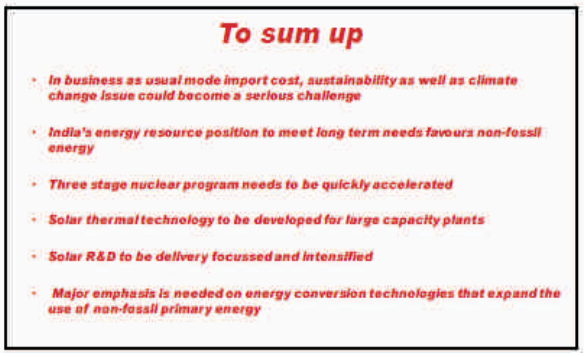




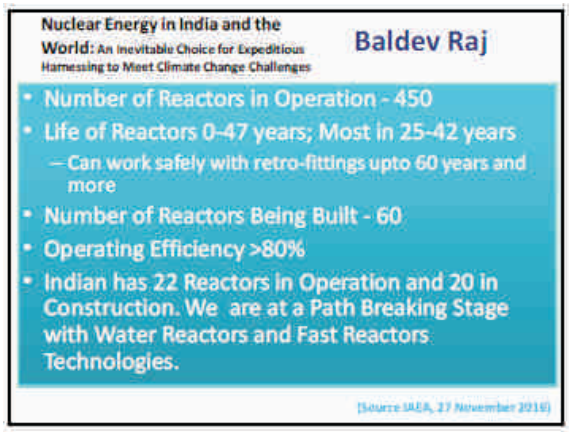


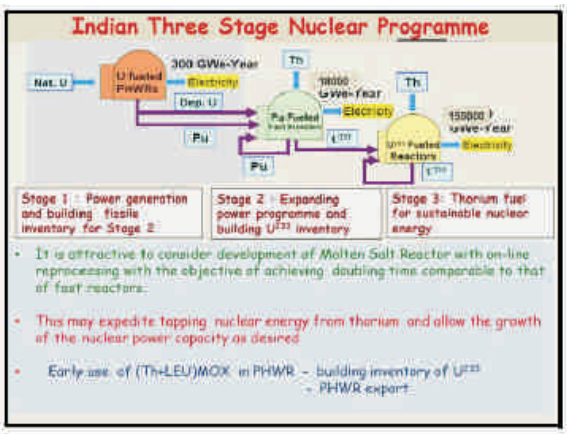


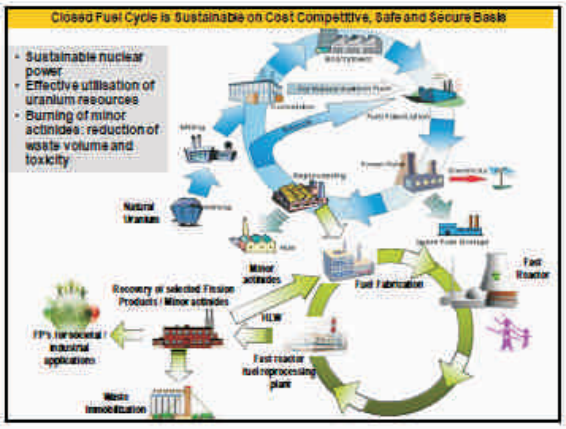


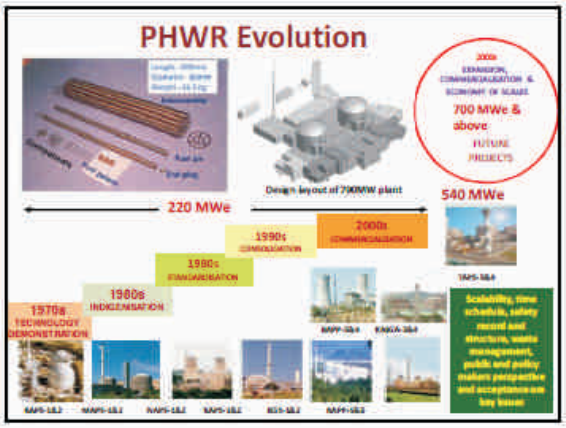


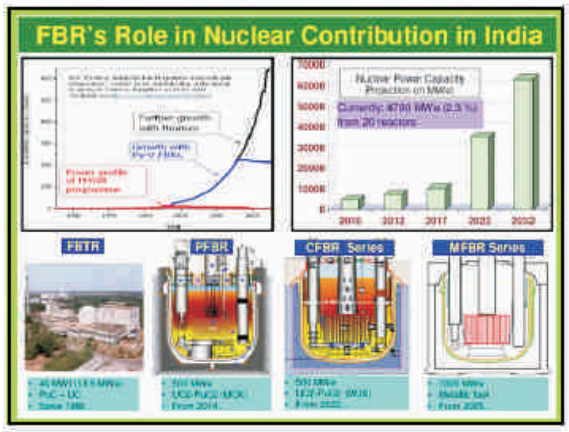
Dr. Baldev Raj, Director, National Institute of Advance Studies, Bengaluru

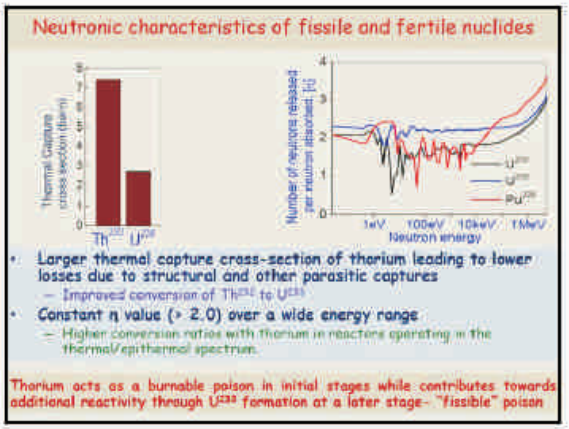


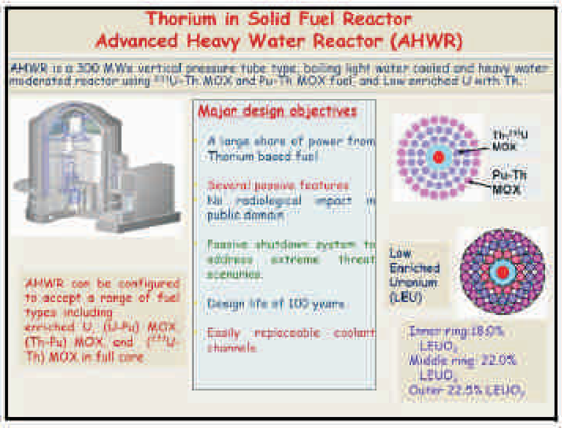


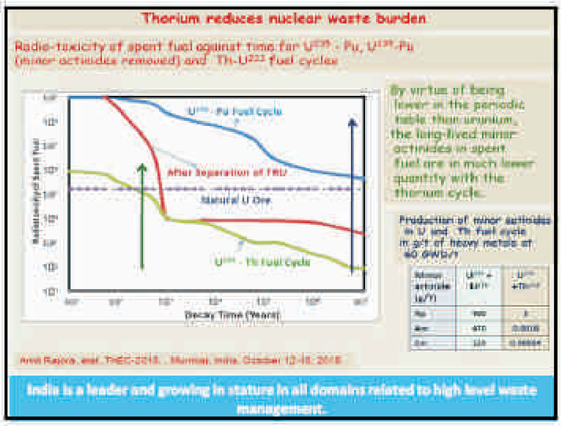


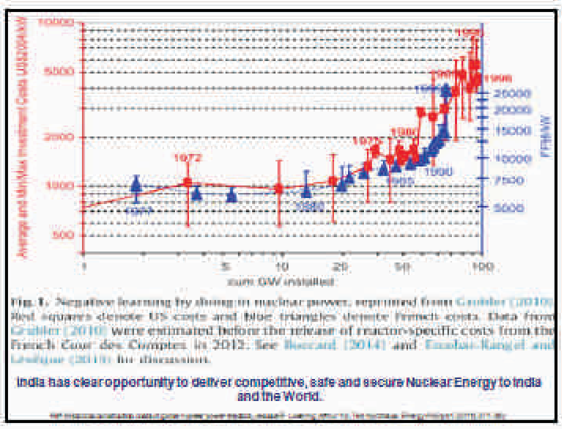


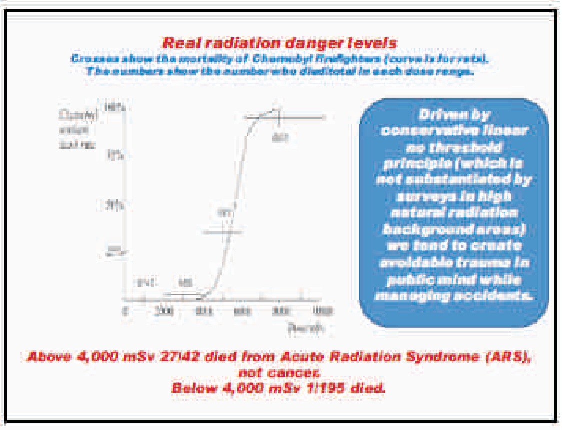




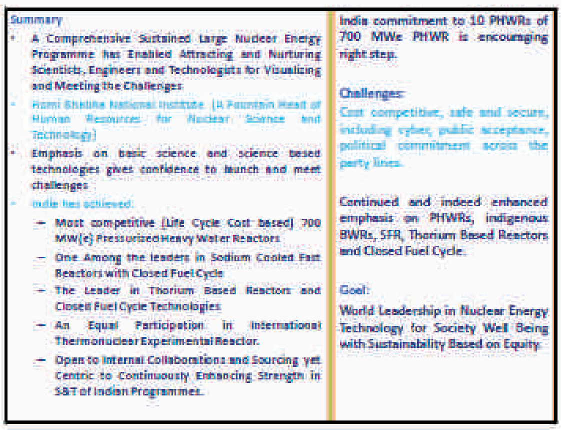

Thorium in Solid Fuel Reactor
Advanced Heavy Water Reactor (AHWR)
AHWR is a 300 MWe vertical pressure tube type, boiling light water cooled and heavy water moderated reactor using 233U-Th MOX and Pu-Th MOX fuel and Low enriched U with Th.
Major design objectives
A large share of power from Thorium based fuel
Several passive features
No radiological impact in public domain
Passive shutdown system to address extreme threat scenarios
Design life of 100 years
Easily replaceable coolant channels
AHWR can be configured to accept a range of fuel types including enriched U, (U-Pu) MOX (Th-Pu) MOX, and (233U-Th) MOX in full core
Th-233U MOX
Pu-Th MOX
Low Enriched Uranium (LEU)
Inner ring:18.0% LEUO2
Middle ring: 22.0% LEUO2
Outer 22.5% LEUO2

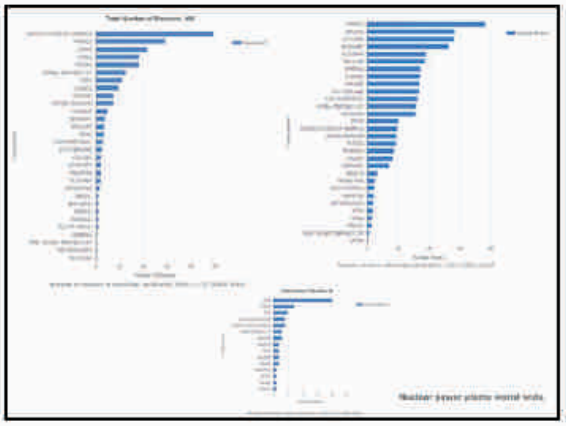

Thorium reduces nuclear waste burden
Radio-toxicity of spent fuel against time for U235 - Pu, U235-Pu (minor actinides removed) and Th-U233 fuel cycles
U235 - Pu Fuel Cycle
After Separation of TRU
Natural U Ore
U233 - Th Fuel Cycle
Decay Time (Years)
By virtue of being lower in the periodic table than uranium, the long-lived minor actinides in spent fuel are in much lower quantity with the thorium cycle.
Production of minor actinides in U and Th fuel cycle in g/t of heavy metals at 60 GWd/t
India is a leader and growing in stature in all domains related to high level waste management.


Average and Min/Max Investment Costs US$2008/kW
10000
5000
2000
1000
500
1972
1977
1986
1990
1993
1996
25000
20000
15000
10000
7500
5000
1
5
10
20
50
100
cum. GW installed
Fig. 1. Negative learning by doing in nuclear power, reprinted from Grubler (2010). Red squares denote US costs and blue triangles denote French costs. Data from Grubler (2010) were estimated before the release of reactor-specific costs from the French Cour des Comptes in 2012. See Boccard (2014) and Escobar-Rangel and Lévêque (2015) for discussion.
India has clear opportunity to deliver competitive, safe and secure Nuclear Energy to India and the World.

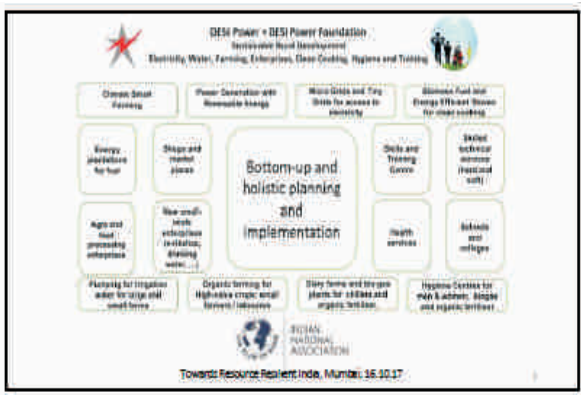

Real radiation danger levels
Crosses show the mortality of Chernobyl firefighters (curve is for rats).
The numbers show the number who died/total in each dose range.
Driven by conservative linear no threshold principle (which is not substantiated by surveys in high natural radiation background areas) we tend to create avoidable trauma in public mind while managing accidents.
Above 4,000 mSv 27/42 died from Acute Radiation Syndrome (ARS), not cancer.
Below 4,000 mSv 1/195 died.


The Price of Pollution
Each individual or industry must move, as a policy, to pay for price of pollution and climate change parameters for example CO2 (say $40/tonne of CO2 to begin with and in calibrated way establish charges of $100/tonne of CO2
Ref: Why it matters by Mike Orcutt

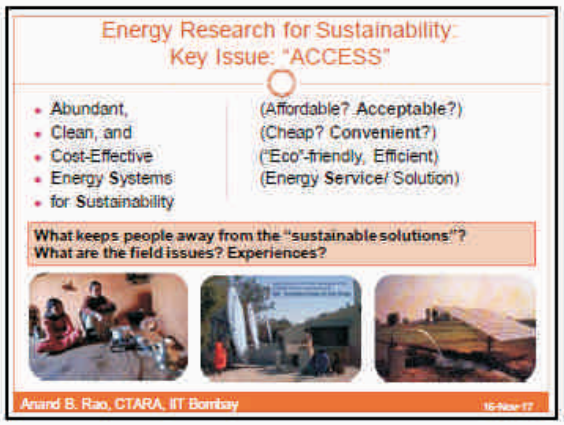

Summary
A Comprehensive Sustained Large Nuclear Energy Programme has Enabled Attracting and Nurturing Scientists, Engineers and Technologists for Visualizing and Meeting the Challenges
Homi Bhabha National Institute (A Fountain Head of Human Resources for Nuclear Science and Technology)
Emphasis on basic science and science based technologies gives confidence to launch and meet challenges
India has achieved:
– Most competitive (Life Cycle Cost based) 700 MW(e) Pressurized Heavy Water Reactors
– One Among the leaders in Sodium Cooled Fast Reactors with Closed Fuel Cycle
– The Leader in Thorium Based Reactors and Closed Fuel Cycle Technologies
– An Equal Participation in International Thermonuclear Experimental Reactor.
– Open to Internal Collaborations and Sourcing yet Centric to Continuously Enhancing Strength in S&T of Indian Programmes.
India commitment to 10 PHWRs of 700 MWe PHWR is encouraging right step.
Challenges:
Cost competitive, safe and secure, including cyber, public acceptance, political commitment across the party lines.
Continued and indeed enhanced emphasis on PHWRs, indigenous BWRs, SFR, Thorium Based Reactors and Closed Fuel Cycle.
Goal:
World Leadership in Nuclear Energy Technology for Society Well Being with Sustainability Based on Equity.

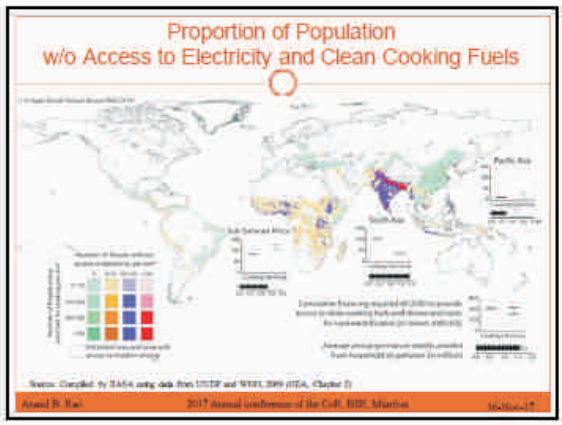


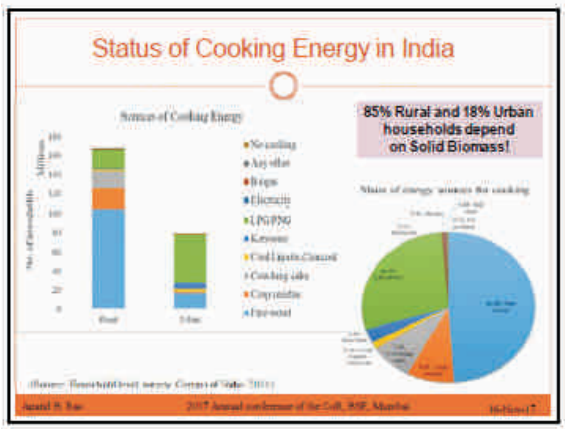
Hari Saran, DESI Power

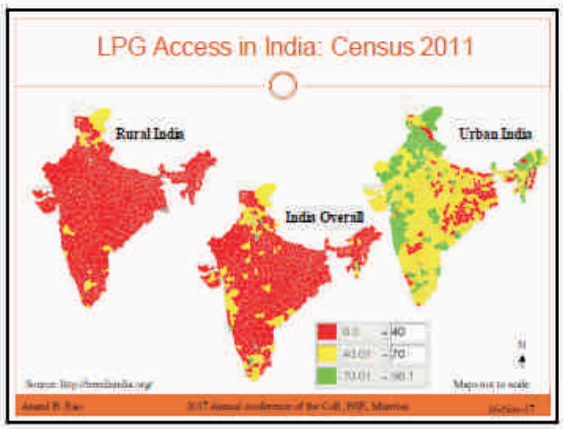


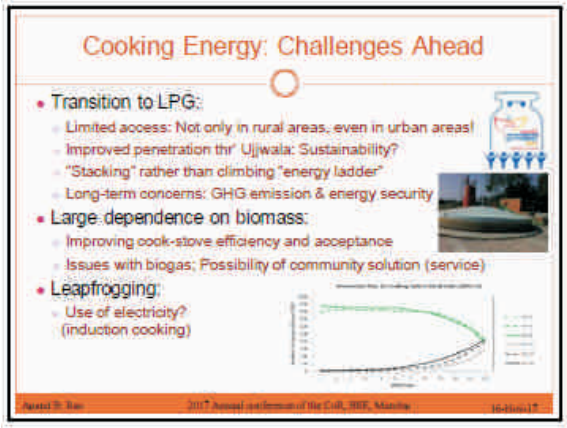
Anand Rao, IIT Bombay, Mumbai

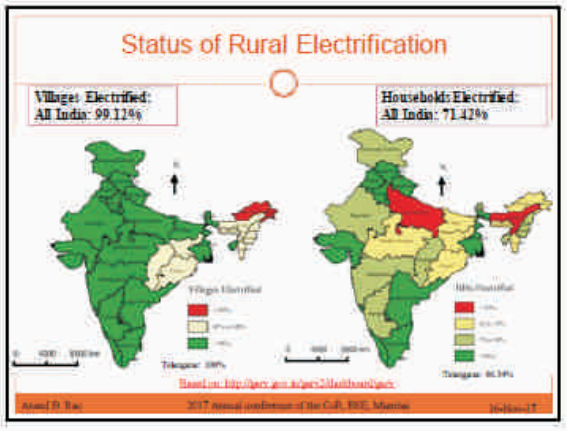


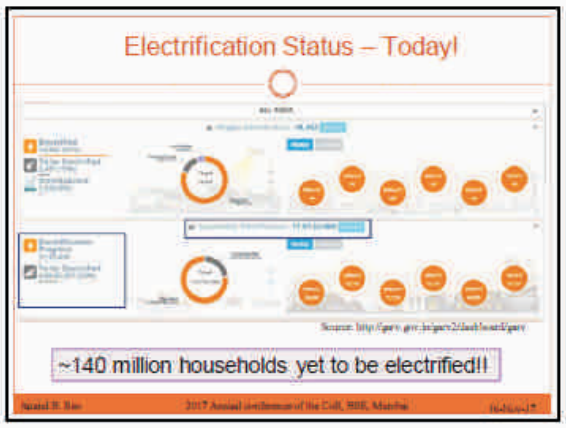


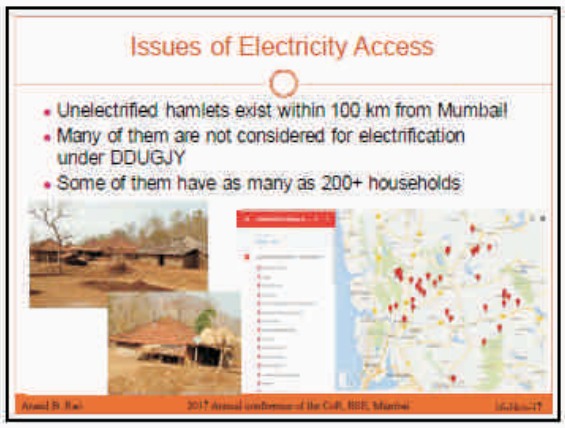


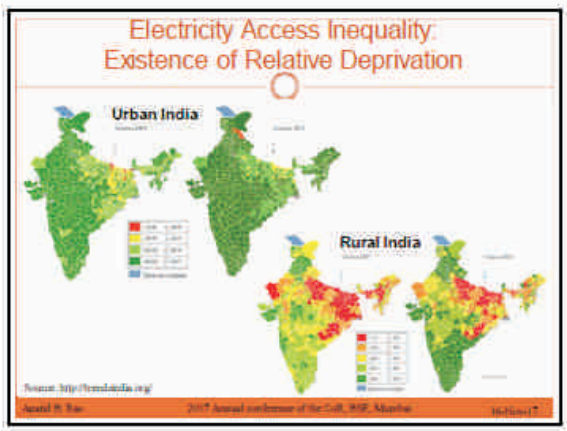


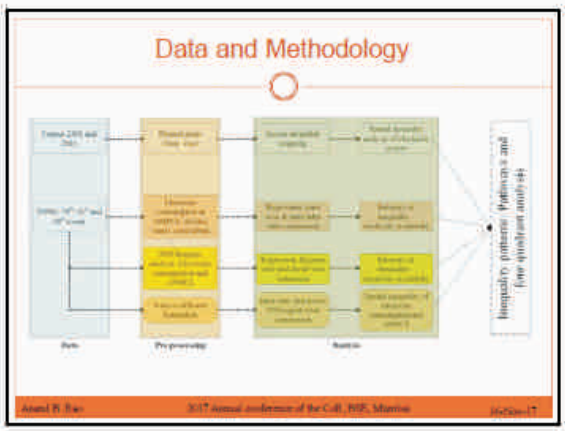

Cooking Energy: Challenges Ahead
Transition to LPG:
Limited access: Not only in rural areas, even in urban areas!
Improved penetration thr' Ujjwala: Sustainability?
"Stacking" rather than climbing "energy ladder"
Long-term concerns: GHG emission & energy security
Large dependence on biomass:
Improving cook-stove efficiency and acceptance
Issues with biogas; Possibility of community solution (service)
Leapfrogging:
Use of electricity? (induction cooking)

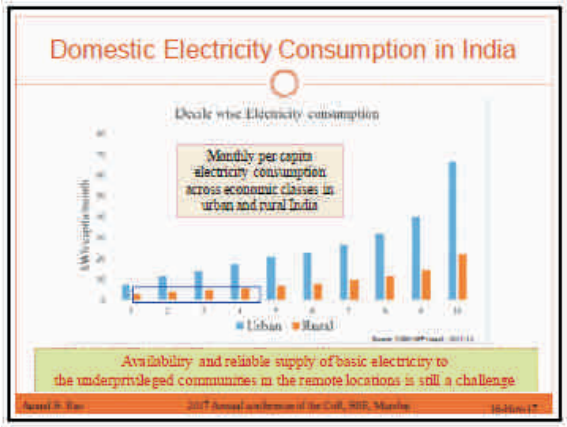

Status of Rural Electrification
Villages Electrified: All India: 99.12%
Households Electrified: All India: 71.42%

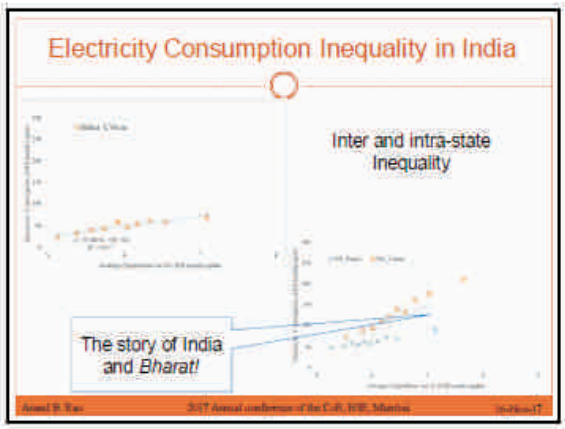

Electrification Status – Today!
~140 million households yet to be electrified!!

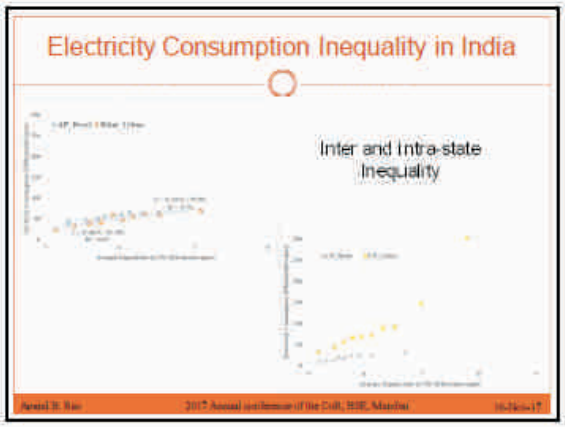

Issues of Electricity Access
Unelectrified hamlets exist within 100 km from Mumbai
Many of them are not considered for electrification under DDUGJY
Some of them have as many as 200+ households

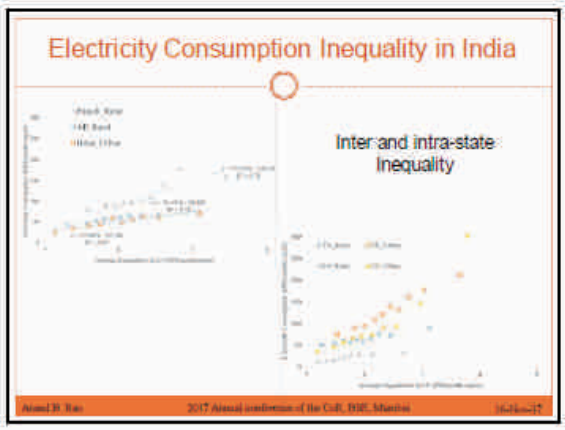

Electricity Access Inequality: Existence of Relative Deprivation
Urban India
Rural India

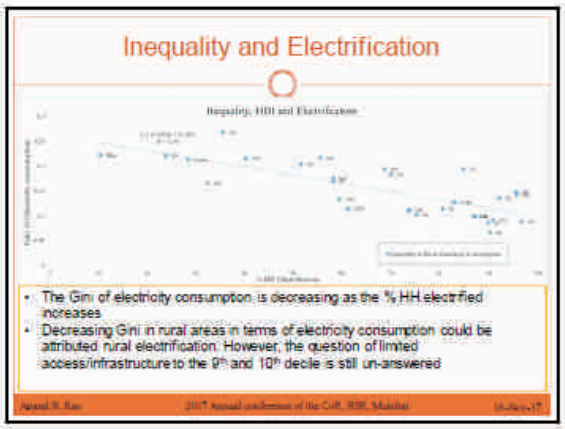

Data and Methodology

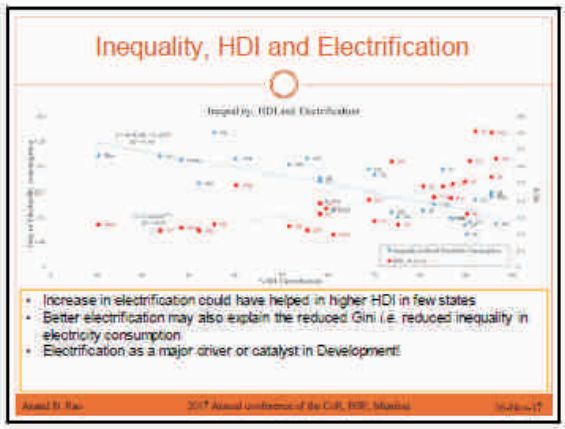

Domestic Electricity Consumption in India
Decile wise Electricity consumption
Monthly per capita electricity consumption across economic classes in urban and rural India
Urban
Rural
Availability and reliable supply of basic electricity to the underprivileged communities in the remote locations is still a challenge

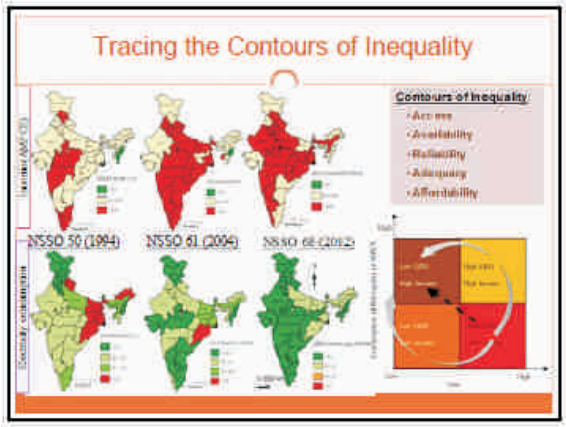

Electricity Consumption Inequality in India
Inter and intra-state Inequality
The story of India and Bharat!

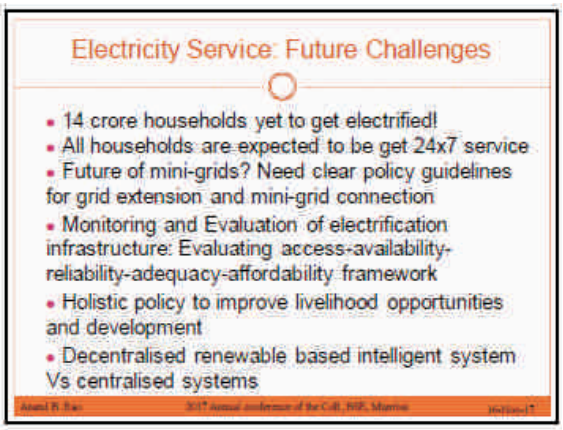

Electricity Consumption Inequality in India
Inter and intra-state Inequality

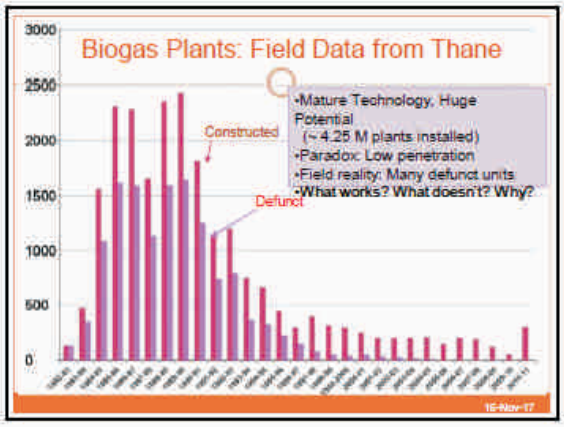

Electricity Consumption Inequality in India
Inter and intra-state Inequality

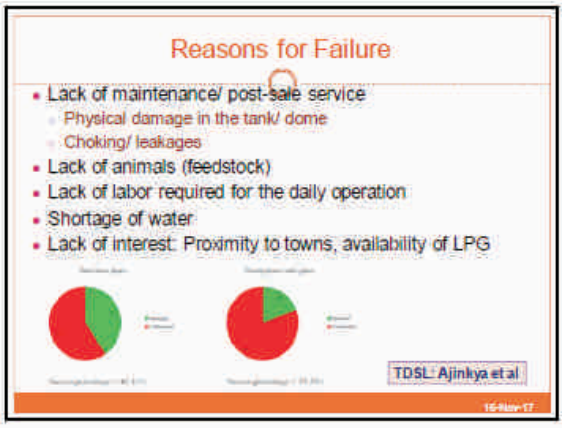

Inequality and Electrification
The Gini of electricity consumption is decreasing as the % HH electrified increases
Decreasing Gini in rural areas in terms of electricity consumption could be attributed rural electrification. However, the question of limited access/infrastructure to the 9th and 10th decile is still un-answered

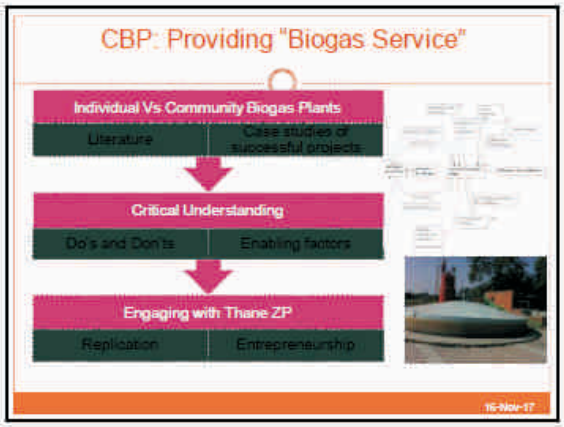

Inequality, HDI and Electrification
Increase in electrification could have helped in higher HDI in few states
Better electrification may also explain the reduced Gini (i.e. reduced inequality in electricity consumption
Electrification as a major driver or catalyst in Development!


Tracing the Contours of Inequality
Contours of Inequality
NSSO 50 (1994)
NSSO 61 (2004)


Electricity Service: Future Challenges
• 14 crore households yet to get electrified!
• All households are expected to be get 24x7 service
• Future of mini-grids? Need clear policy guidelines for grid extension and mini-grid connection
• Monitoring and Evaluation of electrification infrastructure: Evaluating access-availability-reliability-adequacy-affordability framework
• Holistic policy to improve livelihood opportunities and development
• Decentralised renewable based intelligent system Vs centralised systems

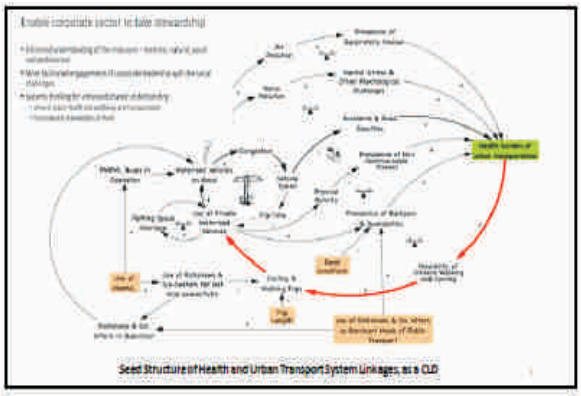

Biogas Plants: Field Data from Thane
3000
2500
2000
1500
1000
500
0
Constructed
Defunct
•Mature Technology, Huge Potential (~4.25 M plants installed)
•Paradox: Low penetration
•Field reality: Many defunct units
•What works? What doesn't? Why?

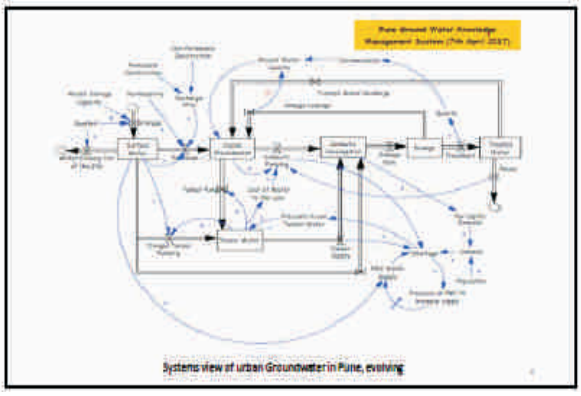

Reasons for Failure
• Lack of maintenance/ post-sale service
Physical damage in the tank/ dome
Choking/ leakages
• Lack of animals (feedstock)
• Lack of labor required for the daily operation
• Shortage of water
• Lack of interest: Proximity to towns, availability of LPG
TDSL: Ajinkya et al

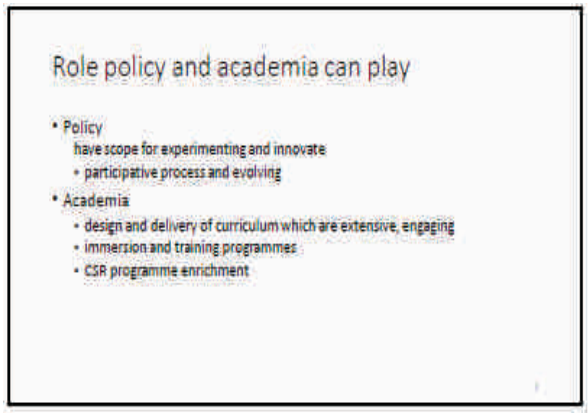

CBP: Providing "Biogas Service"
Individual Vs Community Biogas Plants
Literature
Case studies of successful projects
Critical Understanding
Do's and Don'ts
Enabling factors
Engaging with Thane ZP
Replication
Entrepreneurship

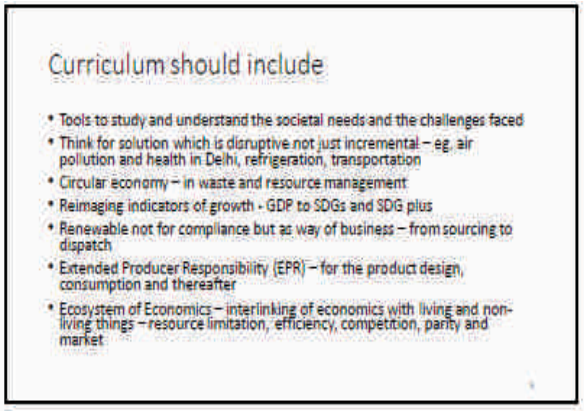
Plenary 5: Importance of Natural Resource Efficiency in Corporate Education and the Curriculum

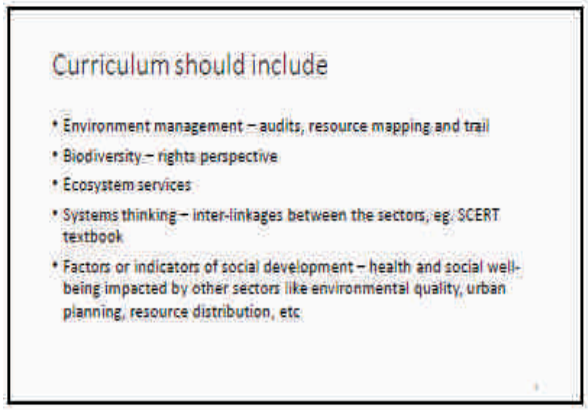
Amarnath Karan, CEE, India





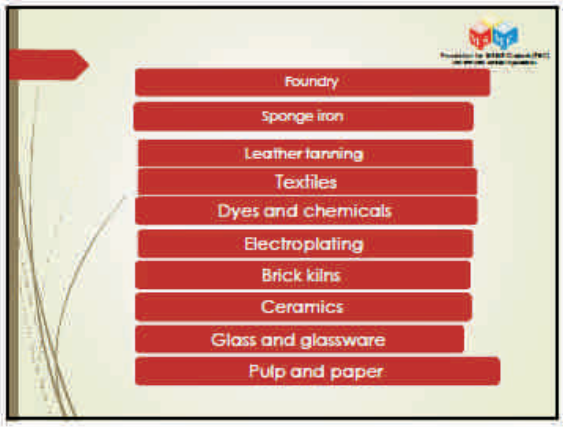

Role policy and academia can play
• Policy
have scope for experimenting and innovate
• participative process and evolving
• Academia
• design and delivery of curriculum which are extensive, engaging
• immersion and training programmes
• CSR programme enrichment

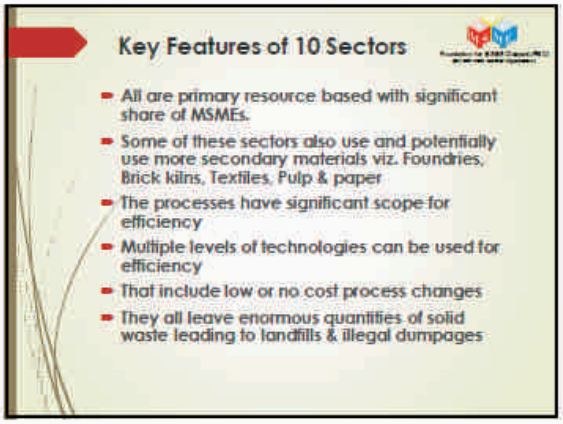

Curriculum should include
• Tools to study and understand the societal needs and the challenges faced
• Think for solution which is disruptive not just incremental – eg. air pollution and health in Delhi, refrigeration, transportation
• Circular economy – in waste and resource management
• Reimaging indicators of growth - GDP to SDGs and SDG plus
• Renewable not for compliance but as way of business – from sourcing to dispatch
• Extended Producer Responsibility (EPR) – for the product design, consumption and thereafter
• Ecosystem of Economics – interlinking of economics with living and non-living things – resource limitation, efficiency, competition, parity and market

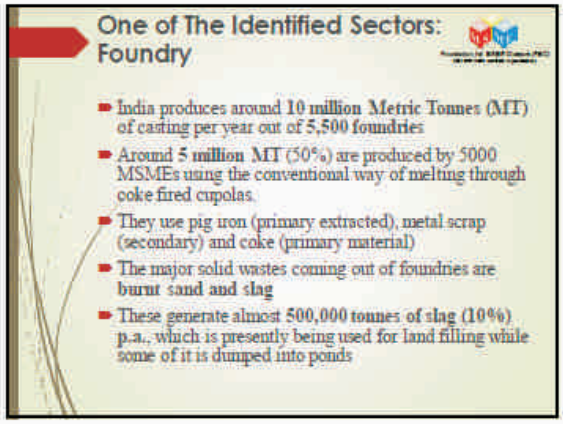

Curriculum should include
• Environment management – audits, resource mapping and trail
• Biodiversity – rights perspective
• Ecosystem services
• Systems thinking – inter-linkages between the sectors, eg. SCERT textbook
• Factors or indicators of social development – health and social well-being impacted by other sectors like environmental quality, urban planning, resource distribution, etc

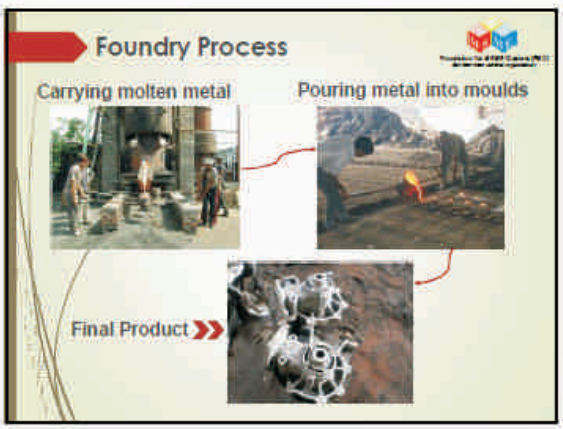
Plenary 6: Circular Economy and Material Recycling (secondary raw material use) - Business Scope towards Material Security

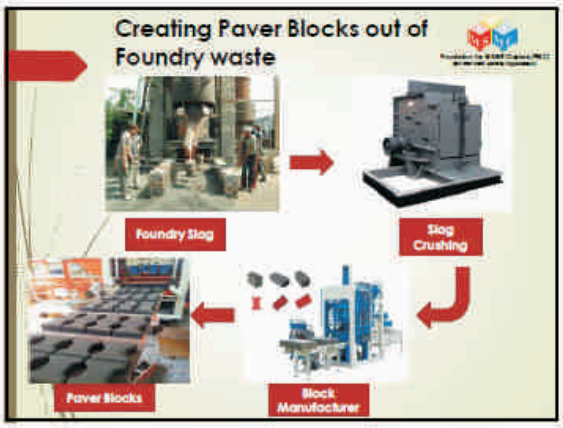
Mukesh Gulati, Senior Advisor, Foundation for MSME Clusters



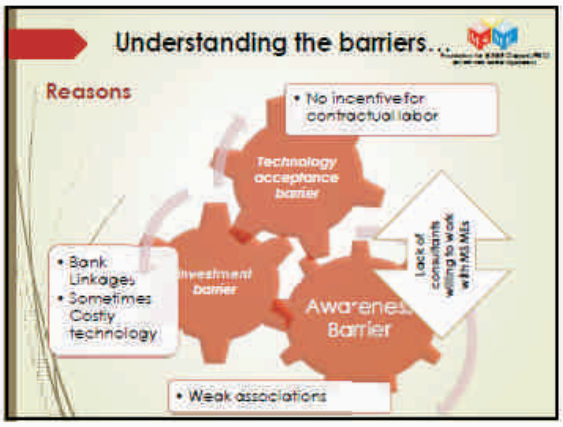


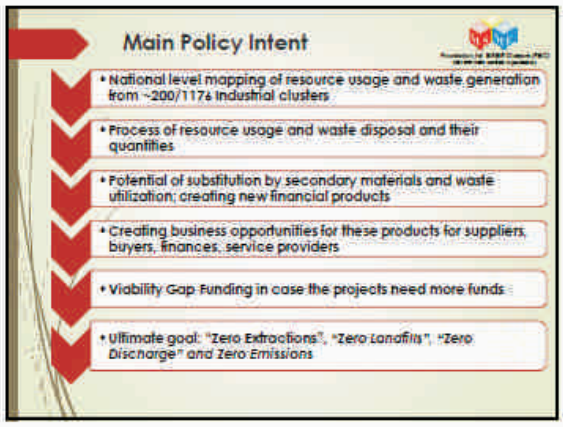





Creating Paver Blocks out of Foundry waste
Foundry Slag
Slag Crushing
Paver Blocks
Block Manufacturer


Achievements
DST has a scheme: "Promoting Sustainable and Inclusive growth by Enterprise creation through Science & technology based Innovative Solutions"
Only 250 paver block enterprises using waste slag are needed to ensure Zero Land Fill from this 500,000 Tonnes foundry waste p.a.
By September 2020, the project targets to create/ upgrade 50 such enterprises using this technology using up 20% of this waste
In the last 2 out of 5 years, 12/50 targeted enterprises have already been set up and become functional
Big Question is: What are the reasons and what can policy do about it? Who takes the responsibility?

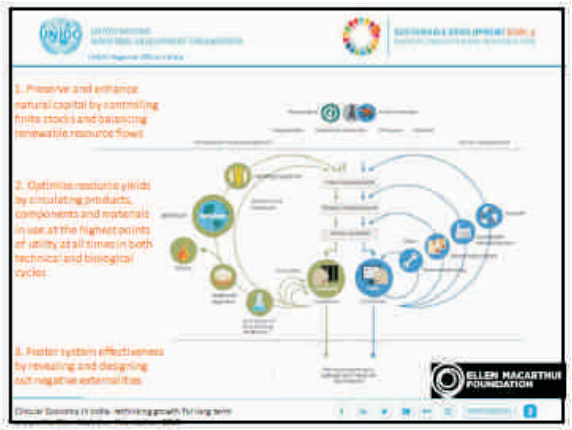

Understanding the barriers...
Reasons
• No incentive for contractual labor
Technology acceptance barrier
• Bank Linkages
• Sometimes Costly technology
Investment barrier
Awareness Barrier
Lack of consultants willing to work with MSMEs
• Weak associations

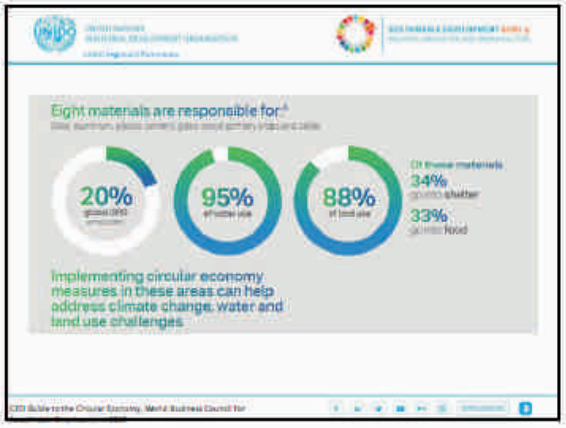

Main Policy Intent
• National level mapping of resource usage and waste generation from ~200/117 industrial clusters
• Process of resource usage and waste disposal and their quantities
• Potential of substitution by secondary materials and waste utilization; creating new financial products
• Creating business opportunities for these products for suppliers, buyers, finances, service providers
• Viability Gap Funding in case the projects need more funds
• Ultimate goal: "Zero Extractions", "Zero Landfills", "Zero Discharge" and Zero Emissions

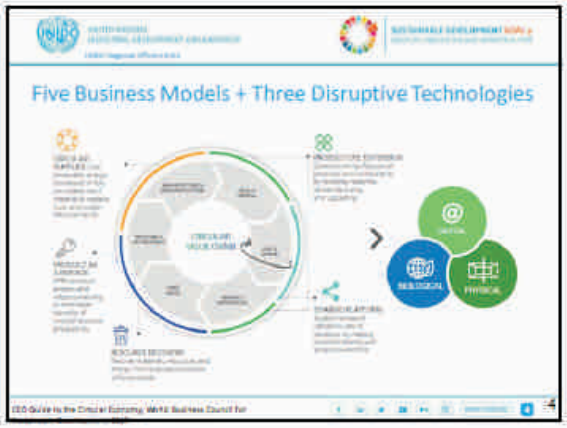

11
Policy Recommendations
1. Create a repository of available technologies with business plans and support acquisition through quality business development service providers disaggregated at sectoral level to augment supply. Avoid working in silos. Get to the details.
2. Access to institutional finance as a big driver: Training of existing bankers and performance systems that support project based financing and not asset based
3. Linkages with the Global value chain/ markets and benchmark enterprises: Policy Support for Exposure building
4. Need for a more stringent enforcement of laws: Special studies that track progress over time
5. Public procurement with standards in favour of secondary material usage has a strong potential to support progression


12
Policy Recommendations
6. Undertake integrated initiatives that help connect diverse actors at various levels; viz. clusters, regions and sectors
i. Create local, regional and national online repositories of problems in search of solutions to reach out to innovators, academic & technical institutions and enterprises
ii. Create 'Challenge grant funds' for identification of creative ideas to be harnessed
iii. Create plug & play facilities to try out new ideas as incubators with select equipment, connectivity and a meeting point for complementary stakeholders to connect and mutually support
iv. Institute development initiatives in special cross cutting areas that require special thrust or long term investment for solution creation
v. Demonstrate successful innovations through innovation on fairs and institution of awards

Rene Van Berkel, UNIDO Representative, Regional Office India

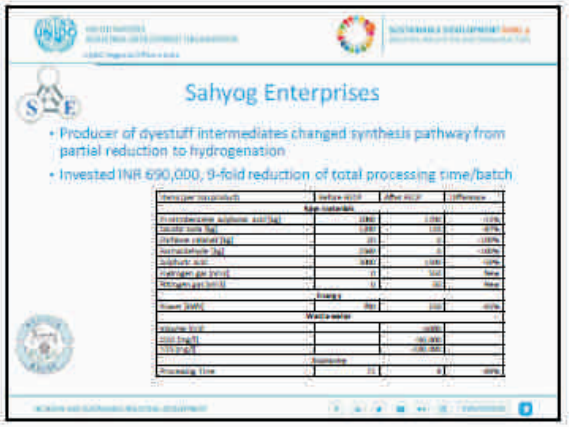







Circular Economy
Resource Efficient and Cleaner Production
Secondary Use in Industry
Cleaner production
Better service
Recycle waste, reuse resources
Collect at end-of-life remanufacture
Reduce Resource Dependency


Resource Efficient and Cleaner Production
•Finding and implementing ways to:
•Improve productive use of materials, water and energy (thereby)
•Reduce the generation of waste, effluent and emissions (thereby)
•Improve well being of employees, consumers and community
Global Programme with UNDP since 1995, Implemented
CII


Sahyog Enterprises
• Producer of dyestuff intermediates changed synthesis pathway from partial reduction to hydrogenation
• Invested INR 690,000, 9-fold reduction of total processing time/batch


Input Change
Better Process Control
Good House-keeping
Equipment Modifi-cation
Resource Efficient and Cleaner Production
Product Modifi-cation
Technology Change
Production of Useful Byproduct
On Site Reuse & Recycling


• Typical examples
• Use renewable energy
• Use sustainably-sourced renewable materials
• Use of secondary materials, water and energy
• Use fit for purpose materials
• Use less harmful substances
• Source locally

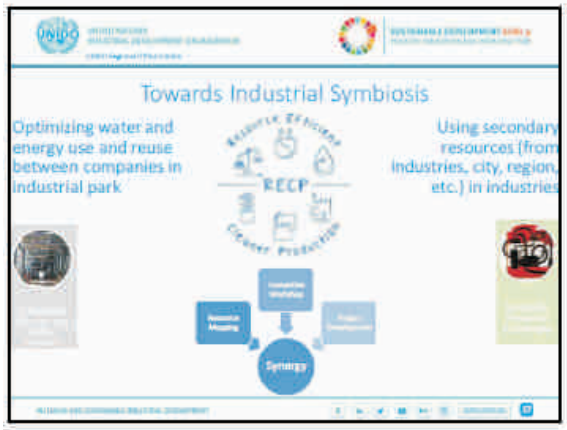

Pure Waste Textiles
www.purewastetextiles.com

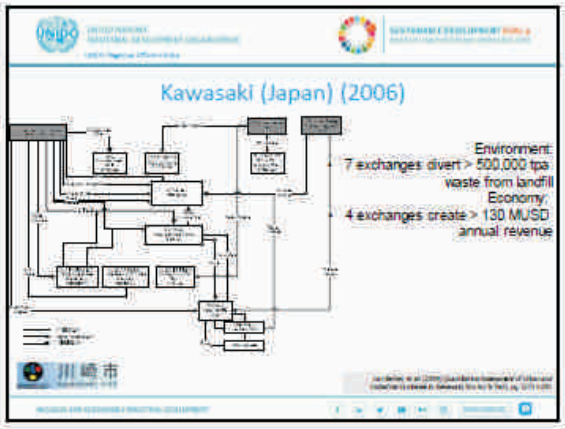

Alternative Fuels in Paddy Drying
• Chea Hap Rice Mill, Cambodia


Processing of Fresh Chilled Hides in Tanneries
• Avoiding use of salt and 30-40% reduction of TDS in tannery effluents
• Operational cost savings INR 130/ton hides, plus avoided effluent treatment costs of INR 1,260/ton (dilution) to INR 4,600/ton (evaporation)
• Upfront investment in cold storage required

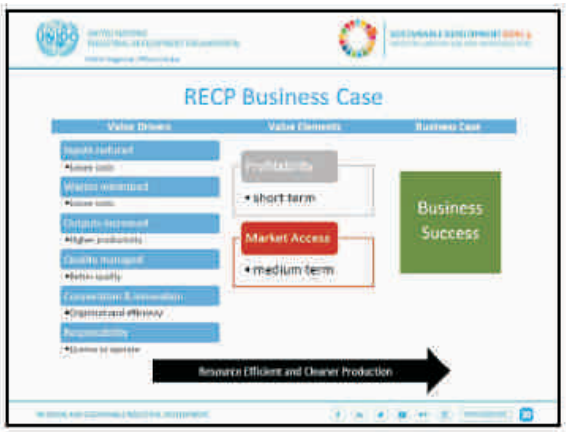

Typical examples
• Provision of used cooling water for external heating or cooling purposes (buildings, fish farms etc.)
• Segregate recyclables for external recycling and resource recovery, e.g. pet food
• Industrial symbiosis, reuse in industrial processes


GCIP
• MSME clean tech innovators
• Annual competition in four thematic areas: energy efficiency; renewable energy; waste beneficiation; and water efficiency
• Training and business mentoring for competitors with high environmental merit, innovation and market capability
• B2B match making and development of innovation ecosystem
• Rays Energy
• Advanced Supercritical Thermal Treatment to produce diesel-substitute from non-recycled plastic (PP, PE and PS)
• First commercial plant to be commissioned in Dec 2017 for 15,000 lt capacity in Patiala, Punjab
• Chakr Innovation
• Retrofit device to capture 70-90% of particulate matter from diesel generator exhausts for reuse in paint and ink
• 30 installations operational in NCR
• Bridgedots
• Silica extraction from rice husk ash for use as tyre filler, reducing rolling resistance of tyres with up to 5% fuel savings on vehicles
• Pilot plant is being upscaled to commercial scale in partnership with tyre-company

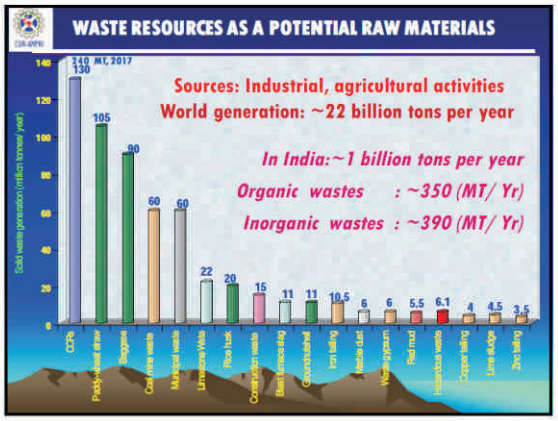

Towards Industrial Symbiosis
Optimizing water and energy use and reuse between companies in industrial park
Using secondary resources (from industries, city, region, etc.) in industries
RECP
Synergy

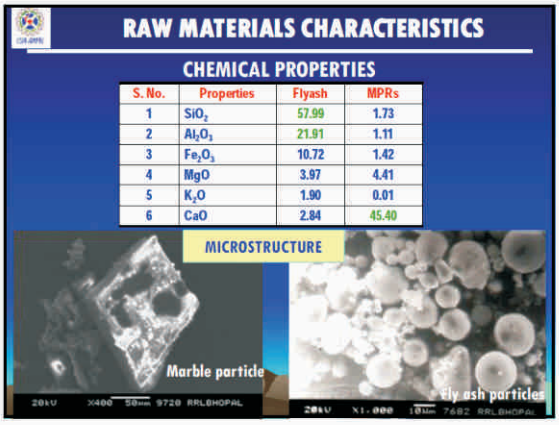

Kawasaki (Japan) (2006)
Environment:
7 exchanges divert > 500,000 tpa waste from landfill
Economy:
4 exchanges create > 130 MUSD annual revenue

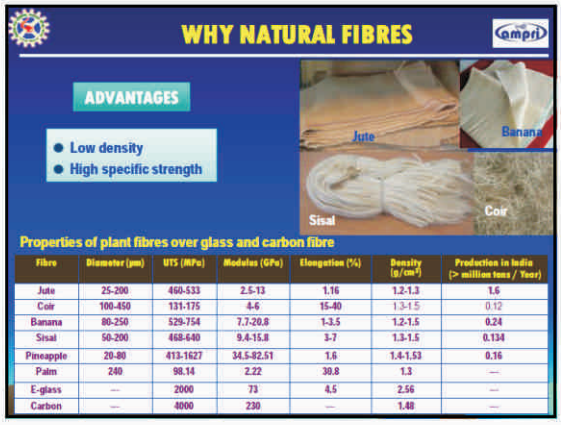

Organic Waste to Energy
• Significant opportunity, despite uncertainty in availability, volume and composition of organic waste and technology performances
◦ Estimated potential between 510 and 5,200 MWh in India
• Multiple WtE technologies available
◦ Bio-methanation, incineration, gasification, pyrolysis, RDF, ethanol
• Bio-methanation versatile technology for range of (wet) organic waste streams
1.66 MW Biogas based Power Plant at Jain Irrigation, Jalgaon, Maharastra

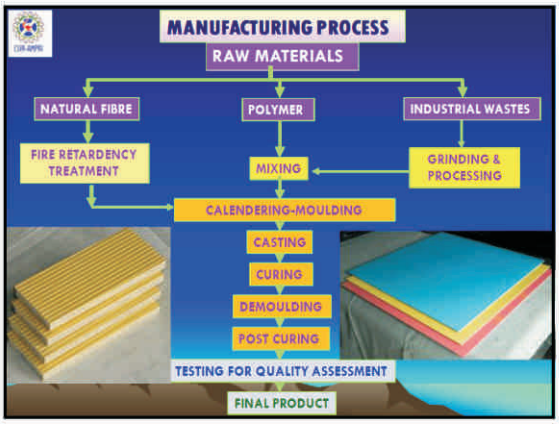

RECP Business Case
Value Drivers
Value Elements
Business Case
• short term
Market Access
• medium term
Business Success
Resource Efficient and Cleaner Production

Asokan Pappu, CSIR, AMPRI, Bhopal



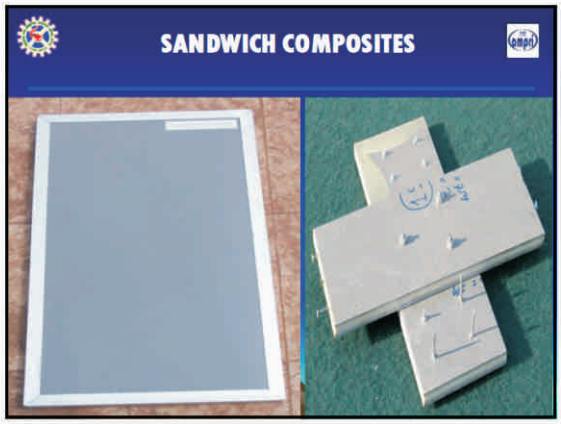

RAW MATERIALS CHARACTERISTICS
CHEMICAL PROPERTIES
S. No. | Properties | Flyash | MPRs
1 | SiO_2 | 57.99 | 1.73
2 | Al_2O_3 | 21.91 | 1.11
3 | Fe_2O_3 | 10.72 | 1.42
4 | MgO | 3.97 | 4.41
5 | K_2O | 1.90 | 0.01
6 | CaO | 2.84 | 45.40
MICROSTRUCTURE
Marble particle
Fly ash particles

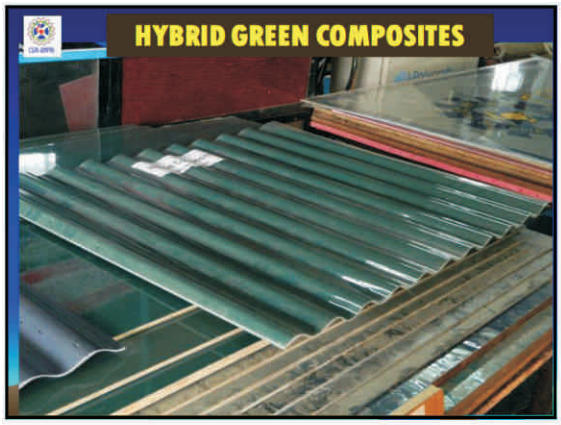

WHY NATURAL FIBRES
ADVANTAGES
Low density
High specific strength
Jute
Banana
Sisal
Coir
Properties of plant fibres over glass and carbon fibre
Fibre | Diameter (μm) | UTS (MPa) | Modulus (GPa) | Elongation (%) | Density (g/cm³) | Production in India (> million tons / Year)
Jute | 25-200 | 460-533 | 2.5-13 | 1.16 | 1.2-1.3 | 1.6
Coir | 100-450 | 131-175 | 4-6 | 15-40 | 1.3-1.5 | 0.12
Banana | 80-250 | 529-754 | 7.7-20.8 | 1-3.5 | 1.2-1.5 | 0.24
Sisal | 50-200 | 468-640 | 9.4-15.8 | 3-7 | 1.3-1.5 | 0.134
Pineapple | 20-80 | 413-1627 | 34.5-82.51 | 1.6 | 1.4-1.53 | 0.16
Palm | 240 | 98.14 | 2.22 | 30.8 | 1.3 | —
E-glass | — | 2000 | 73 | 4.5 | 2.56 | —
Carbon | — | 4000 | 230 | — | 1.48 | —

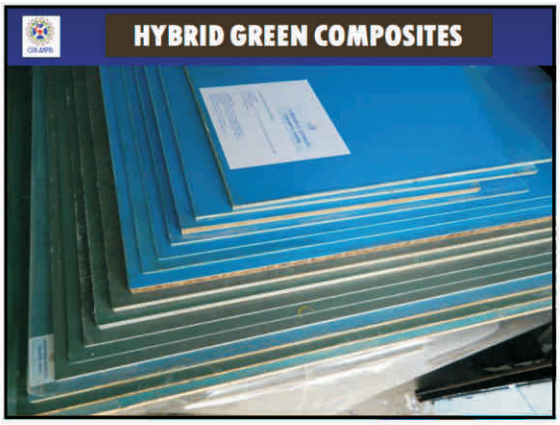

MANUFACTURING PROCESS
RAW MATERIALS
NATURAL FIBRE
POLYMER
INDUSTRIAL WASTES
FIRE RETARDENCY TREATMENT
MIXING
GRINDING & PROCESSING
CALENDERING-MOULDING
CASTING
CURING
DEMOULDING
POST CURING
TESTING FOR QUALITY ASSESSMENT
FINAL PRODUCT


HYBRID COMPOSITE PRODUCTS
FOR BUILDING CONSTRUCTION INDUSTRY


AN ALTERNATIVE FOR :
• Wood / Timber
• Synthetic wood (MDF, Particle Board, Ply wood...)
Target :To achieve the performance of Plastic & FRP / GRP

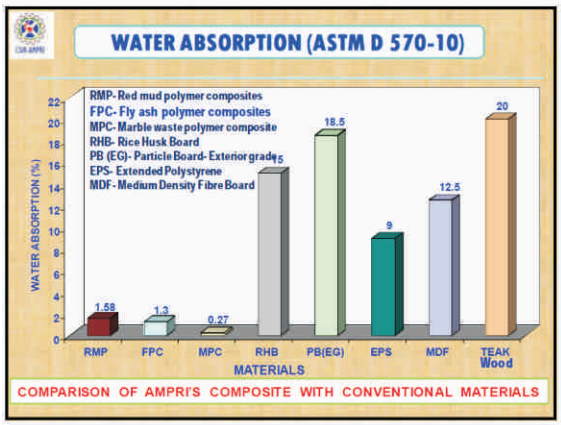

SANDWICH COMPOSITES

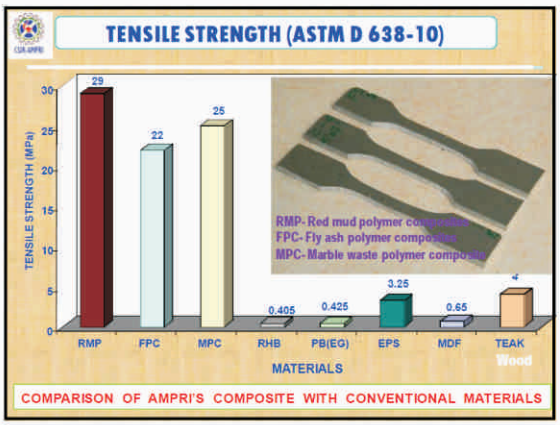

HYBRID GREEN COMPOSITES

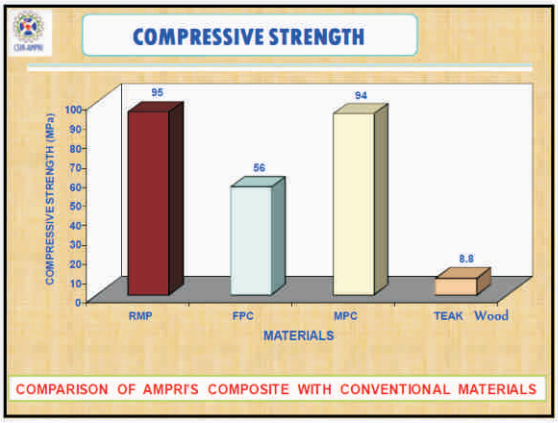

HYBRID GREEN COMPOSITES

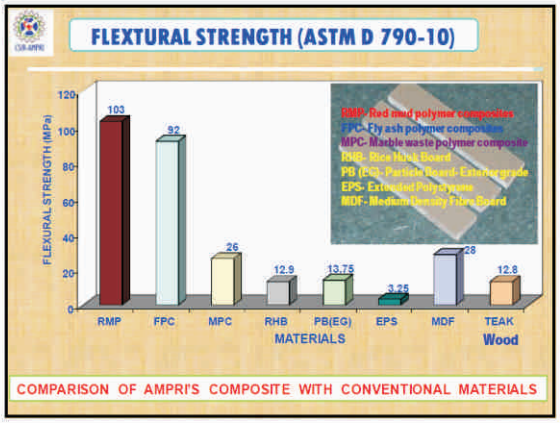

National Convention
on
Making Policies for Promoting Innovations, Entrepreneurship and Startups
Bhopal Smart City Development Corporation
CSIR-AMPRI Participation & showcasing

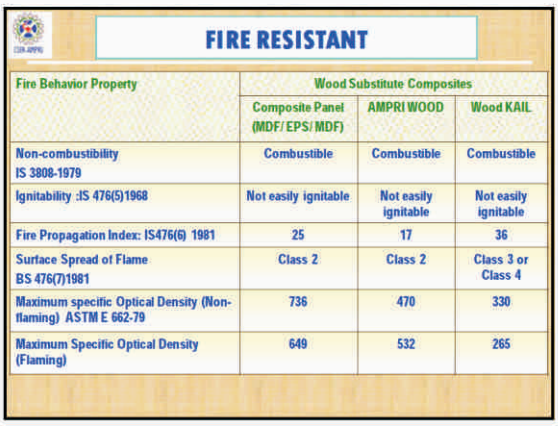

PROPERTIES OF COMPOSITES


WATER ABSORPTION (ASTM D 570-10)
RMP- Red mud polymer composites
FPC- Fly ash polymer composites
MPC- Marble waste polymer composite
RHB- Rice Husk Board
PB (EG)- Particle Board- Exterior grade
EPS- Extended Polystyrene
MDF - Medium Density Fibre Board
WATER ABSORPTION (%)
1.58
1.3
0.27
15
18.5
9
12.5
20
RMP
FPC
MPC
RHB
PB(EG)
EPS
MDF
TEAK Wood
MATERIALS
COMPARISON OF AMPRI'S COMPOSITE WITH CONVENTIONAL MATERIALS


TENSILE STRENGTH (ASTM D 638-10)
TENSILE STRENGTH (MPa)
29
22
25
0.405
0.425
3.25
0.65
4
RMP
FPC
MPC
RHB
PB(EG)
EPS
MDF
TEAK Wood
MATERIALS
RMP- Red mud polymer composites
FPC- Fly ash polymer composites
MPC- Marble waste polymer composite
COMPARISON OF AMPRI'S COMPOSITE WITH CONVENTIONAL MATERIALS

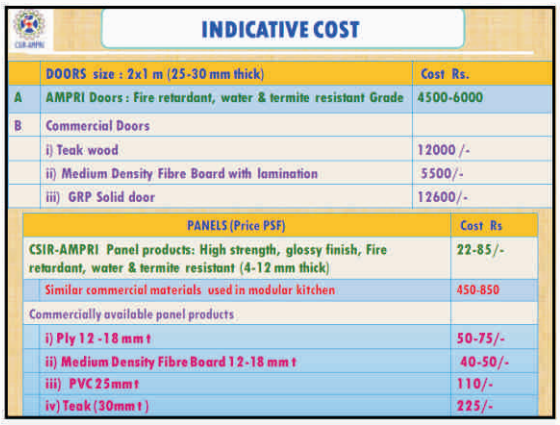






FIRE RESISTANT

Fire Behavior Property	Wood Substitute Composites		
	Composite Panel (MDF/ EPS/ MDF)	AMPRI WOOD	Wood KAIL
Non-combustibility IS 3808-1979	Combustible	Combustible	Combustible
Ignitability :IS 476(5)1968	Not easily ignitable	Not easily ignitable	Not easily ignitable
Fire Propagation Index: IS476(6) 1981	25	17	36
Surface Spread of Flame BS 476(7)1981	Class 2	Class 2	Class 3 or Class 4
Maximum specific Optical Density (Non-flaming) ASTM E 662-79	736	470	330
Maximum Specific Optical Density (Flaming)	649	532	265



INDICATIVE COST

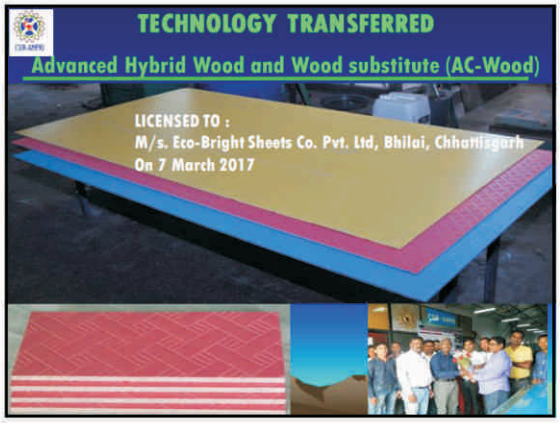
	DOORS size : 2x1 m (25-30 mm thick)	Cost Rs.
A	AMPRI Doors : Fire retardant, water & termite resistant Grade	4500-6000
B	Commercial Doors	
	i) Teak wood	12000 /-
	ii) Medium Density Fibre Board with lamination	5500/-
	iii) GRP Solid door	12600/-

PANELS (Price PSF)	Cost Rs
CSIR-AMPRI Panel products: High strength, glossy finish, Fire retardant, water & termite resistant (4-12 mm thick)	22-85/-
Similar commercial materials used in modular kitchen	450-850
Commercially available panel products	
i) Ply 12 -18 mm t	50-75/-
ii) Medium Density Fibre Board 12-18 mm t	40-50/-
iii) PVC 25mm t	110/-
iv) Teak (30mm t)	225/-


ADVANTAGES
Uniqueness of Products:
Durable and stronger than teak wood
High strength to weight ratio
Resistance to weather, termite, corrosion
Fire retardant, self extinguishing
Maintenance free green composite
Cost-effective than teak wood
Use in multifunctional applications
Commercial Opportunities
Transforming waste into wealth in construction sector
Convert lab research & Create start-up industries
Enhance economy & employment
Process know-how? is ready for commercialization


ACHIEVEMENTS & OPPORTUNITIES
Simple process, address multiple issues, multifunctional applications
Alternative for
Timber
MDF
Particle board
Ply wood
New wood &
Plastic
Advantages
Stronger than timber, synthetic wood, plastic and durable
Resistance to weather, corrosion, moisture, termite...
Fire retardant materials having self-extinguishing nature
Cost effective & maintenance free products
HYBRID GREEN COMPOSITES


TECHNOLOGY TRANSFERRED
Hybrid Wood Substitute Composite Materials
(CM WOOD)
LICENSED TO :
M/s. VSM Industry, Surat Gujarat
On 29 Aug 2015

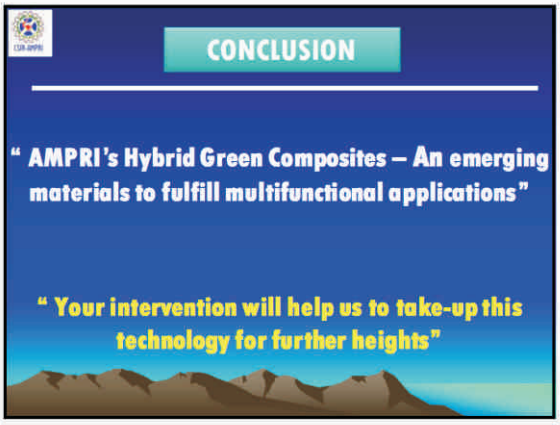

TECHNOLOGY TRANSFERRED
Advanced Hybrid Wood and Wood substitute (AC-Wood)
LICENSED TO :
M/s. Eco-Bright Sheets Co. Pvt. Ltd, Bhilai, Chhattisgarh
On 7 March 2017


HNOLOGY TRANSFERRED AND COMMERCIALISED
High-Performance Hybrid Composite Materials
(HP -Composites)
LICENSED TO :
M/s. Sidhhi Poly Matrix, Chandrapur, Maharashtra
On 26 September 2015


OPPORTUNITY
New class of hybrid green composites with:
Varying thickness
Size
Shape
Colour
Surface finish
Texture
Design
Screen printing
CSIR-SERC


OPPORTUNITY
High strength composites
Lightweight composites
Glossy finish composites
Sandwich composites
Target Applications:
Civil infrastructure & transport system


SUCH INNOVATIVE TECHNOLOGIES ARE READILY AVAILABLE FOR COMMERCIAL SCALE MANUFACTURING AND ENTREPRENEURSHIP
AMPRI Hybrid Composites Technology(6 min u tube film) available at:
https://www.youtube.com/watch?v=8SnnK5zmAKM&feature=youtu.be
You are welcome for licensing CSIR-AMPRI Technologies !


CONCLUSION
" AMPRI's Hybrid Green Composites – An emerging materials to fulfill multifunctional applications"
" Your intervention will help us to take-up this technology for further heights"


For more details please contact :
The Director
CSIR-Advanced Materials and Processes Research Institute, Bhopal -462026
OR
Dr. Asokan Pappu
Senior Principal Scientist & Chairman Business Development Cell
CSIR-AMPRI, Bhopal
Email: asokanp3@yahoo.co.in, pasokan@ampri.res.in
Phone: 755 2489402, 9425600260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Acknowledgements:
CSIR, New Delhi
DST
NALCO
BMTPC
MOEF
Dr. Avanish K Srivastava, Director CSIR-AMPRI
Dr. M. Saxena & my Group members, CSIR-AMPRI Bhopal
Thanks to YOU all & spl thanks to INA, EVPL.. I...

Annex II

Media Coverage

BusinessLine

Home News Subscribe

News

Mumbai hosts conference on natural resources

Updated: November 17, 2017 21:26 IST | Our Bureau

A two-day conference on 'Towards Resource Resilient India' began here on Friday to go into the issues related to both biotic and abiotic natural resources.

Organised by the Indian National Association — Club of Rome, the conference was inaugurated by Vice-Admiral Girish Luthra, Flag Officer Commanding-in-Chief, Western Naval Command. The conference will discuss resource efficiency, resource nclusivity, resource security and resource use impact at different plenary sessions.

"We are putting unsustainable pressure on our planet. The need of the hour is to use our natural resources in a way that allows them to be replenished at the rate we consume them. We have to make the best possible use of resources available to us on Earth – learning to use them in an efficient and sustainable manner. So resource efficiency is a commercial imperative," said S Ramadorai, Chairman of the association.

Business Standard

Resource efficiency a commercial imperative: S Ramadorai

'We have to make the best possible use of resources available to us on Earth'

BS Reporter November 18, 2017 Last Updated at 23:16 IST

S Ramadorai. Photo: PTI

Association for the Club of Rome organised a two-day conference, "Towards Resource Resilient India", in Mumbai with focus on resource efficiency, resource inclusivity, resource security and resource use impact, and to find solutions relating to natural resources. It included the possibility of disruptive technology to find solutions and suggestive policy actions.

"Everything we can measure tells us that, without creative action, natural systems supporting economies and livelihoods across the planet risked collapse," said S Ramadorai, chairman, Indian National Association Club of Rome, India. "The need of the hour is to use our natural resources in a way that allows them to be replenished at the rate we consume them. We have to make the best possible use of resources available to us on Earth — learning to use them in an efficient and sustainable manner. So resource efficiency is a commercial imperative," he said.

The Indian

indiatoday.in NEWS TV

Blue Economy is in dire need of resource resilience: Officer

PTI

November 16, 2017 | UPDATED 22:10 IST

Mumbai, Nov 16 (PTI) Resource efficiency and sufficiency are critical prerequisites for achieving security and resource inclusivity, a top navy officer said today.

Speaking at a two-day conference, Vice Admiral Girish Luthra, Flag Officer Commanding-in-Chief, Western Naval Command, elaborated on the importance, potential and threats facing the rapidly-growing, water-based Blue Economy.

The Blue Economy is in dire need of resource resilience, he said.

The conference, "Toward a Resource Resilient India", aims to deliberate on resource security and sustainable use and management of natural resources in India and seeks to highlight urgent and critical need for coherence in environmental policies and actions.

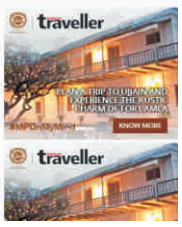
He highlighted the need for Greening the Blue Economy, by tapping into ocean-based alternative and renewable sources of energy.

He familiarised the audience with the Navys Energy Conservation Roadmap and various green initiatives being undertaken across naval ships and establishments to ensure environmental conservation and resource resilience. PTI VT RSY

Outlook

THE NEWS SCROLL

'Blue Economy' is in dire need of resource resilience: Officer



india

Mumbai, Nov 16 (PTI) Resource efficiency and sufficiency are critical prerequisites for achieving security and resource inclusivity, a top navy officer said today.

'Blue Economy' is in dire need of resource resilience: Officer

Published: November 16, 2017 10:57 PM IST

By PTI Feeds

0 Share Tweet Share Comments

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This is published unedited from the PTI feed.

Published Date: November 16, 2017 10:57 PM IST

FINANCIAL EXPRESS

S Ramadorai: Planet witnessing unsustainable pressure

S Ramadorai, chairman of the Indian National Association Club of Rome (India), said on Friday that the planet is witnessing unsustainable pressure. "We are putting unsustainable pressure on our planet.

6 SHARES SHARE

He said everything we can measure tells us that without creative action, natural systems supporting economies and livelihoods across the planet risked collapse. (PTI)

TOP NEWS

S Ramadorai, chairman of the Indian National Association Club of Rome (India), said on Friday that the planet is witnessing unsustainable pressure. "We are putting unsustainable pressure on our planet. The need of the hour is to use our natural resources in a way that allows them to be replenished at the rate we consume them." Ramadorai said at a two-day conference on 'Towards Resource Resilient India'. He said everything we can measure tells us that without creative action, natural systems supporting economies and livelihoods across the planet risked collapse. "We have to make the best possible use of resources available to us on the Earth – learning to use them in an efficient and sustainable manner. So resource efficiency is a commercial imperative." Ramadorai said. The conference, organised by the Indian National Association Club Of Rome, was inaugurated by Vice Admiral Girish Luthra, Flag Officer Commanding-in-chief, Western Naval Command. The two-day annual event saw a host of domain experts participating in various discussions that attempted to find solutions to important questions related to the use of both biotic and abiotic natural resources.

They noted, inter alia, that natural resources weather they are minerals, energy, water or air, are a driving force for the economy and a major, long-term concern for our society, not only in terms of supply but also of the management of their industrial cycle and the environmental impact of their use. Various debates under four themes – resource efficiency, resource inclusivity, resource security and resource use impact – held during the course of the conference. The three different dimensions – ecological, economical and ethnological (i.e. social or cultural) – are associated with natural resources. If a natural resource is required to be used, its use must be physically possible, economically viable and culturally acceptable. Ranjit Barthakur, secretary general of the association, said the sustainable use of the environment and ensuring fair, equitable access to genetic resources are part of the picture, since well-managed ecosystems were critical for economic functioning.

The Indian Association for the Club of Rome will define a distinct Indian paradigm to address the most pressing concerns such as food security, the challenge of water and the need to generate 'green jobs' and 'green skills'. Its strength will be derived from the national and global memberships of the Club of Rome. The network of Club members and their institutions is extensive. It draws members from many sectors and disciplines. Bankers, economists, corporates, scientists, academics, technologists, social scientists, politicians and philosophers are the members of The Club of Rome.

THIS WEEK INDIA

Bangalore Delhi Hyderabad Pune Kerala Kolkata guwahati Explore SIGN IN

Towards Resource Resilient India

Posted By This Week India on Nov 16,2017

Mumbai

Mumbai 16th November 2017: The 1st day of two day conference on 'Towards Resource Resilient India' organised by the Indian National Association - Club Of Rome was inaugurated by Vice Admiral, Girish Luthra, PVSM, AVSM, VSM, ADC- Flag Officer Commanding- in- Chief, Western Naval Command, Indian Navy, Government of India. The two day annual event will see a host of other dignitaries and domain experts participating in various discussions that attempts to probe for solutions to a vitally important questions relating to the use of both biotic and abiotic natural resource.

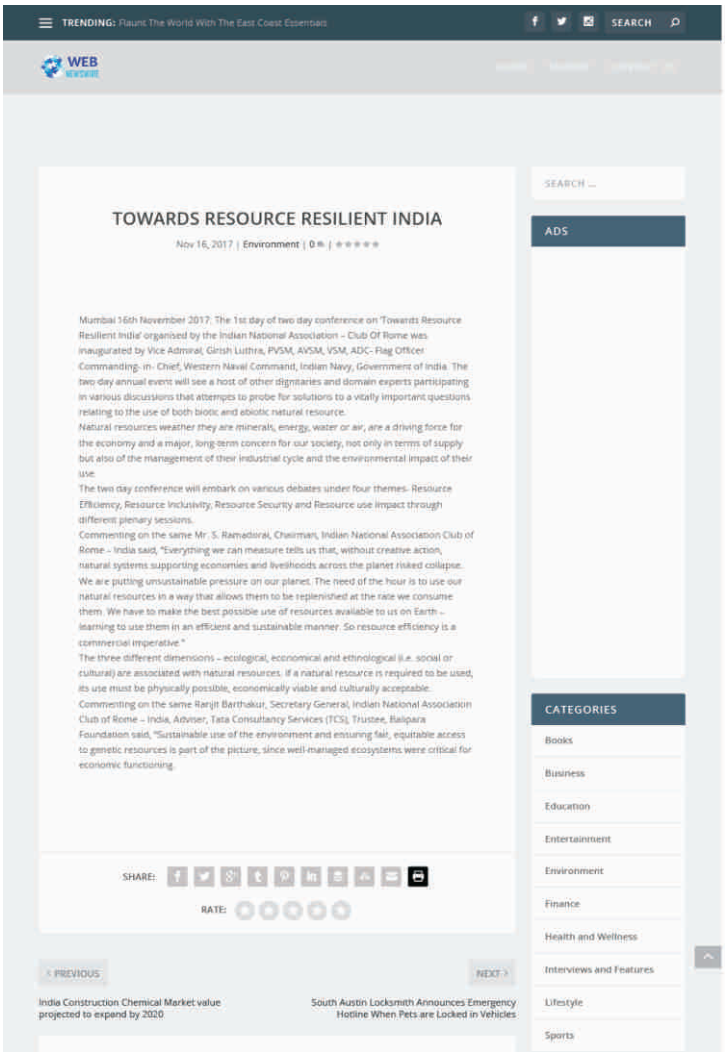
Naturalresources weather they are minerals, energy, water or air, are a drivingforce for the economy and a major, long-term concern for our society, not onlyin terms of supply but also of the management of their industrial cycle and theenvironmental impact of their use.

The two dayconference will embark on various debates under four themes- ResourceEfficiency, Resource Inclusivity, Resource Security and Resource use Impactthrough different plenary sessions.

Commentingon the same Mr. S. Ramadorai, Chairman, Indian National Association Club ofRome – India said, "Everything we can measure tells us that, without creativeaction, natural systems supporting economies and livelihoods across the planetrisked collapse. We are putting unsustainable pressure on our planet. The needof the hour is to use our natural resources in a way that allows them to bereplenished at the rate we consume them. We have to make the best possible useof resources available to us on Earth – learning to use them in an efficientand sustainable manner. So resource efficiency is a commercial imperative."

The threedifferent dimensions - ecological, economical and ethnological (i.e. social orcultural) are associated with natural resources. If a natural resource isrequired to be used, its use must be physically possible, economically viableand culturally acceptable.

Commentingon the same Ranjit Barthakur, Secretary General, Indian National AssociationClub of Rome – India, Adviser, Tata Consultancy Services (TCS), Trustee, BalliparaFoundation said, "Sustainable use of the environment and ensuring fair,equitable access to genetic resources is part of the picture, sincewell-managed ecosystems were critical for economic functioning.



TRENDING: Flaunt The World With The East Coast Essentials

SEARCH

WEB NEWSWIRE

TOWARDS RESOURCE RESILIENT INDIA

Nov 16, 2017 | Environment | 0 |

Mumbai 16th November 2017: The 1st day of two day conference on 'Towards Resource Resilient India' organised by the Indian National Association – Club Of Rome was inaugurated by Vice Admiral, Girish Luthra, PVSM, AVSM, VSM, ADC- Flag Officer Commanding- in- Chief, Western Naval Command, Indian Navy, Government of India. The two day annual event will see a host of other dignitaries and domain experts participating in various discussions that attempts to probe for solutions to a vitally important questions relating to the use of both biotic and abiotic natural resource.

Natural resources weather they are minerals, energy, water or air, are a driving force for the economy and a major, long-term concern for our society, not only in terms of supply but also of the management of their industrial cycle and the environmental impact of their use.

The two day conference will embark on various debates under four themes- Resource Efficiency, Resource Inclusivity, Resource Security and Resource use Impact through different plenary sessions.

Commenting on the same Mr. S. Ramadorai, Chairman, Indian National Association Club of Rome – India said, "Everything we can measure tells us that, without creative action, natural systems supporting economies and livelihoods across the planet risked collapse. We are putting unsustainable pressure on our planet. The need of the hour is to use our natural resources in a way that allows them to be replenished at the rate we consume them. We have to make the best possible use of resources available to us on Earth – learning to use them in an efficient and sustainable manner. So resource efficiency is a commercial imperative."

The three different dimensions – ecological, economical and ethnological (i.e. social or cultural) are associated with natural resources. If a natural resource is required to be used, its use must be physically possible, economically viable and culturally acceptable.

Commenting on the same Ranjit Barthakur, Secretary General, Indian National Association Club of Rome – India, Adviser, Tata Consultancy Services (TCS), Trustee, Balipara Foundation said, "Sustainable use of the environment and ensuring fair, equitable access to genetic resources is part of the picture, since well-managed ecosystems were critical for economic functioning.

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According to Dr Andheria, the diversion of surplus water from the Ken basin to the dry Betwa basin will have several repercussions.

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The linking of Ken and Betwa rivers in Madhya Pradesh will affect the fishing economy in the region, according to Dr Anish Andheria, president of the Wildlife Conservation Trust. Addressing the annual conference of the Indian National Association for the Club of Rome, he said, "The government's river linking proposal is a no-go project. They are only considering the benefit it will have on agriculture, not realising the impact on the fishing economy. More than 30 per cent of the country gets its livelihood from it. This is applicable to all river-linking projects."

He was speaking on the topic "Towards a Resource Resilient India — Security of Natural Resources for All: The Critical Need for Coherence in Policies and Actions."

According to Dr Andheria, the diversion of surplus water from the Ken basin to the dry Betwa basin will have several repercussions.

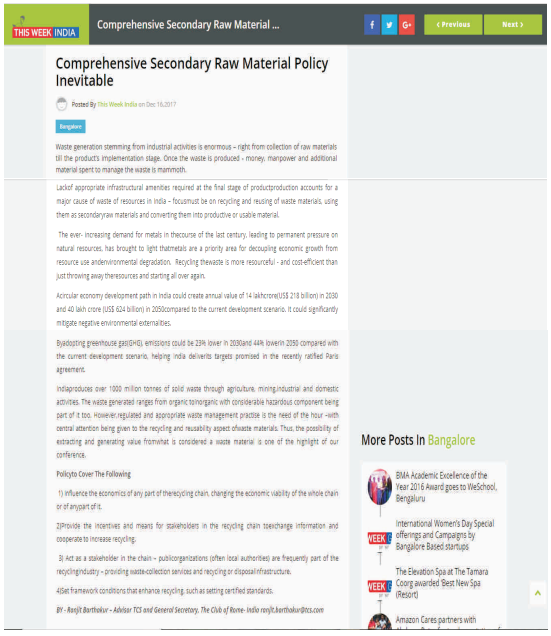
"There is no such thing as surplus water. It is important for fresh water to flow into the sea as it reduces salinity at the mouth of the river. Fishes are found abundantly in this region where the fresh water merges with brackish water. If the water is diverted to other rivers, there will be no fish there," said the city-based conservationist.

He added that the government has not accounted for the large number of trees that will be lost in the project. "It will also increase power consumption as they will have to use electricity to pump water in the direction away from its natural flow," he said.

Speaking in the backdrop of the conference, professor Kirit Parikh, a former member of the Planning Commission, said farmers should get incentives to save solar power.

"Farmers using solar power should be able to sell surplus solar power. That will make the use of solar power more energy efficient as they will want to save as much power as possible to sell the rest. This model was implemented in Dhundi village in Gujarat and was found to be highly successful," said Parikh, who is currently the chairman of the Integrated Research for Action and Development, a research institute that focuses on energy, climate change and environment.

The Maharashtra government has started a solar project under which solar panels powering agricultural pumps are connected to feeders and the supply is at subsidised rates. However, Parikh believes this alone will not motivate farmers to save power.



THIS WEEK INDIA

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Comprehensive Secondary Raw Material Policy Inevitable

Posted By This Week India on Dec 16,2017

Bangalore

Waste generation stemming from industrial activities is enormous – right from collection of raw materials till the products implementation stage. Once the waste is produced – money, manpower and additional material spent to manage the waste is mammoth.

Lackof appropriate infrastructural amenities required at the final stage of productproduction accounts for a major cause of waste of resources in India – focusmust be on recycling and reusing of waste materials, using them as secondaryraw materials and converting them into productive or usable material.

The ever- increasing demand for metals in thecourse of the last century, leading to permanent pressure on natural resources, has brought to light thatmetals are a priority area for decoupling economic growth from resource use andenvironmental degradation. Recycling thewaste is more resourceful - and cost-efficient than just throwing away theresources and starting all over again.

Acircular economy development path in India could create annual value of 14 lakhcrore(US$ 218 billion) in 2030 and 40 lakh crore (US$ 624 billion) in 2050compared to the current development scenario. It could significantly mitigate negative environmental externalities.

Byadopting greenhouse gas(GHG), emissions could be 23% lower in 2030and 44% lowerin 2050 compared with the current development scenario, helping India deliverits targets promised in the recently ratified Paris agreement.

Indiaproduces over 1000 million tonnes of solid waste through agriculture, mining,industrial and domestic activities. The waste generated ranges from organic tonorganic with considerable hazardous component being part of it too. Howeverregulated and appropriate waste management practise is the need of the hour –with central attention being given to the recycling and reusability aspect ofwaste materials. Thus, the possibility of extracting and generating value fromwhat is considered a waste material is one of the highlight of our conference.

Policyto Cover The Following

1) Influence the economics of any part of therecycling chain, changing the economic viability of the whole chain or of anypart of it.

2)Provide the incentives and means for stakeholders in the recycling chain toexchange information and cooperate to increase recycling.

3) Act as a stakeholder in the chain – publicorganizations (often local authorities) are frequently part of the recyclingindustry – providing waste-collection services and recycling or disposalinfrastructure.

4)Set framework conditions that enhance recycling, such as setting certified standards.

BY - Ranjit Barthakur - Advisor TCS and General Secretary, The Club of Rome- India ranjit.barthakur@tcs.com

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Established in 2011, The Indian National Association for the Club of Rome (CoR-India) is a non-profit organisation, which aims "to act as a global catalyst for change through the identification and analysis of the crucial problems facing India and the communication of such problems to the most important public and private decision makers as well as to the general public." The broad goal of the national chapter, CoR-India, is to help design an agenda for governments in India, the business sector as well as all its citizens' organisations that could enable everybody in this country to live a full life in harmony with their surroundings by the centenary of the nation, 2047.

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Development Alternatives (DA), a not-for-profit action research and development organisation, is the primary knowledge partner of CoR-India. DA innovates and disseminates sustainable solutions aimed at reducing poverty and regenerating natural ecosystems and their services. Established in 1982, its eco-solutions deliver basic needs products through the small, local enterprises that generate green jobs and sustainable incomes. Based on its innovative environment-friendly technologies and market principles, these enterprises help build local economies and communities while maintaining a minimum ecological footprint.

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