IWSA NEWSLETTER

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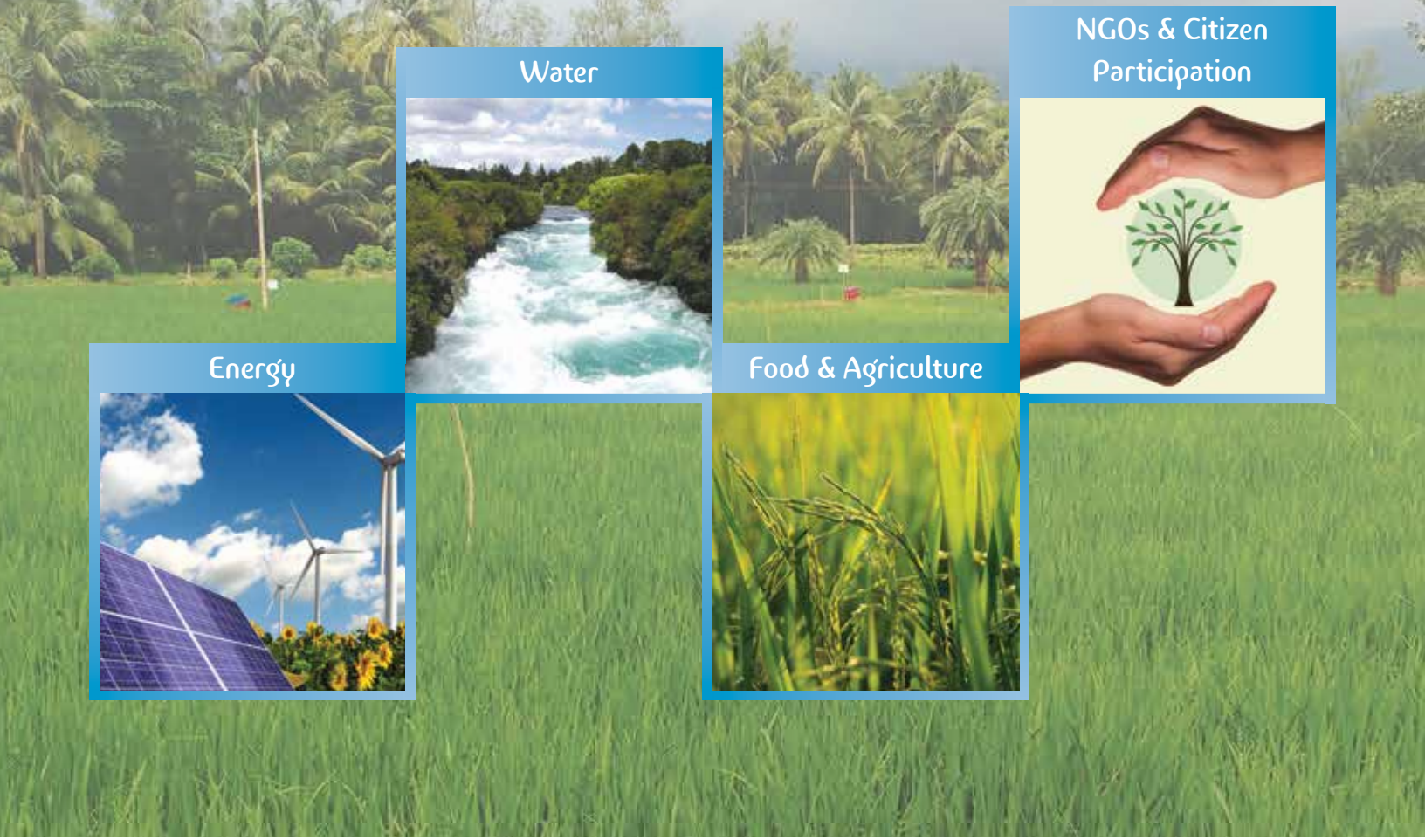
BOOK OF ABSTRACTS

XIII Triennial National Conference of Indian Women Scientists' Association (IWSA) on "Sustainable Development in India: Role of Science & Technology", 2nd to 4th Dec. 2016, IWSA Campus, Vashi, Navi Mumbai



BRANCHES

ROORKEE 1979 ▪ HYDERABAD 1979 ▪ PUNE 1980 ▪ NAGPUR 1982 ▪ KOLHAPUR 1982
DELHI 1987 ▪ KALPAKKAM 1987 ▪ BARODA 1988 ▪ LUCKNOW 1997 ▪ AMRAVATI 2010

IWSA's Contribution to Sustainable Development

Solar Energy

Biogas Plant

Composting the Kitchen Waste

Garden with Variety of Flora anf Fauna

We thank the Sponsors of the Conference

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From The Editor's Desk

Dear IWSA Members,

This is a special issue of the IWSA Newsletter containing the abstracts of the invited talks and contributory papers that are being presented at the XIII Triennial Conference of IWSA on "Sustainable Development in India: Role of Science & Technology" during December 2-4, 2016 at IWSA Complex, Vashi, Navi Mumbai. The main objectives of the conference and the efforts that have lead to successfully bringing together various experts in the fields of energy, water, food and agriculture and also the contributions of NGOs for the sustainable developments have been highlighted in the messages from IWSA President, Dr. Devaki Ramanathan and the Convenor of the conference, Dr. Surekha Zingde. You can gauge the importance of such a conference from the message received from Dr. Sekhar Basu, Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy, Government of India. The abstract of the talk by Dr. Anil Kakodkar, Chairman, Technology Information, Forecasting and Assessment Council (TIFAC) brings you the snapshot of India by the year 2035. I am sure that the abstracts of the invited lectures by the experts in their respective fields will give you an idea about the way forward to sustainable development of our country. The abstracts of contributory papers also give us several novel ideas on this topic.

I have also included the reports on the various activities that have been carried out by IWSA during the period of September to November 2016, such as several popular science talks in various colleges of Mumbai and Navi Mumbai, workshop on eco friendly Ganesha, workshop on puppetry etc. I do hope that all the readers will enjoy and get useful information from this issue of Newsletter.

With Best Wishes,
Dr. Shyamala Bharadwaj
shyamala.bharadwaj@gmail.com

President's Message

IWSA is happy to conduct this Triennial National conference on "Sustainable Development in India: Role of Science and Technology" at our head quarters, Vashi, Navi Mumbai, 2-4 December, 2016. This issue of IWSA Newsletter is a compilation of all abstracts invited, contributory and poster presentations to be delivered in the three-day deliberations.

I would like to share a few thoughts on this topic. Development is an important pursuit for progress. Every country has to develop its socio, economic and scientific productivity to cater to its population and bring a certain degree of living standards for its people. This development process is influenced by its environmental, economic, social and political factors. Hence we have developed countries like the U.S. or Canada and developing countries like India, - a division well classified by the U.N across all countries.

What is sustainable development? The Wikipedia definition states that "sustainable development is a process for meeting human development goals while sustaining the ability of natural systems to continue to provide the natural resources and ecosystem services upon which the economy and society depends" So, environmental protection and curtailment of the use of FINITE natural resources are requirements for sustainable development (SD). The United Nations, in its September 2015 meeting, has defined 17 SD goals (SDGs) to redress poverty, inequality and climate change factors, across the globe, by 2030. I do not have to stress on the evils of environmental destruction, pollution hazards and climate change catastrophes faced by our country (and all countries) from every sector arising out of our own activities. These have been discussed loud and hoarse by every expert in their fields and remedial steps are suggested. As an NGO, dedicated to the spreading of scientific temper in the society and having a very small carbon foot print, IWSA feels excited to hold a conference on this theme but due to time constraints we have focused only on three vital goals: Energy, Water and Food & Agriculture. These, we feel, require crucial developments which, by reaching far and wide, can help to remove poverty from our country. Science & Technology will play a central role to bring a paradigm shift to provide SD in all the three goals. The conference aims to bring experts in these fields to discuss with other young research workers, young scientists and college students on a common platform. This will give a clear direction to the research domains needed to be pursued to achieve SD.

A special session on the contribution of other NGOs in the preservation of the ecosystem has been included as a half-day program. We have encouraged even a few school children to think deeply about these goals so they could come up with their ideas and thoughts to solve our country's futuristic needs.

Dr. Surekha Zingde, Convener of the conference, has discussed separately all details of the conference program. I hope all our members enjoy the sessions and get valuable leads for S&T. Our Conveners, Dr. Surekha Zingde and Dr. B.S. Mahajan have spent yeomen efforts, time and energy to plan every detail of this conference with full support from the organizing committee. I would like to personally thank them and place on record IWSA's appreciation for their zeal and passion.

Dr. Devaki Ramanathan
President, IWSA
devakir@yahoo.com

Convenor's Message

On behalf of the Organizing Committee, I extend a warm welcome to all our delegates who are attending IWSA's XIII Triennial Conference on 'Sustainable Development in India: Role of Science and Technology".

Today, newspapers and the advertisements on the TV are all abuzz with "sustainable" issues—ie ways to address societal needs in a sustainable manner to optimally meet the requirements of today and also ensure that there is sufficient for generations to follow.

This conference brings together experts in the area of Energy, Water, Food& Agriculture which are three of the 17 Sustainable Development Goals identified by the United Nations. The experts will place before the delegates the status of each of the themes, the challenges to be faced and the way forward.

Energy for all at affordable prices has and is of concern to all. Energy from fossil fuels, such as coal and oil will soon be difficult to obtain as the reserves of these natural resources are fast diminishing. Efforts are on to generate Energy from renewable sources such as solar, wind, etc. The speakers for this session will provide you a birds' eye view of the scenario and how we can utilize energy efficiently.

Water resources such as rivers and oceans, are being affected by climate change, societally induced pollution which leads to an imbalance in the ecosystem and in turn reduction in the amount of water available for use by human beings and other creatures. The speakers in this session will cover the status of water, its sustainable management, the innovative technologies that are now available to meet the requirements of today with the future in mind.

Food & Agriculture is of major concern for all of us. Efficient agricultural production of crops requires efficient management of soil with least use of fertilizers, water management for optimal growth, best use of available land by crop rotation, post-harvest technologies and related parameters. Innovative methods of food processing and packaging ensure that the products are available for longer periods of time. The experts for this session will cover these aspects and many more.

Ideas in the laboratory must reach the society. Further policy decisions for optimal use of resources must have inputs from the society at large to ensure that the requirements are met. NGOs play a major role in implementing the ideas and involving members of the society in policy decisions. The session on NGOs has experts who have involved the community for defining sustainable measures and in turn empowered the members to meet the challenges.

In addition to invited experts we have interesting presentations from the delegates who have submitted abstracts. These papers will bring to fore the work being done in different Institutions.

I hope that you will enjoy the intellectual feast that we bring to you.

Wishing you happy deliberations during the Conference and a Happy New Year that follows.

Dr. Surekha M. Zingde
Convener, XIII Triennial Conference,
Vice President, IWSA,
surekha.zingde@gmail.com

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&
Secretary, Department of Atomic Energy

Message

I am happy to know that the Indian Women Scientists' Association (IWSA) is holding its XIII Triennial National conference on "Sustainable development in India: Role of Science and Technology" on 2-4 Dec. 2016, at its headquarters, Vashi, Navi Mumbai.

Our country, with its 1.2 billion population, faces a herculean tast to provide clean water and sanitation, food security, energy etc to all its people, specially in the remote villages and rural areas. The conference strands: Water, Energy and Food & Agriculture have been well-selected as they are vital to meet the challenges posed by our country's continuing growth. To achieve sustainable development in these three strands, fresh thought processes and modified insights will be mandatory, for which, the application of Science and Technology is the natural step. The 3-day deliberations in the conference, I am sure, will bring experts in these fields who will share their knowledge and expertise with younger researchers so that a new direction is laid for our future developments, in fact, for our very survival on this planet.

I understand that the conference is also providing a special slot to bring out the role of other NGO's in the country who have undertaken innovative methods for sustainable developments.

IWSA is an NGO with two thousand women members working in /retired from natural, physical and applied science research. With its laudable commitment to develop scientific temper in the society, IWSA is well suited to conduct this conference.

My best wishes for a grand success of the conference.

(Sekhar Basu)

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ई-मेल / E-mail: chairman@dae.gov.in

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Mahesh D. Zingde

IT12 **Impact of climate change on water resources**
Anjali Parasnis

Keynote Address – Food and Agriculture

Ravinder Kaur, Indian Agriculture Research Institute, New Delhi

IT13 **Food Security: integration of agricultural production with preservation and food processing**
Sharad Kale

IT14 **Transforming Rural India With PRIDE™**
Srinivasu Pappula

IT15 **Tropical Tuber Crops: An Alternative for Food, Nutrition & Livelihood Improvement**
Archana Mukherjee

IT16 **Role of Beneficial Microorganisms in Sustainable Agriculture: Current Scenario and Future Prospects**
Seema Mishra

December 4, 2016

IT17 **Post Harvest Technology Innovations for Increasing Farmer's Income**
R. T. Patil

IT18 **Sustainable Technologies for Fruits and Vegetables Processing in India**
Smita Lele

IT19 **Role of Packaging Science and Technology**
P. V. Narayanan

IT 20 **Role of Geomatics in Sustainable Development**
G. Sandhya Kiran

Keynote Address – NGO and Citizen Participation

Role of Indian Woman Farmer in Sustainable Development of India by using Smart Agriculture Technology – SRT (Saguna Rice Technique)
Chandrasekhar Bhadsavle

Contributory Papers

Energy

Food and Agriculture

Water

NGOs and Citizen Participation

Reports from Headquarters

Report from Kalpakkam Branch of IWSA

XIII Triennial Conference of the Indian Women Scientists' Association on "Sustainable Development in India: Role of Science and Technology"

2nd- 4th Dec. 2016,

IWSA's-ICICI Multipurpose Hall, IWSA Campus,
Sector 10 A, Plot 20, Vashi, Navi Mumbai 400703

2nd Dec. 2016

8am-9am	**REGISTRATION**		
9 am -11 am	**INAUGURATION**		
	Welcome	Dr. Devaki Ramanathan, President, IWSA	
	About the Conference	Dr. Surekha Zingde, Vice President, IWSA & Convener of Conference	
	Inaugural Address	Prof. Shyam Asolekar, Centre for Environmental Science and Engineering, IITB, Mumbai	
	Address & Release of Abstract Book by Guest of Honour	Mrs. Prajakta Lavangare-Verma, IAS Jt. MD. CIDCO, Navi Mumbai	
	Acknowledgements	Dr. Lalitha Dhareshwar, Secretary, IWSA	
11 -11.15 am	**Tea**		
11.15 am to 1.00 pm	**Energy I Abstract No.**	Chairperson: Dr. G. K. Dey, Director, Materials Group, BARC	
	Key Note Lecture	Dr. Rangan Banerjee, Dept of Energy Science and Engineering, IITB, Mumbai	Sustainable Energy for the Future : Challenges for India
	IT1	Dr. Arvind Lali, DBT-ICT Centre for Energy Biosciences ICT, Mumbai	Biofuels: What, When and How
	IT2	Dr.Chetan Solanki, Department of Energy Science and Engineering IITB, Mumbai	Sustainable solar electricity solutions through horizontal and vertical expansions in rural areas
	IT3	Mr Prashant Kokil, Corporate Environment & Climate Change, The Tata Power Company Ltd., Mumbai	Renewable Energy: Future and Challenges
1.00-2.30 pm	**Lunch & Posters**		
2.30 pm-4.10 pm	**Energy II Abstract No.**	Chairperson: Prof. S. Kailas, Raja Ramanna Fellow, BARC & CEBS-UOM-DAE, Mumbai	
	IT4	Dr. Mahua Mukherjee Department of Architecture & Planning IIT, Roorkee	Urban Resource Conservation to Save Energy
	IT5	Dr. Umashankari, Reactor Physics Design Division, BARC, Mumbai	Power from Thorium - The Indian scenario
	IT6	Mr. B. G. Tilak, Technical Center. SAR Region, Bureau Veritas India.	Energy Conservation in Everyday Life for Sustainability
	IT7	Dr. Shyamala Bharadwaj, Ex-Chemistry Division, BARC, Mumbai	Utilizing Nuclear Energy for Hydrogen Generation
4.10-4.25	**Tea**		
4.25 -5.15 pm	**Energy III Abstract No.**	Chairperson: Dr. R. Nagarajan, CEBS, Mumbai	
	E12	Dr. Sunita Mahajan, Ex-MET ICS,	Shifting to Cloud Technology for

		Mumbai	Sustainability and Green Computing
	E7	Ms. Gitamayee Sahu, SNDT Womens' University, Mumbai	Energy Saving Methods using Green Communication Technology
	E2	Dr. Prasad Mandade, IITB, Mumbai	Assessing Sustainability of Biofuels from Indian Context: Some Insights
	E10	Ms. Jayanti T, IGCAR, Kalpakkam	The Role of Human Machine Interface in Efficient Plant Monitoring and Control of PFBR
	Short break		
5.30 pm-6.30pm	**EVENING TALK**	Chairperson: Dr. Saswaty Roy , Ex- BARC, Mumbai	
		Dr. Anil Kakodkar, Chairman, TIFAC, & Ex. Chairman AEC, Secretary DAE	Snap Shot of India 2035-A Technology Vision
	High Tea		

3rd Dec. 2016

9.00 am - 9.20 am	**Energy IV Abstract No.**	Chairperson: Dr. Shyamala Bharadwaj, IWSA	
	E9	Ms. Minakshi Mishra, Reliance Industries Ltd., Navi Mumbai	4D seismic-future oil & gas exploration
	E13	Ms. Jemima Ebenezer , IGCAR, Kalpakkam	Energy Harvesting in Wireless Sensor Networks
	Break 5 min		
9.30 am - 11.10 am	**Water I Abstract No:**	Chairperson: Dr. Vijay Kulkarni-Shapoorji Pallonji	
	Key Note Lecture	Dr. P.P. Mujumdar, Interdisciplinary Centre for Water Research, IISc, Bangalore	Sustainable Water Management in India: Implications of Climate Change
	IT8	Dr. Pushpito Ghosh, ICT, Mumbai	Water – A Stressful Situation: The Challenges before us & the Innovations that will be necessary for Sustainability
	IT9	Ms. Parineeta Dandekar, SANDRP, Pune	Ecological management of Rivers
	IT10	Dr. Saly Pannicker, BARC, Mumbai	Rural- Friendly Drinking Water Purification Systems
	Tea		
11.20 am - 1.00 pm	**Water II Abstract No.**	Chairperson: Dr B.S. Mahajan, IWSA	
	IT11	Dr. Mahesh Zingde, ex NIO-RC, Mumbai	Consequences of human induced alterations to marine environment in India
	IT12	Dr. Anjali Parasnis, TERI, Navi Mumbai	Impact of Climate Change on Water Resources
	W5	Ms. Annie Thomas Heavy Water Board, Mumbai	Water Resource Management Strategy adopted at Heavy Water Plants - Conservation and Waste Water Treatment
	F6	Ms. Beena Nathani MSU, Vadodara	Utility of Remote Sensing and GIS in Land Use Land Cover Mapping of Narmada District for Sustainable Land and Watershed Management
	E1	Ms. Prerana Goswami, ICT,	Potential of Wave Energy

		Mumbai	along Western Coast of India
	W4	Mr. Alok Singh, VES College, Mumbai	Development of an Effective Microbial Consortium for Greywater Treatment
1.00 pm-2.30 pm	**Lunch & Posters**		
2.30 pm - 4.00 pm	**Food & Agriculture I Abstract No:**	Chairperson: Dr. Susan Eapen, IWSA	
	IT13	Prof. Sharad Kale, Symbiosis International University, Pune ; Ex- BARC	Food Security: integration of agricultural production with preservation and food processing
	IT14	Dr. Srinivasu P, Digital Farming Initiatives, TCS-Ltd, Hyderabad	Transforming Rural India with PRIDE™
	IT15	Dr. Archana Mukherjee CTCRI, Bhubhaneshwar	Tropical Tuber Crops - An Alternative for Food, Nutrition and Livelihood Improvement
	IT16	Seema Mishra, SIES Indian Institute of Environment Management, Navi Mumbai	Role of Beneficial Microorganisms in Sustainable Agriculture: Current Scenario and Future Prospects
4 to 4.10	**Tea**		
4.10 pm-5.10 pm	**Food & Agriculture II Abstract No:**	Chairperson: Prof. Debjani Dasgupta, D.Y. Patil University, Navi Mumbai	
	F1	Dr. Jessy Pius, Ramnarain Ruia College, Mumbai	Vertical Farming – Rising High For A Greener Tomorrow
	F4	Ms. Abhisha Joshi, MSU-Vadodara	CO2 Flux Assessment for Sustainable Management of Certain Plant Species
	F11	Dr. Savitri Bhat, B M S College of Engineering, Bangalore	Pilot Scale Production and Characterization of Manure from Food Wastes
	N1	Yogendra Shastry IITB, Mumbai	Sustainability in Science and Technology: Challenges in Research and Education
	Tea & posters		
5.15 to 6.15pm		IWSA's Central Council Meeting	
6.15 pm- 7.15pm		Cultural show	
7.30 to 8.30 pm		Dinner	

4th Dec. 2016

9.00 am - 10.30 am	**Food & Agriculture III Abstract No:**	Chairperson:- Dr. Rita Mulherkar, ex ACTREC, Navi Mumbai	
	IT17	Dr. R.B. Patil, ex- CIPHET, Ludhiana	Post Harvest Technology Innovations for Increasing Farmers Income
	IT18	Dr. Smita Lele, ICT, Mumbai	Sustainable technologies for fruit & vegetable processing in India

	IT19	Dr. P. V. Narayanan SIES, School of Packaging, Navi Mumbai	Role of Packaging Science and Technology
	IT20	Prof. G. Sandhya Kiran, MSU, Vadodara	Role of Geomatics in Sustainable Development
10.30 am-10.45 am	**Tea**		
10.45 am - 1.00 pm	**NGOs & citizen participation I Abstract No:**	Chairperson- Dr. Sugra Chunawala, Homi Bhabha Centre for Science Education, Mumbai	
	Key note Lecture	Mr. Chandrashekar Bhadsavle, Saguna Baug, Neral	Role of Indian Woman Farmer in Sustainable Development of India by using Smart Agriculture Technology – SRT (Saguna Rice Technique).
	IT21	Mrs. Jyoti Mhapsekar, Stree Mukti Sanghatana, Mumbai	Human Face of Solid Waste Management
	IT22	Ms. Janjri Jasani, CERE, Mumbai	Review of CERE's Work with a Focus on Carbon Management
	IT23	Ms.Richa Chaturvedi CHINTAN, New Delhi	CHINTAN - Environmental Research and Action Group
	IT24	Dr. Jayshree Phadnis, VES College, Mumbai	Innovative Home Composting of Kitchen Waste - A Reality
1.00- 2.30	Lunch & posters		
2.30 pm - 3.15 pm	**NGOs & citizen participation II Abstract No:**	Chairperson: Ms. Vrushali Magdum, NGO Forum, Vashi, Navi Mumbai	
	W3	Ms. Valeire Monteiro, Action for Food Protection, (AFPRO), New Delhi	Role of Science and Technology in Participatory Management of Groundwater: Experiences from Rural India
	N5	Ms. Vijaya Chakravarty IWSA, Navi Mumbai	Childrens' Experience of Wild Food Plants: Key to Conservation and Sustainability of the Natural World
	N3	Ms. Jalaja Madan Mohan, IGCAR, Kalpakkam	Science and Society: Role of Public Awareness in Governmental Organizations
3.15 pm-4.15 pm	**Panel Discussion**	Moderator: Dr. Lalitha Dhareshwar, IWSA, Dr. Jayshree Phadnis, VES College, Mumbai, Dr. V.S. Shivankar, KBP College, Navi Mumbai, Dr. A. P. Jayraman, IDP, Mumbai	The Way Forward for Sustainable Development in India
4.15 pm-5.15 pm	**Valedictory**	Chief Guest : Dr. Sanjay Deshmukh, Vice Chancellor, University of Mumbai	
	High Tea		

Evening Lecture

Snapshot of India 2035: A Technology Vision

Anil Kakodkar
INAE Satish Dhawan Chair of Engineering Eminence, BARC, Mumbai 400085.
Chairman, Technology Information, Forecasting and Assessment Council.
kakodkaranil@gmail.com

Scientific research has been impacting our lives in a variety of ways. Technologies and products which emerge through translation of new research have multiplied human capabilities several folds and have created competitive edge for countries/societies that have excelled in this regard. Technology as it leads to higher human capabilities, also results in growth in economy and consumption. This has also led to issues of sustainability since earth resources as well as earth's carrying capacity is finite. Today the earth seems to be at the threshold of instability even as a large part of humanity remains deprived of basic human necessities. We therefore need develop and adopt affordable and environmentally clean technological solutions that enable sustainable satisfaction of human aspirations within the available resources.

India which constitutes around a sixth of humanity is currently blessed with the largest youth population. India also constitutes one of the largest markets that currently fuels economy of technologically advanced countries in a significant way. Capacity building of our youth to develop India specific technological solutions is thus the key to development autonomy, sound economic growth and meeting our aspirations. Thus on one hand there is a question of empowering our youth and leveraging their enhanced capabilities and on the other withstanding the competition from advanced countries while leveraging their current technological capability to leapfrog in the global competition. This is a challenge our S&T system must squarely meet.

It is thus clear that we need a technology vision that is well aligned to the needs of Indians in years to come. Technology Vision 2035 exercise was carried out by TIFAC involving several thousand stakeholders with this objective. The presentation would describe the outcome and the way forward.

Keynote Address - Energy

Sustainable Energy for the Future: Challenges for India

Rangan Banerjee
Department of Energy Science and Engineering
IIT Bombay, Powai, Mumbai 400076
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India has made significant progress in developing its energy systems over the last twenty five years. We review the trends in the growth of the energy sector. The main transition in the past has been from traditional energy sources to fossil based energy and electricity. Despite the best efforts of our energy planners, energy shortages persist. Access of affordable energy to all is a pre-requisite for development but is a challenge to be met given the problems of financing. The climate change problem has resulted in an increased emphasis on energy efficiency , low carbon and clean energy solutions and nuclear energy. We review the status of renewable energy options and their possible role in the future sustainable energy systems in India. We define the elements of sustainability-cost, emissions, land, water and compare some of the key technology options on these metrics. Urban air quality and indoor air quality currently have significant adverse health impacts. The chulha and the petrol/ diesel fuelled car are potential health hazards.

India has recently signed the Paris agreement for combating Climate change. As a part of our Intended Nationally Determined Contributions, we have targeted to have a cumulative installed capacity of 40% of non-fossil electricity generation by 2030 and reduce the emissions intensity of GDP by 33-35% of our 2005 value by 2030. We review the viability of different renewable energy technologies in India. While we have seen significant growth in solar PV and wind deployment, the competitiveness of Indian industry in these areas needs to be strengthened. We highlight the challenges involved in large scale renewable deployment – variability, impact on tariffs and the need for large amounts of investment.

Energy security implies ensuring uninterrupted supply of energy. We should not replace our reliance on fossil energy imports (mainly oil) with a dependence on renewable technology imports (PV cells, modules, systems). The challenge of high renewable penetration will need an emphasis on Demand response, DSM and energy storage.

Innovations, Technology development and research are essential for Indian leadership in these areas. We provide examples of consortium based approaches – development of a MW scale solar thermal demonstration power plant and a student project for a fully functional solar (net energy positive house) to illustrate some possible approaches that may work. We need to assess the impact of different future energy pathways on employment, economic growth and equity.

The Indian energy sector provides interesting challenges and opportunities for young women scientists and engineers.

IT1 Biofuels: What, When and How

Arvind Lali
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The world has charted for itself an aggressive path towards (a) Reducing Carbon emissions, and (b) Reducing dependency on fossil sources. India has mandated a blend 5% of green biofuels into gasoline (petrol) and diesel through a National Biofuel Policy drafted in 2009. However, the country today has no diesel substitute of note while barely managing to achieve about 3% bioethanol blending in gasoline. Similar story repeats all over the world especially in a scenario where the first generation biofuels have failed to arrest carbon emissions. Major hurdles have been inadequate manufacturing capacity and non-availability of non-edible vegetable oils, corn and molasses for making biodiesel and bioethanol, respectively. Mankind must look towards second generation advanced biofuels to achieve the set blending targets in the immediate and near future. For example, substantial and under-utilized non-fodder surplus agricultural wastes and piling Municipal Solid Wastes (MSW) in A-grade to C-grade cities put together have the potential to fully replace petroleum fuel requirements in India. Biomass residues alone amount to more than 250 million ton of surplus agri-residues which if collected can produce more than 75 million ton of biofuel equivalent to more than three times entire country's petrol consumption. Further, more than 150 million ton of MSW already collected in large to small cities also has the potential to produce more than 40 million ton of biofuel.

The biofuels of interest can be one or more of the following: Alcohols and others (methanol, ethanol, butanol, dimethylether etc.); Biodiesel or Green Diesel (from above feedstocks and not from vegetable fat/oil); Hydrocarbon/s (bio-gas methane and higher); and Hydrogen.
Technologies needed for production of second generation and other advanced biofuels have been under development around the world now for over two decades. However, there have been many yet un-cleared hurdles. The technologies so far developed suffer from three major issues especially for a country like India:

A. The recommended scales of economy i.e. biomass processing/day are in excess of 500 ton/day and thus are too large and present biomass collection challenges.
B. Most technologies are feedstock specific and need pilot trials for varied and different feedstock.
C. Both operating and capital costs are too high

The lecture will attempt to throw light on the on-going efforts across the world and highlight how and what India can do in this highly competitive and challenging field of innovation.

IT2 Sustainable Solar Electricity Solutions Through Horizontal and Vertical Expansions in Rural Areas

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Use of artificial light has now become fundamental requirement of human being. Three billion people in the world lack access to affordable, abundant and clean energy services to support their daily needs and livelihoods. Among them, 1.2 billion are without any electricity; 221 million of whom are in rural India. It is expected that 81.2 million students are likely to use kerosene for their basic lighting needs. Reliance on the dirty fuels especially kerosene results in household air pollution which harms women and children's health.

Solar Photovoltaic technology has been progressing very fast both in terms of efficiency improvement as well as cost reduction. The worldwide PV module production has reached to 55,000 MW level in 2015 and now solar electricity is seen as economically viable electricity option. However, solar solutions provided for remote rural areas suffer from sustainability issues.

Renewable energy solutions, implemented since the 1980s, have failed due to lack of community involvement in design and implementation, weakening sustainability and durability. An alternative approach for a replicable solution is therefore, essential to ensure access to clean, sustainable, basic lighting and in this regard IIT Bombay proposes the 'Localization-Affordability-Saturation' (LAS) model. 'Localization' focuses on knowledge and skill transfer to local communities by involving them in deployment of technology in rural areas and simultaneously providing employment for people. Using the LAS model in the Million SoUL Program, one million students were benefited through solar study lamps in the span of just 2 years! And, there is plan to reach nearly 100 million school going students in rural India, let's give them Right to Light.

IT3 Renewable Energy: Future and Challenges

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Power is one of the most critical components of infrastructure crucial for the economic growth and welfare of nations. India's power sector is one of the most diversified in the world. Sources of power generation range from conventional sources such as coal, lignite, natural gas, oil, hydro and nuclear power to viable non-conventional sources such as wind, solar, and agricultural and domestic waste. Electricity demand in the country has increased rapidly and is expected to rise further in the years to come. In order to meet the increasing demand for electricity in the country, massive addition to the installed generating capacity is required. Indian power sector is undergoing a significant change that has redefined the industry outlook. Sustained economic growth continues to drive electricity demand in India. The Government of India's focus on attaining 'Power for all' has accelerated capacity addition in the country. At the same time, the competitive intensity is

increasing at both the market and supply sides (fuel, logistics, finances, and manpower). The power sector contributes nearly half of the country's carbon emissions. On average, every 1GW of additional renewable energy capacity reduces CO_2 emissions by 3.3 million tons a year.

Total capacity of renewable energy plants in India stood at 42,850 megawatts as on April 30, 2016, thereby surpassing the 42,783 megawatts capacity of large hydroelectricity projects in the country. Tata Power has an installed generation capacity of 10477 MW in India. The thermal power generation capacity stands at 7435 MW, while generation through clean sources such as hydro, solar, and wind stand at 3042 MW. Tata Power Renewable Energy Limited (TPREL), a 100% subsidiary of Tata Power, has completed acquisition of 100% shareholding in Welspun Renewables Energy Private Limited (WREPL) and its subsidiaries. Accelerating the use of renewable energy is also indispensable if India is to meet its commitments to reduce its carbon intensity. While renewable energy sector enjoys benefit of being non-polluting source, there are certain challenges in the same too.

Challenges in renewable energy sector

- Solar is available only during day time.
- Wind pattern is unpredictable.
- Grid stability becomes an issue beyond a certain level of installed capacity.
- Availability of sufficient quantity of biomass at reasonable price on long term basis.
- Fossil fuel thermal plant PLF is 80 – 90 % as compared to 20-30 % of renewables

IT4 Urban Resource Conservation to Save Energy

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Saving equates to generation when it comes to Energy. Urban resources like building, infrastructure, open spaces etc. can be developed or retrofitted to ensure sustainable built environment. Energy is the most measurable indicator towards it.

Depletion of natural resources at alarming rate is demanding inclusion of resource conservation perspectives in urban development programmes globally. Sustainable Development Goals demand for security of resources. Introduction of alternate and/ or complementary infrastructure services, i.e. green infrastructure are major tools in this Sustainable Total Living Environment (SusTLE) mission in urban areas. Urban ecosystem gets modulated from natural one and the deviation is so wide that it is accepted as a new ecosystem by itself. The efforts made in alternate infrastructure services through inclusion of natural ecosystem services wherever it's possible. The green infrastructure can be resiliency tool to fight with rising temperature and water stress (scarcity and urban flooding) too. And in both cases it helps in resource and energy conservation directly and indirectly.

Cities employ best practices based on identified target and geo-climate context. Citizens' engagement in preparing vision documents and targets have proved successful methodology to achieve targeted plan. Smart city initiatives in continuation to Jawaharlal Nehru National Urban Renewal Mission (JnNURM), Pradhan Mantri Awas Yojana-Housing for All (Urban)(PMAY-HfA U) and Atal Mission for Rejuvenation and Urban Transformation (AMRUT) are opportunities for Indian

cities to bring SusTLE. The selected cities will inspire other aspirant cities and towns to provide quality urban living to their residents.

Scope of this present discourse will be to establish the value propositions of green infrastructure through relevant case studies and discuss its relevance for Indian cities. It will also discuss basics design strategies for integrating the same in any development.

IT5 Power from Thorium - The Indian Scenario

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India has a well planned strategy for nuclear power generation bearing in mind the natural resources available which has been outlined in the three stage programme of the Department of Atomic Energy. With moderate uranium reserves, a nuclear power programme with heavy water technology was initiated and at present there are 18 Pressurised Heavy Water reactors (PHWRs) and 2 Boiling Water Reactors (BWRs) and 1 PWRs power producing about 5780 MW(e) which roughly 3 % of our total energy production.

For India, since our indigenous uranium sources are limited, we have to go for thorium cycle at the earliest for energy security and sustainability. The utilisation of thorium in power reactors presents an important long-term option for India. Thorium reserves are more abundant than uranium reserves and its energy potential is three times that of uranium. The estimated domestic energy potential of thorium is over 200,000 Gwe years. We have been developing the thorium technology over the years, with a number of R&D programs and commercial application in our operating reactors.

The major disadvantage with thorium is that it is not associated with a fissile species. One has to convert the fertile 232Th to fissile 233U in a reactor, and energy is obtained by the fission of 233U. However separating the 233U from irradiated thorium and fabricating newer fuel with the bred 233U are technologically challenging. This aspect coupled with the fact that it is quite different from that of the uranium fuel processing has contributed to the lagging behind in thorium as energy source. The easier and cheaper availability of uranium supplies in other nuclear developed countries was another reason for slower development of thorium fuel cycle.

In India we have studied several design options on the use of thorium in different reactor systems from thermal to intermediate and fast spectrum, molten salt reactors, high temperature reactors, compact nuclear power packs and even Subcritical systems. In this talk, a brief overview of the nuclear properties of the isotopes of thorium cycle will be given followed by an overview of the research on thorium being done in Bhabha Atomic Research Centre. The various physics aspects of thorium fuel cycle will be discussed and the programmes in DAE for mastering the technology will highlighted.

IT6 Energy Conservation in Everyday Life for Sustainability

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Energy (inherent ability to deliver work) seems to be as ancient as the human race, if not more. Energy perhaps is the basis of this Universe. The need and importance of energy in various forms is known to all and does not need specific emphasis. Never the less the various forms of energies available and being harnessed need a mention.

Conservation (prevention from decay) of energy is multi faced. Energy Balance, Conservation & Sustainability are a part of Ecological evolution and form the very basis of evolution of this Universe. Somehow, man has become more self-centered in the recent centuries, consuming more energy and depleting the resources / reserves. The per capita energy consumption (KWh) of a country has become a measure of its prosperity. This unfortunately is being achieved at a cost of future ecological diversity and sustainability.

The Energy Conservation (a Combination of Energy + Conservation) is challenging and require multi-pronged approach for India. Development and Growth are thrust with challenges in Energy Security / Independence, Switch-over to renewables, Energy Efficiency and most important ENERGY CONSERVATION.

Energy Conservation is neither available off-the-shelf nor the implementation can be delegated. Each one of us is required to think, contribute, practice, measure and achieve. Thus contributing at large in future Ecology & Sustainability.

Awareness of Energy Conservation in everyday life is presented in the form of slide-show with practical examples, for quick results.

IT7 Utilizing Nuclear Energy for Hydrogen Generation

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Increase in global energy demand during the 21st century, combined with the necessity to reduce the green house gas emission, has lead to the introduction of a new and universal energy carrier, viz., hydrogen. Today, most of the hydrogen production comes from hydrocarbons: oil (18 %), coal (30 %) and natural gas (48 %). Only about 4 % of H_2 comes from water through electrolysis. Water and biomass are viable long term candidate raw materials for hydrogen production, as the fossil resources are dwindling and there are limitations on the release of green house gases. Two processes that have greatest likelihood of successful massive hydrogen production from water are electrolysis and thermochemical cycles. The thermochemical cycles are processes where water is decomposed into hydrogen and oxygen via chemical reactions using intermediate species which are recycled. The required energy can be provided by nuclear energy or by solar energy.

Hydrogen can be produced by thermochemical and/or electrochemical processes using nuclear energy as the primary thermal energy source. Nuclear energy can be used in hydrogen production mainly in three ways: (i) by using the electricity from the nuclear plant for conventional liquid water electrolysis, (ii) by using the high temperature heat and electricity from the nuclear plant for high temperature steam electrolysis or the hybrid processes and (iii) by using the heat from the nuclear plant for thermochemical processes.

Nuclear heat can be supplied abundantly for large scale hydrogen production by water splitting. Nuclear energy for hydrogen production is an innovative "green" idea that can take a significant step towards saving modern society from climate change and irreversible damage to worldwide ecosystems In this talk, various thermochemical routes for production of hydrogen using nuclear technologies will be discussed.

Keynote Address - Water

Sustainable Water Management in India: Implications of Climate Change

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India and several other developing countries are facing an impending water crisis. Visible signals of the crisis are: inaccessibility of safe drinking water to sizable sections of population, unsustainable exploitation of ground water, pollution of large stretches of rivers, frequent floods and droughts, contaminated groundwater, transport of water to cities over large distances and severe and frequent water shortages. Climate change will most likely introduce an additional burden on the already stressed water systems. Increasing temperatures are likely to change precipitation patterns resulting in alterations of regional water availability, evapotranspirative water demand of crops, extremes of floods and droughts and water quality. A comprehensive assessment of regional hydrological impacts of climate change is therefore necessary.

This presentation provides an overview of the current hydrologic scenario in the country, identifies the stresses, challenges and opportunities towards sustainable water management and summarises the recent research initiatives to improve the understanding of climate change impacts on hydrology. Projections of likely changes in water availability, water demands and water quality at river basin scales are discussed, with description of uncertainties in the projections. A brief discussion on implications of other forces such as land use and demographic change superimposed on climate change is also provided.

IT8 Water – A Stressful Situation: The Challenges before Us and the Innovations that will be Necessary for Sustainability

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TIFAC's Techvision 2035 document on Water has identified the following key challenges that must be addressed through concerted effort:

1. Augmentation of water availability by all affordable and viable means
2. Arresting the trend of declining water quality
3. Reducing the water footprint in agriculture
4. Viewing wastewater as a resource and managing residues from water treatment plants
5. Making seawater desalination more affordable
6. Mitigating the risks posed by growing uncertainties
7. Large scale monitoring and surveillance of water bodies
8. Human resource development in line with the thrust on water
9. Imbibing the concepts of water footprint and responsible care among all citizens

The presentation will dwell on the above challenges, directions for mission oriented R&D, and scope for innovations.

IT9 Ecological Management of Rivers in India

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IT10 Rural- Friendly Drinking Water Purification Systems

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Drinking water with physical, chemical or biological contamination has harmful effects on human health. In general, surface water is contaminated with disease-causing organisms and ground water at certain locations contain high loads of dissolved salts, including toxic elements. Membrane based technologies provide a one-step solution in making such waters safe for drinking. While Ultra-filtration (UF) based systems are effective in removing biological and other colloidal species, Reverse Osmosis (RO) is capable of bringing down the concentration of dissolved salts within potable limits. In India, many of the remote and rural areas do not have good quality drinking water. As most of the infectious illnesses are water borne, supply of safe drinking water would be a preventive measure in the health improvement program for the less privileged community. UF and RO are pressure driven processes and hence require energy in the form of

electricity. Most of our rural areas do not have access to grid electricity. This restricts employment of water purification systems in such areas.Stand-alone, water treatment systems which can work on renewable energy or human power are the only viable solution to deal with such situation. The most useful renewable energy sources are sun and wind.

As a part of the societal commitment of BARC under non-power application program, Desalination Division (DD) has developed rural -friendly water treatment systems, supported by renewable energy and human power. If properly deployed and managed, they would be of great help to the most deserving communities for obtaining safe drinking water. The manually operable units can be transported and used wherever required.

The talk will be covering the effects of poor quality drinking water on human health, the techniques for making impure water potable and the details of the rural-friendly water purification systems developed & demonstrated by BARC.

IT11 Consequences of Human-Induced Alterations to Marine Environment of India

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The coastal zone of the country with its mangroves, coral reefs, wetlands, lagoons and sea-grass meadows coupled with an intricate network of shallow estuaries, backwaters, lagoons, bays and creeks provide conducive environment for spawning, breeding, feeding and protection to a wide range of organisms. Majority of commercially important fishes which supports about 4 million fishermen in more than 3200 marine fishing villages dotting the coast, spend some part of their life cycles in these habitats.

However, the coastal zone of India is under considerable stress due to indiscriminate and ill-planned developments, haphazard resources exploitation, transportation and disposal of wastes – often untreated. Open access system of exploitation of marine fishery has resulted in overcapitalization apart from damage to benthic habitats due to over-dependence on trawlers. Mangroves which form the first line of defence are being reclaimed or cut for wood and fodder, and corals which are very sensitive to environmental changes are degraded due to human interference.

The open-shore waters beyond a few kilometres from the coast are fairly clean with near baseline concentrations of pollutants such as heavy metals, pesticides, petroleum hydrocarbons and phenolic compounds except in some isolated pockets along coastal cities.

With the industrial and urban establishments largely located on the banks of backwaters, several inshore regions such as estuaries, creeks, lagoons and bays are degraded to a varying degree. Domestic wastewater is the major source of pollution though industrial emissions also contribute locally in some instances. Bacterial contamination, eutrophication and anoxia prevail in many areas with decrease in biodiversity and occurrence of sporadic fish kills.

Explosive blooms of harmful algae which produce toxins causing damage to commercial fishery and transferred to humans through the consumption of seafood, are on the rise possibly due to nutrient

enrichment in the Indian coastal waters. Introduction of alien invasive species through shipping and intentional introduction is another concern that can threaten the local marine ecology.

With growing awareness of intimate linkage of oceans, seas and coastal areas to the very survival of the Earth's ecosystem there are signs of actions to arrest further deterioration of these systems with the long term goal of their sustainable use.

IT12 Impact of Climate Change on Water Resources

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Fresh water resources are expected to be increasingly scarce in the coming decades, partly due to climate change. With only 2 % of fresh water available for human consumption, climatic factors have a drastic impact on water availability on global scale. The indicators associated with climate change jeopardizing water resources include change in water supply and demand causing water stress conditions and seasonal variability projected for the coming years based on climate and economic factors. It has been projected by World Resources Institute (WRI) that more than a billion people currently live in water-scarce regions, and as many as 3.5 billion could experience water scarcity by 2025 . In the Indian scenario, the over growing population and mismanagement of water resources allied with climatic variations is expected to become a leading cause of water scarcity, affecting the rural and tribal areas the most.

In Maharashtra, Palghar district, known as a tribal district, is the least developed and neglected in terms of availability of fresh water for primary and secondary purposes. TERI, through its research has been implementing projects in few of the villages to provide solutions for a long-term availability of replenishable water resources . Although the climatic conditions of the selected area is hot and humid, it remains dry for most of the year. The topography of the area delineates the villages on the hillocks while the water sources at the downstream. This not only affects the accessibility but also the quality and the quantity of water available to the tribal communities for their daily needs. The condition becomes worse in the dry months leaving the tribal communities with unsafe drinking water and lack of availability of food resources

Considering the scenario, the impact of climate change could only be reduced by taking preventive measures to ensure availability and access to water for primary and agricultural needs. Thus, TERI focuses on adopting climate-risk management practices which focuses on conserving water by promoting rainwater harvesting at the village level, re-cycling and reusing water at the household level to cultivate nutritious food and endorse climate smart agricultural practices to develop resilience to both present as well as projected weather variability and climate change.

Keynote Address –Food and Agriculture

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Indian Agriculture Research Institute, New Delhi

IT13 Food Security: Integration of Agricultural Production with Preservation and Food Processing

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Our greatest challenge in 21st century is in food and agricultural sector. There are several dimensions to this all important issue which need an integrated approach at a national level. Our agricultural production is coping up with our increasing population through adopting high yielding and disease resistant crop varieties and management of cultivation practices. Radiation induced mutated varieties have played a significant role in increasing the production. There are now a fairly large number of Agricultural Universities and State owned Research Centres. The Central Government has shown enough willingness towards development of modern infrastructure facilities for this purpose. Orientation of all these facilities and human resources would definitely help in increasing the overall agricultural production in a sustained manner.

We need to improve soil carbon levels of our agricultural fields which have fallen below alarmingly in last few decades. The average percentage of organic carbon in our soils is lesser than one while we need to raise these levels to approximately 2 to 2.5. Management of agricultural residues and organized processing of food waste will be needed to be done on a regular basis to achieve these increased organic carbon levels.

We also need to concentrate more on preservation of our agricultural produce through processing and improving the storage facilities. We still lose a large fraction of our agricultural produce either on the field due to diseases or because of poor storage facilities. The farmer is the ultimate sufferer in this chain. It is very essential that we encourage the farming and food processing sectors to attract more and more younger talent apart from developing proper infrastructure.

IT14 Transforming Rural India with PRIDE™

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Agriculture is an important focus area for India providing livelihood to nearly 600 million Indians and contributing +to about 15% of the Indian GDP. The GDP of Indian agriculture reached US $212. billion in FY16 while providing livelihood to nearly 55% of the population and contributing to about

17% of the GDP. However, all is not well in this sector. Food production has seen only a marginal increase over the past 20 years while there has been an exponential jump in the population. Productivity is extremely low due to unscientific farming practices, fragmented land holdings, lack of agro-climatic focus for crops selection, lack of access to the right farming advice at the right time. Farmers are plagued by myriad issues all around like timely and reliable access to farm inputs, access to markets, access to reliable information at the right time and cheap access to credit. Thus, farming is becoming a "dead" profession with many marginal farmers opting to leave their lands barren and migrating into the cities in the hope of a better life. Here the situation is even worse than anticipated and the once proud farmer who was the cornerstone of the Indian economy is leading a quiet life of economic desperation and angst.

This situation has led to serious introspection within TCS and various initiatives leveraging technology to alleviate the issues in the agricultural sector have gathered momentum. The Progressive Rural Integrated Digital Enterprise (PRIDE™) powered by the TCS mKRISHI® platform is one such initiative.

IT15 Tropical Tuber Crops - An Alternative for Food, Nutrition and Livelihood Improvement

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India has 833.10 million people in 6, 40,867 villages. The tropical tuber crops like cassava (Manihot esculenta) sweet potato (Ipomea batatas) taro (Colocasia esculenta) (L.) Schott) and yams especially Greater yam (Dioscorea alata) and Elephant foot yam (Amorphophallus paentifolius) are important food crops after cereals, legumes and are common to rural, tribal areas. These crops thrive in all agro climatic conditions including harsh climate with its resilient wide adaptive nature. At ICAR- Central Tuber Crops Research Institute, breeders have developed improved sweet potato varieties tolerant to biotic (weevil) and abiotic (salt) stress, having high yield (18-22 t/ha), starch (20%), beta-carotene (14mg/100g) and anthocyanin (95mg/100g). Other tuber crops varieties have also been developed. These crops are gaining popularity for their high productivity (20-50 t /ha) and valued traits. The "minerals" and "fiber" contents are 1.5 to 5 times higher in these crops than rice and wheat. The climatic resilience of sweet potato and taro as life support species was the reality during post super cyclone (1999), Tsunami(2004). Inclusion of tuber crops in rice based farming resulted in three times higher net return than rice farming alone. Further, when the whole world is moving towards 'Zero hunger challenge', there are many such districts in India which are struggling "hand to mouth for food and nutrition". ICAR-CTCRI, with its improved tuber crops technologies is progressing ahead to address the issues of "food insecurity", "malnutrition" and "livelihood improvement" especially in rural, tribal and backward areas. Tropical tubers would also satisfy the enigma of 'availability, 'accessibility' and 'affordability'. Improved technologies and its outreach for 'wellness' will be discussed.

IT16 Role of Beneficial Microorganisms in Sustainable Agriculture: Current Scenario and Future Prospects

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Agriculture is the mainstay of Indian economy because of its high share in employment and livelihood creation notwithstanding its reduced contribution to the nation's GDP. The Green Revolution technologies, which partly solved the problem of food demand, appeared to be too expensive, as the costs of technology transfer, soil erosion and loss of plant genetic materials that were resistant to diseases are high. The rampant use of chemical fertilizers, pesticides, monocropping and other inputs have reduced the fertility of farmlands. At this juncture it is imperative to adopt sustainable solutions for the improvement of crop yield and soil fertility.

Soil fertility is a complex quality of soils that is closest to plant nutrient management. Many beneficial microbes present in soil improve the soil fertility, control the pathogenic microbes and support the plant growth. Beneficial microbes mostly harbour in rhizosphere of plants and perform many important functions such as organic matter decomposition, nitrogenfixation, solubilization of micro and macronutrients etc. therefore they can be used for the reclamation of the waste soil and other materials. Microbial diversity is very important for maintaining the soil health and quality because a wide range of microorganisms are involved in important function of soil such as organic matter decomposition, nitrogen fixation, solubilization of micro and macronutrients, maintenance of soil structure, soil borne disease suppression, plant growth promotion, siderophore production and release of hormones. Microbial population inhabiting soil includes bacteria, fungi, algae, viruses, protozoa. Among all the microorganisms found in the soil bacteria and fungi are versatile.

Furthermore, sustainability involves multidimensional approach. In order to maintain agricultural sustainability integration of organic inputs, irrigation water management, crop rotation and other relevant technology components for resource optimization are required to maintain the microbial density in soil for the maintenance of fertility and crop yield.

IT17 Post Harvest Technology Innovations for Increasing Farmers Income

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To keep farmers interested in agriculture we need to help farmers to increase their income. This can be done by modern agriculture with improved agricultural technologies to increase the productivity. However so far we have seen that only increased productivity has not helped to achieve it. Generally with increase in productivity there is a glut in the market which brings in slump in the

prices and leads to distress sales. However proper cleaning, grading, storage and off season sale of cereals can help to get benefit of higher prices. Similarly in case of perishables like fruits and vegetables cold storage and intermediate processing to reduce volume and increase shelf life is needed. Production of agri and horticultural produce required production as well as post harvest technologies. When post harvest technologies are not proper then it results in losses of 10% in food grains and upto 30% in perishables amounting to about Rs. 90,000 crores. Indirect effect of this loss is lower price to farmer and increased price to consumers. Only way to increase the farmers income is to increase his involvement in post harvest management and value added processing of perishables as well as durables. It would generate rural employment, assured buy back of farmers produce and value added products with freshness and traceability assurance for consumers.

Some of the recent developments in post harvest management technologies/equipment and value added processing are: Non-destructive measurement of maturity and sweetness of mango, Fruit Saving Gadget, Fruit and vegetable washing machine, Low Cost Basket Centrifuge for Minimal processing, Low cost evaporatively cooled chambers for fruits and vegetables, fruits and vegetable graders, Pomegranate Aril Extractors, Banana Hand Cutter and various novel value added products.

IT18 Sustainable Technologies for Fruits and Vegetables Processing in India

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Food processing is an indicator of nation's economic growth. Inspite of being in the top three producers of fruits and vegetables worldwide, India ranks in the bottom three for processing. There are several reasons why food processing has not gained momentum in India, Within India the state of Maharashtra is leading in both production and processing of fruits and vegetables. There are two types of products, high value low bulk products such as saffron and spices and others are low value high bulk type viz. branded atta and rice. The main challenge is sustainability of low or moderate value low bulk products. Inconsistent quality, unreliable supply and small land holding are few issues. Another concern is product specific machinery. For example, a typical mango processing unit is barely sustainable since the set up is specific for mango products and the plant operates for only 30 days and remains non- functional for over 300 days in a year. There is a need for general purpose small scale processing plants (few tons per month) withmulti-processing equipment capable of handling different raw materials. Backward integration will give assured market at fair price to 100 farmers in the vicinity catering to a land of 200 to 500 acres. Another role of science is in developing value added products from waste produced during processing. For example, mango peels, kernels, vegetable peels could be used to prepare pigments, natural food colours, antioxidants, enzymes or edible starch and dietary fibre. Products such as biscuits and beverages could also be explored for "holistic" approach. High value speciality products like fruit wines can also be developed. This paper discusses case studies on dehydration of vegetables, development of wet RTE vegetable products, fruit wines and use of mango kernel in cookies with complete utilization of fruits and vegetables.

IT19 Role of Packaging Science and Technology

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The global packaging industry by value is estimated at USD. 32.00 billion in 2015 and at the CAG of over 15 percent will touch USD. 73.00 billion by 2020. The contribution of flexible packaging is over 20 percent and rigid plastics 15 percent. The other rigids is in single digits. Paper and boards is closely on the heel of plastics based packaging. Notwithstanding the huge population and significant growth in the demand for all products in all walks of life the consumption of packaging is yet at a low ebb when compared to other developing and developed economies. The per capita consumption of packaging in the country is of the order of 4.3 kg as compared to 42 kg in Germany and 19 kg in Taiwan. Among the varieties of packaging media plastics based packages used in food packaging is estimated over 50 percent. The Indian retail market is expected to double to USD. 3.6 trillion by 2020 and the consumer spending is expected to touch about Rs. 240 trillion (USD. 3.6 trillion). India's share in global consumption should be of the order of 5.8 percent more than twice its current level. The overall health food market has crossed over Rs. 10,000 Crores. The savory snacks market is yet another segment said to witness interesting growth.

All these justify the unprecedented demand for packaging and with its demand for a critical review as to the waste generated by the used packages and generally thrown away in the absence of organized collection, segregation and recycling. More often this has led to extreme criticism branding the "Package Waste" creating enviro imbalances and sustainable environment. The realization that however needs to be dawned is "packaging is part of the solutions" as means to: prevent product spoilage and wastage, protect the natural wealth and processed and manufactured products, saves resources, and thus contributes to more sustainable consumption. A life cycle approach could be more appropriate wherein integrating supply chain and downstream activities viz Suppliers – Customers – Consumers – end of life can help to avoid burden shifting. Sustainability is a business opportunity through successfully transforming various operations with a focus on sustainability keeping customer satisfaction as a key through better products, inherently safer, renewably resourced and alternate energy sources. Other facets would include "Better processes with reduced waste and lower energy content besides smaller environmental foot print, recyclability, better land use and less impact on biodiversity".

The world commission defines "Sustainability" as "Development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs".

IT20 Role of Geomatics in Sustainable Development

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Information on the nature, extent, spatial distribution along with the potentials and limitations of natural resources is a pre-requisite to achieve the goals of sustainable development. It has been clear that the utility of advance integrated techniques of Geomatics has the potential of achieving this goal. Geomatics mainly comprises of: (i) Remote sensing (RS), (ii) Geographic Information System (GIS) and (iii) Global Positioning System (GPS). By virtue of providing synoptic view of fairly large area at regular intervals, Remote Sensing or spaceborne multispectral measurements hold great promise in generating reliable information on various natural resources, namely soils, mineral, surface and ground water, forest cover, marine resources, in a timely and cost-effective manner. GIS offers an ideal environment for integrating spatial and attribute data on natural resources and environment, and for subsequent generation of optimal land use plan on a micro-watershed basis. Furthermore, GPS enables making precise in situ measurements on various terrain parameters which are used for both generating baseline as well as derivative information on natural resources for various developmental activities. Spatial information is an integral part of this information pool and is of utmost importance for sustainable development. Geomatics can play a major role in support of the policy-making process and preparing the sustainable plans for urban areas, forests, water bodies, etc. The present paper highlights the high potential of Geomatics in generation of sustainable plan for Pavagadh region of Halol taluka, Eco-city plan generation of Vadodara city, Assessment of forest variables and micro plan generation. Studies on various natural resources for their sustainable management have been attempted using spatial data for different spatial resources.

Keynote Address – NGOs and Citizen Participation

Role of Indian Woman Farmer in Sustainable Development of India by using Smart Agriculture Technology – SRT (Saguna Rice Technique).

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Saguna Rice Technique is a unique new method of cultivation of rice and related rotation crops without ploughing, puddling and transplanting (rice) on permanent raised beds. **This is a zero till, Conservation Agriculture (CA) type of cultivation method** evolved at Saguna Baug, Neral, Dist. Raigad, Maharashtra, India. It reduces treacherous labor by 50%, cost of production by 40%, stops emission of greenhouse gases and improves soil fertility. **On top of all SRT brings joy and confidence to the rice farmer.**

Usually "new technology" refers to something difficult, expensive, only for educated & so on. For example Drip Irrigation, Clean drinking water etc. are very important technologies yet not accepted even by 5% users? But there can also be a simple technology which if used, either by PhD Professor or the last woman of the village, it works with same efficiency with both and is used by 100% users; that is " turn on electric light switch & there will be light!" This is the best example of a science and technology for everybody. SRT is such a science and technology.

Impacts of SRT

- Farmers become more confident about their profession and feel dignified.
- Farmers have gained independence from the problem of labor shortage and expensive equipment like tractors.
- Soil became more productive.
- Water holding capacity of soil has been drastically improved.
- Presence of earthworm in farms attracts some of the rare species of birds, so it improves the eco-system.
- Groundwater level increases.
- Reduction in Methane Gas generation.
- It reduces water, Fertilizers & other chemicals requirements.

Thus use of SRT gives happiness and enhances confidence of Indian farm woman. By use of SRT, the smart agriculture technique wherein she is unknowingly using the most scientific approach towards food security, recharging of aquifers and global warming.

For more information please visit: srt.kisan.com and/or www.srt-zerotill.com

IT21 Human Face of Solid Waste Management

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Parisar Vikas Stree Mukti Sanghatana 's (SMS) initiative which recognizes the need to empower women for greater equality alongside improved economic opportunities., SMS has been participating in women's movement over the past 40 years which has provided significant credibility and experience with which to start innovative programs addressing the needs of marginalized women. Through its extensive experience and knowledge, SMS has ample evidence that providing women with education, skills and freedom to earn an income enables women to take decisions that result in the benefits to both themselves and society.

For SMS, development means more than providing economic opportunities and basic needs such as health, nutrition, sanitation and education. SMS has incorporated a unique aspect of developing the individual capabilities and transforming these new capabilities into institutional arrangements in the economic, political and social spheres for greater social change and equality. In other words, the program interventions focus on empowering both the individual and then progressively the collective groups in order to address social issues and expand their economic opportunities. Stree Mukti Sanghatana was successful in acquiring space for seven dry waste sheds and two Biomethanation plants from the Municipal Corporation of Greater Mumbai. Public- private

partnerships of this kind and development of small entrepreneurship programs for the urban poor can bring about a visible change and can definitely benefit the Municipal Corporations and the environment. The experience of Parisar Vikas, the initiative of involving waste pickers in the mainstream of the Solid Waste Management system of the MCGM, highlights the reality that women from marginalized groups need not be passive victims of poverty and human rights violations; they can successfully participate in the struggle to survive, to gain control over economic, social and political resources and lead a life of dignity.

IT22 A Review of CERE's Work with a Focus on Carbon Management

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The Centre for Environmental Research and Education (CERE) is a Mumbai based non-profit organisation working to promote environmental sustainability through formal education, government partnerships, corporate consultancy in the field of CSR and primary research. CERE have been pioneers in the field of designing carbon management systems through the Carbon Map & Cap program wherein the carbon footprint of an establishment is determined and subsequently offset through our Urban Afforestation project. Similarly CERE has successfully completed a number of rural and urban development and research projects. The organization has also published 27 titles and created short educational films on the subject of global warming and climate change. This talk will present a review of CERE's work and will highlight the Carbon Map and Cap Project.

IT23 CHINTAN-Environmental Research and Action Group

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CHINTAN-Environmental Research and Action Group is a non-profit, non-governmental organization established in December 1999 as a means of addressing issues of sustainable consumption and environmental and social justice.

CHINTAN works across the solid waste vertical. Its implementation work includes providing waste management services to waste generators. CHINTAN organizes wastepickers and kabaris, training them to provide professional quality services for waste handling. CHINTAN trains wastepickers to offer professional services, from e-waste handling to doorstep collection and facilitates waste handling across a number of sites in Delhi, Jammu and Kashmir, Uttar Pradesh and Haryana, through its Scavengers to Managers Programme, enabling at least 2000 livelihoods. Over 25 tons of waste is collected, segregated, composted and recycled daily. Over 1 lakh citizens have benefitted directly and 5 lakh indirectly by CHINTAN's waste services every day.

At the grassroots, it has organized over 12,000 wastepickers, small traders and other waste workers to enable them advocate for inclusive waste management. It has incubated a registered association of wastepickers, SafaiSena.

In order to address the crisis of child labour in recycling, CHINTAN works through its No Child in Trash Programme to enable children waste pickers to access education in government schools. About 60% of the children are girls. Nearly 5000 wastepicker children have been positively impacted, gaining access to education.

CHINTAN has also served on several policy committees of the government, and impacted several policies and rules related to Solid Waste. Through its Voice for Waste programme, CHINTAN's advocacy efforts have resulted in the passing of 5 new policies and rules that are inclusive of the informal waste handling and recycling sector. It has also undertaken cutting edge research, with over 18 widely circulated publications to its credit. CHINTAN's implementation and research spans across India-Delhi, Jammu and Kashmir, Uttar Pradesh, Assam, Andhra Pradesh, Maharashtra and Haryana.

IT24 Innovative Home Composting of Kitchen Waste - A Reality

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Municipalities face the **challenge** to provide an effective and efficient system for waste management in cities. The problems are mainly lack of organization, financial resources, complexity and system multi-dimensionality. **The shortage of dumping grounds to handle the ever increasing quantum of waste generated makes it imperative to adopt eco-friendly solutions which will enhance sustainability of our environment along with value addition. The realization of our dream to make Mumbai city cleaner may be feasible only if we could tackle the problem of overflowing garbage bins at every lane and corner.**

Every citizen can become responsible for disposal of the domestic waste by adopting a simple principle of segregation that could help us reduce, recycle and re-use the waste generated. Kitchen waste could be disposed off easily at home by employing the innovative **Kachra Khanari basket.** A consortium of organisms derived from a previous batch can be used as inoculum to initiate efficient kitchen waste decomposition at the source of generation itself. Simple precautions such as maintaining humidity, controlling load and type of waste can be easily managed by households.

A scale up of this principle has been employed at VES institute, wherein the entire canteen waste and dry leaves and twigs of garden litter are effectively treated to generate substantial manure for maintaining a green campus since November 2014.

Specific efforts were also made to involve the neighborhood as well as the municipal machinery. Details of the same will be covered in the presentation.

Adopting such practices will contribute a big way towards the drive for enhancing sustainability and arresting deterioration of the ecosystem.

Energy

E1 Potential of Wave Energy along Western Coast of India

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Renewable energy share of the total electricity generation capacity of India is around 14%. India has a very long coast line of 7516.6 km and therefore ocean energy has enormous potential for electricity generation in India. A study performed by CRISIL with IIT Madras, Agence Française De Développement (AFD) & IREDA on Potential of Tidal & Waves Energy in India suggests that India has potential of around 12 GW of tidal and more than 40GW of wave energy. Wave energy can be exploited by oscillating water column technology for electricity generation.

Stand alone microgrids fed by hybrid Wave energy and solar generation can be an answer to the problem of electricity for remote coastal areas which are either not connected to the grid or receive electricity practically for a very few hours in a day.

Wave energy depends on the significant wave height HS and wave period TJ. Where TJ =1.2* TZ, TZ is the time period between two successive crossings of mean water level. TJ is said to be the period of energy transport.

$$P = 0.489\ H_s^{\ 2} T_J\ \text{KW/m}$$

The month-wise data was collected for Significant wave height and Mean wave period from wave rider buoys at locations, Ratnagiri in Maharashtra, Karwar in Karnataka and Kozhikode and Kollam in Kerala from ESSO- INCOIS. The collected data shows considerable rise in significant wave height during south west monsoon in western coast of India. Thus the wave energy can offset deficit in solar generation during monsoon months. The stand alone microgrid fed by hybrid solar and wave energy can be optimized to generate electricity to feed remote coastal areas of India.

E2 Assessing Sustainability of Biofuels from Indian Context: Some Insights

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Over the last few decades fossil fuel depletion and global warming issues have strongly motivated research on renewable energy technologies. Due to concerns over both climate change and energy security, biofuels have gained an increased interest worldwide. Abundant availability of biomass in the country and initiation of uses of biofuel motivates researchers to think of its availability, potential and feasibility in Indian context. This research aims to provide insight into the sustainability of tropical biofuels, and their impact on ecosystem services.

The difficulty of finding appropriate life cycle inventory data for the analysed biofuels in the Indian context is overcome by combining data from diverse sources which are used to calculate environmental sustainability metrics, such as energy return on investment, life cycle greenhouse gas emissions and life cycle water use for each fuel. Biomass sources considered in this work include cellulose from wheat stalk, rice husk, sorghum stalk, sugarcane bagasse and cotton stalk.

Results of the analysis indicate that sorghum stalk is most attractive due to its high energy return on investment, low greenhouse gas emissions, and low water and land use. Ethanol from rice husk has relatively high water use and greenhouse gas emissions, but these are within the margin of variability of other fuels. Despite the attractiveness of sorghum stalk from the current analysis, it is not likely that this will become a major feedstock for cellulosic ethanol in India. This is because farmers value sorghum as an animal feed and may not be willing to convert it into ethanol.

This is the first life cycle study of Indian cellulosic biofuel pathways. The inventory data collected in this work is a novel contribution that should be useful for other studies. Findings from the analysis can help guide the decision-making process in the biofuel sector for India.

E3 Nuclear vs Renewable energies : Looking for a Sustainable Power Scenario in India

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We are among the world's fastest growing economies for the past two decades. The country continues to lead not only in growth but also in energy demand growth. India's power demand is growing by the day.

At present India is heavily dependent on imported energy resources. Coal provides 68 per cent of electricity consumption at present. Gas and hydropower each supply 12 per cent, nuclear power

about 4%. India's per capita electricity consumption is expected to double by 2020, with 6.3 per cent annual growth, to about 1700 TWh. It is expected to reach 8000 TWh/yr by 2050, ten times as much as today. Hence there is an acute demand for more and more reliable power sources.

Coal, which currently provides almost 70 percent of India's power, probably will remain the dominant primary fuel for a long time to come, holding out commercial opportunities to those producers who are global leaders in high efficiency, clean-burning plants. But with India needing to diversify production, openings will exist for nuclear, gas and small hydro schemes. Also the need to extend basic electricity to the vast rural population means that there are massive opportunities in wind, biomass and, if we can get the prices right, especially solar energy.

Renewable energy generation in India is higher than its nuclear power generation and is growing at a much faster pace because it is cheaper and quicker to install. The cost of renewable energy is now lower than the cost of nuclear power and does not come with attendant risks.

Renewable Energy generation in India was 61.8 billion units, versus 36.1 billion units of nuclear power generation during the financial year 2014-'15. Renewable energy accounted for 5.6% of electricity generated in India, against 3.2% for nuclear power.

As a country with such a huge population and wide geographical diversity, we need to use our limited resources judicaially for attaining a greener future to the benefit of all. In this paper, we would like to analyze the ground situation and suggest a sustainable way out of the future crisis.

E4 DC Conductivity and Stability of Different Anode Materials in Biogas for Application in Solid Oxide Fuel Cells

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The interest of using traditional fuels such as methane, methanol, natural gas or biogas, for the solid oxide fuel cells (SOFCs), has been seen in recent years although hydrogen is the fuel of choice. The operating temperature of SOFC is high enough to provide sufficient heat for reforming these fuels internally. Biogas is an environmentally friendly fuel derived from biomass, which is an interesting candidate for fueling SOFCs. Typical biogas contains methane (40 - 65 %) and carbon dioxide (30 - 40 %). The CO2 in biogas would promote dry reformation of methane. The carbon monoxide and hydrogen are the major products of these reactions and both can be used as a fuel for SOFC. In order to increase the efficiency of these reactions, major efforts are being expended in the development of catalysis materials. Although, Ni based catalysts are favored, they cause carbon deposition in certain circumstances. The present paper explores different materials as fuel electrode for SOFC. The DC conductivities of these electrodes are compared with those in hydrogen. The stability tests were also performed and will be reported.

E5 Shale Gas Exploration And Associated Geoscientific Uncertainties

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Energy is one of the fundamental requirements of a developing country. To bridge the gap between the demand and supply of energy, the interest towards the exploration and exploitation of unconventional resources like – Shale gas, Coal bed methane, Gas hydrates, tight gas etc has immersed. Nowadays, Shale gas prospects are emerging rapidly as a promising energy source in India. Shale gas is a type of natural gas, which occurs in compact low-permeability rocks beneath the earth surface. It is one of the promising assets that can turn India's dream into reality by making it energy sufficient. According to most recent estimates in 2013, India's reserve estimates of shale-gas are likely to cover about 26 years of natural gas demand.

Shale gas presence was known for years but the methods for extraction having limitations. Globally, oil (and gas) is produced by drilling and extracting from "conventional" reservoirs: it works like putting a straw into a coconut and sipping out the water. Production from shale formations, on the other hand, requires a technique called "fracking". Since the rocks (or sands) that contain the oil (and gas) are not porous enough for the oil to flow out with little effort, the flow has to be stimulated by fracturing the rock using pressurised liquids.

In the present study, selection of hydraulic fracking zones, data processing and corresponding uncertainties related to depth of actual production zones have been discussed for the point of geoscience applications. This adds value in estimation of in place gas reservoir at nanoscale. Due to high clay content in the shale reservoirs utmost care is required for viable production of shale-gas from fracking zones. Large uncertainties in exact depth of reservoir zones can create serious threats on living beings residing near to drilling sites.

E6 Design of a Pyramidal Photobioreactor for Enhanced Production of Algal Biofuel.

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Three types of pyramidal photo-bioreactors of 1.5L capacity were designed to study their efficiency of producing increased algal biomass compared to shake flasks. The reactors differed in the arrangement of their inner plates viz., horizontal plates, vertical plates and a pyramidal inner plates. All the reactors have ports for inlet, outlet and air circulation.

Chlamydomonas Sp. were used at an inoculum level of 15% to all reactors and shake flask. It was observed that the time period for harvesting of biomass came down by five days and an increased growth of 21 % was observed in the reactors compared to shake flask cultures. The algal oil content was estimated by Bligh and Dyer method and was analyzed by GC MS.

E7 Survey paper on Energy Saving Methods using Green Communication Technology

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In recent years telecommunication is playing a vital role in communication field. The power usage has become a major problem since the usage of wireless communication has increased, which has lead to environmental impact in a drastic manner. The main goal of designing green base stations is for saving energy and reducing power consumption while guaranteeing service and coverage for users and ensuring the capability of base station for evolution. To reduce the energy consumed by base station sleep mode mechanism is adapted. For uplink and downlink communication a joint bandwidth and power allocation method is deployed which promotes energy saving for both network operators and mobile users. Thus, Green technology is to reduce the unnecessary energy consumption keeping environmental factors into consideration. This paper deals with the survey of the problems upon implementation of base station in cellular networks for heterogeneous communication.

E 8 Smart grids for future energy sustainability

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Energy supplies are getting completely exhausted all the world over. Alternate energy sources are being researched upon but across the globe, no alternate resource has been able to equate the amount of electricity generated by the available non renewable sources. The daily energy requirements, however, is increasing by the day. Therefore, there is a need to use a smart grid that functions more efficiently with the present energy resources. These smart grids will also impact the economy, environment and society more beneficially. This survey based study is involved in understanding the importance of smart grids and its relevance in the present day energy scenario.

E9 4D Seismic, A Key Technology for Future Oil and Gas Exploration

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To fulfil outgrowing demand of energy, the conventional and unconventional sources both should be utilized to its utmost limit. In the conventional sources of energy, oil and gas play a major role. To produce more oil and gas, reservoir monitoring and its optimum exploitation is required. Deep water drilling is an expensive process; therefore 4D seismic technology is proved to be a cheap and

reliable solution for reservoir characterization in offshore areas. Another name of 4D seismic is time lapse seismic. It is an important emerging technology for reservoir management. This has been successfully used as a tool to monitor and manage reservoir production in many producing fields across the world, for example Norne Basin, Norway; Duri, Indonesia; Alberta, Canada and Balol, India.

Time lapse seismic is basically a 3D seismic survey repeated in time, to monitor the changes in reservoir shape. Changes observed in formation structure as a result of production gives an idea on where and how hydrocarbons have been drained. Due to this, any change in reservoir will affect acoustic impedance of the reservoir rock and therefore seismic amplitude gets altered. With passing years of oil and gas production, timing of seismic reflections reflects the change in reservoir shape.

In the present study, an attempt has been made to understand how rock properties change with production in Norne field of North Sea. Multiple 3D seismic data acquired over a period of time is used to study the effect on production of oil and gas. Detailed analysis of surface data (seismic) along with the sub-surface data (well) has been carried out. The study gives an overview of how acoustic impedance affects the seismic amplitudes as a result of exploitation of reservoir. This understanding is of utmost importance for better monitoring and management of producing reservoirs.

E10 The Role of Human Machine Interface in Efficient Plant Monitoring and Control of PFBR

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The Human Machine Interface solutions using graphical user interface (GUI) play a key role in the design and implementation of efficient Plant Monitoring and Control system. With the on-going revolution taking place in the field of Computer Science and Technology, there is a paradigm shift in system control and monitoring of Nuclear Power Plants observed from main plant control room. The graphical user interface (GUI) is extensively used for signal communication through digital display systems, status monitoring and control of various components like valve open/close, pump on/off, heater on/off, temperature, flow, pressure and level controls of plant sub systems.

This paper discusses about the Prototype Fast Breeder Reactor **(PFBR)** that has been designed indigenously by IGCAR and being built at BHAVINI site. The construction of PFBR is a part India's Three Stage Programme envisioned to provide energy security for the country. This paper details out the main features of PFBR, the interconnected sub systems, the concept of main control room and monitoring & control of various processes of PFBR through Human Machine Interface.

The Prototype Fast Breeder Reactor **(PFBR)** is a 500 MWe capacity, pool type reactor utilizing sodium as the main heat transport medium. The reactor core consists of fuel sub assemblies made up of (Uranium, Plutonium) Mixed Oxide Fuel. The heat transport system consists of primary sodium circuit, secondary sodium circuit and steam water system (Refer Fig.1). The steam and water system adopts a reheat and regenerative cycle using live steam for reheating. The energy transfer is done through Electrical System using Turbo Alternator set of capacity 500 MWe with an efficiency of 40 percent.

E11 Biodiesel from Algae is the Better Option of Alternative Energy in India

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In India like developing countries and most young nations in the world need fuel for industries and transportation. Current situation of Oil, since it has a 96 percent monopoly on transportation, is a substantial problem from the point of view of emissions of carbon dioxide.

The international Committee OPEC dominates oil and sets oil prices. Practically everything that we do requires transporting something. So, oil dominance and OPEC's dominance of oil presents an extraordinary national security problem for us, in a number of ways.

Thus Scientists have a challenge in front of them to provide energy for developing processes to become economically stable. India has rich biodiversity including plenty of Algae that can be grown in different places..Many projects run on Bio-fuel formation from Algae.

The major challenge is to get sufficient amount of Biodiesel from Algae, It is feasible to collect diesel from Algae and refine. Today's smart world is looking towards Algae as a major source for Biodiesel. In India, Algae Biodiesel is a good replacement for standard crop Biodiesels like soya. Up to 70% of algae biomass is usable oils. Algae do not compete for land and space with other agricultural crops. Algae can survive in water of high salt content and use water that has been deemed unusable.

E12 Shifting To Cloud Technology for Sustainability and Green Computing

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It has been observed that in past two decades, use of computers is increased tremendously consequently increasing the carbon footprints due to heat emissions, energy usage and use of printer papers leading to wastage of trees. Lately, cloud computing has emerged as a viable alternative to huge private computer installations. It is identified as a more efficient way to operate computing infrastructure. As per a recent case study done in US, researchers found that if all American businesses moved their computational load to centralized off-site servers of cloud installations, companies would shrink their computing energy footprints considerably. This is equally valid for any business company's computational load. Usually, many companies have servers and computing hardware on-site, which are often underutilised as they are over provided to take care of sudden increase in computation. Such computing hardware devices are just wasting electricity while sitting idle. If cloud infrastructure is used instead of establishing their private installations, they don't need to buy extra hardware and relevant setup to cater to the spurt in computing load, rather they can pool resources in a central location provided by cloud services.

Thus, shifting to a cloud installation, means companies can effectively buy computing power in bulk while reducing need of more computers. A strong incentive for cloud technology is increased utilization, i.e. servers can spend more time during actual work per processing unit. If the cloud servers remain idle, they can be loaned to other companies, thus fully utilizing the energy consumption and reducing wastage of resources.

The paper aims to introduce cloud technology, explain the concept behind energy saving, thus leading to less carbon footprints, leaving the computing world greener for future generations.

E13 Energy Harvesting in Wireless Sensor Networks

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In today's fast growing digital world, the wireless sensor network (WSN) technology is emerging as a game changer in the field of sensing. In another few years, the WSN technology will govern the world in a pleasant way to enhance the quality of human life in all aspects. Though Wireless Sensor Network (WSN) has potential applications in all the areas, it has lot of challenges to address such as compact size, small memory, limited energy source, low range, low bandwidth, security, unreliable communication etc. Among all, limited energy is a major bottleneck of WSN technologies.

In general, WSN nodes are powered by batteries which decide the lifetime of the nodes. Even though researchers are working on various innovative developments on battery technology, there are multiple energy harvesting methods to support the energy needs of WSN nodes. The most efficient alternate energy source is solar. For the outdoor deployments of WSN, solar panels are used invariably to power the device. But for indoor applications, researches are going on to extract energy from various sources such as Electro Magnetic waves, heat, vibration, sound, indoor lightings etc. This paper gives overview of the energy requirements of various WSN nodes, different energy sources, their efficiency and power extraction methods suitable for WSN technology.

E14 Madhuka Indica (mahua) Biodiesel as an Alternative fuel for Diesel Engine

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Biodiesel is an alternative fuel for diesel engines that is produced by chemically reacting non edible oil with an alcohol such as ethanol methanol in the presence of catalyst. About 30- 40 % of tribal economy in north India such as Bihar, Madhya Pradesh and Orissa is dependent on the mahua seeds and flowers. Mahua seeds oil is an excellent source as a biodiesel as it meets the standards. Hence the mahua oil can be used as a substitute for diesel, for sustainable development of rural areas and as a renewable fuel. The present study deals with the transesterification of mahua oil by using methanol, iso-propyl alcohol and mixture of methanol and iso-propyl alcohol by using the potassium hydroxide catalyst. The yield of the biodiesel obtained was more than 90% by using oil

/alcohol molar ratio 1:9, potassium hydroxide as catalyst, at 650c and stirring at 900 rpm for two hours. The properties like viscosity, density, saponification value, pour point, acid value, iodine number have been determined for accessing the fuel quality of mahua oil based biodiesel.

Food and Agriculture

F1 Vertical Farming – Rising High For A Greener Tomorrow

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Sustainability is the key to survival. With the random change in the climate, increased growth in population and lack of space, alternate farming technology has become the need of the hour. Vertical farming is one such technology, which is ideal for metropolitan cities. It has low demands on energy and water, not susceptible to climatic changes and occupies less land space compared to traditional farms. The aim of this technique is to ensure food security, food safety, green jobs and also to keep our support system green. Many entrepreneurs and innovators around the world have successfully converted this concept into reality.

Ramnarain Ruia College, Mumbai, under DD KAUSHAL Kendra, has established a greenhouse and net houses with soil less cultivation units as a part of the skill based degree course in "Green House Management". The installed hydroponic and aquaponic units have been successfully utilised to grow leafy and fruity vegetables (indigenous and exotic). The hydroponic systems also showed promising results in cultivation of flowering, medicinal and aromatic plants. Preliminary comparative nutritive evaluation of hydroponically and conventionally grown leafy / fruity vegetables showed promising results in favour of this new technique. More efforts and research are required to develop suitable techniques to grow staple crops like rice, wheat and maize. The results also indicated that if judiciously tapped to its full potential, vertical farming by soilless cultivation could be a practical solution to meet the impending food crisis facing humanity.

F2 Synthetic Seed studies in Stereospermum suaveoloens – a Threatened Medicinal Plant

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Synthetic seed technology is an emerging area for ex situ conservation of germplasm and has now become necessary for future sustainable harvesting systems and as a means of maintaining species diversity. Plant propagation using synthetic seeds derived from somatic embryos or other vegetative propagules has been useful in agriculture and forestry. It also plays a vital role in propagation of endangered and threatened species. In Stereospermum suaveolens synthetic seeds were prepared in a gelling matrix of Murashige and Skoog's medium (half and full strength) with 3% sodium alginate and 75mMCaCl2 solution. The in vitro nodes were encapsulated, stored at 4°C temperature in different substrates and placed on media fortified with various plant growth regulators to assess their viability to regenerate into plantlets. A varied morphogenic response was observed in terms of percentage germination, percentage shoot formation, percentage shoot and root in each regenerative media. In the cytokinin based media, synthetic seeds germinated into shoots whereas in auxin based media shoots and roots.

F3 Siderophore Producing Rhizobacteria and its Effect on Plant Growth Promotion

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Plant Growth Promoting Rhizobacteria (PGPR) are naturally occurring beneficial bacteria present in the rhizosphere. They are known to promote plant growth through increased uptake of iron using siderophores; solubilisation of insoluble nutrients such as phosphorus, production of phytohormones and suppression of phytopathogens. Siderophores are low molecular weight organic compounds that have the ability to chelate iron and make it available to the plants. Siderophores of some PGPR are known to have antimicrobial activity against plant pathogens. The ability of root colonising PGPR to produce siderophores with anti- microbial activity gives them a competitive advantage in inducing plant growth promotion. The development of techniques for the utilization of PGPR as a biofertilizer can be recommended to prevent environmental pollution caused due to the application of chemical fertilizers to cultivated fields

Here we report the isolation of two siderophore producing Rhizobacteria colonising the roots of locally grown maize plants. Chemical characterization of the siderophore showed the presence of hydroxamate in the siderophore extract. The siderophore was observed to be conjugated with the amino acid glycine. Maximum production of siderphore was observed after 24h of growth. Production of siderophores was seen to be repressed in the presence of iron. Pigeon pea and green gram seeds inoculated with these isolates showed increase in growth, thereby confirming their plant growth promoting activity. Hence these isolates may prove vital for plant growth promotion, increased crop yield and as a biofertilizer to provide iron nutrition to plants.

F4 CO_2 Flux assessment for Sustainable Management of certain Plant Species

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Efforts on alleviating the rising CO_2 concentration at global level are becoming increasingly important for mitigating the global climate change. Research areas, which link the triangle of vegetation, soil and carbon playing a significant role in global carbon cycle have become imperative. Soil and vegetation both serve as either sink or source of the carbon in terrestrial ecosystem. Measuring and monitoring CO_2 flux of soil and vegetation of an ecosystem helps in understanding their role in carbon cycle. Utilizing conventional closed chamber technique, the CO_2 flux of various patches showing mixed vegetation, pure vegetation (patch having only one species), and absence of vegetation were analysed. The plants which were included were Amaranthus, Lantana etc. Results showed that the CO_2 flux changed significantly in different patches having various conditions. Different biotic and abiotic factors were also assessed in order to find out their impact on the CO_2 flux. The CO_2 flux pattern along with correlation with various biotic and abiotic factors exhibited significant difference highlighting the role of vegetation. The study is important in understanding the role of various vegetation types in the carbon dynamics. The study identified the vegetation types with high carbon uptake capacity which can further be utilized for plantation campaigns for sustainable development.

F5 Criteria and Indicator Approach for the Assessment of Ecologically Sustainable Development Using Geospatial Techniques

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Mankind's desire to achieve his development objectives through heavy reliance on natural resources and the implications this might have on the environment could potentially leave adverse footprints for future generations. This has affected the carrying capacity of the ecosystems throughout the world and created an ecological imbalance. The need to prevent this situation is more critical than ever. That is why the time is ripe to renew the call for development that is both sustainable and ecologically friendly for entire ecosystem as a whole in order to reverse some of the negative environmental and social trends. This concept is recognized as Ecologically Sustainable Development (ESD).

In this paper, an attempt is made to assess this concept of ESD by using Criteria and Indicators (C&I), which have been integrated into advance technologies like remote sensing and GIS. It represents an important tool permitting a better knowledge of past, present and long term consequences of human activities in that particular area. In the present study ESD has been

generated with sustainability categories and based upon their category, various suggestions have also been proposed which can be considered to upgrade their sustainability categories. The present approach of ecologically sustainable development planning through the use of high resolution of remote sensing data, can provide a model methodology for similar research programmes.

F6 Utility of Remote Sensing and GIS in Land Use and Land Cover Mapping of Narmada District for Sustainable Land Management

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Land use and Land Cover (LULC) changes are very dynamic in nature and have to be monitored at regular intervals for proper land use planning and formulation of sustainable land use policies. By virtue of providing synoptic view of enormous area at a regular interval, space borne multispectral measurements hold great promise in generating reliable, information on LULC change in a timely and cost-effective manner. This technique has now become a pre-requisite for achieving the goals of sustainable development. In the present study, Remote Sensing and GIS is used to produce a land use and land cover map of Narmada district of Gujarat at a span of 12 years in order to detect the changes that have taken place over a given period. Landsat TM satellite imageries covering the area at two different years viz. 1996 and 2008 were interpreted based on visual interpretation keys and were characterized into five LULC classes namely Water Body, Forest area, Built up Area, Agricultural land and Barren land. During last twelve years, prominent changes have occurred in land use and land cover of the study area. Study highlighted more than 50% change in forest area wherein transformation of forest land to other land categories like agriculture and built up by anthropogenic activities was observed and overall accuracy obtained was more than 80%. Thus there is a need to apprehend the situation to ensure sustainable forest management. The forest area in the study area was further classified into open forest, dense forest and moderate forest. This was done to understand forest density in two different years and to maintain it sustainably by conserving areas with high and moderate forest cover. Results from the present study can be used as base for developing land use plans by decision makers which can counteract the detrimental effects on environment, and at the same time improve productivity of land. In order to determine the most desirable direction for future sustainable development, further studies will be carried out to study the suitability for various land uses with the aim of directing growth of the land use to the most appropriate sites. Use of GIS in the present study helped in bringing out maps and statistics with constructive options for alternate land use plans, which are expected to be both productive and sustainable.

F7 Estimating CO_2 Flux for Sustainable Management of the Grasslands

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Grasslands are the major contributors to the carbon dynamics owing to their high terrestrial coverage and biodiversity. They are the potential indicators of seasonal variation and have high influence on CO_2 flux and its components. Various biotic and abiotic factors also affect CO_2 flux pattern of these ecosystem. Many studies have shown that managed grasslands show increased amount of carbon uptake capacity and thus may act as a sink of the carbon. In this study, attempt has been made to understand the effect of application of organic manure and fertilizer on CO_2 flux of different grass species. Plants considered for the study included Cenchrus, Aristida, Apluda, Sehima etc. Different plots having same types of species and mixed types of species were prepared, which were then given different treatment i.e. control plot (without application of manure or fertilizer), plot with application of manure (different quantity) and plot with fertilizer application (different concentration). CO_2 flux of these plots was measured using conventional closed chamber technique. The results showed that there was a significant difference in the CO_2 flux in the plots having single species and mixed species. Carbon flux pattern also changed with changing treatment i.e., control plots showed low CO_2 capacity whereas plot with fertilizers showed high CO_2 flux. In addition, plots with mixed species showed high carbon uptake capacity than the plots having single species indicating the positive role of species diversity in CO_2 flux. Thus, the results proved that managed grassland can show significant increase in carbon sequestration as compared to grasslands with anthropogenic pressure. Also the species with the high carbon uptake capacity can be recommended in the areas which are acting as source of carbon for their sustainable management.

F8 Understanding Spectral Patterns of Forest Tree Species for Forest Sustainability

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Forest type maps play a significant role in sustainable forest management. For many years aerial photos and satellite data were a primary data source supporting forest type mapping. Recent developments in remote sensing provide opportunities to further enhance forest type maps by introducing variations of spectral, biochemical and biophysical properties at various scales. A structural sampling and collection of the above variables will support an improved interfacing between spatially continuous data, forest type maps and finally will support forward and inverse modelling of advanced forest biochemical, structural and other relevant variables. The main objective of this study is to acquire, process and analyze spectral signatures of main forest tree species (namely Tectonagrandis, Buteamonosperma, Madhucaindica) under water stress obtained using ASD Handheld Spectroradiometer 2. Leaves of these tree species were collected and were

subjected to different water stress conditions. All spectral signatures after preprocessing were analyzed physically and statistically. Leaf chlorophyll and RWC in all stress conditions were also estimated in the laboratory. It was noted that water deficits caused the chlorophyll reduction which reduced the total concentration of chlorophyll. Even RWC in the leaf gets decreased with increasing water stress. Water stress induced changes in chlorophyll and RWC was clearly seen from the spectral signatures of the leaves of different trees as well. The results demonstrated that reflectance in near infrared (NIR) (700 nm–900 nm) measured in water stressed leaves was higher than in leaves with high water content and lower in the red portion (600 nm–700 nm). Such studies can help in determining health status of the plant by assessing and differentiating water stress using biochemical/biophysical parameters (such as chlorophyll & RWC readings) and spectroradiometric data. Further better results can be obtained by transforming spectroradiometric data into various spectral vegetation indices.

F9 Band Characterization for Leaf Chlorophyll Content in Tectona grandis L. – A Need for Sustainable Management

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Hyperspectral remote sensing in large continuous narrow wavebands provides significant advancement in understanding the subtle changes in biochemical and biophysical attributes of the plants and their different physiological processes, which otherwise are indistinct in multispectral remote sensing. Although the high spectral resolution of hyperspectral data is quite useful for determining biochemical and biophysical parameters, it contains redundant information at the band level. The objective of this study was to identify those bands that contain the most information needed for characterizing one of the important biochemical parameter viz. leaf chlorophyll with minimal redundancy. In the present study, weekly spectroradiometric readings of leaves of one of the dominant forest tree species of Narmada district namely TectonagrandisL, was acquired using ASD Handheld Spectroradiometer 2. Leaf chlorophyll content in Tectonawas also estimated weekly in the laboratory. Throughout the range of 325 nm to 1075 nm, all possible two-bands combinations for the Normalized Difference Vegetation Index (NDVI) were evaluated using linear regression analysis against the leaf chlorophyll content. This work has introduced a more comprehensive sustainable way of using the "correlation matrix" method for the selection of optimal bands in the estimation of chlorophyll. Significant relationships between two band combinations NDVIs and chlorophyll was obtained with R2 coefficients above 0.7. The study highlighted the best optimal band that can be used for the estimation of chlorophyll in Tectona. It can be stated that hyperspectral remote sensing has great potential for providing a reliable and sustainable estimate of photosynthetic pigment content namely chlorophyll at the leaf level through computed NDVI. Further studies should be carried out for evaluating few more indices at the canopy level, both in the laboratory and under field conditions, using spectroradiometers and hyperspectral images.

F10 Comparative Analysis of Thorium Bio-Sorption and Reduction Capacity of Geobacter Species Isolated from Different Indian Soils

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The problem: The disadvantage of the growing industrial culture is the toxic wastes as byproducts which contaminate soil and ground water. Contamination of heavy metals and radio nucleides such as uranium is of great concern. Bioremediation of these contaminants using newer sustainable technologies based on metal binding or reducing capacities of various biological organisms is of advantage due to low cost and high efficiency.

Iron reducing bacteria reduce ferric iron to ferrous iron in environment under anaerobic conditions. They are used for bioleaching of mineral ferric iron contamination. Among these bacteria, Geobacter species has been well studied for its capability to harvest electricity from waste organic matter, remediate petroleum contaminants, precipitate uranium out of groundwater and for creation of nanowires in very small circuits and electronic devices to create a microscopic power grid.

Thorium Biosorption and reduction: Thorium is an abundant, naturally occurring radio nucleide. Of several forms of thorium, isotopesTh232 andTh230 are of concern due to their long half-life. We have isolated Geobacterspecies from five different Indian soils and performed biochemical characterization of 11 isolates. DNA was extracted from the isolates and performed PCR amplification of 16S rDNA sequence of G. metellireducens using specific primers. The identified isolates were tested and compared for Thorium uptake and reduction capacity. Additionally, fixed bacterial cells of each isolate when tested exhibited Thorium uptake capability.

F11 Pilot Scale Production and Characterization of Manure from Food Wastes

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Bangalore is one of the fastest-growing cities in India. With a population approaching 9 million, it produces around 4000 tonnes of solid waste each day. Most of this is dumped in land fill sites on the city's outskirts. It has become highly essential to come out with solutions for garbage disposal which are less damaging to both people and the environment. Even garbage segregation into dry and wet wastes has not been of much help. Food wastes are rich in nutrients. But untreated food wastes stinks, creates unhygienic conditions and can pose hazard to health as well as environment. Hence the Bruhat Bangalore Mahanagara Palike (BBMP) is struggling to get land to process the city's waste. Every time its officials go looking for place, they face the wrath of villagers. If food wastes can be treated and converted to organic manure, it can find use as fertilizer for crop development provided the conditions are maintained. One of the challenges in composting is its

odour. The main reason why the composting process produces a foul odour is because the initial C/N ratio is not maintained. Vegetable and fruit wastes contain high nitrogen content which results in production of ammonium compounds giving rise to a stinky pile. Hence, if the C/N ratio is maintained at 25-30 initially, the microbes utilize both carbon and nitrogen for synthesis of proteins and they metabolise at an optimum rate, resulting in reduction of the odour produced by the compost pile. Our project aims at exploring the traditional methods of composting from food wastes in a lab and pilot scale and evaluate which method produces the best quality of compost by comparing the important physical parameters such as pH, moisture, C/N ratio and phosphorous with the standard. It was found that the manure produced from food waste met the specifications set by the Government of Karnataka.

F12 GM foods: The new concept for the global age

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India ranks second in the world in farm output. Agriculture and allied sectors account for 13.7% of the GDP. Agriculture is a major sector and it plays a significant role in the socio economic fabric of India. However, natural disasters like droughts, flash floods, landslides, torrential rains and cyclones pose great danger to mankind in general and the agricultural sector in particular. Therefore, there have been reforms in the agricultural policy focusing on food grain sufficiency. Sustainability is the key word and genetically modified foods are the order of the day. Genetically modified food involves introduction of novel genes of agronomic value into the plant. The present survey based study has been aimed at trying to correlate the requirement of crops that have higher nutrition and can overcome pest, stress attack with sustainable economic agricultural growth in the country.

F13 Sustainable Floriculture through Combined Vermicompost and Vermiwash technology

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Experiments were carried out to study effects of vermicompost and vermiwash on the physico-chemical properties of the soil and productivity of ornamental flowers like chrysanthemum and goldenstick. There has been a significant improvement in the soil qualities of Vermi plots treated with vermicompost at 5 tonnes/hand vermiwash at 1:10 v/v in water at 1kl/h than those of control vermin-ve plots(supplied with equal quantities of chemical fertilizers) and water. Increase in the vegetative as well as reproductive vigor of the flower plants with reference to the height, number of branches, number of flowers as well as the colour of flowers were found to be significantly higher in vermin+ve plots along with the increased concentrations of photosynthetic pigments in their flowers. From these results it can be concluded that the combined vermicompost and verminwash technology is also applicable to improve the crop yield in floriculture by soil conditioning and maintaining soil health of agro-ecosystems in an eco- friendly and pollution free environment.

F14 A Chromatographic Study for some Legume Seeds: Amino Acids Composition

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Proteins normally occupy 20% of the human system and play a crucial role in most biological processes. Amino acids are the building blocks that construct protein. Most amino acids were synthesized in the body itself, but not all. Some proteins are essential for the body (isoleucine, leucine, lysine, methionine, phenyalanine, tryptophan, threonine, valine and histidine) were provided from food. These are necessary for smooth functioning of the body. Amino acids not only affect the functions of organs, glands, tendons and arteries, but also heal wounds and repair tissue.

Proteins obtained from different food stuffs, support diet and are considered as a main ingredient for healthy life. Legumes have been shown to be rich in proteins. Utilization of legume seeds in daily diet not only will be a good option to overcome the problem of protein-caloric-malnutrition among the people coming from low income group but also it supports the vegetarian community in Indian prospects. Availability of the essential amino acids from legume seeds enhances nutritional benefits. The quality of a seed depends on the total amount of amino acids present in protein.

The present investigation is an attempt to determine amino acid composition in hybrid varieties (Glycine max (NRC-37), Vignaradiata (LGG-460), Phaseolusmungo (LBG-20), Cicerarietinum (JG-130) and Lens esculenta (JL-3)) of some legume seeds. The HPLC technique was applied to ascertain nutritional quality for seeds. All the varieties were found rich source of dietary protein and presenting high nutritive value.

F15 Effect of Salinity on Inorganic Elements of Green and Senescent Leaves of Phaseolus aureus Roxb. Varieties

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Senescence is the natural process that occurs in every plant, but if the plants are growing on saline condition, plants may be salt tolerant to some extent but at higher concentration they show physiological changes. Attempts have been made to study comparative account of physiological changes in senescence of two varieties of Phaseolus aureus Roxb. The results are prominent in the Pusa Vaishakhi variety indicating the salt tolerance nature. Toxic effect of salts affect the metabolism of plants and shows chlorophyll decreasing the photosynthetic area., total biomass, relative water content, protein content, grain yield, and content of potassium (K) and calcium (Ca) and Na/K ratio. Comparative study of the two varieties of Phaseolus aureus Roxb. shows that Pusa Vaishakhi is more tolerant than the local variety which also showed significant Ca accumulation in Pusa Vaishaki which is helpful to increase the salt tolerance and comparatively higher K/Na ratio. Contents of Fe, Mn, Cu, and Zn were reduced due to soil salinity; whereas total chloride contents shows more accumulation in senescent leaves than green leaves of both varieties. Salt tolerance variety maintains optimum level of nutrient in leaves and seed and shows more yield.

Water

W1 Effect of Idol Immersion on the Water Quality of a Lake in Mumbai

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Ganesh Chathurthi is celebrated with lot of devotion in Mumbai. The festival ends with immersion of the idols in water. This poses a threat to the water body and the aquatic ecosystem. A study was conducted to understand the impact of synthetic and non-biodegradable idol immersion on the water quality of a lake in Mumbai. Pre and post immersion water samples were collected during September. The physico-chemical parameters namely water Temperature, pH, Total Acidity, Total Alkalinity, Phosphate-Phosphorous, Conductivity, COD, BOD, Total Carbon, Total Organic Carbon and Total Inorganic Carbon were evaluated.

The variations in the values of these parameters were prominently seen in before and after immersion samples. There was a significant rise in the values of Alkalinity (mean value from 117.6 mg/L to 138.4 mg/L), Phosphate phosphorous content (mean value from 0.352 mg/L to 0.704mg/L), BOD (mean value from 30 mg/L to 132 mg/L), COD (mean value from 69.4 mg/L to 126.4 mg/L) and the Total Carbon content (mean value from 37.58 ppm to 42.19 ppm). The increase in values needs to be considered as a warning sign.

A third set of samples collected after cleaning of the lake showed a considerable decrease in the values of all the above parameters; Alkalinity (mean value 130.4 mg/L), Phosphate phosphorous content (mean value 0.422mg/L), BOD (mean value 26mg/L), COD (mean value 32.2 mg/L) and the Total Carbon content (mean value 38.26ppm).Water quality assessment is an important exercise to determine the nature and extent of pollution. Appropriate measures if adopted by the authorities and the society together will help to conserve such water bodies.

W2 A Review of Integration of Advanced Oxidation Processes (AOPs) for Waste Water Treatment

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In the past two decades, advanced oxidation processes (AOPs) have proved to be powerful and efficient treatment methods for degrading pollutants. These technologies could be applied for contaminated ground water, surface water and waste waters containing recalcitrant, inhibitory and toxic compounds with low biodegradability as well as for the purification and disinfection of drinking water. The present paper provides an overview of integration of advance oxidation and other traditional waste water treatment processes which has proved to be more effective economically for treating polluted waste water economically. The treatment cost of AOPs being on

a higher side can also be brought within considerable level by combining the AOPs with conventional primary and secondary processes, particularly activated sludge treatment. At the same time the knowledge about the exact mechanisms of AOPs is still to be completely understood. AOPs are to be important tools for environmental technology and they must be placed on more sound, scientific and engineering basis. This paper previews different AOP used (O_3, O_3/UV, H_2O_2/UV, O_3/H_2O_2/UV, UV/H_2O_2/Fe^{2+} Fenton reagent), their theoretical basis, efficiency, economics, laboratory and pilot plant testing and comparison of different studies in this area. Since every waste water is a different waste in itself, process optimization for their treatment should also include aspects such as operation time, operating cost and energy consumption.

W3 Role of Science and Technology in participatory management of Groundwater: Experiences from rural India

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With utilizable water resources more or less constant, populations projected to increase and stiff competition amongst multiple sectors, regions face a widening of the gap between supply and demand for water. Manifesting as 'Water Stresses', concerns increase in the peninsular states, where groundwater has developed under complex hydro geo thermal conditions and restoring it to its potential poses a challenge. In addition, increases in water quality affected habitations, unscientific exploration of groundwater, poor (O&M), weak institutions and impact of climate change on groundwater increase its overall vulnerability, with the brunt often borne by women.

Science and technology have been addressing these issues through design of scientific approaches such as the water security approach for planning the management of water resources and the creation of public domain information systems such as Bhujal Bhuvan for informed decision making etc. However, science and technology in these forms are often restricted to the scientific community. Here strengthening of institutions and rural communities through capacity building (technology transfer) has the power to ensure that natural resources are sustainably used.

This paper shares experiences from the National Rural Drinking Water Security Pilot Project in Karnataka where village wise drinking water security plans have been prepared and implemented in consultation with the local community contributing to an improvement in the overall stage of groundwater development. The groundwater prospecting maps have been applied in budgeting groundwater, recommending groundwater development sites and sites for effective recharge (aquifer management). While, the World Bank supported Jalswarajya program demonstrated technology transfer through capacity building for multiple stakeholders and the NRDWSPP streamlining service delivery through installation of water meters and pricing, similar strengthening of institutions on (O&M) is still required.

W4 Development of an Effective Microbial Consortium for Greywater Treatment

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Greywater can be defined as any domestic wastewater produced, excluding sewage. This comprises 60-70% of the total domestic wastewater and is usually collected from showers, baths, washbasins, washing machines and kitchen sinks. In modern times with an exploding population and limited water resources, effective water management is a challenge for civic authorities and greywater recycling can substitute usage of precious drinking water for purposes like toilet flush, gardening etc. Microorganisms have great potential to degrade organic & inorganic pollutants and are used for such purposes in STP's and CETP's globally. The present study deals with the development of a microbial consortium capable of treating kitchen greywater collected from institutional canteen with the objective of development of a novel and economic system for its treatment.

For this purpose 15 microbial isolates were tested for their greywater treatment potential. Out of this 6 isolates were developed into a consortium referred to as Bacterial seed (BS). The treatment process of a continuous aeration system with the addition of 50mg/L BS and 1% $KMnO_4$ was used for the experiment. These levels were subsequently brought down to 3mg/L BS and 0.001% KMnO4. There was 92.5% reduction in BOD and 75% reduction of suspended solids after treatment which met with the national and international guidelines for reuse of such water. Biochemical and molecular characterization of bacterial isolates was studied. Molecular characterization was carried by sequencing 16S rRNA gene. The developed consortium can be explored for large scale greywater treatment with the huge potential for non-potable reuse within communities to contribute towards sustainable water management.

W5 Water Resource Management Strategy adopted at Heavy Water Plants - Conservation and Waste Water Treatment

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Heavy Water Board (HWB), an industrial unit of Department of Atomic Energy is mandated for heavy water production, a complex and energy intensive technology involves separation of deuterium from feed. Presently, India is the largest global producer of Heavy water and a credible global supplier of virgin Heavy Water. Two chemical isotopic exchange processes viz. H_2S-H_2O isotopic exchange and NH_3-H_2 isotopic exchange followed by distillation have been adopted for heavy water production in India. In H_2S-H_2O exchange process, deuterium is enriched from as low as 150 ppm up to 99.90%. Water is a major resource input in Heavy Water Production and other diversified activities of HWB and used in Deuterium Extraction (process feed water), Steam Generation (boiler feed water), cooling water, chilled water, valve sealant, fly ash disposal, dilution in process effluents, fire hydrant, drinking, sanitation & gardening etc.

Optimization of water use a virtuous responsibility for any industry and HWB is putting continuous effort towards it. HWB is committed for zero discharge of effluents in all its plants by implementing water conservation measures, recycle & reuse which drastically reduced water intake. Following measures have been adopted:

1. Water drawn from source is treated to get desired quality for different applications
2. Reducing heating & cooling requirement
3. Reducing effluent water temperature from 75ºC to 50ºC – reduced dilution load
4. Operating Cooling Towers at higher CoC-Reduced CT blow down through improved water chemistry & maintaining higher CoC through CW treatment programme
5. Recycling & Reuse of effluents-
   Recycling of cooling tower blow down to fire water reservoir
   Recirculation of sealant water to process feed water
   Recycling of DU ejector condensate to cooling tower
   Recycling process feed pump balancing water to WTP
   Sewage Treatment Plant – recycling sewage effluent for gardening purpose
   Reverse Osmosis Plant
   Fly ash transportation from CPP to ash ponds
   Guard pond water to cool effluent water
6. Rain water harvesting

W6 Water Purification Technology

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The provision of clean water is an important issue to solve and there is no one solution. Different areas have different problems and resources and no one solution can be applied to all. In developed countries, water is often pumped from a nearby lake or from groundwater and extensively treated in several stages in large plants to ensure safety. Water is commonly filtered, sometimes in several stages with chemicals added, to completely eliminate the smallest particles of pollutants and to speed up the process. Chemicals are then filtered out again. Filtration in various forms is so far the only method to clean water, apart from UV-purification, whether it be a traditional slow sand filter or a reverse osmosis system or a modern, large scale filter in a water-purification plant. In developing countries such large-scale infrastructure does not exist, thus polluted water is a big problem. The focus of this paper will be on smaller, household systems for purifying water, looking at existing appropriate technology, with a special focus on sub-dry area of India. Background information is also provided on water, the diseases associated with unsafe water and their effects on population. The goal of the COOL Water Purification Project is to make potable water using two sources of energy. For everyday use, the mechanism uses wind as a renewable energy source. Additionally, a mechanically powered prototype was constructed and tested. The details of the prototype will be discussed during the presentation. All components of the device are cost efficient and require minimal maintenance.

NGOs and Citizen Participation

N1 Sustainability in Science and Technology: Challenges in Research and Education

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Unmitigated growth and degradation of natural resources have brought to fore the importance of incorporating sustainability in technological innovations. Sustainability strives to balance the economic, environmental and social dimensions, and sustainable development is the development that incorporates these dimensions while considering the long term implications of decisions. However, sustainable decision making is quite complex due to its inherently inter-disciplinary and multi-disciplinary nature. This presentation will first highlight the importance of considering sustainability in science and technology and will identify the key challenges in translating ideas into design solutions. Different approaches for sustainability quantification, including indicators and indices will be discussed. Subsequently, the key approaches for sustainability assessment such as life cycle analysis will be reviewed. Novel ideas such as biomikry for coming up not innovative and sustainable design solutions will be discussed. An important challenge is to incorporate sustainability in science and engineering education. The presentation will discuss the new course started at IIT Bombay in this area. Moreover, similar courses and educations initiatives initiated worldwide and the resources available for teaching will also be reviewed.

N2 Rituals and Environmental Concern

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India is a land of harmony with various religions, festivals and diverse cultures. Rituals followed in different religions have significant relevance to the environment and social life. Irrespective of religion, nature and environment are considered as sacred and worshipped. Each ritual practiced, directly or indirectly, emphasizes the protection of environment for sustainable development. Of the five elements of nature, fire is always associated with purification of air and immediate environment. Lighting of holy lamp, candle, burning of camphor, incense sticks, herbs, formulations are prime and general rituals followed. 'Havan' is a ritual where different herbs, twigs, camphor, ghee and other odoriferous substances are offered in fire. This ritual is considered to purify the environment. The present study was carried out to assess the effect of havan on aeromicroflora. Havan was simulated in a closed environment and growth of aeroflora was studied on nutrient agar and sabouraud's agar plates before and after exposure to the havan environment. Individual components used in havan were extracted in water and their effect on growth of E.coli was studied by disc diffusion method. Significant anti-microbial activity was observed in both cases. Havan aids in purification of the environment in an eco-friendly manner.

N3 Science and Society: Role of Public Awareness in Governmental Organizations

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Government organisations are formed with specific mandates and have their own vision and mission statements that broadly define their areas of work and specific deliverables to society. Creating awareness is to make the public understand the significance of what these organisations are delivering to society. In scientific organisations, such initiatives relate to creating awareness about the applications of science in society. Building public awareness is not the same as telling the public what to do; it is explaining issues and disseminating knowledge so that people can make their own decisions based on the information they have gathered. Public awareness programmes in scientific organisations are basically designed to ensure that a significant section of society gets convinced that science plays a major role in one's day-to-day life. There are two main areas to focus on when raising awareness about a scientific invention or application. First, there is general public awareness, which involves widespread understanding and acknowledgement of the need for it. Second, there is self-awareness, which occurs when individuals understand how an invention benefits them personally. There are different ways to raise public awareness about scientific topics. It can be done through specific planned events, poster campaigns, websites, documentaries and newspaper articles, in schools and workplaces or in any publicly available medium. Ideally, a few strategies can be combined, each tailored to accommodate the priorities and demography of specific groups of the population.

In the Department of Atomic Energy, the awareness programmes are designed to explain the need for expanding avenues for production of energy that does not contribute to global warming and attaining energy security through its 3-stage Nuclear Power Programme, besides enlightening the public about how society benefits from The DAE's research programmes, which, among other things, helped recharge ground water, showed cheaper routes for purifying water, produced better crop varieties through irradiation technologies and increased the efficiency of devices. Public awareness can be part of an overall approach in taking science to the masses and showing them how they can gain in every sphere of life from scientific developments.

N4 Solar Cooker a Gift of Technology -a Need for Awareness Campaign

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Sustainability defines how the humanity can meet its demands today without compromising the needs of future generation. The greatest challenge of sustainability is promote social development with environmental preservation. Technology plays a significant role sustaining the Earth's ecosystem, banning poverty and related health and housing issues, a sustainable agricultural and food system, and employment and leisure for all.Use of new technologies and management methods providing an equilibrium on the different expectations: economic, social and environmental.

According to the United Nations, about one third of the world – two billion people – now suffer fuel wood shortages, which means it is harder to find and more expensive. Over 80 percent rural population of India still rely on firewood and dung as their primary cooking fuel. Further, LPG and kerosene fuel are not easily available to many rural communities in remote areas. A major source of cooking is on open fires and traditional chullhas. Fumes from household cooking fires trigger upto 30% of fine-particulate ambient pollution, a government study shows. Indoor pollution can trigger pulmonary and respiratory disorders in women and children under five, including pneumonia, cancer, and chronic obstructive pulmonary disease. Other hazards include adverse pregnancy outcomes (low birth weight), cardiovascular diseases and cataracts etc. Research shows adoption of cleaner, efficient cooking methods and fuels help reduce negative impacts to health and environment.

India is a country where more than 60% of population earns its living from agriculture. A tropical country like India that receives solar energy for around 300-330 days in a year. To make the most use out of solar energy by using it to cook food directly with the help of solar cookers. The estimated number of people in India who will suffer from fuel scarcity is 157,400,000, but these people will continue to have ample access to the sun. Solar cooking has even been recommended in the Rig Veda, a sacred Hindu text, stating: "All edibles ripened or cooked in the sun's rays change into super medicine, the amrita.

Introductions of new technologies fail in villages for many reasons, but most commonly due to a lack of knowledge and understanding of local cultural customs. Solar cooking has often suffered this fate despite the purported cost savings because it is not introduced in a way that suited the lifestyles of the individuals using it. There is a great need for stating the importance of solar cookers to these people and for that, the role of NGOs is very much important.

N5 Childrens' Experience of Wild Food Plants: Key to Conservation and Sustainability of the Natural World

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Children, especially urban are being increasingly alienated from nature. Their connection with the natural world is eroding. For children, food is the primary source of contact with nature, biodiversity and conservation. Besides nutrition, food provides joy, comfort and a sense of place, belonging and community spirit which helps foster conservation and sustainability. Over the millennia, children have experienced a diet, rich in plant diversity, which provided them tasty and nutritive meals. Most of these edible plants were either wild or uncultivated and include edible fruits, tubers, leaves, flowers and seeds like bahwa, jamun, karvandamahua, junglisuran, etc which are not commercially grown.

Today, these wild edibles are 'looked down upon' and considered weeds, unpalatable foods or simply 'fare for the poor'. The trend is towards a global monodiet of rice, wheat, corn, potatoes, cabbage, spinach etc. Local foods are no longer consumed and the skills to identify and use them is disappearing.

It is difficult to conserve what we cannot recognize, enjoy or attach value to. Learning the skill sets necessary to identify, preserve, propagate and use these plants in everyday lives will be helpful for all including children in conserving nature. Many adults who are now closely connected with conservation have acquired the love for nature and knowledge about it as children from their elders, who were knowledgeable, skilled and had affinity for nature. Today's children face a vacuum

both of outdoor experiences and 'knowledgeable adults'. Skill based school education can prepare children to preserve and promote the natural world.

This paper draws on several years of study with NGOs, farmers, villagers, city dwellers, women, elders, farm hands, corporate workers and children. Study areas have been Mumbai, Navi Mumbai and surrounding areas of Alibaug, Murbad, Khopoli and Khandala.

Reports from Head Quarters

BRNS Sponsored IWSA Popular Science Lectures

In the past two months (September and October 2016) IWSA conducted six popular science lectures in Mumbai and Navi Mumbai to reach out to college students and to inculcate scientific temper in them.

Popular Science Lecture at K.J. Somaiya College, Vidya Vihar on 16th September, 2016

A popular science lecture was delivered at K. J. Somaiya College of Science & Commerce, Vidya Vihar, Mumbai on 16th Septemeber, 2016 at 10.00 am by Dr. Prathibha Shetty, Principal Scientist, Reliance Life Sciences, Mumbai on "Stem Cells: Basics and their role in regeneration medicine."

Dr. K. Z. Marolia, Head, Biotechnology Department of K. J. Somiya College welcomed the gathering and Dr. Susan Eapen, Trustee, IWSA spoke about the various activities of IWSA and the need to motivate students to take up science as a career. About 100 undergraduate and post-graduate students attended the program and there was an active discussion. The lecture generated lot of interest among the students.

Popular Science Lectures at IWSA Complex, Vashi on 17th September, 2016

Indian Women Scientists' Association (IWSA) in collaboration with KBP College, Vashi, and Rotary Club of Satellite City organised two lectures on "Organ/Cadaver Donation: All You Need to Know" on 17th September, 2016. The speakers were: Dr. Vineeta Puri, Head, Department of Plastic, Reconstructive Surgery and Burns, KEM Hospital, Parel, Mumbai and Dr. K. Jawade, Surgeon, Department of Surgery, DY Patil College, Nerul, Navi Mumbai. Both the speakers are active members of the Zonal Transplant Co-ordination Committee, in charge of spreading awareness about the importance of organ donation in the country.

The most important aspect of this topic is to PREVENT diseases that lead to organ failure, which, in turn, will lead to reduction in demand of organs. At another level, a clean environment with healthy lifestyles (no alcohol, tobacco intake, etc), also could help a lot in supporting healthy lives. Hence support to Swach Bharat Abhiyan is important and the song of the same (with lyrics of Prasoon Joshi and singer Kailash Kher) was sung first by the audience, largely consisting of students, seniors etc.

Following the welcome and introduction by the President and Secretary of IWSA and our collaborators, Dr. Puri gave a short and succinct talk accompanied by attractive slides about Skin Donation, and about which we do not know much. First, it was noted that India has the largest number of burns cases (fire or acid attacks) in the world and hence the urgency of skin donation. Any person, irrespective of sex, blood group, can donate his/her skin after death, and it has to be donated within 6 hours from the time of death. However, the person should be 18 years of age. The entire procedure for procuring the skin is simple, with consent from the next of kin of the donor and a witness, taking only about 40 minutes, with no hospitalisation as the skin bank team takes over (home, morgue, or hospital). Only about 1/8th layer--the topmost layer--of the skin is harvested from both the legs, thighs and the back, with minimum disfigurement of the body. The operated part is neatly bandaged and the body is given back to the relatives.

To questions from the audience, Dr. Puri explained that only those suffering from certain diseases like AIDS, hepatitis B/C, STDs, skin cancer, and septicemia are barred from skin donation. Once the skin is harvested, it will be evaluated at the skin bank, and then supplied to the Burns Surgeon for transplantation on burn patients. Skin is preserved at Skin Banks in 85% glycerol solution, between 4 - 8°C, and could be stored for five years. While it is not compulsory to pledge or register, skin donation is done if a call is received. One can register online : www.skindonation.in, or telephone at Skin Donation Helpline No. 27793333 (24 hours on call).

Dr. Kailash Jawade, the next speaker, gave a detailed overall view of the subject. First, it was observed that by this noble act of organ donation, seven to eight individuals could be saved by transplantation under proper procedures: eyes (2), kidneys (2), liver, heart and pancreas. Around 1.5 lakh people die in road accidents /year in India, with majority being healthy. They are ideal potential donors, though the first priority is to save lives. He made a distinction between brain dead patient donation and cadaver donation. In the former, the brain stem is irreparably damaged, and hence the patient cannot breathe or regain consciousness, though the heart may be beating with a ventillator for a max of 36-72 hours. As the blood supply to different organs is maintained during this crucial period, organs are retrieved by a team of doctors in operation theatre, with permission of relatives. Only when brain deaths occur in hospitals (ICUs), organs can be retrived; this is not possible in homes. After a clean up, the bodies are given back to relatives for cremation, etc.

Cadavers are used for skin, bones (bone marrow), etc. Today, even multi-organ donation is also carried out. He emphasised on creating more awareness of this important topic, and setting up of institutional machinery at every level. In fact, in India, today more than five lakh people are in urgent need of different transplants. The program ended with a vote of thanks. Forms for donation were distributed with a few responses.

Popular Science Lecture on 27th September, 2016 at Karmaveer Bhaurao Patil Colllege, Vashi.

Mr. Prasad Kolte, Chief Operating Officer, Maha Online Ltd (JV of TCS and Govt. Maharashtra) spoke on 'Digital India" on 27th September, 2016 at Karmaveer Bhaurao Patil Colllege, Vashi. Right from the beginning he involved the audience of about 250 students and faculty with an interactive lecture format.

He inquired of the students as to how many of them were Digital Natives, to which he received a hall full of hands-up. Mr Kolte informed the students that Digital India of today was earlier known as NEGP1 and NEGP2 (national e governance plans) which dealt with organizing digital technologies for the individual and for rural and urban requirements. Digital India now is a focussed program

which is aimed at providing good governance through synchronized and co-ordinated involvement of the central and state governments. It aims to provide digital facilities as a utility to every resident, governance and services on demand and digital empowerment of people.

The Digital India program has nine pillars: broadband highway, universal accessibility, public Internet connection, e-Governance, e-Kranti, information for all, electronics manufacturing, IT for jobs and early harvest program. Mr Kolte explained briefly about each of these. He informed about Digital Locker which is Government of India's cloud based platform for issuance and verification of documents & certificates digitally.

At the end of the lecture, Mr Kolte advised the students to become internet savy and use digital facilities.

Popular Science Lecture at D.Y. Patil University, CBD, Belapur on 30th September, 2016.

IWSA conducted a popular science lecture at Department of Biotechnology & Bioinformatics, Padmashree Dr. D. Y. Patil University, CBD Belapur, Navi Mumbai on 30th September, 2016 at 2.00 pm. Dr. Chitra Seetaram Misra, Molecular Biology Division, BARC spoke on CRISPR - A Bacterial Adaptive Immune System and its Applications.

CRISPRs (Clustered Regularly Interspersed Short Palindromic Sequences) literally refers to a series of short direct repeats interspaced with short sequences found in the genome of many bacteria and archaea. They are generally found in the vicinity of Cas (CRISPR-associated) genes that code for proteins with nuclease or helicase functions. The CRISPR-Cas is essentially a DNA/RNA targeting system that functions against invading viruses and other mobile genetic elements. It is a one of its kind bacterial adaptive immune system. Foreign DNA from invading bacteriophages are integrated as spacers into the CRISPR loci in a process called spacer acquisition. The CRISPR loci is transcribed into an RNA molecule which associates with the Cas proteins to form a ribonucleoprotein complex. On encountering the same DNA sequence subsequently, the complementary RNA molecule directs its cleavage by Cas proteins, thus warding off a viral infection. This highly specific RNA guided DNA targeting function of the CRISPR-Cas system has found many applications including genome editing, gene silencing, generating cancer models etc. The mechanism of the CRISPR-Cas adaptive immune system and its applications will be presented.

Dr.Susan Eapen, Member, Board of Trustees, IWSA spoke about the various activities of IWSA. Dr. Sunita Singh introduced the speaker and Ms. Smitha Mathew co-ordinated the program. About 80 M.Sc. and M.Tech. students attended the lecture and were very happy to learn this new development in biological science.

Popular Science Lecture at at D.Y. Patil University, CBD, Belapur on 4th October, 2016

Dr. Sanjeev Waghmare, Principal Investigator, Cancer Research Institute, ACTREC, Kahrghar, Navi Mumbai gave a lecture on Stem Cells: current knowledge and promises for regenerative medicine at the D.Y Patil University, School of Bioinformatics and Biotechnology, Belapur, Navi Mumbai on 4th Oct 2016

Dr. Waghmare described how stem cells self-renew and differentiate during the entire life of an organism. These stem cells are slow cycling and remain quiescent in their microenvironment / niches, and divide either during normal process to maintain tissue homeostasis or when there is an injury to the tissue. Once there is a trigger, these stem cells migrate out of their niche and commit to differentiation and maintain homeostatsis. For instance, hematopoietic stem cells are already being used in clinics to treat leukaemia patients, human skin stem cells for burn victims etc.

Recently, with the advent of induced pluripotent stem cells (IPS), it is possible to culture patients own cells in vitro and reprogram these cells similar to embryonic stem cells (ES) state, which are termed as induced pluripotent stem cells. These IPS cells possess the ability to differentiate into all the tissue cell types of the patient's body. In addition, human disease specific models can be generated with these IPS cells, which can also provide a screen for chemical library of small molecules that may provide drugs for human diseases. The central question remains in stem cell biology is how the self-renewal and differentiation of stem cells are being controlled? This warrants understanding the molecular mechanisms that are involved in the regulation of these adult stem cells and induced pluripotent stem cells. The information would not only enhance our knowledge about the basic stem cell regulation and but may be useful in regenerative medicine to cure various human diseases.

About 80 students and teachers attended the talk. The lecture was appreciated by the audience as apparent from the questions and answers that followed. Prior to the lecture by Dr. Waghmare, a brief introduction to IWSA was given by Dr. Surekha Zingde, Vice President, IWSA. She also informed the audience about the forthcoming IWSA's Triennial Conference 2nd-4th Dec 2016.

Eco-Friendly Ganesha Workshop

IWSA in collaboration with "ERA" organized a WORKHOP ON MAKING OF ECO-FRIENDLY "Ganesha" on Saturday 3rd September from 2 to 5 p.m. at IWSA's ICICI Multipurpose Hall, near Balaji Temple, Vashi – 400703. The aim of this workshop was to create awareness about saving our environment.

Majority of Ganesh idols are made up of POP, on immersion these do not degrade for several months. It creates threat to aquatic flora & fauna. Whereas, ecofriendly idols made of clay disintegrate immediately on immersion.. This year, two new ideas were added to the workshop - you make your own clay idol & add some Tulsi seeds. After worshipping at home, immerse the idol in your garden or in a pot to grow holy Tulsi plants (cost is Re. 200/- including clay & Tulsi seeds). Another variation was a ready to color /paint clay idol (cost is Re. 300/- including Ganesh Idol). Natural colors like chandan, haldi, gulal were used for coloring.

Puppetry Workshop and other Activities

A very interesting Puppetry workshop was conducted by Ms. Antupa Roy on 8 th October, 2016. She taught how to put life in puppets when you are telling a story using paper mache puppets. She also demonstrated voice modulation to make the puppet shows more lively.

Visiting faculty Ms Asha Verma conducted a workshop on importance of play in preschoolers on 14th October, 2016.

Diwali was celebrated with Nursey children on 14th October, 2016. A puppet show was done showing them how to celebrate Green Diwali and Safety measures while burning crackers. Games were organised on 15th, October, 2016 for day care children. Ms. Vijaya Chakravarthy arranged a very impressive gardening experience for about 22 children on 19th October, 2016. They were taught how to plant vegetables like ginger, lemon, brinjals, garlic and chillies and also how to nurture these plants.

Report from Kapakkam Branch of IWSA

Kalpakkam Branch

Water Conservation Essay Competition -2016

A water conservation essay competition was organised by IWSA for the year 2016 for the Kalpakkam/ Anupuram township residents. The aim of the program is to appreciate the importance of water conservation and the measures to be taken to conserve water by everyone at home. More than 100 women and men participated. The competition was conducted in english, hindi and tamil languages. A panel of judges comprising IWSA members were chosen and they have selected 3 prizes in each languages.

The award function was held at NESCO open auditorium on 18th July, 2016. The program started with the welcome address by Convener, Smt. T. Jayanthi. "Seema & Group, Kalpakkam" had performaed a dance-cum-drama on the title "Save Girl Child". Dr. Jayanthashri Balakrishnan, a well known TV personality and renowned speaker was invited on that day as a Chief Guest. She had delivered a lecture titled "Harmony in human relationships". She made the talk very interesting by correlating Human Relations and Water Scarcity. The prizes were distributed to the awardees at the end of talk. All the participants were also awarded with eco friendly plants as prizes. The program was loved by one and all and was considered as one of the outstanding events conducted by IWSA-Kalpakkam Chapter.

Our Heart Felt Condolences

IWSA regrets to inform the sad demise of two of our members from the branches.

1. Prof. Vijaya Agarwal, Head, Department of Metallurgical & Material Engg & Centre of Nano technology, Roorkee.
   She was the past convener and member IWSA Roorkee branch.
2. Dr. Manorama Bharghava, Member Hyderabad branch.

Our heart felt condolences to their family, friends and co-members of the branch.

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Lecture by Dr. Prathibha Shetty on “Stem Cells” K.J. Somiya College, Vidyavihar on 16th Sep. 2016

Dr. Sudha Padhye felicitating Dr. Vinita Puri & Dr. Kailash Jawade at the "Organ Donation" lectures on 17th Sep. 2016, at the IWSA Campus

Lecture by Dr. Chitra Seetaram Misra on 30th Sep. 2016 at Dr. D. Y. Patil University, CBD Belapur, Navi Mumbai

Lecture by Dr. Waghmare on “Stem Cells” at Dr. D.Y. Patil University CBD Belapur on 4th October, 2016

Lecture by Mr. Prasad Kolte on “Digital India” at Karmaveer Bhaurao Patil College, Vashi, Navi Mumbai on 27th September 2016

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BOOK POST

T. Jayanthi, Convener, Kalpakkam Branch and activities of the branch: Lecture by Dr. Jayanthashri Balakrishnan, Eco Friendly Plants for Prize Distribution and Save Girl Child – Dance Drama

"Eco-Friendly Ganesha Workshop"
IWSA Campus, 3rd September, 2016

Puppetry workshop by Ms. Antupa Roy
IWSA Campus, 8th October, 2016

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