# sustainabilitynext.in

# **Rediscover Hemp's Magic**



For long, Hemp has been one of the most useful and sustainable plants. But because of its close resemblance to cannabis, it has been ignored. Meet seven Indian entrepreneurs with no background in farming. They are revolutionizing cannabis farming as a big solution to most of the problems associated with ecology, food and lowcost housing.

#### By Benedict Paramanand

The cannabis we are talking about is a close cousin of the family of Cannabis Indica from which narcotics is made. The Bombay Hemp Company (BOHECO), run by these entrepreneurs cultivate **Cannabis Sativa. This does not have the** 



#### Confederation of Indian Industry Knowledge Partner

#### Inside

#### News

Indian Railways to Re Gas Emissions	educe
India needs \$850 bill Low Carbon Plans	ion for
Green World Cup in Brazil	
Infv & Grameen Gree	en e

Infy & Grameen Gree Win Ashden Awards



Unnati & Tambul Plates Marketing win Power to Empower Awards

16

g

1

2

#### GreenVenture

How Mathew Jose Uses 'Waste' Money to Fund Schools



#### **Renewable Energy**

Where's the Storage Plan?	20
---------------------------	----

#### BookExtract

Haiti's Agro-forest and Happiness 22

### sustainabilitynext

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**Purpose :** To excite Indian businesses, SMEs, executives and students about the immense business opportunity in not only adopting Sustainability as Strategy in their companies but also inspire them to the possibilities of a big market for innovative sustainability products and services.

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Information in this publication is drawn from a variety of sources, including published reports, interviews with practicing managers, academia and consultants. While doing so utmost importance is given to authenticity.

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#### Editorial

#### Letter from the Editor

It's just over a year since SustainabilityNext e-magazine went live in April 2013. The response to the E-magazine by the readers and those spearheading sustainability in their organizations has been positive. Yet, it's still early days since we have set ambitious goals.



The bigger challenge is the nascent nature of digital

publishing where almost everyone seems to be at the start of the learning curve. Those who have moved from print to digital are discovering that this is an entirely different ball game.

While grappling with the market trends, SustainabilityNext has been quietly strengthening its association with thought leaders. A hearty welcome to **Vasanthi Srinivasan**, the fire-brand evangelist of responsible business and sustainability, as the Editorial Advisor to the magazine. Prof. Srinivasan teaches at IIM Bangalore. She will ensure that the magazine continues to stay alert and continue to address provocative and constructive issues.

A big welcome to CII Sohrabji Godrej Green Business Centre as the knowledge partner of SustainabilityNext. This is a big encouragement to the fledgling magazine's efforts to provide rich local content. Thanks to **Mr. Raghupathy** for facilitating this.

SustainabilityNext is one of the early customers of the startup Patterbuzz (www.patterbuzz.com) which is disaggregating digital content of magazines and offers single articles for sale. Best of luck to **Amit Goel** and his team.

#### **Old is Gold**

The central theme of this issue is the growing belief in rediscovering simple past practices which were very sustainable but were ignored for various reasons. The cover story focuses on the magic properties and use of hemp.

Small wind mills in farms used to be a common factor that helped lift water from the wells. If India adopts this practice, it could free up a lot of power which is currently being used inefficiently because it is free. The micro wind mill manufacturers say the technology is much better now and would be more efficient.

Considering the amount of subsidy the government gives for power to the agriculture sector, the same or a good part of it can be used to distribute the wind mills with subsidies. Even small solar-powered pumps are being suggested to rid farmers of power-guzzling pump sets. Local solutions for global problems could be the way to go.

Next Issue Special

Indian Cement & Sustainability

### **Next Issue**

### Indian Cement Industry & Sustainability – Special Issue July 2014

Knowledge Partner – CII Green Business Centre, Hyderabad

The year **2014** is the **CENTENARY YEAR** of the **Indian Cement Industry.** Among several other achievements, the Indian cement industry's record on Sustainability is the most impressive. This proud story needs to be told to Indian entrepreneurs, executives and students in an effective way – through an E-magazine. This is part of the magazine's purpose to engage and involve everyone in the **GREEN CEMENT MOVEMENT**.

SustainabilityNext is India's premier E-magazine on the business of sustainability. It is one year old and is already the largest read magazine on sustainability in India.

The magazine plans to publish a 16-20 page special issue along with July 2014 Edition. Apart from 40,000 plus readers, invitation to read the special issue will be sent to One Million potential readers through a newsletter.

The magazine will be available on platforms such as www.magzter.com & www.patterbuzz.com in iPad, Android and other channels.

#### **RANGE OF PROPOSED ARTICLES**

- 1. Cover Story How the Indian cement industry is world class in sustainability
- 2. How Indian cement industry can solve Indian cities' garbage/waste problem
- 3. Interview with Philippe Fonta, MD Cement Sustainability Initiative of World Business Council for Sustainable Development (WBCSD)
- 4. Case Studies of Leaders
- 5. Concrete Vs. Asphalt in road construction
- 6. Alternative fuel How India can improve
- 7. Fly ash Why a better pricing and distribution policy is the need of the hour
- 8. Laws and taxes that could promote the robust growth of the cement sector
- 9. Technology Update
- 10. Thought Leadership of prominent Experts

#### How the Special Issue could benefit the Indian Cement Industry

- a. It will enhance the brand profile of the cement sector in the eyes of consumers and general public as a responsible sector
- b. It will enthuse quality talent to consider career in the cement sector
- c. It will enthuse people that there's more to cement than just cement manufacturing like contribution to waste management; to infrastructure development of India

#### Sponsorship/Advertising opportunity

Exclusive Sponsor/2 Associate Sponsors

Full page ads

Advertorial of cement equipment manufacturers

Branding opportunity includes representation in E-magazine, banner ad in the portal (www.sustainabilitynext.in) and newsletter

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#### Ad Material Deadline – June 25th 2014



Soil improvement in crop rotation

**substance** THC that gets people high. But it has 25,000 uses across 41 industries which are waiting to be harvested in a big way. But unfortunately, this crop has got a bad name because of its close association with its evil cousin.

BOHECO is reviving an interest in this as a magic crop to solve big problems facing India – soil erosion, pollution, affordable housing, effective low cost medicine, affordable clothing among others.

It is a **trillion dollar global super crop** that grows up to 12 feet in just three months. Called hemp for practical purposes, it is one of the oldest cultivated crops. Egyptians were growing it. Christopher Columbus could sail to distant America because he had ropes made out of industrial hemp.

Henry Ford is said to have made his first Ford car out of industrial hemp. He said: "Why use up the forests which were centuries in the making and the mines which required ages to lay down, if we can get the equivalent of forest and mineral products in the annual growth of the hemp fields?"

#### CoverStory

The seven boys are now striving to bring back its glory. Not just that, they believe it could revolutionize Indian agro-forestry and help eradicate poverty in a big way. They didn't want to follow the current rush towards building digital or cloud technologies or build creative financial products but wanted to do something radically different.

**Sanvar Oberoi** was invited to talk from a global pool as the INK Fellow powered by Google and TED last year. Sanvar is even pursuing his Ph.D. in Business Economics on the topic *'Economic Significance of Industrial Hemp in Indian Agronomics.'* 

Sanvar's colleagues are: Avnish Pandya, who take care of R&D; Jahan Peston Jamas - strategy and collaborations; Sumit Shah - operations and supply chain; **Delzaad Deolaliwala** - accounting, legal and administration; **Delzaad** is a chartered accountant and lawyer; Chirag Tekchandaney runs the marketing, sales and HR functions while Yash P. Kotak does the chief marketing officer's role. The these guys were doing very well in different areas – from treasury function to advertising before taking a plunge into the hemp business.

"We consciously decided that instead of working in digital and cloud technology, we are going to go across the spectrum and work in a fundamental industry like agriculture and change it because agri-reform in India is inevitable," Sanvar said at the Ted talk.

"We are creating **hemp foods**, as it is the world's most nutritional and balanced food source. WHO says this is the best source of protein and essential fatty acids like omega 3, 6 and 9. We are making textiles; it is the **world's most sustainable textile solution.** The hemp shirt would have taken 4 times the resources if it was cotton and this is extremely critical because in India there is high amount of land fragmentation and small and medium farmers."

The company is excited about the potential of **hempcrete**, construction material for green building and it has hemp biomass inside the brick. What's more, it is carbon neutral. It sucks in carbon because it has lime in it and over a period of time the walls and the bricks actually get stronger and is a cheaper solution than every day building material. It's a massive industry in northern America and Europe to make **green buildings out of hempcrete.** 

### Low cost housing solution

The Indian government with BOHECO to address India's

sustainable, low cost housing problem. Given India's natural geographic advantages, Sanvar thinks India can become one of the leading hemp producing countries in the world. "We work with global hemp companies and get their best practices into India. We are working with the government to create policy and framework with the hemp industry."

The company is involved in the complete life-cycle of hemp. Sanvar says: "We work with scientists to engineer seeds specific to the Indian climatic condition. We work with farmers not only to cultivate the crop but process it to make products so that they do most of the value addition. We work with the industry to support the farmers with technology and we work with consumers to understand hemp markets and create hemp markets."

"We are not trying to create a company, we are trying to create an entire industry from scratch and change the game for a lot of other industries while still keeping in mind sustainable poverty alleviation and rural development. At the end of this we are making agriculture sexy now."

https://www.youtube.com/ watch?v=GsQrlfdFtNA#t=14

#### CoverStory

### How hemp is better than cotton

Hemp leaves lower eco-foot print than cotton – production requires less land and water usage. Cotton contributes for 78% of natural fibre in the global market, takes twice the amount of land and water for its cultivation. Also hemp grows fast like weed and it produces 200% more fibre yield than cotton on the same land. What's more the hemp plant is pest resistant; this means less chemical treatments needed for its growth.

#### The biggest producer of hemp

**is China.** More than 30 countries are involved in industrial hemp production and there is growth for hemp commodities in the areas of agriculture, textiles, recycling, automotive, furniture, food, paper, construction materials, and personal care. Altogether 55,700 metric tons of hemp gets produced worldwide and the global market for hemp boasts of more than 25,000 products in the





above mentioned sub markets. India is the main producer and exporter of hemp seed oil.

#### Super Sustainable Crop

Industrial hemp absorbs carbon dioxide, approximately 22 tonnes per hectare during its growth than any other crop. Coupled with the fact that hemp is a fast growing plant, hemp can be the answer to carbon dioxide reduction in the atmosphere. Add

> in biodegradable hemp plastic, hemp biomass fuel and other non toxic oil based products to the list and you would have got a simple solution towards global warming.

Hemp improves soil structure. It aerates the soil with its deep penetrating roots, prevents soil erosion and what's more, after harvest the roots can be mulched back to soil thus retaining its nutrients. Thus hemp is an ideal candidate for crop rotation on farm land and does not tie up agricultural land.

Hemp provides an alternative to tree derived products like paper. It is easy to cultivate, and it can be harvested within months for production of paper. **An acre of hemp equates to a minimum of 4 acres of trees annually.** Besides that – the conversion process of hemp to paper requires fewer chemicals compared to paper from trees.

Hemp is also used to pull out toxins from soil thereby cleaning polluted and contaminated landfills. It acts as a filter and breaks down metal contaminates and radioactive elements in soil thus replenishing soil.





#### Highlights of GreenCo Summit 2014

- The future of business is dependent on how well companies adopt ecologically sustainable business growth. This is an excellent platform to learn the latest trends & concepts of ecological sustainability
- Initiatives & Success stories from ACC, Auto Desk, BMW, CII Godrej GBC, Godrej, Larsen & Toubro, Mahindra & Mahindra, PE International, Renault Nissan, SABMiller, SGS, Sundram Fasteners, Tata Motors, Tata Steel, UNIDO and many more..
- Attend the Panel Discussion where CEO's of various companies will share their views & experiences on green & environmental sustainability. Topic of the panel discussion is -"In pursuit of Green How to make it a reality?"
- Participate sessions on advanced sustainability concepts like Life Cycle Analysis, Green Supply Chain, Product Stewardship, Green Innovations, etc., by industry experts
- GreenCo Summit 2014 will also provide you the opportunity to hear from companies who have been awarded with the GreenCo Rating





International Conference & Exposition on Renewable Energy 17 & 18 July 2014 Chennai, India 🔽 

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- **Equipment Manufacturers and Suppliers**
- **Exporters**

13<sup>th</sup> Edition

- **Project Developers**
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- **Operation & Maintenance Engineers & Users**
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# Indian Railways to chart a new route to reduce emissions

Focus on low-carbon inter-urban passenger and freight transport, and tools like NAMAs for technology transfer and financing

Indian Railways is in process of evolving a roadmap for greenhouse gas (GHG) reduction. It intends to club all its projects in the rail sector for the proposal under Nationally Appropriate Mitigation Actions (NAMAs) under the UN Framework Convention on Climate Change. The matter was discussed during a workshop organized by Ministry of Railways and Asian Development Bank on NAMAs in inter-urban rail in New Delhi.

According to Indian Railways, the objective is to reduce GHG emissions through lowcarbon inter-urban passenger and freight transport, and tools like NAMAs can be used for technology transfer and financing. The projects include dedicated freight corridor, doubling of lines, construction of new lines, electrification of trains, investments in terminals, investments in locomotives, coaches, wagons and technology up gradation, among others.

The present green initiatives include induction of light weight stainless steel coaches and new design of freight stock, highhorsepower and fuel efficient diesel locomotives, double-decker trains and suburban trains with regenerative braking features. Indian Railways plans to increase the renewable energy share from 10 per cent to 20 per cent by 2020. At present,

Indian Railways is harnessing wind and solar energy from its 10.5 MW wind mill plant and solar PV modules of about 5 MW installed at railways stations and buildings.

It was discussed that the policy proposals in India recognize that to reduce GHG emissions from transport sector requires the shift away from road and air and towards rail and water. Railways are considered more energy efficient and less polluting than road transport for long-range trips and they also use less land while carrying more people and goods. Emissions reduction from



improvement in the rail sector over the next few decades with all planned investments are estimated to save about 1.3 billon tones of CO2 from 2014 to 2030.

Over that past two decades, roads have become the predominant mode of transportation in India. The share of rail with respect to road has declined from 86 per cent in the 1950s to 36 per cent in 2012 and the share of rail with respect to road of passenger traffic from 74 per cent in 1950 has declined to 15 per cent in 2012. Unless significant investments and measures are implemented this trend can continue, according to experts.

## **Environment ministry renamed, online system for green clearances launched**

The Union Ministry of Environment, Forests and Climate Change (name changed by the new government) will now accept online applications for environment clearances for development projects. The move comes in the backdrop of BJP government's promises to the industry to ensure timebound, hassle-free clearances to development projects.

The online system will ensure transparency, real-time monitoring and adherence to timelines in the process of environment clearances. Under the new system, the applicant will be provided with a username and password through which the applicant can keep track of his/her application and there will be transparency between the ministry and the applicant. A similar system will be in place for forest clearances from next month. Addition of words "Climate Change" in the name of the ministry is significant as India is set to present its case in international forums on climate change very forcefully.

http://www.downtoearth.org.in/ content/environment-ministryrenamed-online-system-greenclearances-launched-0

# **Green tax on vehicles made mandatory in Uttar Pradesh**

### Number of vehicles in Noida has increased by three folds between 2004 and 2012

To bring vehicular pollution under control, the Uttar Pradesh government has recently made green tax mandatory for all the motor vehicles which are over 15 years old.

In a cabinet meeting held on May 20, The UP cabinet gave a go ahead to the amendment in the UP Motor Vehicles Act and decided that all the vehicles that have completed 15 years from the manufacturing date will be registered again and 'green tax' would be levied on them at that time.

Non-transport or private vehicles will have to pay 10 per cent of the due tax at the time of renewal of registration as green tax. The modalities of the 'green tax' would be announced soon.

The number of vehicles in Noida

has increased by three folds between 2004 and 2012. This is the largest increase in the state. However, the state also plans to earn from the vehicles entering Uttar Pradesh. This is to ensure that even the bordering states adopt similar mechanisms.

http://www.downtoearth.org.in/ content/green-tax-vehicles-mademandatory-0

## India needs \$834 billion for low carbon growth plans

Planning Commission report highlights huge challenge facing new government, but stresses need to act

India will need to invest US\$ 834 billion to place its economy on a low carbon trajectory by 2030, a report published in April by the national Planning Commission reveals.

It says the country will require "massive" changes to the energy mix to lower the carbon intensity per unit of GDP by 42%, as opposed to 22%, which is its 'business as usual' scenario.

Coal and oil use will need to decline 20%, while gas demand will rise 10%. Solar capacity will need to be increased from 2GW to 11GW, wind from under 1GW to 118GW.

"This diverts resources from other needs, and may not be possible to sustain if the growth is not fast enough," says the document. It continues: "International help, in both finance and technology, would therefore be critical to support India's pursuit of Low Carbon Strategies."

But highlighting India's acute vulnerability to climate impacts, the report says a low carbon growth strategy is "essential" and says it is in the national interest to "accelerate" UN talks on a global climate deal.

#### **Political will**

The 144-page report highlights the challenges facing any Indian government seeking to achieve high levels of growth while ensuring the country's greenhouse gas emissions do not spiral out of control.

India already has renewable energy strategies in place, but the report highlights how these will need to be radically boosted, as will the country's flagging hydropower and nuclear programmes.

And in a warning that could set the government on a collision course with the country's huge extractive industries, it recommends raising the nation's forest cover targets.

"It is no longer possible to pursue growth, inclusion and sustainability as independent imperatives. Faster, sustainable and more inclusive growth



can only be realized, when all these goals are pursued together, in a unified framework, as systematic components of a well thought out growth strategy," the report says.

#### **UN contribution**

The study offers few clues to the ambition of any emission reduction pledge India could make ahead of a proposed global climate change deal, set to be signed off at a UN summit in 2015.

At 1.4 tCO2/person in 2010, India's emissions are less than one third of world average of 4.5 tCO2/ person, a quarter of China's and one twelfth that of the US.

Any ambitious UN target will likely require assurances that India will gain financial support and access to key low carbon technologies, above and beyond what it has already.

# Brazil targets climate victory at 'greenest' World Cup

A few days before the first ball starts rolling at the 2014 FIFA World Cup, organizers Brazil have announced the offset of its greenhouse gas emissions.



A round US\$ 1.5 billion is being set aside to address the climate impacts of the world's largest mass spectator event. The projection estimates an amount of 1.4 million tons of CO2 during the tournament, which runs from June 12 – July 13.

The biggest challenge was to create a brand new mechanism to compensate for all the emissions before the World Cup kicks off. Brazil wants to be a pioneer in the field of offsetting CO2. The direct emissions are an estimated 60,000 tons of carbon.



#### News

The equivalent to 520,000 tons of carbon credits have already been donated to the country by 11 different companies from agribusiness sector, as well as civil engineering building and steel enterprises.

Last April, Brazilian authorities launched a low carbon initiative making a call for proposals for companies willing to participate in the process of compensating the World Cup CO2 emissions by contributing with Certified Emission Reductions (CER) from projects able to neutralize greenhouse effect gases.

This program has received the recognition from the UN Framework Convention on Climate Change (UNFCCC) as part of a global trend by organizers to green big sporting events. It encourages holders of carbon credits from the UN's Clean Development Mechanism (CDM) to donate, offsetting emissions from construction and renovation of stadiums, consumption of fossil fuels from official and public transport, and other sources.

The CDM allows emissionreduction projects in developing countries to earn certified emission reductions equivalent to one ton of CO2. Those certificates may be traded and sold in order to help industrialized countries to meet a part of their emission reduction targets under the Kyoto Protocol. Brazil is part of the 105 developing countries list registered aiming to deliver finance for emission-reduction projects.

It is likely to be the first time that 100% of the direct emissions from the World Cup are mitigated, and all of the stadiums environmentally certified, a requirement FIFA may adopt in the future.

Surfing on this trend, FIFA has also estimated its carbon footprint of this largest single-sport event in the world. The period of preparations recorded 38,048 tons of CO2, but the total amount of the event regarding FIFA operations and matches could be around 2.7 million of tons of CO2.

Certified stadiums, incentives for sustainable consumption, production and the recycling of solid waste are some 'actions' that are being sold in a massive green propaganda push throughout the Brazilian media.

As a condition to receive financing for the arenas, the country's stateowned development bank (BNDES) established a requirement that all stadiums had to attain the LEED certificate (Leadership in Energy & Environmental Design) granted by the US Green Building Council, and recognized by more than 130 countries.

This shall be the first ever World Cup to have all the football arenas with the green certification either by reusing water or energy efficiency as well as recycled materials. Two out of 12 arenas (Salvador and Fortaleza) are already certified, other six one are undergoing the certification process with the expectation of obtaining the LEED seal before the event starts next week.

And the rest of the arenas located in Porto Alegre, Natal, Cuiabá and São Paulo shall get it by the end of the year due to delays in the reforms. All stadiums are reducing in at least one third the emissions.

The iconic Maracanã stadium in Rio de Janeiro where the final will take place on 13 July has been completely renovated and boasts of being a "sustainable temple". Built for the 1950 World Cup, the arena has a capacity of 78,000 people and has being showing off its water saving and rainwater storage systems to local media.

The refurbishment includes the installation of 2,500 square meters of photovoltaic panels on the surface covering the terraces generating 400,000 kW/h every year enough only to supply 3% of the stadium's power requirements.

# Infosys, Greenway Grameen Win 2014 Ashden Awards

Two Indian businesses, Infosys and Greenway Grameen, have been announced today (22 May) as winners of this year's International Ashden Awards, the world's leading green energy awards. The Awards were presented at a ceremony at the Royal Geographical Society in London recently.

Infosys is this year's winner of the prestigious Gold Award. Since 2008, global IT giant Infosys has cut more than \$80 million from its electricity bills and reduced electricity consumption per staff member by 44%. Its success lies in seizing every opportunity to reduce energy consumption in its existing buildings – from reducing the size of chiller plants for air conditioning, to painting roofs white so they reflect the heat. The cutting-edge design of the new buildings also helps keep offices cooler and maximises natural light.

Rohan Parikh, Head of Green Initiatives and Infrastructure, Infosys, said: "Today we consume the earth's resources at almost double the rate that nature can replace them. Therefore, it is imperative that organisations across the world ensure they have practices to help economise natural resources and reduce their environmental footprint."

Without its efficiency programme, during the past year Infosys would have:

- Used an extra 210 GWh of electricity
- Spent an extra US\$25 million
- Produced an extra 260,000 tonnes of CO2

Infosys was founded in 1981, and has grown to become one of the largest IT businesses in the world, with a global revenue of US\$8.2 billion and more than 160,000 employees in 2013-14. The sustainability work is managed by its 'Green Initiatives' and Infrastructure teams, which have about 58 employees.

During the same period, Infosys has reduced its connected load by more than 10 MW, exceeding its target of 7 MW. About two-

	FY 2007-08	FY 2013-14	% change
Floor area of Infosys buildings in India (m2)	1.5 million	3.4 million	+127%
Number of employees in India (FTE)	63,100	130,000	+106%
Electricity use (GWh/year)	225	254	+13%
Electricity use per unit floor area			
(kWh/year per m2)	200	85	-58%
Electricity use per employee			
(kWh/month per person)	297	167	-44%
Electricity from renewables (GWh/year)	0	74.5	-

thirds of the reduction came from upgrading cooling systems, and one third from UPS replacement.

Future milestones – "Our goal is to reduce our current resource consumption by another 2X from our current consumption or 4X from where we started in 2008."

#### **Greenway Grameen**

Greenway Grameen is a rapidly growing clean cook stoves business co-founded by entrepreneurs Neha Juneja and Ankit Matthur just two years after they completed their MBA in 2008. Greenway Grameen's mission is to provide an affordable, desirable cook stove to improve quality of life for Indian women.



So far the company has sold more than 120,000 stoves, thanks to clever marketing and a focus on designing a product that women actually want to use. Greenway Grameen has won the Ashden Clean Energy for Women and Girls Award. The runner up for this Award was the Sahki Unique Rural Enterprise (SURE). **Infosys** was awarded the first ever international Ashden Award for Sustainable buildings. Runner up was Kéré Architecture.



Now in their 14th year, the Ashden Awards celebrate pioneering businesses and organisations that are helping tackle climate change and transforming people's lives.

# Winners of India's biggest online entrepreneurship challenge

he third edition of India's biggest online entrepreneurship challenge -"Power to Empower 2013" this year received some very distinct solutions to address our country's skill development problems. The winners were Ramesh Swamy,



Arindam Dasqupta Founder & Director of Tambul Plates Marketing

Founder, Unnati an NGO from **Bangalore** and Arindam Dasgupta, Founder & Director of Tambul

**Plates Marketing Pvt from** Barpeta, Assam in the operations and idea categories respectively.

Supported by the Muthoot Pappachan Foundation, the CSR arm of the Muthoot Pappachan Group, the P2E 2013 Challenge was launched in October 2013 with the aim of identifying, selecting and rewarding the best solutions bridging the gap between the supply and demand of skilled labor in India.



The winning Idea submitted by Guwahati based Tambul Plates Marketing which focuses on generating rural livelihoods by producing and marketing biodegradable dinnerware. They also provide technical support and financial linkages to rural arecanut - commonly referred to as betel nut - producers.

Tambul

TPMC was created under Arecanut Leaf Plate Initiative of Dhriiti a nonprofit, development organization that has undertaken an initiative to promote many community level

sustainable micro enterprises in North East India in order to resolve the problem of increasing unemployment in the region.

TPMC headed by Mr. Arindam Dasgupta was established by the rural producers of Arecanut Leaf plates in this region and the employees of Dhriiti who collectively market the high quality, eco-friendly, disposable, plates and bowls manufactured in rural North East India at a national and international level. Today apart from marketing support, TPMC provides many more services to the rural producers and entrepreneurs. It is the focal point through which the

rural entrepreneurs interact with the world.

In order to resolve the problem of unemployment in North East India, TPMC as part of the "Power To Empower" challenge proposed an unique idea of generating rural livelihood by encouraging production of earthy disposable dinnerware. They further proposed that rural producers should be provided with training, technical support and financial linkage for establishing their arecanut leafplate making enterprise. Unlike, their plastic and Styrofoam counterparts earthy disposable dinnerware does not pollute the environment.

TPMC is already running this successful endeavor in North East India and till date have trained 500 people in producing these plates and more than 1000 people in collecting these sheaths.

Unnati

won in the

Operations

Unnati is a

Bangalore

organization

that runs

a 70-day

based

category.

#### UNNATI



Ramesh Swamy Founder, Unnati

vocational training program for economically backward youth with an assured job at the end of the training period.



In India, a large percentage of youth have no access to formal / higher education. Around 80% of them don't reach even 10th standard. Left unattended, these youth could potentially turn to nonproductive / anti-social activities.

An initiative of SGBS Trust, Unnati was conceived in Oct 2003 to harness the potentiality of the underprivileged kids and mould them in to self-reliant, productive workforce for the country. The motto of Unnati, 'learn, earn, stand tall' is aimed not only to enable them to become 'employable' and engage in a gainful job, but also to transform them in to responsible citizens for our country. It intends to bridge the socio-economic divide present in the country by bringing underprivileged youth into the mainstream.

As part of the operations category of the Power to Empower

sustainabilitynext {17} June 2014

Challenge, Unnati proposed a plan to uplift a generation of underprivileged kids through vocational training and social transformation programmes within a span of 70 days.

The organization admits youth aged above 18 years from underprivileged (below poverty line) families and provides them with employable skills like communication and value education which helps to develop an attitude that is progressive and inclusive thus making them an asset to the society.

Their programs are designed to provide an opportunity/platform for underprivileged and unemployed youth even without financial means or formal education. They also counsel students on role expectation and career paths to help them take a long term approach.

### **Paperman: Discovering Value in Waste**

A commerce graduate in Chennai is building a high-tech solution for collecting household waste to fund education of poor girl students

By Vaani Anand (eco.alternatives11@gmail.com)

In a country where there is no economic value for segregating and selling waste, Mathew Jose (27), battled with how to motivate people to recycle. A chance conversation that he had with a local *Kabadiwallah* (waste picker and recycler) in Chennai, who had come to pick up waste items from his house, got him thinking.

His quest helped him realize that Indians are an emotional people and do something only if it appealed to them emotionally. "For instance, people like to donate money for a cause whether it is for poor feeding or the education of a child. I realized very quickly that the only way to motivate people to segregate and recycle waste is to connect it to a social cause". Thus Paperman was born in July 2010.

Although recyclable waste in India has the potential to be a Rs. 20,000 crore (US\$ 4 Billion) industry, currently only about 20% of India's waste actually gets recycled. Door-to-door recyclable waste collectors pay about Rs. 100 for a months' worth of newspapers.



Jose Mathew

A commerce graduate from Madras Christian College, Chennai, Mathew's Paperman Private Limited works on a simple philosophy - segregate your waste and call their helpline. Your inorganic and e-waste is picked up from your doorstep. You can choose a social cause that you want to donate the money you thus raise or let Paperman donate the money to Nanhi Kali (initiated in 1996 by the K. C. Mahindra Education Trust) to help educate a girl child. Paperman has kept 150 Girls in school over the last 4 years through this Program.

#### How the idea developed

As a young graduate, Mathew joined Exnora International which is a civic movement in Chennai and worked as an intern under Chennai's "Father of the Green Movement" M B Nirmal. There he watched how Nirmal attracted and inspired people to sustainable living and green practices. After working with him for over a year, Mathew decided that he needed to do something on his own. "Mr. Nirmal gave me confidence and Exnora helped me realize my purpose. I was just a kid having fun until I worked there. I met some most amazing people who have dedicated their lives for green causes and that inspired me," he says.

Paperman started as an NGO and Mathew started collecting waste paper from schools. He soon got talking to the school authorities to sensitize children to the waste that they generate. He encouraged children to segregate their paper waste and collect old newspapers. Mathew connected the school with a local *kabadiwallah*. When



enough waste was collected, it was sold and the students donated the money generated to a cause. Thus two messages were clearly embedded in their minds: 1) that they need to segregate and recycle paper 2) They can also help with the larger good of society (the emotional connect that Mathew believes in)

Paperman created a "Recycle Wall" in every school. It was a wall where they would pictorially depict on a calendar how much money they had raised and what causes they had contributed it to. Paperman has touched over 200 schools where the effort is still being run by teachers and students in various forms. Over 30 schools still have "Recycle Walls" which are being updated regularly.

In 2012, Mathew worked with the MCTM School in Luz Church Road and raised close to INR 15,000/that year using the "Recycle Wall" initiative which was donated to an orphanage and an old age home.

#### High on Technology Use

Paperman started off as an NGO but is now a social enterprise. With a single number call-in facility

and operations that geographically touches most places across Chennai city, Paperman offers SMS billing and doorstep pickup. Mathew has mapped most of the local kabadiwallahs in Chennai and created a network of 120 of them. When there is a call for pick up of waste (inorganic segregated waste; essentially paper, plastic and some ewaste), he taps into the network and sends the nearest kabadiwallah for a pick up using mobile phone technology. Today, over 820 homes across Chennai call Paperman for their trash pickup. This is truly the most ecofriendly method considering that precious fossil fuel is not wasted to pick up trash. A kabadiwallah in the Paperman network currently makes anywhere between INR 6000/- to INR 7000/- per month. The larger ones who deal in bigger volumes and higher value of trash generate around Rs. 5 lakh a month.

"I wanted to define social innovation and change. We need people to engage with their waste". In an attempt to reach more households, Mathew and his team of three Tech team-members are building an online platform that will make an easy interface for people who want Paperman to pick their waste. His team of four operations people and three marketing people has already reached out to about 60 institutions including corporates and educational institutions.

#### Mathew and his team are looking at educating and empowering the Kabadiwallah community

**too.** They are helping them open bank accounts and also working on getting them tamper-proof weighing scales. "I want them to be sources of knowledge and empower them to be green entrepreneurs." he insists.

In a world where young people chase high-flying careers, Mathew is a rare-breed fuelled by his purpose. "I did face some pressure from parents and peers but overall they have been very supportive. Whenever the pressure to have a regular career came up, some media attention on me helped quieten them up," he smiles. Paperman will soon scale up to reach other cities in India this coming year.



# Where's the Storage Plan?

It's not enough to have ambitious renewable energy generation plans, they have to go hand-in-hand with modern storage strategies, say **Bishal Madhab** and **Mridula Dixit Bharadwaj** 



**Bishal Madhab** 

supply to the country's more than 1.2 billion people and its ambitious targets for renewable power sources. The popular opinion is that by expanding renewable sources like wind and solar power, the country can achieve a future with sustainable energy supply. In fact, the Planning Commission's recently published report outlines targets of 118 GW and 110 GW of wind and solar power respectively by 2030 under the Low Carbon Strategies for Inclusive Growth scenario.

Such targets raise grid-reliability issues due to their inherent variability and unpredictability. This issue is more pronounced particularly for wind power which comes with a large amount of diurnal and seasonal variations, as can be seen for two representative days in 2011 for Karnataka (Figure

The Indian power grid is under the spotlight due to two overlapping issues - its inability to provide stable electricity

1). Limited coincidence between renewable power generation and load results in a large amount of curtailed energy. As the curtailment rate increases, the effective capacity factor, or the ratio of actual plant output over a period of time to the rated output, drops. Curtailment results in increased levelised costs substantially. Thus in spite of India's rich renewable resources, there is a high chance of these systems becoming cost-prohibitive. Under these circumstances, a major question arises: can renewables alone pave India's way for a future with sustainable energy supply?

There is a need to re-engineer the Indian energy infrastructure to absorb such high levels of renewable generation without causing grid instability. Energy storage technologies can be potential game changers as they can capture excess electricity generated by renewables and release it when the grid needs it. However, for larger penetration of renewables into the electricity grid, the storage component has to be low cost and offer high reliability. None of the current storage technologies meet this

criterion fully and hence developing optimum storage solutions will bring a major transformation



Mridula Dixit

in the electricity infrastructure.

Energy storage technologies range from mechanical systems such as flywheels, Pumped Hydroelectric Storage (PHS) and Compressed Air Energy Storage (CAES) systems, electrical systems such as super-capacitors, to electrochemical systems encompassing a number of battery chemistries. Storage technologies are characterised by energy capacity and power capacity, the energy to power ratio being an important criterion.

Systems like PHS and CAES are matured technologies having high energy capacity and negligible loss of energy when sitting idle, a phenomenon termed as self-discharge rate, thus making them ideal for largescale grid applications. Large arrays of flywheels can support frequency management in the



figure 1: Diurnal and seasonal variation in wind power in Karnataka

grid, particularly with significant renewable penetration. But the requirement of precision engineering methods, superconducting magnets, hightensile strength composites and their short energy storage time make flywheels too expensive to be commercialised in India. Supercapacitors are systems capable of high pulse power applications necessary for smoothing variable power output but have very low energy capacity. Batteries are capable of both, power intensive and energy intensive applications in the grid.

India has expansive goals with PHS systems despite the socio-ecological drawbacks associated with it, and has identified 56 suitable sites with a total potential of 94 GW of storage capacity. This is over and above the existing 4.8 GW of installed PHS capacity. The need for underground caverns, preferably naturally available ones such as dried up aquifers, makes it difficult to plan CAES installations in India. However, there may be interest in second generation CAES systems with high thermodynamic efficiencies that store energy in the form of compressed air in convenient shipping containers, providing freedom from geological mandates in selecting installation sites.

#### **Cost Factor**

The single most important metric in assessing feasibility of grid storage systems is cost, making it necessary for any technology to be rooted in extremely low cost materials that can be scaled indefinitely. Unlike electric vehicle applications, size is not an issue for stationary grid storage systems. This should have dominant impact on the design and development of storage technologies for enabling India's targets with renewable energy. While PHS and CAES systems have reached maturity and are less likely to see innovation, the same is not true for scalable and emerging battery technologies including sodium ion and flow battery systems. Currently, besides a few PHS, India does not have any other grid level storage installation. Compared to this, China is being

projected as the next big grid scale storage market in the world owing to its large wind sector base and also, high declared investments in renewable energy sector. It is high time India invests in research, development and deployment of safe, reliable, and most importantly, economically feasible battery technologies.

Decision makers should appreciate the criticality of energy storage in ensuring a sustainable Indian power grid and make more informed decisions in terms of national policies regarding research funding and technology roadmap for these technologies. Appropriate government incentives, subsidies and policy framework are required to improve the value proposition of grid-scale energy storage technologies.

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www.worldscientific.com/ worldscibooks/10.1142/8922

### **Raising Gross National Happiness Through Agro Forestry**

#### By Pahuna Sharma-laden and Croix Thompson

In 2010, an earthquake devastated Haiti. The rebuilding work has been slow, with tens of thousands still living in emergency tents. It may not seem like a good time to talk about envisioning a sustainable future for the island, but that may be exactly what is needed to stave off the next disaster. Deforestation has been a major problem in Haiti, as with other Caribbean and Central American countries, where collectively 285,000 hectares of forest are lost each year.

Haiti has been particularly hard hit, losing almost 10% of its remaining tree cover between 1990 and 2005. Tree cover cannot stave off an earthquake, but it is vital for increasing resilience in the face of floods and storms-both of which are expected to increase in this era of global warming.

Reforestation can lead the way to a more sustainable form of living. Agriculture is currently the leading driver of deforestation. Unsustainable agricultural practices such as 'slash and burn' have been particularly detrimental to forest. Additionally, a growing population and its increasing need for fuel wood, timber, and other forest products have accelerated the rate of deforestation. Addressing the problem requires multiple approaches that encompass social, cultural, and economic dynamics.

Agro forestry is a land-use system that integrates agriculture, trees, people, and animals in the same space, resulting in improved soil quality, higher yields, and improved standards of living. Agro forestry has been practiced in varying forms for thousands of years, and as such it works well with the low-input land management systems that are common in the developing world. In the practice of agro forestry called intercropping; nitrogenfixing native and noninvasive tree species are selected and grown alongside agricultural crops.

This can dramatically benefit soil fertility: **a study from Nepal** on the impact of agro forestry on soil fertility and farm income showed that agro forestry intervention nearly doubled farm income per hectare from US \$ 800 to US \$ 1580. 1.2 Intercropping can also protect agricultural crops from unwanted exposure to the sun, providing a 'shade systems' that creates a microclimate, resulting in higher yields. Rows of shrubs and bushes are planted to create buffers and windbreaks,



which prevent soil erosion and overgrazing by livestock. Agro forestry also emphasizes crop diversity, increasing resilience among small landholders. Trees provide fuel, fodder, and timber. Fruit trees specifically can provide valuable income: a study of 1000 farmers from 15 districts in Kenya found that tree fruits contributed 18% of crop revenue, while tea and coffee contributed an additional 29% of revenue.

#### In a devastated country like Haiti, these benefits could help transform lives

Trees for the future (TFTF), an agro forestry development organization, has led the way in planting more than 1.4 million agro forestry trees since 2011. Agro forestry species such as **moringa** (Moringa spp.) and **jujube** (Ziziphus spp.) have been intercropped with incomegenerating trees such as neem (Azadirachta indica). **Plans in Haiti are intercrop agro forestry trees with coffee and beans as well.** 

#### BookExtract

More than 3000 farmers in rural Haiti have adopted modern agro forestry techniques. Tress have been planted in four provinces about 6-8h by road from port au prince, both north and south of the city. One particular site in Medor is so rural that the only way to get there is by foot, walking at least 12 miles from the closest city, Bethel. Each of the Haitian projects costs about US \$ 15,000 per year. The key to success has been to use a participatory approach sensitive to cultural practices, especially traditional patterns of land tenure, land use, and vegetation use. For example, it is common practice in many parts of the developing world for a single tract of land to be divided between several farmers or a whole village. Local people therefore need to be the drivers of agricultural change because they are, in the end, responsible for the sustainability of such projects.

TFTF works directly with local communities to adapt agro forestry techniques to indigenous farming methods, building on local pools of knowledge. Projects in Haiti have used native trees that have a cultural value for the local people, such as the Hispaniolan pine (Pinus occidentalis). As a result, in some of our programs, there has been a resurgence of native trees. Our projects have even led to the regeneration of native species that we did not plant-in the case of Honduras, for example, flowering species used locally for medicinal purpose have reappeared.



Because of the damage done by Haiti's 2010 earthquake, it will take time for the country to realize all the benefits from agro forestry. But the agro forestry techniques already introduced are allowing farmers to overcome deforestation challenges in their communities. Teaching the farmers new techniques that build on local knowledge has enabled communities to take ownership of their projects and develop multigenerational reforestation plans while increasing harvest yields.

Worldwide, the scale of the challenge posed by deforestation is huge. The net loss of the world's forests is estimated at 7.3 million hectares per year.4 Central America loses forests at a rate of 1.3% per year, Southeast Asia 1%. and sub-Saharan Africa around 30%. At these current rates of deforestation. it is estimated that the world's rainforests will disappear in the next 100 years. Yet, if farmers the world over commit to implementing agro forestry techniques, it will be possible to at least stabilize the deforestation rates.

#### A major benefit of agro forestry is that it does not

#### require huge investments or aid. It is a practice that creates self-sufficiency, as evidenced in Haiti. This bottomup approach is what we need in order to tackle the widespread problem of deforestation. Therefore, we recommend the

Therefore, we recommend the following: Help farmers learn how to effectively replace conventional agricultural practices with agro forestry. This should be done by forming partnerships with local farmers and communities. Native species of cultural value should be used whenever possible, as should noninvasive, nitrogen-fixing, multipurpose agro forestry species. Farmers should be trained to use shrubs and bushes for fencing, which limits overgrazing by animals and subsequent topsoil erosion.

Low-cost alternatives to fuel wood, such as solar cookers, should be developed. Farmers should be trained in developing useful, economically viable, and environmentally sound products that build self-reliance rather than dependency. Communities should be trained in backyard horticulture, nursery development, and rainwater harvesting, the latter of which builds resilience to droughts. In short, successful agro forestry programs build on communities' cultural values, norms, and traditions. Foreign ideas or technologies should be implemented with extreme caution, given that their sustainability depends on these communities.

http://www.worldscientific.com/ worldscibooks/10.1142/8922

#### Good News & Bad News: Clearing the Air in Indian Cities



By Anumita Roychowdhury Centre for Science and Environment, 2014

The book presents the evidence of change in Indian cities – however small they may seem today. It captures actual policy decision and action in cities for clean air, public transport, walking and cycling, intermediate public transport, and car restraint initiatives like parking and fiscal measures. The challenge now is to learn from these experiences and to upscale the practices so that we can have the great leapfrog – move from cars to no cars, from pollution to clean air.

Nearly three-fourths of Indian cities have particulate pollution (PM) levels exceeding permissible standards affecting the health of lakhs of people across the country, according to an analysis released Thursday. The analysis is part of a book *Good News Bad News:* Clearing the air in Indian cities' by the Centre for Science and Environment (CSE).

The book provides an assessment of the cities in India and how they fare on parameters such as air quality, public transport, walkability, parking policies and fiscal initiatives. "About 78 percent of cities in India have particulate pollution levels that exceed the standards. Only two cities - both from Kerala - meet the clean air benchmark of the central pollution control authority," it said.



#### **EIA Guidelines for Wind Power**

Centre for Science and Environment, 2014

This report gives guidelines for environmental and social impact assessment for the wind power projects. These could be adopted by project developers, government stakeholders, pollution control boards, and forest departments, in order to upscale wind power generation in India while also incorporating sound environmental management practices. This is an attempt to make wind power development more ecologically sound.



#### Catch Water Where It Falls - Toolkit on Urban Rainwater Harvesting

**By Gita Kavarana, Sushmita Sengupta** Centre for Science and Environment

It is a hands-on book based on exhaustive case studies on how rainwater harvesting (RWH) is being implemented, across India – in residential, institutional, and industrial/ commercial segments. You will find cases that you can relate to, with all the details you would need, to implement RWH in your premises.

#### Books



#### Reinvent, Recycle, Reuse - Toolkit on Decentralized Wastewater Management

**By Suresh Kumar Rohilla, Deblina Dwivedi** Centre for Science and Environment, 2014

In today's world, sewage treatment is a challenge for all practitioners. The call of the hour is to reuse and recycle the used water. Book is thoroughly researched and there are a large number of case studies to update our understanding, and address the issue efficiently.



#### The Evolution of a Corporate Idealist: When Girl Meets Oil

**By Christine Bader** Bibliomotion, 2014

There is an invisible army of people deep inside the world's biggest and best-known companies, pushing for safer and more responsible practices. They are trying to prevent the next Rana Plaza factory collapse, the next Deepwater Horizon explosion, the next Foxconn labor abuses. Obviously, they don't always succeed.

The book is based on Bader's experience with BP and then with a United Nations effort to prevent and address human rights abuses linked to business. Using her story as its skeleton, Bader weaves in the stories of other "Corporate Idealists" working inside some of the world's biggest and best-known companies.



#### The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies

By Nicos Komninos Routledge, 2014

This book concludes a trilogy that began with Intelligent Cities: Innovation, Knowledge Systems and digital spaces (Routledge 2002) and Intelligent Cities and Globalization of Innovation Networks (Routledge 2008). Together these books examine intelligent cities as environments of innovation and collaborative problem-solving. In this final book, the focus is on planning, strategy and governance of intelligent cities.

Divided into three parts, each section elaborates upon complementary aspects of intelligent city strategy and planning. Main findings of the book are related to a series of models which capture fundamental aspects of intelligent cities making and operation. These models consider structure, function, planning, strategies toward intelligent environments and a model of governance based on mobilization of communities, knowledge architectures, and innovation cycles.



### The Big Pivot: Radically Practical Strategies for a Hotter, Scarcer, and More Open World

**By Andrew S. Winston** Harvard Business Review Press, 2014

The evidence is all around us. Extreme weather, driven by climate change, is shattering records all over the planet. Our natural resources are in greater demand than ever before as a billion more people enter the global middle class, wanting more of everything. Radical transparency is opening up company operations and supply chains to public scrutiny.

This is not some futuristic scenario or model to debate, but today's reality. We've passed an economic tipping point. A weakening of the foundations of our planetary infrastructure is costing businesses dearly and putting our society at risk. The mega challenges of climate change, scarcity, and radical transparency threaten our ability to run an expanding global economy and are profoundly changing "business as usual." But they also offer unprecedented opportunities: multi-trillion-dollar markets are in play, and the winners of this new game will profit mightily.

In this indispensable new book, Winston provides ten crucial strategies for leaders and companies ready to move boldly forward and win in this new reality. With concrete advice and tactics, and new stories from companies like British Telecom, Diageo, Dow, Ford, Nike, Unilever, Wal-Mart, and many others, The Big Pivot will help you, and all of us, create more resilient businesses and a more prosperous world. This book is the blueprint to get you started.



#### A Better World, Inc.: How Companies Profit by Solving Global Problems... Where Governments Cannot

**By Alice Korngold Palgrave** Macmillan, 2014

In *A Better World, Inc.*, Korngold shows companies and their executives how to profit by developing solutions to the world's most daunting challenges – those that governments cannot and have not addressed. Using case studies of various global companies from Nike to Pfizer to Vodafone and GlaxoSmithKline, *A Better World, Inc.* delineates best practices for corporations to maximize profits, decrease costs, and build the longer-term value of their companies by ensuring a more sustainable and humane world.

In declaring that 'only global corporations have the resources, global reach, and self-interest to build a better world,' Korngold shows how to ensure that this is a mutually beneficial and equitable relationship for business and society. The book provides a roadmap to success, including stakeholder engagement; partnerships among businesses, NGOs, and governments; measurement, accountability and reporting; and effective corporate governance. Korngold also discusses the most powerful drivers for companies to further intensify their innovations in solving global challenges: consumers, employees, and investors.

#### Greenco Summit

26 & 27 June 2014, Chennai

www.cii.in

#### Workshop - Sustainable Mini-Grid for Energy Access

June 27, 2014, Delhi http://cseindia.org/content/workshop-sustainable-mini-grid-

energy-access

#### Training programme on SOCIAL IMPACT ASSESSMENT

June 23-27, 2014, Delhi

http://www.cseindia.org/content/training-programme-social-impact-assessment

#### Sustainable Urban Water Management: Rainwater Harvesting and Decentralized Wastewater Treatment

June 30 - July 4, 2014, Delhi

http://www.cseindia.org/content/sustainable-urban-watermanagement-rainwater-harvesting-and-decentralised-wastewatertreatm-0

#### **Green Power**

17 & 18 July 2014, Chennai www.cii.in

#### **Green Sugar Summit**

23 & 24 July 2014, Hyderabad www.cii.in

#### Power Plant Summit

31July & 1 August 2014, New Delhi www.cii.in

#### **5th World Renewable Energy Congress**

Aug 21 - Aug 23, New Delhi http://www.wretc.in/#sthash.ACj9hTz8.dpuf

Renewable Energy India Expo Sep 3 - Sep 5, Greater Noida http://www.renewableenergyindiaexpo.com/#sthash.E5NqODEw. dpuf

#### **Green Building Congress**

2 – 6 September 2014, Hyderabad www.cii.in

#### Watertech India 2014

Sep 10 - Sep 12, New Delhi http://www.watertechindia.com/#sthash.G6XqlcHb.dpuf

#### 4th India Smart Utilities Week

Sep 16 - Sep 18, New Delhi http://www.wsgcindiaweek.com/

#### **Light India**

Sep 18 - Sep 21, New Delhi http://www.messefrankfurt.com.hk/other/country\_list. aspx?country\_id=12

#### **Energy Efficiency Summit**

29 October – 1 November 2014, Hyderabad www.cii.in

### Greenco Best Practices Award and Waste Management Summit 2014

20-22 November 2014, Pune www.cii.in

Mail suchitra@managementnext.com for inclusion of conferences, seminars, events related to renewable energy, forest, cleantech, water, climate change, green economics

#### Advanced Course on Sustainable Lighting Practices

18th to 20th June, 2014 | Pune www.eai.in/360/events/pages/463#sthash.gJ0urrsH.dpuf

#### Post-Graduate Diploma Course in Sustainable Development (PGDM-SD)

Bimtech Birla Institute of Management Technology www.bimtech.ac.in

#### **Post-Graduate Diploma**

Entrepreneurship Development Institute of India www.ediindia.org

#### Post-Graduate Certificate in Sustainable Enterprise

Indian Institute for Sustainable Enterprise www.theiise.net/pgcertinse.html

#### Post-graduate in Sustainability Management

Silver Bright Institute of Management www.htcampus.com/college/silver-bright-institute-managementsbim

#### M. Tech, M.Sc Environmental Science

Thapar University www.thapar.edu

#### **Post-Graduate Diploma**

IGNOU-Indira Gandhi National Open University www.ignou.ac.in

#### Master of Architecture (Sustainable Architecture)

Bharati Vidyapeeth Deemed University www.bharatividyapeeth.edu/Campuses/Pune/default.aspx

MBA and MA in Sustainability Management TERI University www.teriuniversity.ac.in

#### M.Sc. in Sustainable Development-Distance learning Course + information The Global Open University www.nagaland.net.in

Post-Graduate Diploma in Sustainability (Distance learning) Chhattisgarh University www.cguniversity.com

#### M. Tech in Environmental Engineering

The National Institute of Technology, Tiruchirappalli www.nitt.edu/home

Advanced Diploma in Bio Degradable & Solid Waste

Vellalar College for Women www.vellalar.com/Arts/carrer-oriented-programmes.php

Ph.D in Environmental Science Gauhati University www.gauhati.ac.in

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