POST-CONFERENCE REPORT

National Conference on
AIR AND WATER POLLUTION

Innovations in Regulation, Abatement and Monitoring

EPIC INDIA
ENERGY POLICY INSTITUTE
AT THE UNIVERSITY OF CHICAGO

सत्यमेव जयते
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National Institution for Transforming India

THE UNIVERSITY OF CHICAGO | Center in Delhi

Contents

Executive Summary

On the 7th of July, 2017, EPIC India, in association with NITI Aayog, organized a conference to discuss the current state of pollution regulation in India, and outline innovative pathways to alter the status quo into a more efficient and effective system. Speakers touched upon different topics, ranging from governments faced with conflicting goals of environmental protection and economic development to the need for better information and stronger enforcement. A common thread that tied these discussions together is the use of economic instruments to resolve conflicts of interest through markets.

The challenges faced by Indian environmental regulators are multidimensional. India has witnessed a giant leap in improving the ease of access to pollution data over the past two decades. However, inequitable expansion of monitoring stations across rural, urban and industrial areas of the country has resulted in a gap in information. Current penalty structures encourage perverse incentives to pollute as the costs of violating the standard can be lower than the costs of sustainably complying.

There has historically been a lack of sufficient, reliable information on emissions. This problem is now being tackled through the use of Continuous Emissions Monitoring Systems (CEMS). CEMS remains a work in progress, and presently regulatory action based on data from CEMS is yet to be allowed by law.

Indian environmental regulations are almost always designed from a technological or legal standpoint, and rarely from the lens of enhancing socio-economic well-being. However under command and control mechanisms they impose high compliance costs. There is therefore scope for markets to re-align incentives for the regulators, so that they have a unified goal of achieving maximum emissions reductions at

the lowest possible costs. To implement a robust market, three necessary pre-requisites need to be achieved:

- to obtain high quality, reliable data
- to achieve complete data transparency
- to accurately compute the value of unintended costs imposed on society and the environment and incorporate them into the design of the market

While these conditions are not sufficient by themselves, when achieved together, they promise to create a resilient framework that may be suitable for the market to deliver its expected results.

Markets, however, are not the solution to every problem. To effectively resolve any problem, it is important to take stock of the differences between intended outcomes and actual results. The objective of this conference was to determine opportunities to reinvent the Indian environmental regulatory and political regime, and some important questions were raised to this end:

- Is there a need for a separate body of experts from academia, industry, policy and regulation who can contextualize technologies from other countries to India?
- How can we get more information to address immediate crisis as well as understand long-term trends? How can this information be made available in the public domain?
- If we need administrative fines, then who should collect these fines and what should the money be used for?
- How can SPCBs take on advisory roles and facilitate innovation?

Learnings and Recommendations from the conference

India's emissions reduction targets may be achieved by working at the nexus of emissions and energy pathways. Policymakers and regulators need to revisit the link between the environment and public health. There is growing evidence of the positive impacts of market-based instruments on improved energy access, and protecting the environment and public health while minimizing India's climate change impact.

To ensure a functioning market, it is necessary to have credible data, transparency, and effectively enforce penalties, accounting for unintended costs imposed on society and the environment. While these conditions are not sufficient by themselves, when achieved together, they promise to create a resilient framework that may be suitable for the market to deliver its expected results.

Command-and-control Regulation: Successes and Challenges

- The current regime of regulation encourages regulatory action only when met with dire circumstances, resulting in weak monitoring and enforcement.

- Command and control approaches have seen partial victories across the country, such as mandating the installation of Air Pollution Control Devices across industries and catalytic converters as well as via action plans drawn by the Supreme Court. Schemes such as the odd-even scheme for regulating air pollution from vehicles in Delhi, have not had any long-term effect on ambient air quality. This highlights the need to test policy experiments through pilot studies before rolling them out to a large population.

Information and Transparency

- Currently, the rollout of online monitoring stations is skewed heavily towards metropolitan hubs. In less densely-populated cities as well as in rural areas, there are inadequate and ill-placed monitoring stations, rendering the data transmitted a poor representation of ambient air quality in that location. There is a need to acknowledge the fact that air pollution is not limited to urban areas, but is a truth in rural areas as well. Sufficient monitoring stations are required such that data obtained is representative of the city and produces a statistically strong sample.

- More information needs to be in the public domain. Sharing information and improving transparency brings about market forces that are invisible while using command and control

More than 20 officials from state pollution control boards from 14 states pose for a photograph along with some speakers at the National Conference on Air and Water Pollution on 7th July in New Delhi.

regulation. An example of such an initiative is the Maharashtra Star Rating scheme.

Legal Framework

- The current environmental justice mechanism is not functioning the way it was intended. Skewed timelines, exacerbated by acquittals, combined with institutional problems pose significant challenges to the system. Moving from criminal to civil courts may partially improve the system but many procedural challenges remain.

Monitoring and Enforcement

- There is need for institutional innovation; to exercise social and economic elements of enforcement, in addition to considering technological feasibilities and legal obligations. There is an opportunity to redefine environmental compliance and move away from a largely self-monitoring, self-reporting regime. Taking stock of the differences between expected outcomes and actual results is a significant step towards reinventing the regime of environmental compliance.

- Continuous emissions monitoring systems may significantly improve monitoring of pollution, provided careful attention is paid to calibration and auditing. In addition there must be the proper integration of these instruments into the regulatory process.

- There are multiple opportunities to innovate, including streamlining consent approvals, reallocating manpower to focus on compliance monitoring, aligning incentives to comply by altering payment structures, improving information and moving towards using market-based instruments.

- It may be valuable to alter the dynamics of the relationship between SPCBs, the public and the industries. The SPCB needs to be viewed as a facilitator, not just a regulator, who may serve in an advisory role to industries and work closely with them to achieve their compliance targets.

Experts exchange thoughts with different stakeholders during one of the sessions.

Market-based Regulation: Successes and Challenges

- Markets help to align economic incentives and seemingly conflicting goals of economic development and environmental protection at lower costs. It rewards innovation and provides flexibility for businesses, thereby creating economic incentives to reduce a much greater amount of pollution at the same cost of compliance.

- The cap-and-trade amendment to the Clean Air Act in the 1990s yielded benefits that were approximately thirty times greater than the costs. SO_2 emissions drastically reduced within a very short period and there was greater electricity generation per unit of fuel and actual costs were much lower than anticipated costs. These demonstrations of the value of markets for achieving cost-effective emission reductions stimulated the adoption of environmental markets for greenhouse gas emissions in some European countries and California.

Conference Proceedings

Plenary
Overview

In the aftermath of the creation of the National Energy Policy by NITI Aayog, there is much opportunity to work at the nexus of emissions and energy pathways to achieve India's emissions reductions targets. A gap between economic theory and practice needs to be bridged by conducting extensive research on the health impacts of pollution levels, energy pathways and sustainable lifestyles. India has taken a step towards massive clean energy development as an attempt to sew the dichotomy between the Global North and South.

Inequity in consumption patterns across South Asia Pacific and the world at large call for the need for environmental consciousness, which requires thinking at all levels, heavily geared towards the environment. The pressuring rise in global temperatures, interconnectedness of the global economy combined with the complexity of transboundary problems, juxtaposed with the need for development make pollution seems like an insurmountable problem.

A history of international conventions aiming to bring a consensus among countries on climate change adaptation and mitigation strategies, from Stockholm to Paris, have culminated in a progressive and successful agreement with wide scope for innovation. However, in order to innovate, world leaders need to find intermediate paths in a polarized atmosphere of environmental consciousness. Improving ease of public access to conflict resolution can be a major driver in revisiting the link between the environment and public health.

The belief that access to environmental justice should be easy and robust is realized in the wide jurisdiction of the National Green Tribunal to resolve environmental disputes. As a result, the Tribunal has made a tremendous breakthrough in adjudications, by consulting stakeholders. High-level regulator meetings have often aided in identifying and addressing challenges to implementing decisions by the Tribunal. There remains much room for innovation, and there is a need to do away with the supervisory regime, to instead use methods that align incentives through environmental principles using economic benefits.

SPEAKERS

- Swatanter Kumar, *Chairperson, National Green Tribunal*
- Anil Jain, *Energy Advisor, NITI Aayog*
- Michael Greenstone, *Milton Friedman Professor in Economics and the College, University of Chicago and Director, EPIC*

Using economic instruments to resolve environmental problems significantly reshapes the idea that having access to energy, clean air and clean water should be a right. Rather, markets operate on the principle that these goods need to be treated as private goods. Multiple instances from Michael Greenstone's research in India and China provide evidence that fiscal incentives are instrumental in resolving three major conflicts of interest faced by Indian policymakers.

Honourable Justice Swatanter Kumar, Chairperson National Green Tribunal gives the opening keynote address at the National Conference on Air and Water Pollution: Innovations in Regulation, Abatement and Monitoring on 7th July in New Delhi.

- **Gaining access to inexpensive and reliable sources of energy:** The use of a revised business model for distribution companies in Bihar encouraged those to pay more to receive more electricity. This model led to a 40% increase in revenue of the distribution companies, which further fed into increasing overall electricity supply.

- **Protecting the environment and public health:** China's heating policy led to a dramatic increase in air pollution, an unintended consequence. Intended beneficiaries had reduced life expectancy because they were persistently exposed to higher levels of pollution.

- **Reducing India's climate change impact:** The use of third party audits in Gujarat significantly reduced instances of under-reporting and lowered industry emission levels.

Most countries establish standards based on awareness of the impact of particulate matter pollution on human health. However, it requires tremendous effort and costs from regulators to exercise these norms. Conflicts of interest often lead to undesirable outcomes such as corruption. Markets aid in resolving these conflicts of interest by aligning incentives of stakeholders, which can lead to desirable outcomes.

Shri Anil Jain, Advisor - Energy, NITI Aayog greets Michael Greenstone, Milton Friedman Professor in Economics and the College, University of Chicago and Director of the Energy Policy Institute at the University of Chicago; at the National Conference on Air and Water Pollution in New Delhi.

Session 1. Command and Control: Successes and Challenges

Overview

Historically, India has employed the following strategies to regulate pollutants: absolute performance-based standards, technology mandates and bans and rationing. The effectiveness of enforcing these strategies is extremely dependent on the accuracy of data collected. However, collecting good data does not necessarily translate to effective regulation. Due to the severity of punishments meted out to violators, action is taken only when regulators are faced with dire circumstances.

SPEAKERS

- V. Rajagopalan, *Former Secretary, MoEF&CC*
- TSR Subramanian, *Former Cabinet Secretary, Government of India*
- Santosh Harish, *Associate Director of Research, EPIC India*

Dr. Rajagopalan cited the example of remediating contaminated sites across the country. The government has spread itself thin by implementing remediation programs in just eight sites, of an estimated total of 557 contaminated sites

requiring urgent remediation. Random inspections are conducted at extremely low frequencies, varying from once in every one to five years, and do not serve as reliable sources of information. An unfortunate outcome of this kind of weak monitoring and enforcement mechanism is that polluters cannot be identified, and therefore, held responsible.

While technology mandates are easy to enforce, they do not necessarily result in lower pollution levels as it requires substantial follow-up to check if the technologies are being used and well-maintained. Command and control approaches have seen partial victories across the country, such as mandating the installation of Air Pollution Control Devices across industries and catalytic converters as well as via action plans drawn by the Supreme Court. Schemes such as the odd-even scheme for regulating air pollution from vehicles in Delhi, have not had any long-term effect on ambient air quality. This highlights the need to test policy experiments through pilot studies before rolling them out to a large population.

Substantial progress has been made in installing continuous emissions monitoring systems in highly polluting industries across the country. However, there remains a huge gap that needs to be bridged; there are multiple industries that are not circumscribed within the definitions of CPCB's highly polluting categories, but are severely polluting nevertheless, and need to be monitored.

The status quo of online monitoring of industrial pollution in India leaves much to be desired. Amendments to the Air and Water acts are required for regulators to be able to take action based on online emissions data from these units.

The way forward to reduce overall pollution is developing cluster-wise standards instead of individual standards, like the Zero Liquid Discharge mandate for improving the quality of rivers, which applies at the Common Effluent Treatment Plant level. Polluters may be identified using a variety of accounting methods including day-night and seasonal variances. However, online monitoring is critical to the success of these enforcement mechanisms.

The current system of pollution regulation allows transferability of ownership of the pollution problem. The function of the judiciary is not to manage the environment, rather, to resolve individual issues. Institutional reform may facilitate better environmental governance, either by the constitution of a new task force or through the formation of a comprehensive body consisting of technical experts and academicians, who would focus on incorporating learnings from international experiences and contextualizing them to the Indian regulatory regime.

T.S.R Subramanian, Former Cabinet Secretary and V Rajagopalan, Former Secretary, MoEF&CC talk about successes and challenges of Command and Control mechanisms at the National Conference on Air and Water Pollution in New Delhi.

Session 2. Information and Transparency

Overview

Nationwide dispersion of pollutants across the Indian subcontinent is uneven, with some areas requiring urgent attention, and many that do not. Trends in air and water quality differ by geography and season, among other factors. While pollution levels remain severe in the Indo-Gangetic plain, there are significantly lower levels in the South, which has a huge advantage due to the monsoons.

Currently, the rollout of online monitoring stations is skewed heavily towards metropolitan hubs such as Delhi and Mumbai. In less densely-populated cities as well as in rural areas, there are inadequate and ill-placed monitoring stations, rendering the data transmitted a poor representation of ambient air quality in that location. There is a need to acknowledge the fact that air pollution is not limited to urban areas, but is a truth in rural areas as well. Sufficient monitoring stations are required such that data obtained is representative of the city and produces a statistically strong sample.

Installing online monitoring station requires not only purchasing the right equipment; there is also a need for additional manpower as well as the development of a robust data acquisition system. With increasing media and regulatory attention directed towards continuous monitoring stations, the need to understand sources of pollution is more than ever.

SPEAKERS

- AK Mehta, Joint Secretary, MoEF&CC
- Kate Logan, Green Choice Outreach Director, Institute for Public and Environmental Affairs, China
- Sarath Guttikunda, Co-Director, UrbanEmissions
- VM Motghare, Joint Director (Air), MPCB

Public access to pollution monitoring data has vastly improved over the past decade. The development of different metrics has made it easy to interpret this data (such as the National Air Quality Index) and has aided in raising public awareness.

However, much more information is required to use data to tell stories to regulators, the public, civil societies, journalists and other stakeholders. A robust database needs to be built that may be used to create a pollution inventory to observe short-term as well as long-term changes in pollution levels.

A.K. Mehta JS (IC&SD), Ministry of Environment, Forests & Climate Change, Government of India answers questions related to importance of information and transparency in environmental regulations at the National Conference on Air and Water Pollution in New Delhi.

The following questions were raised by Dr. Guttikunda during this session, emphasizing the need for more information in the public domain:

- Do we have enough data to be able to understand trends daily?
- How can we address minor, acute issues? Do we have access to real-time data?
- Can we link pollution data to public health?
- How can we improve from a spatial and temporal perspective, so that we have better information to make more accurate forecasts?

The CEMS rollout mandated in 2014 by the Central Pollution Control Board is supposedly the largest movement that the world has seen towards online monitoring. While this rollout is taking place at a rapid rate across industries, the assessment of data availability and quality is pending. Mr. Mehta clarified that the government does not plan to make this data available in the public domain (currently), as this massive technology transition has been envisioned to encourage self-regulation. He further indicated at the development of a clear action plan for addressing air pollution across 100 cities which would be revealed later in 2017.

Kate Logan discussed her organization's focus on issues of enforcement and motivation rather than of technology and funding. Sharing information and improving transparency brings about market forces that are invisible while using command and control regulation. A commonality between environmental compliance in China and India is that the cost of violations is lower than cost of compliance. This means that it is cheaper to pay fines than to fix the issue, a problem which can be resolved through markets. IPE simply facilitates public access to information that is already publicly available, and has led to a massive increase in regulatory action. Providing the general public real-time access to industrial compliance has provided a push to the government as well as to the industrial violators. To work within the provision that real-time data may not be used to impose a penalty until a site visit is conducted, IPE has created a platform where regulatory agencies can be tagged on individual industry reports through social media.

MPCB's own efforts to improve information and transparency in the public domain were highlighted by Dr. Motghare while discussing the star rating program for roughly 200 industries across Maharashtra. This program aims to encourage self-regulation and influence pollution levels by making industry environmental performance ratings publicly available and has significant implications for improving public and media awareness about particulate matter pollution from industrial sources.

Session 3. Legal Frameworks

Overview

SPEAKERS

- Shibani Ghosh, *Fellow, Centre for Policy Research*
- Shruti Rai Bhardwaj, *Joint Director, MoEF&CC*
- Mark Templeton, *Associate Clinical Professor of Law, Director of the Abrams Environmental Law Clinic, University of Chicago Law School*

Although pollution regulation in India may be carried out through administrative, criminal and civil channel, it largely relies on criminal enforcement mechanisms, resulting in imprisonment or fines determined by the court. Some administrative actions that may be taken by the Pollution Control Boards is issuing directions via closure, by restricting power supply to the industry for example, after issuing a show-cause notice and providing the polluting unit sufficient time to explain itself. In some parts of the country, regulators may ask for bank guarantees when the consent is issued, which will be forfeited in case of violation. However, the same action may be a legal issue in other parts of India. The civil courts, however, have limited jurisdiction over the Air and Water Acts. There is an extremely low number of registered offences, where a penalty has been imposed considering pollution as a civil wrong.

The current mechanism is not functioning the way it was intended. Skewed timelines, exacerbated by

acquittals, combined with institutional problems pose significant challenges to the system. Moving from criminal to civil courts may not improve the system as most procedural challenges remain. After Ms. Ghosh described limitations of current legal processes, she concluded her session with questions that needed to be answered, if the present framework is to be altered:

- Do we want administrative fines?
- Should we have an option of enforcement without going to court?
- Who should enforce/decide penalty structures?
- Who should the penalty amount go to?
- What should the money be used for?
- Are the appellate authorities sufficient?
- Should there be an interim order where the functioning of polluting units is stopped?
- Should the government have the power to compound offences through the Air and Water Acts?

The U.S. Clean Air Act Amendments between 1970 and 1990 initiated the first experiments using market-based regulation to address the acid rain issue through the sulfur dioxide and nitrogen oxide emission trading schemes. These programs, along with California's Regional Clean Air Incentives Market in the South Coast Air Basin, are widely viewed as successful. These demonstrations of the value of markets for achieving cost-effective emission

Participants interact with experts in one of the sessions at the conference.

reductions stimulated the adoption of environmental markets for greenhouse gas emissions in Europe and California. Professor Templeton walked the audience through the steps required to design a robust cap-and-trade system. Several important factors need to be considered such as the pollutant(s) to be regulated, spatial and temporal characteristics of the market as well as its intended participants. The allocation, price and tracking of permits is also crucial to the market's success. Devising penalties that perfectly account for direct and indirect costs of not meeting emissions targets is another key component of market design.

Session 4. Monitoring and Enforcement

Overview

Ms. Giles opened the session by discussing the impact of public disclosure on pollution levels. Following the national requirement for electronic submission of pollution information, the United States has seen a substantial decrease in pollution levels, once again demonstrating that transparency can change pollution outcomes. Although markets do not pose the right solution to every problem, market solutions have great potential for drastically reducing pollution at much lower costs. However, it is crucial to develop a robust market design well before implementation, and it is especially challenging to determine an accurate permit price. However well the market may be designed, there is always a significant gap between what intended outcomes and actual results.

SPEAKERS

- Cynthia Giles, *Former Assistant Administrator for Office of Enforcement and Compliance Assurance, USEPA*
- Akhila Kumar Swar, *Senior Environmental Engineer, Odisha State Pollution Control Board*
- Chirag Bhimani, *Deputy Environmental Engineer, Gujarat Pollution Control Board*
- Chandra Bhushan, *Deputy Director General, Centre for Science and Environment*

In the Indian context, while there exist legal provisions to ensure regulatory consent to establish or operate any polluting industry, there is little incentive for compliance. In the absence of financial penalties, regulators cannot operate on a spectrum of actions and are faced with binary choices of taking no action or resorting to drastic measures. Mr. Bhimani emphasized the severity of shortage in skilled manpower, leading to overworking and consequently, fatigue and lack of motivation to innovate among competent officials. Further, as their efforts are concentrated on pedantic procedures necessary to process consents and consent renewals, officials often lose focus of monitoring compliance of individual units -resulting in weak enforcement.

There are multiple opportunities to innovate, including streamlining consent approvals, reallocating manpower to focus on compliance monitoring, aligning incentives to comply by altering payment structures, improving information and moving towards using market-based instruments. Dr. Swar cited examples of initiatives taken by the Odisha State Pollution Control Board, including technological interventions to improve reliability of CEMS data, using novel penalty mechanisms such as bank guarantees, pollution charges and controlling production capacities. Going forward, it may be valuable to alter the dynamics of the relationship between SPCBs, the public and the industries. The SPCB needs to be viewed as a facilitator, not just a regulator, who may serve in an advisory role to industries and work closely with them to achieve their compliance targets.

Dr. Bhushan stressed the need for institutional innovation; to exercise social and economic elements of enforcement, in addition to considering technological feasibilities and legal obligations. There is an opportunity to redefine environmental compliance and move away from a largely self-monitoring, self-reporting regime. Taking stock of the differences between expected outcomes and actual results is a significant step towards reinventing the regime of environmental compliance. The need of the hour is to establish reliability of CEMS data from industries across the country. Improving the resilience of these monitoring systems before further expanding them is key to using this data for regulatory purposes.

Dr Akhila Kumar Swar, Senior Environmental Engineer, Odisha State Pollution Control Board (OSPCB) presenting experiences of OSPCB at the conference.

Session 5. Market-based Regulation: Successes and Challenges

SPEAKER

- Nathaniel Keohane, *Vice President, Environmental Defense Fund*
- Anant Sudarshan, *Executive Director, EPIC India*

Overview

The US SO_2 trading program is referenced as one of the most successful, completed programs with a lot of data. CEMS needed to be installed on the most polluting units and total caps went down over time. Regulatory analysis is a very important part of implementing innovative instruments. Markets help to align economic incentives and seemingly conflicting goals of economic development and environmental protection at lower costs. It rewards innovation and provides flexibility for businesses, thereby creating economic incentives to reduce a much greater amount of pollution at the same cost of compliance. Five elements that form the backbone of an effective market includes:

- Measurement
- Exchangeability
- Accountability
- Transparency
- Consistency

The cap-and-trade amendment to the Clean Air Act in the 1990s yielded benefits that were approximately thirty times greater than the costs! SO_2 emissions drastically reduced within a very short period and there was greater electricity generation per unit of fuel and actual costs were much lower than anticipated costs. This resulted in tremendous improvement in ambient air quality over the years and more market-based schemes were implemented across the United States.

Closing Address

SPEAKERS

- Anant Sudarshan, *Executive Director, EPIC India*

Overview

The state and the citizens of the country have equal responsibility to protect the environment. Polluters are important, so are those who breathe air of poor quality and those who reduce their emissions. It is important to be mindful of the health impacts of pollution and other externalities, which form the basis for imposing standards and caring about enforcement. The kind of penalties that we can levy are not important. Instead, we need to focus on the costs incurred to impose these penalties. Markets can help answer important questions such as:

- How do we cut air pollution at the lowest possible costs while creating incentives for plants to innovate?
- What are the social costs of these pollutants?

To ensure a functioning market, it is necessary to have credible data, transparency, and effectively enforce penalties. If market-based instruments are the destination, we will need to achieve these objectives along the way. Even if we do not reach the goal, the journey will still be useful.

Dr Anant Sudarshan, Executive Director of EPIC India giving the closing remarks at the conference

Annexure 1 - Agenda

AIR AND WATER POLLUTION: *Innovations in Regulation, Abatement and Monitoring*				
THE UNIVERSITY OF CHICAGO CENTER IN DELHI				*7TH JULY, 2017*
9:15 - 9:25	**REGISTRATION**			
9:25 - 9:30	**INAUGURAL REMARKS**			
	Shri Anil Jain, Advisor - Energy, NITI Aayog			
9:30 - 10:00	**OPENING KEYNOTE**			
	Honourable Justice Swatanter Kumar, Chairperson, National Green Tribunal			
10:00 - 10:30	**INAUGURAL ADDRESS**			
	Michael Greenstone, Milton Friedman Professor in Economics and the College, University of Chicago and Director, EPIC			
10:30 - 11:30	**SESSION 1: COMMAND AND CONTROL: SUCCESSES AND CHALLENGES**			
	V Rajagopalan Former Secretary, MoEF&CC	Santosh Harish, Associate Director of Research, EPIC India	T.S.R Subramanian Former Cabinet Secretary	
11:30 - 12:00	**BREAK**			
12:00 - 1:00	**SESSION 2: INFORMATION AND TRANSPARENCY**			
	A.K. Mehta JS (IC&SD), MoEF&CC	Kate Logan Green Choice Outreach Director, Institute for Public and Environmental Affairs, China	Sarath Guttikunda Co-Director, UrbanEmissions	V.M. Motghare Joint-Director (Air), MPCB
1:00 - 2:00	**BREAK**			
2:00 - 3:00	**SESSION 3: LEGAL FRAMEWORK**			
	Shibani Ghosh Fellow, Centre for Policy Research	Shruti Rai Bhardwaj Joint Director, MoEF&CC	Mark Templeton Associate Clinical Professor of Law, University of Chicago Law School	
3:00 - 3:15	**BREAK**			
3:15 - 4:15	**SESSION 4: MONITORING AND ENFORCEMENT**			
	Cynthia Giles Former Assistant Administrator for Office of Enforcement and Compliance Assurance, US EPA	Akhila Kumar Swar Senior Environmental Engineer, OSPCB	Chirag Bhimani Deputy Environmental Engineer, GPCB	Chandra Bhushan Deputy Director General, CSE
4:15 - 4:55	**SESSION 5: MARKET-BASED REGULATION: SUCCESSES AND CHALLENGES**			
	Nathaniel Keohane Vice President, Global Climate, Environmental Defense Fund		Anant Sudarshan Executive Director, EPIC India	
4:55 - 5:00	**CLOSING ADDRESS**			
	Anant Sudarshan Executive Director, EPIC India			

Annexure 2 - Speaker Biographies

Honourable Mr. Justice Swatanter Kumar

Chairperson, National Green Tribunal

Justice Swatanter Kumar, B.A., LL.B. began his legal career as an advocate with the Delhi Bar Council in 1971. After practicing in various High Courts as well as the Supreme Court, he served as an Additional District & Sessions Judge in the Himachal Pradesh High Court, and thereafter resumed practice at New Delhi. He was the Legal Advisor/Standing Counsel for the Central Pollution Control Board for several years. Justice Swatanter Kumar has practised in various High Courts, particularly in Delhi High Court on the Original Side, Appellate Side, Extraordinary Ordinary Jurisdiction (Writ) and other different fields including environment.

Dr. Michael Greenstone

Milton Friedman Professor in Economics and the College, University of Chicago
Director, Energy Policy Institute at the University of Chicago

Michael Greenstone is the Milton Friedman Professor in Economics, the College, and the Harris School, as well as the Director of the interdisciplinary Energy Policy Institute at the University of Chicago and the Energy & Environment Lab at the University of Chicago Urban Labs. He previously served as the Chief Economist for President Obama's Council of Economic Advisers, and currently serves on the Secretary of Energy's Advisory Board. Dr. Greenstone also directed the Brookings Institution's Hamilton Project, which studies policies to promote economic growth, and has since joined its Advisory Council. He is an elected member of the American Academy of Arts and Sciences and editor of the Journal of Political Economy. Before coming to Chicago, Dr. Greenstone was the 3M Professor of Environmental Economics at MIT.

Shri Anil Kumar Jain

Additional Secretary, NITI Aayog

Mr. Anil Jain is an IAS officer of the batch of 1986 from the Madhya Pradesh cadre. Mr. Anil Kumar Jain holds a BA (Honours) in Economics, an MBA, and a Diploma from the Indian Institute of Foreign Trade. He has published several papers and articles on the energy sector, including a book on natural gas policy framework in India (OUP, Oxford). He has been a Visiting Senior Research Fellow at the Oxford Institute for Energy Studies, Oxford, UK.

Dr. V. Rajagopalan

Former Secretary, Ministry of Environment, Forests and Climate Change

Dr. V Rajagopalan is an IAS officer of 1978 from the Uttar Pradesh cadre. He has extensive experience in environmental governance, pollution control, industrial regulation and water systems. Dr. Rajagopalan retired as the Secretary of the Ministry of Environment, Forests and Climate Change. He has three post-graduate degrees from the University of London, Indian Institute of Technology - Madras and Indian Institute of Management, Bangalore. He also holds a PhD in Air Pollution Modelling from the University of Lucknow.

Mr. T.S.R Subramanian

Former Cabinet Secretary

Mr. T. S. R. Subramanian serves as a Director at HCL Enterprise Solutions Limited. Earlier, he had a distinguished career in the Indian Administrative Service, where he held various positions including that of Cabinet Secretary, the highest post in the Indian administration and the post of Secretary in the Ministry of Textiles. He has also worked in the Ministry of Commerce, where he dealt with trade policy issues and matters relating to General Agreement on Trade and Tariffs (GATT) and with UNCTAD.

Ms. Kate Logan

Green Choice Outreach Director, Institute for Public and Environmental Affairs, China

Kate is Green Choice Outreach Director at IPE, a non-profit environmental organization based in Beijing that promotes information disclosure and public participation as means of strengthening environmental governance mechanisms, reducing emissions and improving environmental quality. Her main work focuses on outreach surrounding IPE's green supply chain initiative to integrate transparency and stakeholder participation into existing supply chain management systems.

Dr. Sarath Guttikunda

Co-Director, UrbanEmissions

UrbanEmissions.info was founded by Dr. Sarath Guttikunda in 2007 with the vision to be a repository of information, research, and analysis related to air pollution. Dr. Guttikunda conducts research on air pollution. His interest stems from the guidance received during Bachelors at the Indian Institute of Technology (Kharagpur, India) and during Doctorate from the Center for Global & Regional Environmental Research (CGRER) at the University of Iowa (Iowa City, USA). He then worked as an air pollution analyst at the World Bank in Washington, DC (USA).

Dr. V.M. Motghare

Joint-Director (Air), Maharashtra Pollution Control Board

Dr. Motghare is an expert on industrial pollution control and has been instrumental in leading many regulatory innovations with the Maharashtra Pollution Control Board including an information disclosure program, and the development of innovative air purifiers with researchers from the National Environmental Engineering Institute and the Indian Institute of Technology - Bombay.

Shri A.K. Mehta

Joint Secretary, Ministry of Environment, Forests and Climate Change (IC&SD)

Mr. Mehta is an officer in the Indian Administrative Services of the batch of 1988 and the Jammu and Kashmir Cadre. Prior to serving as the Joint Secretary at the Ministry of Environment, Forests and Climate Change, Mr. Mehta was the Principal Secretary of the Power Development Department in Jammu and Kashmir. Mr. Mehta is well versed with the system of environmental governance in India, having served in various capacities with the Ministry of Environment, Forests and Climate Change since 1998.

Ms. Shibani Ghosh

Fellow, Center for Policy Research

Shibani Ghosh is a public interest lawyer and a fellow at CPR. She specialises in environmental and access to information laws. At CPR, she researches on issues relating to domestic environmental law and regulation. Ms Ghosh has been a Sustainability Science Fellow at the Harvard Kennedy School (2014-2015), and a visiting faculty at the TERI University and the RICS School of Built Environment, where she taught environmental law. She is a Rhodes Scholar and holds both a master's in science in environmental change and management and a bachelor's in civil law (a graduate degree in law) from the University of Oxford.

Mr. Mark Templeton

Associate Clinical Professor of Law, University of Chicago Law School

Mark N. Templeton is Associate Clinical Professor of Law, Director of the Abrams Environmental Law Clinic at the University of Chicago Law School, and a Research Affiliate of the Energy Policy Institute at Chicago. Previously, Professor Templeton was a Trustee and Executive Director of the Office of Independent Trustees for the $20 billion Deepwater Horizon Oil Spill Trust. He served as the cabinet-level Director of the Missouri Department of Natural Resources, leading the state's efforts in energy, environmental protection, state parks, and water resources and overseeing a staff of approximately 1750 FTEs and a $310 million annual budget.

Dr. Shruti Rai Bhardwaj

Joint Director, Ministry of Environment, Forests and Climate Change

Dr. Bhardwaj's areas of expertise are biotechnology and the environmental sciences. She has worked extensively on issues related to the transboundary movement and regulation of hazardous waste. She serves in the Capacity Building for Industrial Pollution Management Initiative by the Ministry of Environment, Forests and Climate Change.

Ms. Cynthia Giles

Former Assistant Administrator for Office of Enforcement and Compliance Assurance, US EPA

Cynthia Giles has more than 30 years of service in the public, private and non-profit sectors. She prosecuted civil violators of environmental laws as an Assistant United States Attorney in Philadelphia, led the water protection program for the Commonwealth of Massachusetts, served as the Director of Enforcement Coordination for EPA Region 3, and before returning to EPA, was the Director of the Conservation Law Foundation's Advocacy Center in Rhode Island.

Dr. Akhila Kumar Swar

Senior Environmental Engineer, OSPCB

Dr. Akhila Kumar Swar is a Senior Environmental Engineer of the State Pollution Control Board, Odisha with a Ph.D degree in Engineering from Sambalpur University and Masters in Environmental Engineering from the Asian Institute of Technology, Bangkok, Thailand in 1990. He has been working in the State Pollution Control Board, Odisha, since February 1991. He has been heading consent to operate of highly polluting industries, online monitoring and hazardous waste management cell of SPCB, Odisha.

Mr. Chirag Bhimani

Deputy Environmental Engineer, Gujarat Pollution Control Board

In addition to enforcing environmental regulations as the DEE of GPCB, Mr. Bhimani supports independent research projects that seek to partner with GPCB. Some of these projects include the implementation of a novel audit system to improve the performance of environmental auditors to reduce under-reporting, the implementation of Continuous Emissions Monitoring Systems and the implementation of India's pilot emissions trading scheme for particulate matter.

Dr. Chandra Bhushan

Deputy Director General, Center for Science and Environment

Dr. Bhushan advises a range of institutions as part of advocacy for environmental issues worldwide. He was the co-chair of the technical advisory committee, Global Reporting Initiative, USA/Netherlands till 2002. He is also a member of Food and Agriculture Division (FAD 14), Bureau of Indian Standards, BIS Environmental management sectional committee, Copenhagen Working Group on CSR (business and development), Copenhagen Business School, EIA Accreditation Committee, QCI, and on the board of Governors, NABET, QCI. He is also an expert member for the BASIC (Brazil, South Africa, India, China) group of countries.

Dr. Nathaniel Keohane

Vice President, Global Climate, Environmental Defense Fund

Nathaniel Keohane is a Vice President at Environmental Defense Fund, where he leads EDF's Global Climate program and helps to shape the organization's advocacy for environmentally effective and economically sound climate policy. Nat's areas of expertise include U.S. and global climate and energy policy, the economic impact of climate change, the benefits and costs of reducing greenhouse gas emissions, and the design and performance of cap-and-trade programs and other policy instruments.

Dr. Anant Sudarshan

Executive Director, EPIC India

Anant Sudarshan is India Director of the Energy Policy Institute at Chicago University (EPIC India). He is also a Senior Research Associate at the Department of Economics, University of Chicago. Prior to working at EPIC, he was the Giorgio Ruffolo Post-doctoral Fellow in the Sustainability Science Program at Harvard University's Kennedy School of Government. He received his PhD in Management Science and Engineering from Stanford University and he holds undergraduate and masters degrees in Mechanical Engineering from the Indian Institute of Technology (Delhi) and Stanford University respectively.

Notes

The Energy Policy Institute at the University of Chicago, India (EPIC India) is confronting the global energy challenge by working to ensure that energy markets provide access to reliable, affordable energy, while limiting environmental and social damages. We do this using a unique interdisciplinary approach that translates robust, data-driven research into real-world impacts through strategic outreach and training for the next generation of global energy leaders. A hub of our efforts centers in India, where we maintain a robust research portfolio and deep network of collaborations. EPIC India is based at the University of Chicago Center in Delhi.

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