

Designing and Evaluating a Particulate Emissions Trading Scheme in India

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Balancing economic growth and a clean environment is a challenge

Pollution costly

- Ministry of Environment and Forests estimated air pollution contributed to 40,351 premature deaths in only 36 cities of India in 1995
- Nearly 1/3 of India's urban population lives in cities where ambient concentration of particulates exceeds the national standard of 60 $\mu\text{g}/\text{m}^3$

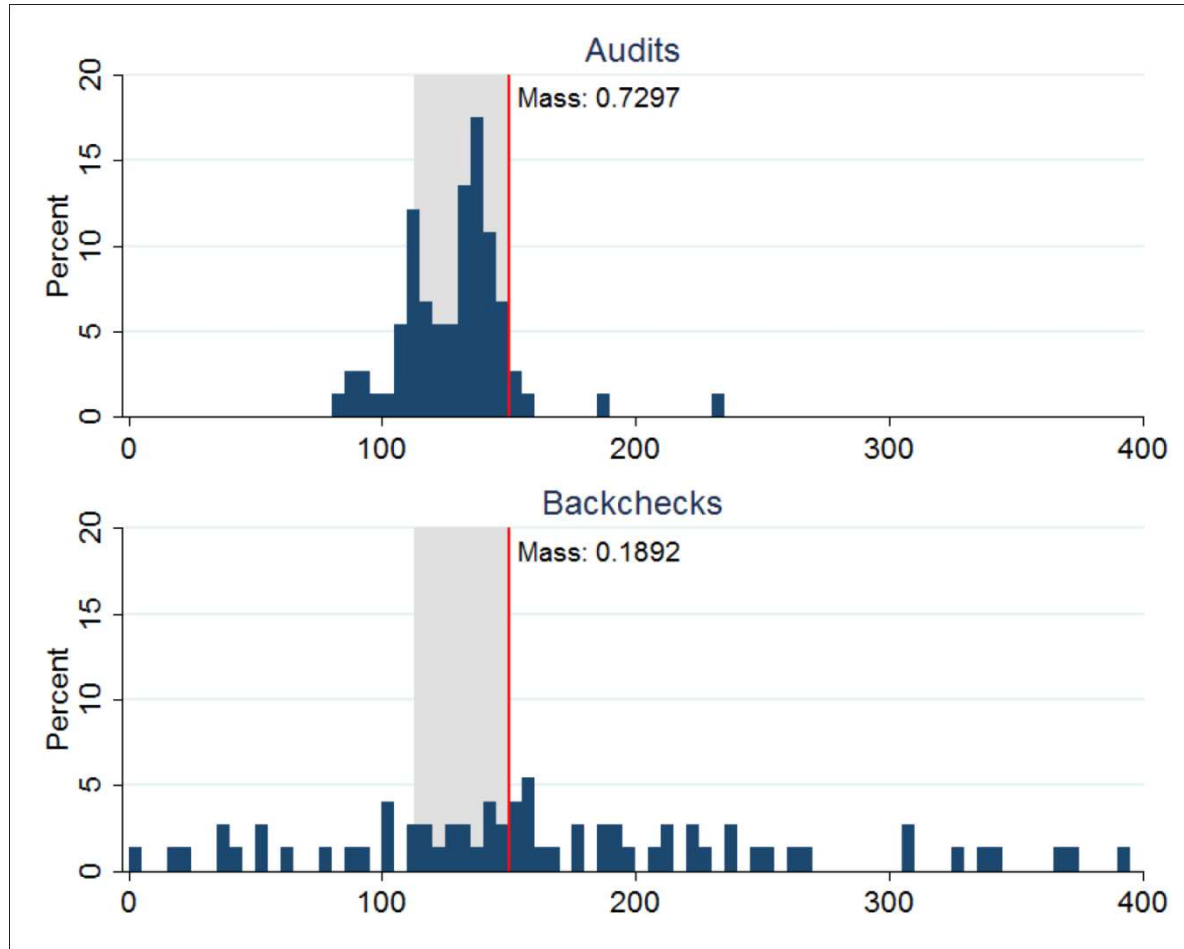
. . . Yet, so may be current system of regulation

- *It is also necessary to ensure that these [environmental] regulatory standards do not bring back the License Permit Raj which we sought to get rid of in the wake of economic reforms - Prime Minister Manmohan Singh, Delhi Sustainable Development Summit, 2011*
- As all regulation at the plant-level, mass-scale industry closures or equipment mandates only tools for addressing regional pollution in growing cities and industry clusters

The Benefits of Effective Environmental Regulation Are Immense

Evidence on Health Effects of SPM	Source
Cardiovascular and respiratory illness, bronchitis, asthma, lung cancer, reduced lung function	World Health Organization (2008)
Increased infant mortality in US	Chay and Greenstone (2003)
Significant increase in mortality and morbidity due to steel plant emissions	Ransom and Pope (1995)
Increase in mortality linked to TSPM levels in Delhi	Cropper et al (1997)
Infant mortality and low birth weights linked to SPM levels in China	Chen, Ebenstein, Greenstone and Li (2011)
SPM linked to life expectancy loss in China	Chen et al (2013)

Effective regulation requires good data



- Recent research (Duflo et al 2013) shows that many plants violate standards
- When regulators do get accurate information on pollution, plants respond by cutting emissions

Markets can provide environmental certainty *and* lower compliance costs

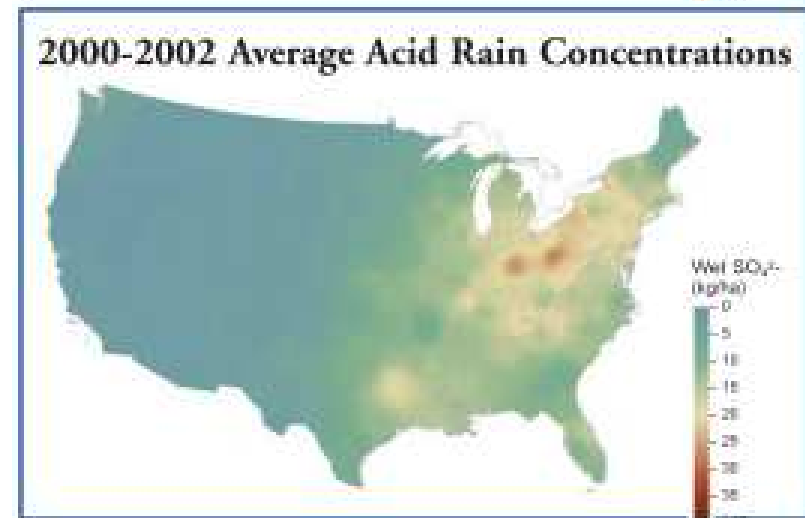
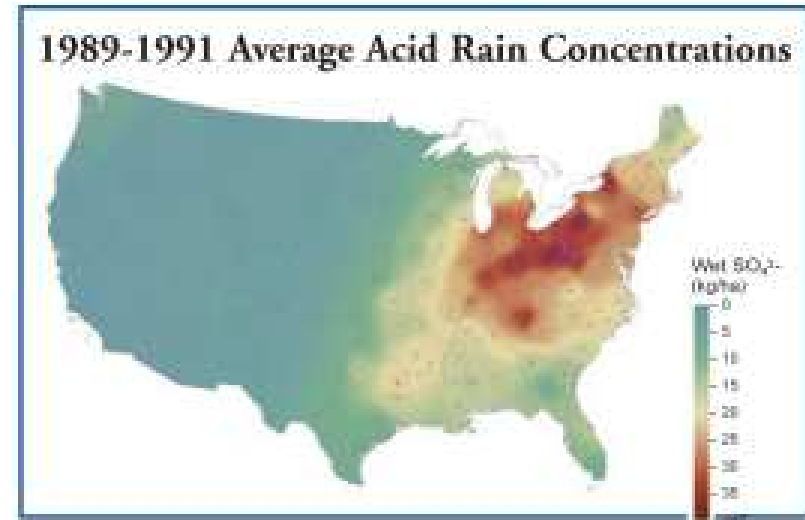
Example of US Acid Rain program for sulfur dioxide:

Environmentally:

- In 1995, total emissions fell from 8 to 5 million tons.
- Large and uniform reductions in acid rain

Economically:

- Switch to low-sulfur coal and using scrubbers to remove SO₂ from stack gases
- Estimated savings to firms was \$225-\$374 million



Broad Stakeholder Support for ETS in India

- **National Government:** ETS considered by Gol since mid-90s
 - Market based regulation included in 5-year plan by National Planning Commission and ETS featured in CPCB annual report
 - Task force created by MoEF in 1997 to evaluate market based instruments for pollution abatement
- **State Government:** Benefits for resource-constrained state pollution control boards to shift away from manual inspections in face of rapid industrial growth
- **Industry:** Reception to ETS has been positive
 - *"The very idea of ETS is revolutionary & it is beneficial to both environment & industry. It will help in sustained & cumulative growth of industry simultaneously protecting the environment."* -President, South Gujarat Textile Processors Association
- **Coverage in Times of India, June 6, 2013:** *"This is a beneficial scheme for all. Mill owners will be able to exactly know how much they emit and pollute. They will be able to regulate their emission which will ultimately result in reduction in pollution," said Kamal Vijay Tulsian of JR Dyeing in Pandesara.*

Why is emissions trading worth trying?

Status Quo: Command & Control

- Compliance costs are higher than necessary
- Monitor inputs to pollution such as equipment, limiting innovation
- Does not target what actually matters, namely Total Load Emitted
- Unpredictable enforcement with harsh criminal penalties

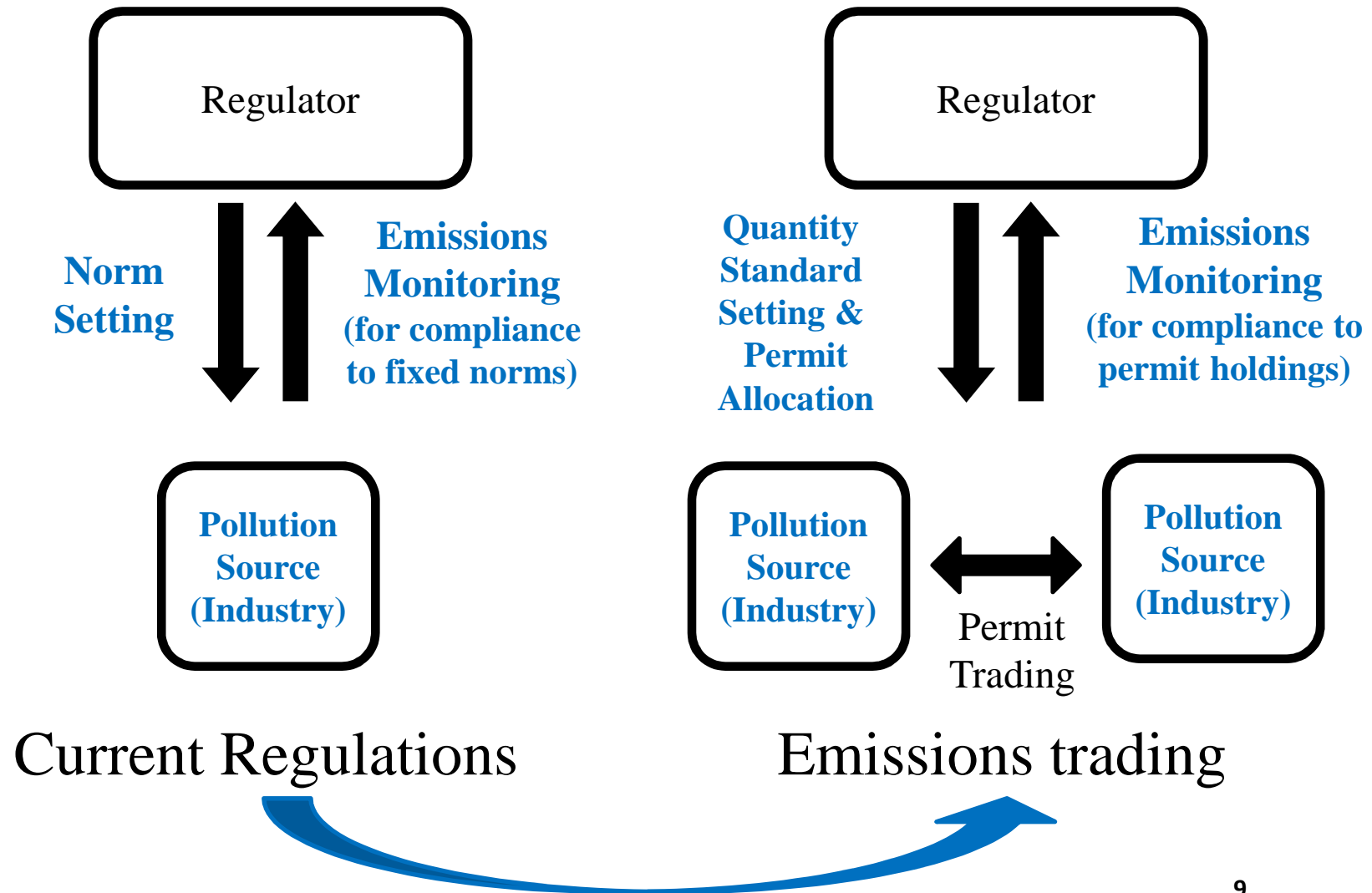
Proposed: Market Based

- Greater flexibility lowers compliance costs
- Monitor actual pollution, opening the door to innovation
- Enables load standards on total emissions for each area
- Steady incentives to reduce pollution from permit price

India's Emissions Trading Scheme

- MoEF released background paper “Towards an Emissions Trading Scheme for Air Pollutants in India” written by JPAL research team in 2010
- MoEF hosted National Technical Consultation on emissions trading with State Pollution Control Boards (SPCBs) and JPAL in early 2011
- Under the leadership of the Central Pollution Control Board, three State Pollution Control Boards of Gujarat, Maharashtra and Tamil Nadu
 - Resolved to focus on particulate matter for pilot ETS as an important pollution problem common across India
 - Selected participating areas and industries on PM emissions contribution
 - Interest in using CEMS to support market based mechanisms

Emissions Trading Schemes



Emissions Trading: Design Fundamentals

- Polluter pays principle a central tenet of environmental law but inconsistently applied
- Regulator sets total emissions amount but does not decide what any particular source will emit
 - Industries face price for their emissions and can buy and sell permits to emit under the cap
 - Price of emissions makes pollution costly and gives incentive to cut back
- Industries have flexibility to design own compliance strategy
 - Abatement through process and/or technology changes vs. permit trading
 - Flexibility allows units with low cost of reductions to emit less and sell their right to emit to others, lowering overall compliance costs

Scope and Objectives

Scope:

- Design, implementation, and evaluation of pilot trading scheme for particulate matter emissions with sample of 1,000 plants in Gujarat, Maharashtra, and Tamil Nadu

Objectives

1. Design and evaluation of monitoring infrastructure using continuous emissions monitoring systems (CEMS)
2. Design and evaluation of trading scheme based on CEMS

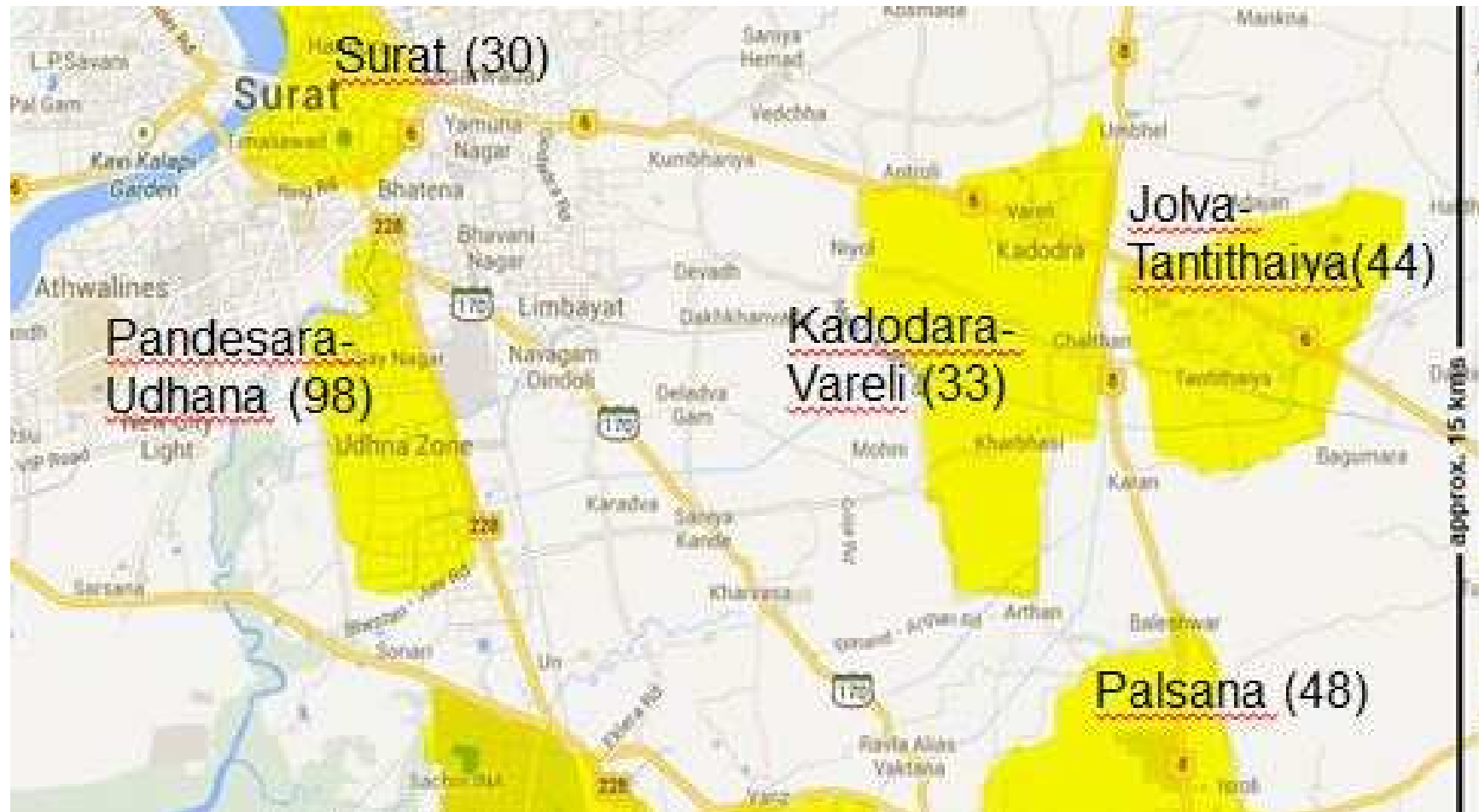
Design and Evaluation: Treatments

Firms Phased into
Different Groups
(Random Assignment)

Research Question

Period 1	CEMS		No CEMS		<i>Measure the effect of continuous emissions monitoring</i>
Period 2	CEMS		CEMS		
Period 3	Trading	No Trading	Trading	No Trading	<i>Measure the effect of market-based regulation; All Plants Move to Load-Based Standard</i>

Pilot Industries Clustered Around Surat, Gujarat



Design and Evaluation: Rationale

Evaluation will provide evidence on the emissions, abatement cost and regulatory cost impacts of trading. Two reasons:

1. Integrating with research will make pilot better.
 - Better information for setting emissions cap, price ceiling and other parameters.

2. Critical for long-term viability of market-based instruments
 - Overcome distrust of uncertainty in the market
 - Transparency can instill public confidence
 - Learning-by-doing : begin at a small scale and expand

Design and Evaluation: Baseline

- There is an absence of extensive field and industry level data on emission levels, industry processes, and existing pollution abatement technology
- In order to design critical parameters of the pilot ETS, and evaluate its benefits, a comprehensive baseline survey is required
- Allows development of analytical outputs such as marginal abatement costs, gains-to-trade estimations, and pollution dispersion models

Design and Evaluation: Baseline

Market Design: setting the cap

- Total limit on mass emissions
- In principle: neither so high that no cuts nor so low as to be prohibitively costly
- Critical data inputs *from research side*:
 - Baseline emissions for 6-9 months before trading
 - Abatement costs through industry-level survey
- Model emissions market to allow regulator to balance these concerns

Implementation: Market Design

- Task – create an emissions market design for particulate matter regulation that will be robust and effective in the Indian context
- In April 2013 Steering Committee, J-PAL asked to lead and form committee to define principles of market design.
 - **Professor Michael Greenstone (Chair)** – 3M Professor of Environmental Economics, MIT
 - **Dr. Ajay Mathur** – Director General, Bureau of Energy Efficiency (Ministry of Power, Government of India)
 - **Professor Severin Borenstein** – E.T. Grether Professor of Business Administration and Public Policy at Haas School of Business, UC Berkeley
 - **Professor Meredith Fowlie** – Assistant Professor of Agricultural and Resource Economics, UC Berkeley
- Series of market design meetings completed and market design document in drafting phase, to be presented for consideration by MoEF by end-2013

Implementation: Market Design

Aspect of Design	Recommendation	Rationale
Scope of trade	State-level markets across clusters	Align scope of trade with particulate dispersion
Permit duration	Annual compliance period to start	Sufficient time for industry to learn about and reduce emissions
Means of trade	Monthly two-sided auctions, with bilateral trade also allowed	Provide clear information on permit price to all
Price limits	Price ceiling to limit maximum permit price	Reduce uncertainty over compliance cost to industry
Penalty structure	Fines for emissions above permit holdings at ceiling price	Compel industry to purchase permits and comply

Capacity Building for Implementation

- CPCB developed capacity building program upon identifying key functions of CPCB and SPCBs in ETS implementation and defining the role of industries and other key stakeholders
 - 16 workshops to date hosted by CPCB and SPCBs
 - Internal staff trainings held at SPCBs on ETS and CEMS, covering both theoretical background and operational aspects
 - Pilot industry outreach – workshops hosted by CPCB and SPCBs for all pilot industries in Gujarat and Maharashtra (forthcoming in TN)
 - Nearly 450 attendees in total from PCBs, industry, environmental laboratories, and CEMS vendors
- ETS project team invited to present at several recent events organized by Confederation of Indian Industry (CII) and Federation of Indian Chambers of Commerce and Industry (FICCI)