ACTIVITY REPORT 2010

Resource Optimization Initiative

ROI

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ROI's logo was specially designed by Jean Letschert Ascharyacharya, a painter and scholar of Belgian origin, who was one of the last students of the world famous surrealist artist René Magritte. Jean Letschert spent most of his life in India, where he became a renowned scholar of ancient Indian wisdom and spiritual tradition. His work is described as original and sensitive, displaying an intuitive understanding of the hidden meaning of universal symbols. He was one of the earliest supporters of ROI as he was very concerned about environmental issues.

ROI's logo depicts progress through the circularization of material and optimization of energy. The O of ROI describes the cycling of resources, but the fading arrow under the logo reminds us that ultimately, resources are degrading over time, thus the cycling of resources does not contradict the second principle of thermodynamics.

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FOREWORD

In 1995, Ramesh Ramaswamy and Suren Erkman engaged in a collaboration in order to disseminate and experiment on the approach of industrial ecology in the Indian context. The collaboration resulted in various field projects, publications, workshops, conferences, and finally in the creation of Resource Optimization Initiative (ROI) in 2004 as a Public Charitable Trust registered in Bangalore. The sudden and premature demise of Ramesh Ramaswamy in 2008 seriously challenged the existence and continuation of ROI.

However, after receiving many encouragements from India and abroad, it was decided to continue this initiative.

As stated in the book 'Applied Industrial Ecology: A New Platform for Planning Sustainable Societies' (Erkman and Ramaswamy, 2003), "Industrial Ecology is very relevant and an urgently needed strategy for developing countries. As a matter of fact, inefficient use of resources and getting rid of wastes with end-of-pipe 'pollution control' technologies are truly unaffordable luxuries for developing countries!"

We think this statement is becoming increasingly relevant, as fast growing economies like India generate unprecedented environmental and social challenges. The present Activity Report gives an overview of the activities performed by ROI during the last two years and presents perspectives for future projects. We hope you will find it interesting and useful.

Mrs. Purnima Ramaswamy,
Member, Board of Trustees

Prof. Suren Erkman,
Chairman

LOCATION

Resource Optimization Initiative (ROI) is located in the rapidly growing south Indian city of Bangalore. Bangalore is the capital of the state of Karnataka whose official language is Kannada. Bangalore is also known by it's Kannada name - Bengaluru. This city is centrally located in south India, which comprises of the states - Tamil Nadu, Andhra Pradesh, Kerala and Karnataka. The city of Bangalore witnessed a rapid growth over the past two decades. Its population doubling from 4.1 million in 1991, to an estimated 8 million in 2011. The population of the state of Karnataka is estimated to be over 60 million.

Bangalore is home to some of the most well respected research and technology institutions in the country such as the Indian Institute of Science (IISc), National Institute of Advanced Studies (NIAS), Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Indian Space Research Organisation (ISRO), Indian Institute of Management (IIM), and Institute for Social and Economic Change (ISEC). ROI's team members are alumni of these esteemed organizations, enabling us to collaborate with distinguished research teams.

Clockwise from top left: UB City, a large comercial complex in the city centre; the main building of the Indian Institute of Science; the Glass House at Lalbagh Botanical Gardens; the Indian Institue of Management; the Vikas Souda, home of part of the state legislature; and M. Chinnaswamy Stadium, one of India's premier cricket stadiums.

SUMMARY

Resource Optimization Initiative (ROI) was founded by Mr. Ramesh Ramaswamy and Prof. Suren Erkman in 2004 with the goal of promoting the concepts, methods and tools of industrial ecology in India. ROI is one of the first groups in the developing world to apply the theory, methods, and tools of industrial ecology in a developing context to inform policy and strategies for sustainable development.

Industrial ecology, also known as the science of sustainability, is an interdisciplinary systems approach to scientifically analyze flows of materials and energy, and its impacts on humans and our environment's health.

Over the years ROI's research focus has grown and it has now established itself as a respected organization that uses novel methods and tools to measure resource consumption, generate high quality data and synthesize this information to recommend and help implement feasible strategies for resource optimization. We have developed strategies and methods to work in challenging situations that have limited prior data on resource consumption patterns. We ensure the reliability of our investigation by using multiple means to gather data and information.

Over the years we have successfully been involved in 21 research investigations throughout India, including 5 case studies published in a book on industrial ecology by Erkman and Ramaswamy in 2003. We are currently investigating 4 research projects to recommend strategies to optimize material and energy flows in industries and agricultural regions.

We have developed strong associations with a network of international experts in the field of industrial ecology. These relationships increase the available "brainpower" of the organization to take on larger scale issues than its small size might suggest. We currently have 4 full time employees at our office in Bangalore.

Additionally we work with interns who have found that provides a stimulating environment to carry out concise research projects on designing novel means for resource management in the context of developing countries. Since 2009 we have worked with 8 interns from around the world and are currently working with 22 engineering graduates from an institute in Bangalore. This experience has shaped our skills in guiding budding industrial ecologists to take on pertinent and challenging issues to promote sustainable use of resources in different contexts.

Apart from our network of industrial ecology experts who provide intellectual stimulation, advice and guidance, we work with local governance and administrative institutions such as the Confederation of Indian Industry, Karnataka State Council for Science and Technology, and Karnataka State Pollution Control Board, to investigate and recommend changes to policy and business practices to ensure sustainable use of resources in India.

We are keen to take up advocacy related tasks to assist in the administration of local resource utilization to minimize wastage. Our outreach activities include organizing and conducting workshops for industrial associations, clusters of industries, government officials and administrators, and designing and spreading information on industrial ecology through videos. In the workshops that we conduct we present practical solutions for resource optimization of critical resources. The critical resource in focus varies depending on the activities of the group we work with. We also present case studies where our recommended strategy has been implemented for simultaneous economic and environmental benefit of stakeholders. Thereby, we encourage the adoption of novel but standardized methods to lessen socio-economic and environmental impacts of resource consumption.

In the future we hope to increase our advocacy and outreach activities to assist administrative institutions to use modules and toolkits that facilitate the sustainable administration and assessment of resources. We are constantly looking for opportunities to investigate prospects for resource optimization in rural and urban contexts in developing economies.

ROI is financially supported through grants from foundations, institutions, universities and government bodies. Initial core funding for ROI has come from the State of Geneva, through a Swiss non-profit organization FIDEST, and the Charles Leopold Mayer Foundation for the Progress of Humankind, Lausanne, Switzerland.

Individual projects have been supported by Institute for Communication and Analysis of Sciences and Technologies (ICAST), Geneva, Switzerland; Center for Industrial Ecology, Yale University, USA; University of Lausanne, Switzerland; Foundation for MSME Clusters, India; Confereration of Indian Industry; Institute for Financial Management and Research, Chennai, India; Karnataka State Council for Science and Technology (KSCST), India; and Karnataka State Pollution Control Board (KSPCB), India.

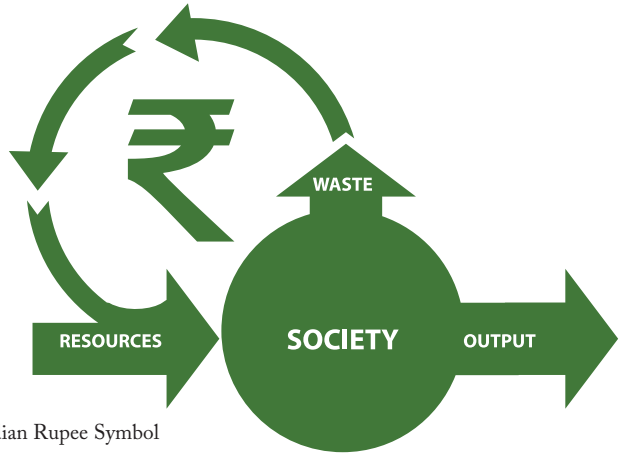
OVERVIEW

Preamble

Industrial ecology holds promise of being a good planning platform in developing countries. Since many developing countries are woefully short of resources, which are often inefficiently used, a planning process that aims to optimize their use is essential. An organized effort is required to promote this concept among policy makers, businesses and communities in developing countries.

Resource Optimization Initiative (ROI) was set up for this purpose in 2004. Over time we recognized that there was a need for well documented case studies that demonstrated the economic, environmental and social benefits of industrial ecology in developing countries. Therefore ROI's research focus grew.

ROI is one of the first groups in the developing world to apply the theory, methods, and tools of the new field of industrial ecology in a developing country context to inform policy and strategies for sustianable development.



₹ = the new Indian Rupee Symbol

Our main strength is in the use of clear and effective research methodology to provide insightful information about current practices and effective solutions for converting currently unsustainable practices in resource utilization to sustainable ones. We adopt a broad definition of resources to include not only land, water, air and materials but also knowledge, social capital and tradition , so that the solutions we provide are reliable and have long term positive effects for participating communities. We have always believed that such solutions will be effective only if all important social, economic and environmental variables are taken into consideration.

Mission

The mission of ROI is to promote the implementation of concepts and tools of industrial ecology in development and business planning processes in developing countries.

Towards accomplishing its mission, ROI's activities include:

Investigating and promoting equitable access to and distribution of resources in industrial and agrarian regions in India.

Evaluating and promoting locally available renewable sources of energy to reduce greenhouse gas emissions and global warming potential.

Characterizing social, economic and environmental benefits and costs associated with extraction, production and consumption of natural resources.

Introducing concepts and tools based on industrial ecology, to policy makers in governments and businesses of developing countries, for optimal utilization of resources by current and future generations.

Relevance

ROI's focus on research is to demonstrate the importance of holistically assessing production and consumption patterns to recommend viable strategies for their optimization. Over time we have realized that understanding social and economic constraints of societies is crucial in changing production and consumption patterns to minimize the environmental and social impact of industrial growth. With increased globalization, large businesses are increasingly shifting their production facilities to developing countries, sometimes straining the slender resource bases of those countries. Furthermore, lack of data on the social and environmental impacts of these global supply chains could lead to the implementation of policies that confer only apparent short term benefits.

With a rise in current awareness on environmental costs of pollution and resource depletion along with hazards of climate change, Indian citizens are demanding new policies and strategies for transitioning from a developing nation to a sustainably developed one. We are confident that the research and capacity building services that ROI will provide will be crucial in informing development policy and strategies for the future.

Constitution

Currently ROI is administered by:
Prof. Suren Erkman, *Chairman*
Mrs. Purnima Ramaswamy, *Managing Trustee*

Research & Management Team

Megha Shenoy, Ph.D., *Research Director*
Mr. Manjunath Prasad, *Administrative In-Charge:*
Ms. Grishma Jain, *Researcher*
Mr. Lokanath S., *Researcher*

We also have strong ties with an extensive network of international academic and practitioner experts in the field of industrial ecology. These relationships increase the available "brainpower" of the organization to take on larger scale issues than its small size might suggest.

Advisory Board

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Sustainability Research Institute (SRI), School of Earth and Environment, University of Leeds, UK.

Technical Resources and Geographical Reach

ROI attempts to tap the best resources available in any part of the world and will not be geographically restricted. Our focus will continue to be on applications of industrial ecology for developing countries.

GENESIS OF ROI

ROI was founded after Prof. Suren Erkman and Mr. Ramaswamy published their seminal book on indutrial ecology in 2003 titled 'Applied Industrial Ecology: A New Platform for Planning Sustainable Societies (Focus on Developing Countries with Case Studies from India)' published by Aicra Publishers, Bangalore, India.

The entire book can be downloaded for FREE from ROI's website:
http://www.roi-online.org/viewbooks.php

The book has been translated into Mandarin (Chinese) by a collaborator of Prof. Erkman. This translated version will soon be available on ROI's website.

This book documents how industrial ecology concepts and tools were applied to different industrial sectors to recommend economically viable strategies for optimizing material and energy resources. The five case studies in the book are those of:

- The textile industry in Tirupur, Tamil Nadu
- The foundries in Haora, West Bengal
- The leather industry in Tamil Nadu
- A corporate paper-sugar complex, Tamil Nadu
- The Damodar Valley Region, Jharkhand

ROI ACTIVITIES

2004 -2009

	Project / Activity	Year	Funding
1	Material and energy resources consumed by three selected agro-industrial systems in Karnataka, India (rice, sugar cane, cotton)	2004-07	Core*
2	Animation and multimedia presentation on industrial ecology: A new planning platform Uploaded on You Tube *http://www.youtube.com/watch?v=EOexAnEIGa4*	2004-05	Core*
3	Contributions to the book: Economic actors' participation in social and environmental responsibility: A guide to promoting ethics and sustainable development	2005-06	Core*
4	Uploading industrial ecology case studies on the repository on ROI's website	2005-06	Core*
5	Study of effluent and hazardous waste management practices in Doddaballapur industrial area based on industrial ecology concepts	2006	KSCST, India
6	Long term social and environmental impacts of using agricultural residues as fuel in rural homes	2006	BP, Global
7	Applying industrial ecology to construct a water balance for Bangalore, India	2006-08	Core* and Yale University, USA
8	Course during Spring Break (2 weeks) on indutrial ecology in Developing Countries for Masters Students from Yale University, USA	2008	Yale University, USA
9	Industrial symbiosis and residual recovery in the Nanjangud industrial area, India	2008-09	Yale University, USA
10	Optimizing material and energy flows at a large scale manufacturing industry in India	2009	IFMR, India
11	Safe recycling of Expanded Polystyrene (EPS) by economically and environmentally comparing recycling strategies	2009-10	University of Lausanne, Switzerland
12	Energy efficiency, water recycling and carbon di-oxide emissions in the silk reeling sector around Bangalore	2010	Yale University, USA
13	Review: Indian energy policy and strategy- pre and post COP 15	2010	The Graduate Institute, Geneva, Switzerland
14	Formatting Material Flow Analysis (MFA) data into Life Cycle Inventory (LCI) format using Ecoinvent database template Ecospold	2010-11	Ecoinvent, Switzerland
15	Gaseous solvent recovery from bulk drug industries, Hyderabad, Andhra Pradesh	2010-11	Foundation for MSME Clusters, India
16	Potential changes in biomass flows due to India's biodiesel policy: A comparative Material Flow Analysis (MFA) of the *Jatropha curcas* and *Prosopis juliflora* economies in Tamil Nadu, India	2010-11	Yale University, USA
17	Compiling an industrial residual inventory for two large industrial areas around Bangalore to recommend sustainable strategies for reuse, recycling and recovery	2011	Confederation of Indian Industry

** Core funding was from the State of Geneva, through the Swiss non-profit organization FIDEST and the Charles Leopold Mayer Foundation for the Progress of Humankind, Lausanne, Switzerland.*

ROI ACTIVITIES 2008-2009

The director of ROI Mr. Ramesh Ramaswamy passed away suddenly on 10th March 2008. Following his sudden demise the organization went into a quiet "hibernation" period while Prof. Suren Erkman, the co-founder, and members of the board of trustees decided the future course for the organization.

Late Mr. Ramesh Ramaswamy

Prof. Suren Erkman

ROI's activities from March 2008 to June 2009, therefore were significantly fewer than in previous years.

In June 2009 Prof. Suren Erkman was appointed as the chairman of ROI. Prof. Erkman is the Director of the Institute for Land Use Policies and Human Environment (IPTEH), Faculty of Geosciences and Environment, Sorge Area - Amphipole Building, University of Lausanne, Switzerland and President and Founding Partner of SOFIES, Geneva, an environmental and regional development consulting company based on the concept of industrial ecology.

In October 2009 Prof. Weslynne Ashton spent almost three months at ROI planning and strategizing on our new growth plan. Weslynne was the Director of the Industrial Ecology in Developing Countries Program at the Center for Industrial Ecology (CIE), Yale University, USA. CIE has been a strong collaborator of ROI and has invested immensely in shaping ROI's future.

Weslynne was instrumental in networking and starting new projects at ROI during her time with us. Weslynne is now Assistant Professor of Environmental Management and Sustainability at the Stuart School of Business, Illinois Institute of Technology, Chicago, USA.

Research and Management Team

Research Director:
In June 2009 Megha Shenoy, Ph.D. joined as a consultant to revive ROI's research activities. In October 2009 she was employed as ROI's Research Director and has been managing its research activities ever since. She is currently a Visiting Fellow at the Center for Industrial Ecology, Yale University, USA. She completed her Masters degree and Ph.D. at the Indian Institute of Science, Bangalore and a post doctoral fellowship at the Center for Industrial Ecology, Yale University, USA.

Administrator In-Charge:
Mr. Manjunath Prasad joined ROI as its Administrator In-Charge in September 2009. Manjunath has 4 years experience in finance accounting and administration.

Researchers:
Mr. Lokanath S. joined ROI's research team in January 2010. He has completed his Masters degree in Public Policy at the School of Public Policy, Indian Institution of Charted Financial Analysis of India (ICFAI), Hyderabad, India. At ROI he has investigated solutions to improve energy efficiency, water recycling and reduce carbon di-oxide emissions in the silk reeling sector around Bangalore. He is currently working on estimating the potential of implementing gaseous solvent recovery systems at bulk drug industries, Hyderabad, Andhra Pradesh.

Ms. Grishma Jain joined ROI's team as a researcher in September 2010. Grishma has completed her Masters in Green Chemistry & Sustainable Industrial Technology from the University of York, U.K. At ROI she has helped compile a review on "Indian energy policy and strategy: Pre and post COP 15" which has been accepted for publication in the International Development Policy Series 2011 published by the Graduate Institute, Geneva, Switzerland. She is currently assessing potential changes in biomass flows due to India's biodiesel policy by comparing the material flow analysis of the *Jatropha curcas* and *Prosopis juliflora* economies in Tamil Nadu, India.

ROI ACTIVITIES 2009

Research Projects:

- Optimizing material and energy flows at a large scale manufacturing industry in Pune, India.
  Duration: September - December 2009
  In collaboration with, and funded by Center for Development Finance, Institute for Financial Management and Research, Chennai, Bangalore.

- Safe recycling of Expanded Polystyrene (EPS) in Bangalore, India
  Duration: September – December 2009
  In collaboration with, and funded by the University of Lausanne, Switzerland.

Publication:

- Ashton, W., Chertow, M. & Shenoy, M. 2009. Industrial ecology - Developing systemic solutions to climate change and other environmental challenges in Indian industry. *Sustainability Tomorrow* 4(4): 48-52.

Conferences and Workshops:

- Shenoy, M. 2009. 'Modeling Simulation and Gaming Workshop'. Conducted by The Center for Science, Technology and Policy (CSTEP), India, in collaboration with Delft University of Technology, Netherlands. 3-4 July.

- Shenoy, M. 2009. Workshop on "Best Environmental Management Practices in Rice Mills" at the Karnataka State Pollution Control Board, Bangalore, India. (Oral presentation by M. Shenoy). 24 October.

- Shenoy, M. 2009. 4th Sustainability Summit: Asia 2009: "Winning Strategies for a Sustainable World" at India Habitat Centre, New Delhi, India. 25-26 November.

- Bain, A., Ashton, W. & Shenoy, M. 2009. Resource reuse and recycling in an Indian industrial network: Efficiency and flexibility considerations. IEEE Conference on Infrastructure Systems, Chennai, India. (Oral presentation by M. Shenoy). 9-11 December.

- Ashton, W. and Shenoy, M. 2009. Awareness-building workshop on "Industrial ecology and eco-industrial networking" with the Karnataka State Pollution Control Board, Mysore, India for National Pollution Prevention Day. (Oral presentation by W. Ashton and M. Shenoy). 3 December.

Articles covering the awareness program with Karnataka State Pollution Control Board on 3rd Dec 2009 on "Industrial ecology and eco-industrial networking" in Mysore, Karnataka:

- The Deccan Herald, 2009. Adding Greenery is Crucial. The Deccan Herald, Mysore. 4 Dec 2009.

- Star of Mysore, 2009. Open spaces to be identified in industrial units of city: KSPCB chief. Star of Mysore, Mysore. 3 Dec 2009.

- Prajavani, 2009. Mundhina Varsha Kaigarike Hasirukarna "Next year industrial pollution control". Prajavani, Mysore. 4 Dec 2009.

- Samyuktha Karnataka, 2009. Kaigarike Badavanegalle Hasirukarna "Industrial area to be pollution free" Samyuktha Karnataka, Mysore. 4 Dec 2009.

- The Hindu, 2009. Develop green belts, KSPCB chief tells units in NIA. The Hindu, Mysore. 4 Dec 2009.

- Andolana, 2009. Naisargika Sampanmoola Rakshanege Tantragnana Agathya: Rashtriya Malinya Niyantrana Dinadandu Sadashivaiah Kare "To save natural resources technology is necessary: Sadashivaiah calls out on National Pollution Prevention Day" Andolana, Mysore. 4 Dec 2009.

ನೈಸರ್ಗಿಕ ಸಂಪನ್ಮೂಲ ರಕ್ಷಣೆಗೆ ತಂತ್ರಜ್ಞಾನ ಅಗತ್ಯ

ರಾಷ್ಟ್ರೀಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ದಿನದಂದು ಸದಾಶಿವಯ್ಯ ಕರೆ

ಮೈಸೂರು, ಡಿ.೫-ನೈಸರ್ಗಿಕ ಸಂಪನ್ಮೂಲಗಳನ್ನು ರಕ್ಷಿಸುವ ಮತ್ತು ಕಾರ್ಬನ್ ಡೈಆಕ್ಸೈಡ್ ಮಾಲಿನ್ಯವನ್ನು ಕಡಿಮೆ ಮಾಡಲು ಎಲ್ಲಾ ಕೈಗಾರಿಕೆಗಳು ಅತ್ಯಾಧುನಿಕ ಉತ್ಪಾದನಾ ತಂತ್ರಜ್ಞಾನಗಳನ್ನು ಅಳವಡಿಸಿ ಕೊಳ್ಳುವಂತೆ ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷ ಎ.ಎಸ್.ಸದಾಶಿವಯ್ಯ ಕರೆ ನೀಡಿದರು.

ರಾಷ್ಟ್ರೀಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ದಿನದ ಅಂಗವಾಗಿ ಅಮೆರಿಕಾದ ಏಲ್ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ ಹಾಗೂ ಬೆಂಗಳೂರಿನ ಆರ್‌ಒಡಿ ಸಹಯೋಗದಲ್ಲಿ ರಾಷ್ಟ್ರೀಯ ಪ್ರಾಕೃತಿಕ ವಸ್ತು ಸಂಗ್ರಹಾಲಯದಲ್ಲಿ ಗುರುವಾರ ಏರ್ಪಡಿಸಿದ್ದ 'ಔದ್ಯೋಗಿಕ ಪರಿಸರ ವಿಜ್ಞಾನ ಮತ್ತು ಜೀವ-ಔದ್ಯೋಗಿಕ ಸಂಪರ್ಕ ಜಾಲಗಳು' ಕಾರ್ಯಕ್ರಮ ಉದ್ಘಾಟಿಸಿ ಅವರು ಮಾತನಾಡಿದರು.

ಯಾವುದೇ ಕಾರಣಕ್ಕೂ ಪರಿಸರದ ಮೇಲೆ ಹಾನಿಯಾಗುವಂತಹ ವಸ್ತುಗಳನ್ನು ತೆರದ ಪ್ರದೇಶದಲ್ಲಿ ಹಾಕಬಾರದು ಎಂದು ಎಚ್ಚರಿಸಿದರು.

ಸಂಪನ್ಮೂಲ ನಿರ್ವಹಣೆಯಲ್ಲಿ ಅತ್ಯುತ್ತಮ ಸಾಧನೆ ಮಾಡಿದರೆ ಸಾಲದು. ಕೈಗಾರಿಕೆಗಳ ಸುತ್ತಾ ಹಸಿರು ವಲಯ ನಿರ್ಮಿಸುವಲ್ಲಿಯೂ ಗಮನ ಹರಿಸಬೇಕು. ಇದು ಪರಿಸರ ಹಾಗೂ ವಾತಾವರಣವನ್ನು ಉತ್ತಮಗೊಳಿಸುವಜೊತೆಗೆ ಸುತ್ತಲಿನ ಪ್ರದೇಶದ ಸೌಂದರ್ಯವನ್ನೂ ಹೆಚ್ಚಿಸುತ್ತದೆ ಎಂದರು.

ಕರ್ನಾಟಕದ ಅಭಿವೃದ್ಧಿಯಾಗಿರುವ ಕೈಗಾರಿಕಾ ಪಟ್ಟಣಗಳ ಪೈಕಿ ನಂಜನಗೂಡು ಪ್ರಮುಖವಾಗಿವೆ. 'ದೇವನ್ಹಾನದ ಪಟ್ಟಣ' ಕಬಿನಿ ನದಿಯ ದಂಡೆಯ ಮೇಲಿದ್ದು, ಇದು ಸಕ್ಕರೆ, ಡಿಸ್ಟಿಲರಿ, ಔಷಧ, ರಾಸಾಯನಿಕ, ಎಲೆಕ್ಟ್ರಾನಿಕ್ಸ್, ಪೇಪರ್ ಮತ್ತು ಪಲ್ಪ್, ಜವಳಿ, ದಿಢೀರ್ ಕಾಫಿ, ಎಂಜನಿಯರಿಂಗ್, ಆಟೋಮೊಬೈಲ್, ಗ್ರಾನೈಟ್ ಕಟಿಂಗ್ ಪಾಲಿಷಿಂಗ್ ಮುಂತಾದ ಕೈಗಾರಿಕೆಗಳನ್ನು ಆಕರ್ಷಿಸಲು ಕಾರಣವಾಗಿದೆ ಎಂದರು.

ಇಲ್ಲಿಗೆ ಎಲ್ಲಾ ಕೈಗಾರಿಕೆಗಳು ಬಹುತೇಕ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಪದ್ಧತಿಯನ್ನು ಅಳವಡಿಸಿಕೊಂಡಿದ್ದು, ಜಲ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣಕ್ಕೂ ಅತ್ಯುತ್ತಮ ತಂತ್ರಜ್ಞಾನ ಅಳವಡಿಸಿಕೊಂಡಿದೆ. ಇದು ಮೆಚ್ಚಬೇಕಾದ ಅಂಶ ಎಂದು ಹೇಳಿದರು.

ಡಾ.ಜೆಸ್ಟಿನ್ ಅಷ್ಟಾನ್ ಹಾಗೂ ಆರ್‌ಒಡಿನ ಡಾ.ಮೇಘ ಶೆಣೈ ಪವರ್ ಪಾಯಿಂಟ್ ಉಪನ್ಯಾಸ ನೀಡಿದರು.

ಹಿರಿಯ ಪರಿಸರ ಅಧಿಕಾರಿ ನಂದ ಕುಮಾರ್ ಸ್ವಾಗತಿಸಿ ಕಾರ್ಯಕ್ರಮದ ಪರಿಚಯ ಮಾಡಿದರು. ವೇದಿಕೆಯಲ್ಲಿ ಎಂ.ಡಿ.ಎನ್.ಸಿಂಹ, ಬಿ.ಎಂ.ಪ್ರಕಾಶ್ ಉಪಸ್ಥಿತರಿದ್ದರು.

ಮೈಸೂರಿನಲ್ಲಿ ಗುರುವಾರ ಏರ್ಪಡಿಸಿದ್ದ 'ಔದ್ಯೋಗಿಕ ಪರಿಸರ ವಿಜ್ಞಾನ ಮತ್ತು ಜೀವ-ಔದ್ಯೋಗಿಕ ಸಂಪರ್ಕ ಜಾಲಗಳು' ಕಾರ್ಯಕ್ರಮವನ್ನು ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷ ಎ.ಎಸ್.ಸದಾಶಿವಯ್ಯ ಉದ್ಘಾಟಿಸಿದರು. ಎಂ.ಡಿ.ಎನ್.ಸಿಂಹ, ಬಿ.ಎಂ.ಪ್ರಕಾಶ್ ಮತ್ತಿತರರನ್ನು ಚಿತ್ರದಲ್ಲಿ ಕಾಣಬಹುದು.

ಬೋಪಾಲ್‌ನಲ್ಲಿ ೨೫ ವರ್ಷಗಳ ಹಿಂದೆ ೧೯೪೪ ಡಿಸೆಂಬರ್ ೨ ಮಧ್ಯರಾತ್ರಿ ಮಿಥೇಲ್ ಐಸೋಸೈನೇಟ್ ಅನಿಲವು ಯೂನಿಯನ್ ಕಾರ್ಬೈಡ್ ಸಂಸ್ಥೆಯಿಂದ ಸೋರಿ ವಿಶ್ವದಲ್ಲಿ ಎಂದೂ ಕಂಡರಿಯದ ಔದ್ಯೋಗಿಕ ದುರಂತ ಸಂಭವಿಸಿತ್ತು. ಸಹಸ್ರಾರು ಜೀವರಾತಿಗಳು ಮೃತ್ಯುಕೂಪ ಸೇರಿದವು. ೬೨ ಗಂಟೆಗಳಲ್ಲಿ ೧೦,೦೦೦ ಮಂದಿ ಜೀವ ತೆತ್ತರು. ನಂತರವೂ ಇಲ್ಲಿಯವರೆಗೆ ೨೦,೦೦೦ ಮಂದಿ ಜೀವ ತೆತ್ತರು. ೧,೨೦,೦೦೦ ಮಂದಿ ವಿವಿಧ ಕಾಯಿಲೆಗಳು, ಅಂಗ ಊನಗಳಿಂದ ಬಳಲುತ್ತಿದ್ದಾರೆ. ಈ ದಿನವನ್ನು ರಾಷ್ಟ್ರೀಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ದಿನ ಎಂದು ಆಚರಿಸಲಾಗುತ್ತಿದೆ.

Above: *Andolana, 2009. Naisargika Sampanmoola Rakshanege Tantragnana Agathya: Rashtriya Malinya Niyantrana Dinadandu Sadashivaiah Kare "To save natural resources technology is necessary: Sadashivaiah calls out on National Pollution Prevention Day" Andolana, Mysore 4 Dec 2009.*

Develop green belts, KSPCB chief tells units in NIA

The Hindu, Mysore, Friday, Dec 04, 2009

Staff Correspondent

Awareness programme on Industrial Ecology and Eco-Industrial Networking held

— PHOTO: M.A. SRIRAM

Exchange of ideas: **KSPCB Chairman A.S. Sadashivaiah (second from left) with Weslynne Ashton of Yale University at an awareness programme in Mysore on Thursday.**

MYSORE: The Karnataka State Pollution Control Board (KSPCB) chairman A.S. Sadashivaiah has called upon industries in the Nanjangud Industrial Area (NIA) to focus on developing green belts in and around their units in order to improve the plant cover and enhance the natural beauty.

Speaking at the National Pollution Prevention Day organised by the board here on Thursday, Mr. Sadashivaiah said, "The performance of the units in the NIA in pollution control: air quality and river quality control has been largely satisfactory. Water quality of the Kabini river conforms to Class 'C' standards which is suitable for domestic water supply after preliminary treatment. Now, the industries should focus on adopting the best available manufacturing techniques and creating green belts."

Major industries such as the TVS Motor Company, Nestle India, and Reid and Taylor are located in Nanjangud.
An awareness programme on "Industrial ecology and eco-industrial networking" in collaboration with the Centre for Industrial Ecology (CIE), Yale University, U.S., and the Resource Optimisation Initiative (ROI), Bangalore, was organised.

Weslynne Ashton from Yale University dwelt on industrial ecology and international best practices on application of industrial ecology in business, and Megha Shenoy of ROI spoke on building eco-industrial networks in the NIA.
"As the Kabini flows in close proximity to the NIA, we have imposed a rule that all industries have to treat their effluents and reuse it; and the excess can be diverted for green belts and agriculture," Mr. Sadashivaiah said.
Whenever problems had been noticed, the board had taken action to address the issues and take preventive measures, he said. Also, penal action had been taken against erring units. "We have adopted the carrot and stick policy for effective enforcement," he explained.

He also stressed on the importance of the reduction of carbon dioxide emissions.

He said that solid wastes and hazardous wastes should be properly managed. Industrial ecology took a systematic approach in understanding the sustainability of materials and energy and water flows within the system, he said.

Above: The Hindu, 2009. Develop green belts, KSPCB chief tells units in NIA. The Hindu, Mysore 4 Dec 2009.

ROI ACTIVITIES

2010

Research Projects

Photo Credit: Rashmi Kumari

Energy efficiency, water recycling and carbon di-oxide emissions in the silk reeling sector around Bangalore, Karnataka

Duration: January - May 2010

India is the second largest producer of silk, contributing to about 18 percent of the world production. The silk reeling process involves boiling of silk worm cocoons to obtain silk filaments that are reeled on wheels. This reeled silk is then dyed and woven into fabric. Silk reeling is one of the most important small scale industries in the state of Karnataka; many households in the suburban and rural regions of the state engage in this activity.

The main purpose of our investigation is to increase the performance of this sector by reducing consumption of firewood, emission of carbon di-oxide and to recycle waste water/channelize it to alternative uses so as to recharge the water bed in these regions. We aim to reduce firewood consumption and emissions by aiding in the installation of solar water heating devices coupled to high efficiency but low cost stoves. We are also investigating the economic and environmental viability of using agricultural waste pellets/briquettes in place of firewood.

Most of the water that is consumed in the silk reeling process is discarded into the common drainage in these towns. This waste water that is free from chemicals but rich in silk protein is mixed with sewage and eventually discarded in inland basins such as lakes and ponds. We propose to further investigate two options to ensure sustainable water management in this sector: (i) recycle water so as to reduce consumption of fresh water by the silk reeling sector or (ii) channel this waste water to fertilize agricultural lands around these silk reeling clusters and simultaneously recharge the water bed.

The availability of both resources (wood and water) is decreasing, causing a sharp rise in their prices, in these regions. Reduced consumption of these resources will increase profit margins of silk reeling units while ensuring environmental sustainability.

Previous attempts to impose environmental regulations in the small and informal sectors have relied on traditional command and control mechanisms that resulted in poor compliance to environmental norms. In contrast, the implementation of cleaner technologies such as solar water heaters and energy efficient stoves in the silk reeling process overcomes environmental hazards while simultaneously offering attractive economic benefits for industries that adopt such technologies.

Funding:
This study was funded through a research grant from the Center for Industrial Ecology, Yale University, USA.

Facing page: Silk cocoons

Photo Credit: Rashmi Kumari

Researchers:
Rashmi Kumari, Intern, ROI; Masters student in Natural Resource Management at TERI University, New Delhi, India;
Lokanath S., Researcher, ROI;
Megha Shenoy, Research Director, ROI;
Shilpa I. Pattanshetti, Researcher, ROI;
Arsha Branson, Intern, ROI; Bachelors student in Economics and Social Science, at Sydney University, Australia.

Facing page, Top: Baskets of silk cocoons; Bottom: Silk waste
Below: Silkworkers

Photo Credit: Rashmi Kumari

Review: Indian energy policy and strategy - pre and post COP 15

Duration: March – October 2010

India is an extraordinarily diverse democratic country with one of the fastest growing economies. It is the sixth largest consumer of energy in the world. Interest in its energy policies and strategies is escalating due to its huge impact on geopolitical relations, global energy prices and increasing effect on climate change. Its current per capita energy consumption and GHG emission values are low; however these are bound to increase if it continues on the path of development that the global North has walked on. If India is to leapfrog the already trodden path to one that ensures sustainable development it is imperative that the country redefines its development paradigm to ensure inclusive growth.

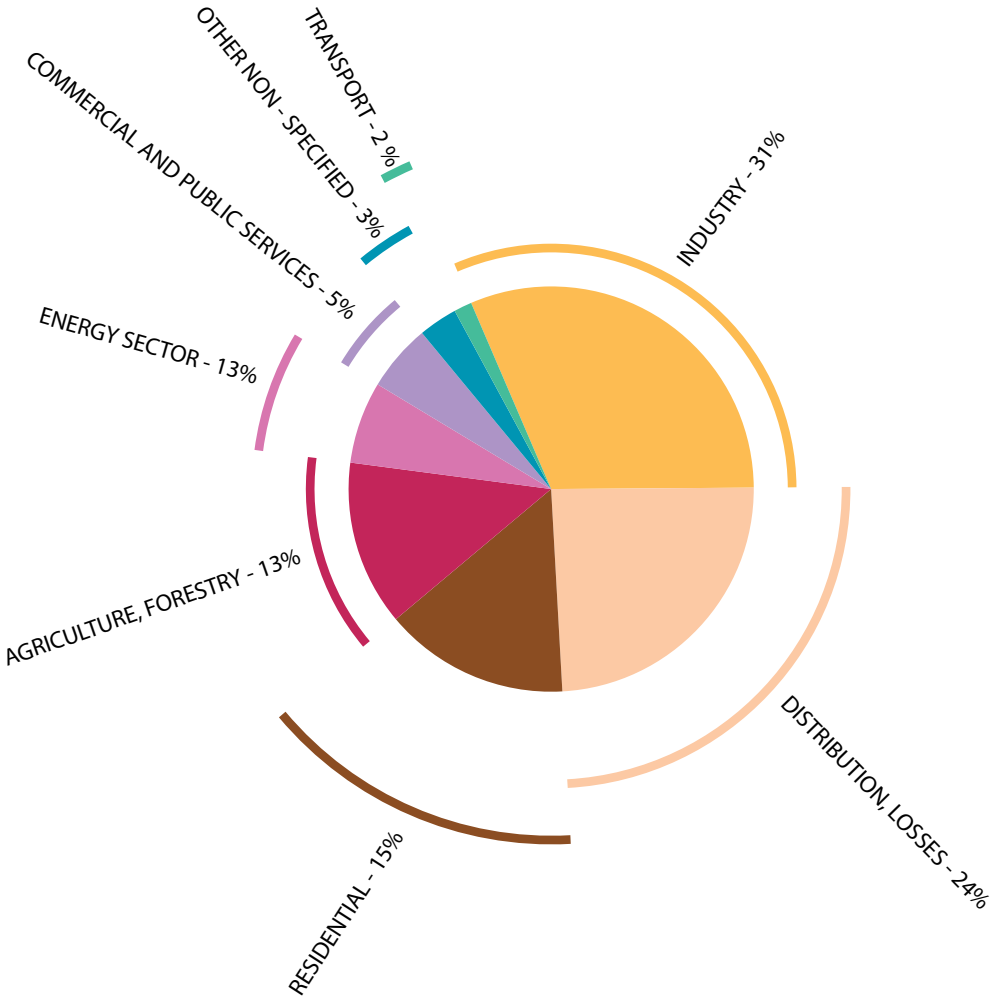
Unsustainable subsidies, poor reform implementation, distorted energy prices and inadequate investment in renewables are some of the major constraints that the Indian government needs to re-examine so as to increase energy security and provide a framework for transitioning to a low carbon economy.

In addition to innovative energy policies such as the National Solar Mission, the National Mission on Enhanced Energy Efficiency and the National Mission on Sustainable Habitat, India needs to adopt a framework for decoupled growth, which we refer to as an increase in the quality of life for its citizens without an increase in environmental damage. Since 2008, India has demonstrated that it is serious about changing its growth pattern and moving to clean energy alternatives. However, this vision will not be fully realized unless the global North provides technical and financial assistance to collectively mitigate the adverse impact of global warming and subsequent climate change.

Article accepted for publication in the International Development Policy Series 2011, published by The Graduate Institute of International and Development Studies, Graduate Institute, Geneva, Switzerland.

Funding:
This project was partly funded by the Graduate Institute, Geneva, Switzerland.

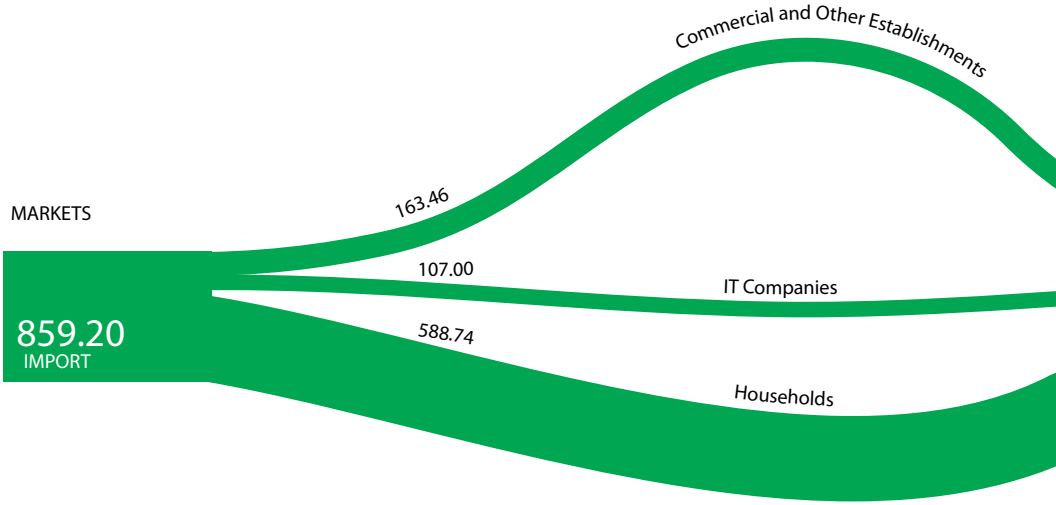
Researchers:
Megha Shenoy, Research Director, ROI;
Grishma Jain, Researcher, ROI;
Tara Parthasarathy, Consultant, Shakti Sustainable Energy Foundation, New Delhi, India



Above: *Electricity Distribution in India*

Source: IEA (International Energy Agency). 2007. Electricity/Heat in India in 2007. http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=IN

Below: Substance Flow Analysis diagram of EPS in Bangalore



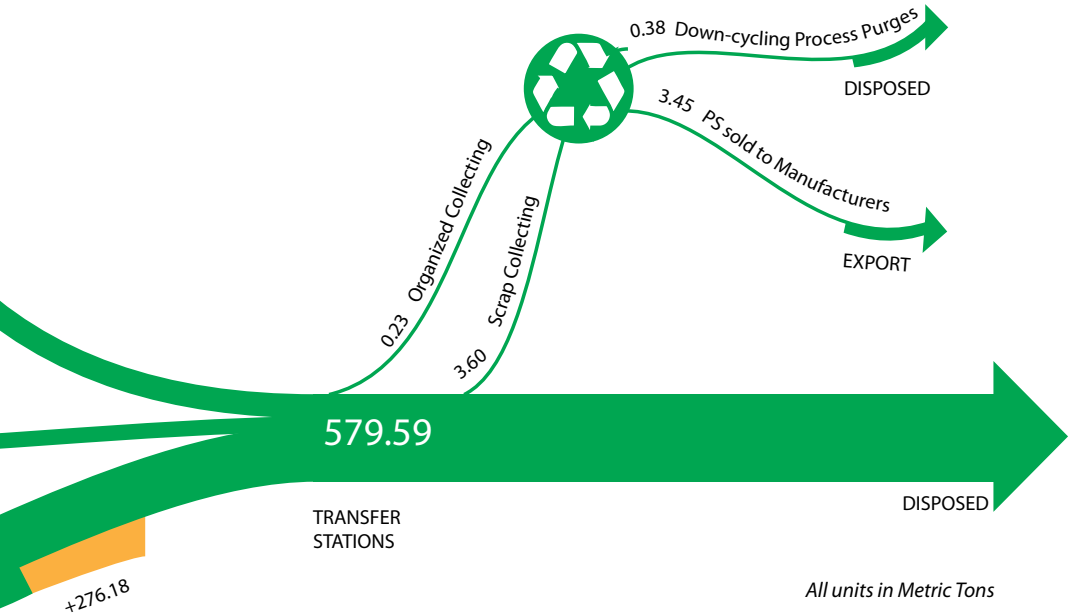
Safe recycling of Expanded Polystyrene (EPS) in Bangalore

Duration: November 2010 – April 2011

Expanded Polystyrene (EPS) also known as Thermocol™ in India is used in a wide range of applications; insulation and packaging being two of the largest, across the world. Due to its very low recovery value, large amounts of EPS are most often disposed of at land-fills or sometimes incinerated at the end of life. Incineration of EPS hasn't been implemented in Bangalore due to the need for expensive technology for complete combustion of EPS to avoid pollutants. EPS waste is relatively safe in the environment due to its inert nature, however due to a very low density and large volumes being produced, it uses up valuable resources, energy and land-fill space. Disposed EPS is also a major cause of waterway blockages. The current study focuses primarily on EPS used for packaging of electronic and consumer goods.

Recycling of EPS is primarily constrained by transport costs due to its dispersed disposal, short useful lifetime and low density. This low density bulky material, results in high transport cost per unit weight, thus making its recycling economically unfavorable. This study is based in Bangalore, a representative of a large and fast growing Indian metropolitan city, in addition to being an Information Technology hub.

A previous study at ROI in 2009 (Safe recycling of EPS: Part I, *http://www.roi-online.org/ongoing_projects.htm*) had discovered that very little down-cycling of EPS (EPS to Polystyrene) is currently present within the city. This previous study also identified important stakeholders in this system and qualitatively mapped the flow of EPS.



The current project expands on the previous study by quantifying and assessing the flows of EPS across Bangalore city, focusing on consumption and disposal patterns, while accounting for import influx and product outflow, in order to assess the economic feasibility for recycling of this material. Results of this investigation shall aid in making informed decisions on strategies to move up the waste management hierarchy by upgrading from down-cycling (EPS to Polystyrene) to recycling (EPS to EPS). The investigation will also discuss the limitations of the current scenario, and propose implementable strategies for economically viable recycling of EPS in Bangalore.

A Substance Flow Analysis (SFA) approach was used to assess all the flows, identify the crucial points of focus and gaps within the EPS lifecycle within the city. A combination of literature research, interviews with various stakeholders, governmental and non-governmental organizations, sampling and data collection in the field were used to compile the findings. A prominent obstacle faced during the data collection was lack of scientific information and records with authorities in charge of municipal solid waste disposal. Thereby, sampling and extrapolation were used to bridge these gaps. Additionally, various scenarios were explored for different uses of recycled EPS, for an enhanced collection process to aid recycling, along with an identification of possible stakeholders and partners who need to improve the use of existing infrastructure and make it economically beneficial to recycle this material. Recycling of EPS seems to be economically feasible through technology transfer from Europe, but it is most crucially dependent on an improved collecting process.

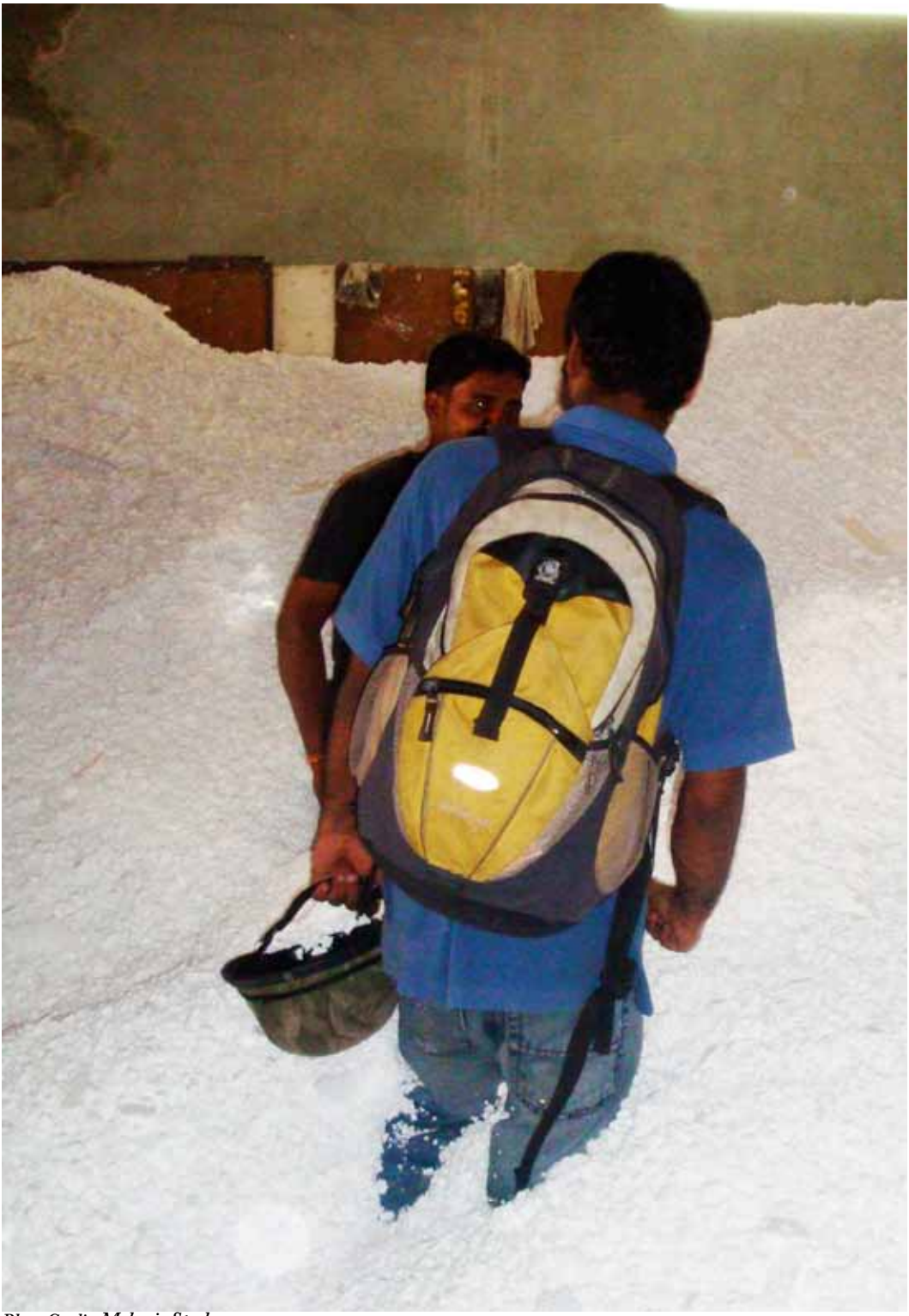


Photo Credit: Melanie Studer

Current recycling technologies are most optimal for recycling EPS for new insulation applications. The volume of down-cycling, already present in most manufacturing and independent recycling units, can be expanded and further complement this proposed recycling process.

Funding:
This study was funded through a grant from the University of Lausanne, Switzerland.

Researchers:
Loic Leray, Intern, ROI; Masters student at University of Lausanne, Switzerland;
Grishma Jain, Researcher, ROI

Facing page: ROI Researchers walking through EPS beads
Below: EPS beads

Photo Credit: Melanie Studer

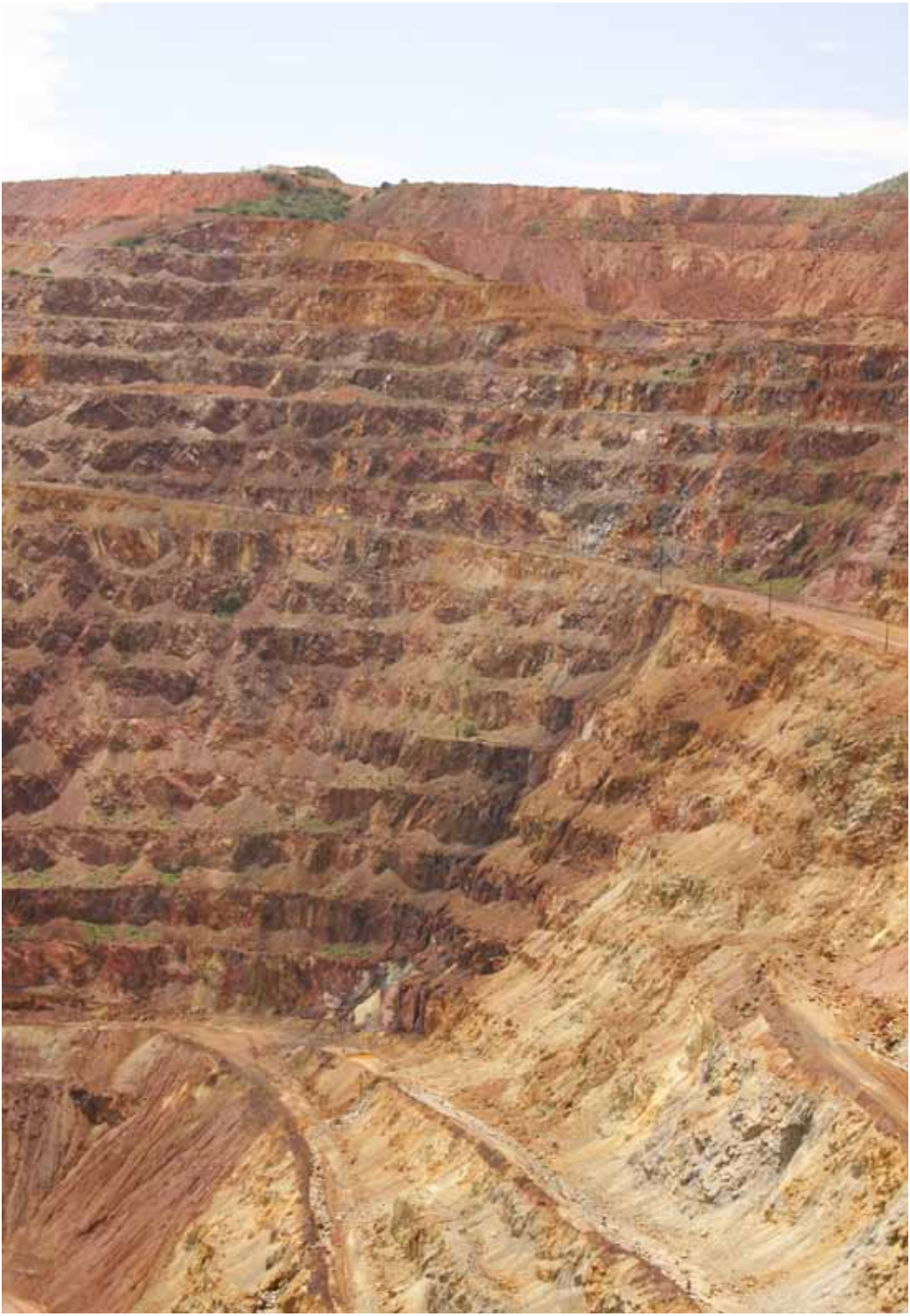


Photo Credit: http://www.morguefile.com

Formatting Material Flow Analysis (MFA) into Life Cycle Inventory (LCI) format using ecoinvent database template ecospold

Duration: November 2010 – January 2011

The main objective of this project was to illustrate the benefits of formatting and expanding pre-existing Material Flow Analysis (MFA) datasets in the Indian textile industry (cotton and silk), pig iron industry and paper industry into Life Cycle Inventories (LCIs). These LCIs provide pertinent information on environmental life cycle impacts of industrial processes in India with the long-term goal of creating sustainable supply chains at the national and global level.

Data was primarily collected for constructing MFAs to inform strategies for optimizing energy and resource flows to reduce adverse environmental impacts. This data is converted into LCI formats using EcoEditor Version 3. MFA datasets have geographical boundaries and lack inputs of infrastructure, primary resources from upstream processes and details on components of emissions to the environment; therefore they are not entirely sufficient to assess the overall impact of a particular product. In this investigation additional information on input of infrastructure and output of emissions to the environment for these varied processes was collated from secondary sources. Investigations on the main supply chain of the two textile industry sectors (cotton and silk), the pig iron industry and the paper industry need to be conducted at the next stage.

National datasets on primary resource use such as that for water, energy, fuels and electricity are of cardinal importance for Life Cycle Assessment (LCA); further research on these aspects will help provide complete LCA datasets that can be used to inform national and international policies so as to facilitate industrial processes and consumption of products and services with lesser overall life cycle impacts. This investigation illustrates that MFA data for industrial processes in developing countries can be used to broaden the application of information already collected without having to create new LCI datasets from scratch. Furthermore, this methodology provides a framework for compiling LCIs in developing countries at relatively lower investigation costs.

Funding:
This project was partly funded by Ecoinvent, Swiss Center for Life Cycle Inventories.

Researchers:
Laure Müller, Voluntary intern, ROI; Graduate from Swiss Federal Institute of Technology (EPFL), Lausanne, Switzerland;
Mariane Schneider, Voluntary intern, ROI; Masters student Swiss Federal Institute of Technology (ETH), Zurich, Switzerland

Facing page: *Copper Mine*

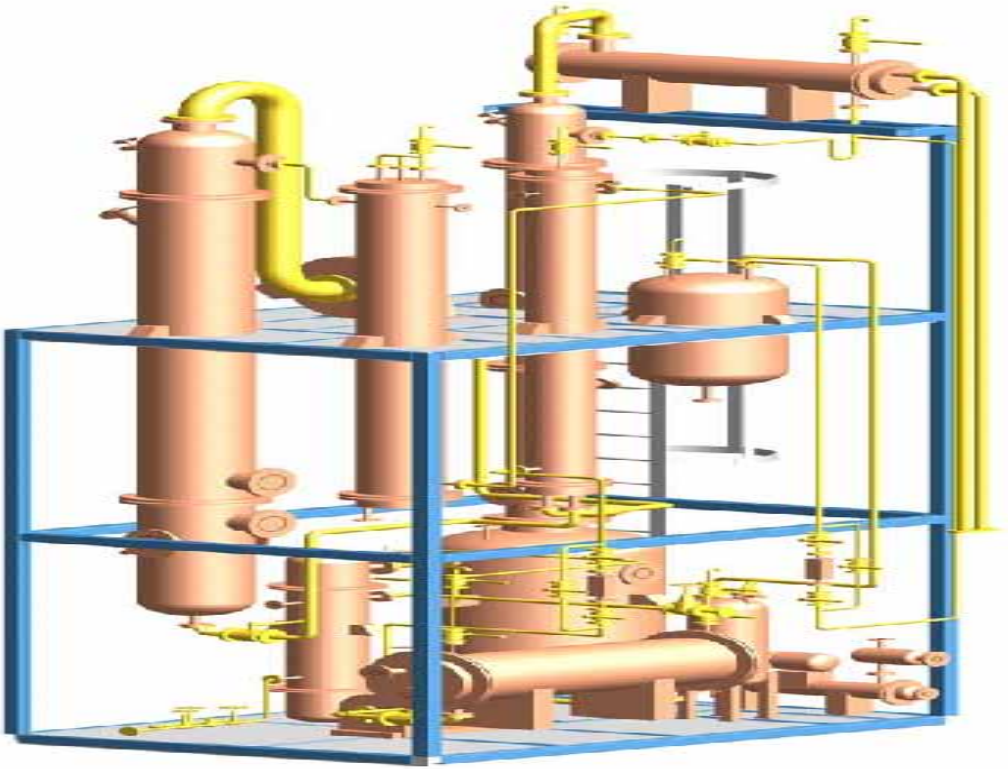


Photo Credit: Zen Consultants, Hyderabad, India

Gaseous solvent recovery from bulk drug industries, Hyderabad, Andhra Pradesh

Duration: November 2010 – March 2011

Currently, the Indian pharmaceutical industry is one of the world's largest, ranking 4th in volume terms and 13th in value terms. The country accounted for 8 percent of global production and 2 percent of world markets in pharmaceuticals in the year 2008. The cluster of bulk drug and pharmaceutical industries around the cosmopolitan city of Hyderabad in south India is currently recognized as the bulk drugs capital of India. Known for its bulk drugs, this cluster exhibits a lot of diversity in the type of companies, their views, products, type of R&D, focus, strategy, and vision. Currently the Bulk Drug Manufacturers Association, Andhra Pradesh has around 450 industry members, of these 300 industries are situated around Hyderabad.

The purpose of this project is to facilitate large scale implementation of technologies that capture and reuse volatile organic compounds (VOCs) from these industries. Additionally the amount of organic solvent emitted in liquid effluent from the facilities will be estimated. This investigation is focused on the prominent bulk drug and pharmaceutical industry around Hyderabad.

Recommendations and results from the investigation will highlight the economic and environmental benefits of such solutions that optimize resource use in industries. Additionally we will evaluate previous attempts of how new technologies diffuse in these clusters and identify important variables that affect the extent to which new technologies or strategies are adopted by large numbers of industries. These variables include the role of innovation leaders, adopters, multipliers, opinion leaders, and other strategies to develop a market to facilitate adoption of new technologies.

Funding:
This project is funded by the Foundation for MSME Clusters, New Delhi, India from a Department of Science & Technology (DST), Government of India grant for "Promoting Innovative Clusters in India".
This project is in collaboration with the Center for Development Finance (CDF), Institute for Financial Management and Research (IFMR), Chennai, India.

Researchers:
Lokanath S., Researcher, ROI;
Ashish Kumar Chicksena, Center for Development Finance, Institute for Financial Management and Research, Chennai, India

Facing page: *3D view of pilot scrubber*

Photo Credit: Grishma Jain

Potential changes in biomass flows due to India's biodeisel policy: A comparative Material Flow Analysis (MFA) of the Jatropha curcas and Prosopis juliflora economies in Tamil Nadu, India.

Duration: December 2010 – May 2011

India's current biodiesel policy mandates the use of non-edible oilseed feedstocks grown exclusively on 'wastelands', the country's term for degraded and marginal lands. In recent years, the Government of India has heavily supported the use of *Jatropha curcas* as a biodiesel feedstock because of its alleged ability to thrive in marginal landscapes. However, India's wastelands are often rich in local biomass resources that support a host of livelihood and industrial activities.

This study will present a comparative Material Flow Analysis (MFA) of the biofuel and biomass economies in Virudhunagar District, Tamil Nadu. The South Indian state of Tamil Nadu has been one of the leading promoters of *Jatropha curcas* biodiesel production and the areas targeted for *Jatropha curcas* cultivation are densely covered with a local biomass resource *Prosopis juliflora*.

Facing page: *Charcoal from Prosopis juliflora wood*
Below: *Firewood stove in match industry*

Photo Credit: **Grishma Jain**

At present, *Prosopis juliflora* is used as a fuel wood by local villagers, and brick, charcoal, cement and electricity production industries. Our analysis will evaluate the resource flows of these two energy economies and assess environmental and social tradeoffs of replacing *Prosopis juliflora* with *Jatropha curcas*.

Funding:
This project is funded by the Center for Industrial Ecology, Yale University, USA.
This project is in collaboration Jennifer Bakka, Ph.D. candidate, School of Forestry and Environmental Studies, Yale University.

Researchers:
Grishma Jain, Researcher, ROI;
Megha Shenoy, Research Director, ROI;
Jennifer Bakka, Ph.D. candidate, School of Forestry and Environmental Studies, Yale University, USA

***Below:** Jatropha curcas shrub*

Photo Credit: Megha Shenoy

ROI ACTIVITIES

2010

Outreach

Conferences, Workshops, Presentations and Courses

- Shenoy, M. 2010. Energy for Sustainable Development (E4SD) Policy Dialogue: Financing mechanisms for renewable energy and energy efficiency projects in developing countries. Delivered by the International Institute for Industrial Environmental Economics (IIIEE) at Lund University, Sweden, in collaboration with the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), and the Global Network on Energy for Sustainable Development (GNESD). 23 August – 3 October.

- Shenoy, M., Kumari, R., Lokanath, S. 2010. Challenges for improving energy efficiency, water recycling and reducing carbon di-oxide emissions for cottage-scale industries in southern India. Summer Symposium on Sustainable Systems (4S). Conducted by Alto University at Sannäs, Finland (Oral presentation by M. Shenoy). 14-17 June.

- Shenoy, M. 2010. Presentation on 'Industrial Ecology and Resource Optimization Initiative'. Summer School for EPFL Graduates in Bangalore. Conducted at Center for Electronics Design and Technology, Indian Institute of Science, Bangalore, India. (Oral presentation by M. Shenoy). 20 August.

- Lokanath, S., Muller, L., Shenoy, M. 2010. Workshop on 'Life Cycle Assessment (LCA)'. Conducted by CII-Sohrabji Godrej Green Business Center, Hyderabad, India and Ecoinvent, Switzerland. 29 September – 1 October.

- Shenoy, M. 2010. Presentation on 'Industrial Ecology: Strategies for Sustainable Societies' at Enzen Global, Bangalore, India. (Oral presentation by M. Shenoy). 9 November.

- Shenoy, M. 2010. Presentation on 'Industrial Ecology: Analogies between Natural Ecosystems and Industrial Ecosystems' at the Department of Management Studies, Indian Institute of Sciences, Bangalore, India. (Oral presentation by M. Shenoy). 12 November.

- Shenoy, M. 2010. Presentation on Industrial Symbiosis in India. 3rd Workshop on Environment Management System organized by Confederation of Indian Industry and Karnataka State Pollution Control Board at Makino India Whitefield, Bangalore, India. (Oral presentation by M. Shenoy). 20 December.

Publications

- Shenoy, M., Jain, G., & Parthasarathy, T. Indian energy policy and strategy: pre and post COP 15. International Development Policy Series. Published by the Graduate Institute, Geneva, Switzerland (in press).

- Bain, A., Shenoy, M., Aston, W. & Chertow, M. 2010. Industrial symbiosis and residual flows in an industrial area in south India. Resources, Conservation and Recycling. 54(12): 1278-1287.

- Eckelman, M.J., Shenoy, M., Ramaswamy, R., & Chertow, M. 2010. Applying industrial ecology tools to demand-side water management in Bangalore, India. Asian Journal of Water, Environment and Pollution. 7(4): 71-79.

Internships

Resource Optimization Initiative (ROI) provides a stimulating environment to carry out research internships in designing novel means for resource management in the context of developing countries. We have a growing network of interns who have worked with us over the years.

November, 2009
Samuel Wicki completed a two month internship in Nov-Dec 2009 at ROI. He worked on 'Expanded Polystyrene (EPS) Recycling in Bangalore'. Samuel has completed his undergraduate studies at the University of Lausanne, Switzerland and is currently pursuing his Masters degree in indutrial ecology offered by Leiden University, Delft University of Technology, and Erasmus University Rotterdam, The Netherlands.

Melanie Studer completed a two month internship at ROI. She worked on 'Expanded Polystyrene (EPS) Recycling in Bangalore'. Melanie has completed her undergraduate studies at the University of Lausanne, Switzerland. Melanie is currently pursuing her Masters degree in indutrial ecology offered by Leiden University, Delft University of Technology, and Erasmus University Rotterdam, The Netherlands.

January, 2010
Rashmi Kumari completed a four month internship at ROI for her Masters thesis at TERI University, New Delhi. She investigated sustainable strategies to improve energy efficiency, water recycling and reduce carbon emissions in the silk reeling facilities around Bangalore. Rashmi is currently Business Development Manager, Promptec Renewable Energy Solutions Pvt. Ltd., Bangalore.

Arsha Branson completed a one month internship at ROI. She worked on sustainable strategies to improve energy efficiency, water recycling and reduce carbon emissions in the silk reeling facilities

around Bangalore. Arsha has recently completed a Bachelors degree in Economics and Social Science, at Sydney University, Australia and is interested in working in the development sector.

June, 2010
Sandipan Sarangi completed a two month internship at ROI for his Masters thesis at TERI University, New Delhi. He examined the feasibility for reusing rice husk ash from rice mills in Tumkur, Karnataka as a raw material for making cement bricks. Sandipan will complete his degree in April 2011.

September, 2010
Loïc Leray completed a two month internship at ROI for his Masters thesis at the University of Lausanne, Switzerland. He quantified the amount of discarded Expanded Polystyrene, also known as Thermocol, using the Substance Flow Analysis (SFA) framework. He then assessed financial feasibility for recycling EPS in Bangalore.

Laure Müller completed a two month internship at ROI on Life Cycle Inventory (LCI) of the silk reeling industry in south India. Laure was trained at Ecoinvent, Dubendorf, Switzerland to convert MFA data into the LCI Ecoinvent format. The data sets she compiled will contribute to our understanding of the Life Cycle Impacts of Mulberry silk that is reeled in south India. Laure completed her Masters in Environmental Engineering from École Polytechnique Fédérale de Lausanne (EPFL), Switzerland.

December, 2010
Mariane Schnieder completed a two month internship at ROI on Life Cycle Inventory of Foundries in Haora, West Bengal, India. Mariane was trained at Ecoinvent, Dubendorf, Switzerland to convert MFA data into the LCI Ecoinvent format. The data sets compiled during this internship will contribute to our understanding of the Life Cycle Impacts of Cast Iron manufactured by small scale foundries in India. Mariane is currently doing her Masters in Environmental Engineering from the Swiss Federal Institute of Technology (ETH), Zurich, Switzerland. .

Website Development, Search Engine Optimization and Web Analytics

ROI's website *www.roi-online.org* was originally developed in 2005. In 2010 we have re-furbished its pages to reflect its current activities. The website currently has 10 web pages relating to ROI's activities. It also has an educational section on indutrial ecology with a repository of 370 case studies and 285 specialists. Two new sections: (i) a repository of books on industrial ecology, (ii) a series of cartoons titled Professor Planet have been recently added to the website.

ROI's website is currently being search engine optimized by a Bangalore based company – Semkraft. Search Engine Optimization will improve ROI's websites visibility in search engines such as Google, Yahoo and Bing. Thereby, users will be able to get to ROI's website when they search for our activities, on search engines. This will also enable interested collaborators, universities, institutes and funding organizations to contact ROI easily.

Along with SEO Semkraft is also providing web analytics services for ROI's website. This is a tool to measure and report a website's user profile. This tool can be used to assess how many users visited ROI's website, which pages they spent time on, and the country of these users. Such information will then be used to increase the relevance of ROI's website and educational section.

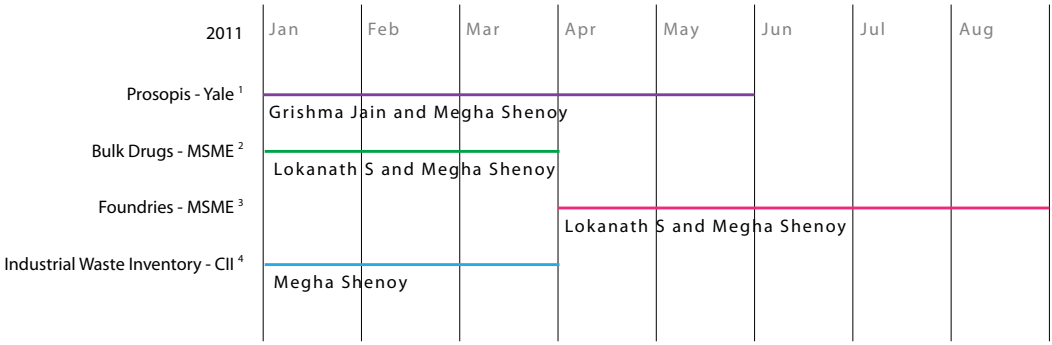
ROI on Google Maps

ROI's office location is now on Google Maps. This placeholder will help visitors easily locate our office in Bangalore.

ROI ACTIVITIES

2011 Outline

ROI Resource Persons

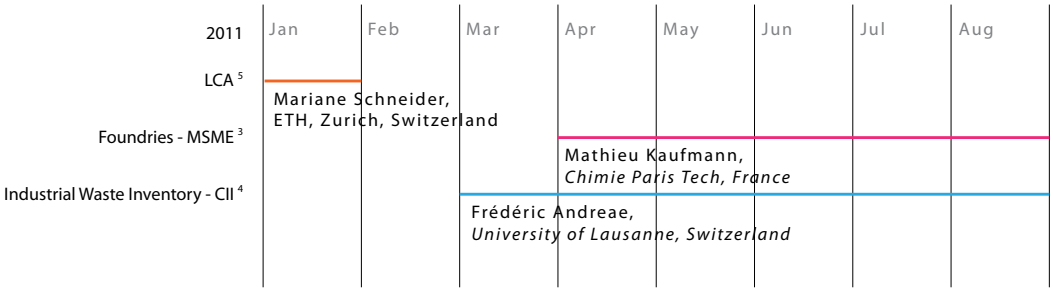


1: Potential changes in biomass flows due to India's biodiesel policy: A comparative Material Flow Analysis (MFA) of the *Jatropha curcas* and *Prosopis juliflora* economies in Tamil Nadu, India.
Funded by Center for Industrial Ecology, Yale University, USA.

2: Gaseous solvent recovery from bulk drug industries, Hyderabad, India
Funded by Foundation for MSME Clusters, New Delhi, India.

3: Environmental and social analysis of cluster of foundries in Samlakha, Haryana.
Funded by Foundation for MSME Clusters, New Delhi, India.

Internships



4: Compiling an industrial residual inventory for Jigani Industrial Area (300 industries) and Bommasandra Industrial Area (629 industries) in Bangalore to provide sustainable strategies for reuse, recycling and recovery.
Funded by Confederation of Indian Industry, Karnataka, India.

5: Formatting Material Flow Analysis (MFA) data into life cycle inventory format using Ecoinvent database template Ecospold.
Voluntary internship technically advised by Ecoinvent, Switzerland.

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