

LESSONS FROM THE IMPLEMENTATION OF THE ODISHA STAR RATING PROGRAM

September 2020



Program implemented by



State Pollution Control Board, Odisha
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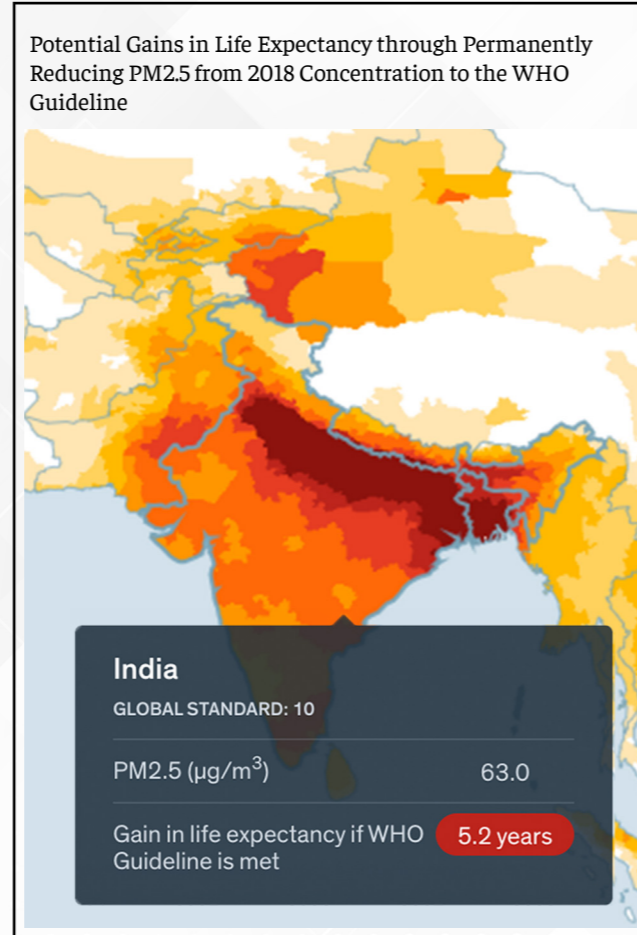
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EXECUTIVE SUMMARY

Across the world, particulate air pollution poses the greatest risk to human health. In India, air pollution shortens lives by over five years, on average, relative to what it would be if the World Health Organization guideline was met (and by over two years relative to what it would be if the Indian National Ambient Air Quality Standards were met).¹ The damages from air pollution are not just restricted to shorter lives. An expanding research literature points to the negative consequences of severe air pollution on a variety of outcomes, including crop yields, labor productivity, cognitive skills, and educational outcomes.^{2,3} In the face of such enormous costs, effectively regulating air pollution remains the critical challenge for policymakers and regulators in heavily-polluted countries like India.

Since 2014, the Energy Policy Institute at the University of Chicago in India (“EPIC India”) has partnered with several State Pollution Control Boards (SPCBs) across India to launch and evaluate new initiatives aimed at enhancing state capacity, reducing compliance costs, and increasing the environmental effectiveness of existing policies. These joint projects have included novel market-based solutions to air pollution, as well as public disclosure programs across multiple states.

In April 2017, the Government of Odisha partnered with the University of Chicago to explore a number of joint projects spanning the humanities, social sciences, and energy and environment. As part of this partnership, the State Pollution Control Board, Odisha (SPCB, Odisha) and EPIC India designed and launched the Odisha Star Rating Program in September 2018. The Star Rating Program is a public disclosure program that categorizes and broadcasts the environmental performance of major industrial plants in Odisha, utilizing continuously monitored emissions data. The Star Rating Program has been continuously operated by the SPCB, Odisha since September 2018.



Signing of the Statement of Intent between the Government of Odisha and the University of Chicago



Chief Minister Naveen Patnaik during the signing of the Statement of Intent in April 2017

EPIC India has served in the capacity of a knowledge partner, providing technical, management, and communications support.

During the period described in this report, there were 136 industries in Odisha belonging to the 17 categories of highly-polluting industries. As of July 2020, the Star Rating Program had successfully enrolled 124 of these industries. Encouragingly, enrollment into the program—which is entirely voluntary—has increased by more than six times over the past two years. Note that the Odisha Star Rating Program was not set up in an experimental manner. Hence, we are not able to present evidence on the causal impacts of information disclosure on environmental performance. However, our experience in Odisha has highlighted how information disclosure and transparency initiatives can complement regulatory efforts by SPCBs by improving the quality and reliability of information and data management systems, in this case, the Continuous Emission Monitoring Systems (CEMS) that have already been installed in thousands of industrial plants across India.

Our experience in Odisha has underscored some key lessons for SPCBs looking to establish information transparency programs of their own in the future. For instance, SPCBs will need to strengthen their institutional capacities—both in terms of manpower and technical knowledge—in order to launch similar innovative programs. In addition, since emissions data is collected on site, new solutions and approaches—at times tailored to the local context—will be needed in order to ensure that the emissions data is both accurate and reliably available. Finally, public awareness and participation must be cultivated and harnessed to maintain political support for information transparency programs and to maximize the likelihood that public disclosure will lead to measurable improvements in environmental performance.

1 INTRODUCTION

Public disclosure and transparency initiatives have been widely used to improve environmental outcomes. In the United States, for example, the Toxic Release Inventory (TRI) has served as a prominent resource for tracking the emissions of toxic chemicals by industrial facilities across different sectors. Similar programs across the world include the Program for Pollution Control, Evaluation, and Rating (PROPER) in Indonesia and GreenWatch in China. Although the evidence base is relatively small, the existing literature suggests that providing information to industries and citizens can increase pollution abatement efforts, and in turn, curb industrial pollution.^{4,5}

In India, the first public disclosure and information transparency initiative targeting air pollution was established in Maharashtra in June 2017, the result of a multiyear collaboration between the Maharashtra Pollution Control Board (MPCB) and researchers affiliated with the Abdul Latif Jameel Poverty Action Lab (J-PAL), Evidence for Policy Design (EPoD) at Harvard Kennedy School, and EPIC India. The Maharashtra Star Rating Program, which utilizes manually-collected data from stack samples, currently covers hundreds of large plants in ten sectors across 32 districts⁶. This program—which is being rigorously evaluated in a randomized control trial—has encouraged SPCBs across the country, including in Odisha and Jharkhand, to launch similar transparency initiatives of their own.

The Odisha Star Rating Program (“the Program”) was launched in September 2018 by then-Chief Minister Sri Naveen Patnaik who hailed the effort as an example of the Government of Odisha’s “3T” (Technology, Transparency, and Teamwork) formula for governance. Importantly, the Odisha Program is the first transparency initiative in India to use Continuous Emissions Monitoring Systems (CEMS) data, as opposed to manually-collected data (as in the case of the Maharashtra Star Rating Program).

The Program rates industries on a 1 to 5-star scale based on their particulate matter (PM) emissions and relevant emissions standards. Specifically, the worst-performing industries are awarded a 1-star report card, whereas the performing industries are awarded a 5-star report card. Ratings are updated each month on the Program’s official website, which is accessible at <https://www.ospcb.info/>.



Stakeholders at the Odisha Secretariat during the launch of the Star Rating Program in September 2018



Chief Minister Naveen Patnaik during the launch of the Star Rating Program in September 2018

The Odisha Program has two main objectives. The first objective is to inform industries about their environmental performance relative to the prescribed standards, as well as the performance of their competitors. The idea is to encourage better compliance by creating a sense of competition between industries. The second objective is to create an accessible platform for the public to learn about the environmental performance of local industries, which would empower them to engage with regulators, policymakers, and the media. Broadly, the Program also aims to strengthen the SPCB, Odisha’s regulatory efforts and capacity to manage industrial pollution in the state.

The remainder of this report proceeds as follows. Section 2 provides some background on air pollution regulation in India, with a focus on the state of Odisha. Section 3 describes the design and implementation of the Program, summarizing our progress thus far. Section 4 discusses key lessons that emerged from our unique partnership, and Section 5 concludes.

2 BACKGROUND

2.1 Regulatory Framework, Technology and Data

Air pollution in India is governed by two primary laws: The Air (Prevention and Control of Pollution) Act, 1981, and the Environment Protection Act, 1986. The Air Act seeks to prevent, control and abate air pollution by empowering the Central Pollution Control Board (CPCB) and the SPCBs to create and implement regulations and programs for regulated entities like industries and thermal power plants. These legal provisions are further built upon in the Environment Protection Act, which enables the Central Government to enact necessary measures to control air, water and land pollution. Broadly, these laws follow a “command and control” approach to air pollution regulation.

For instance, the laws mandate the installation of certain technologies, ban certain production processes and technologies, and determine absolute emissions standards, to name a few examples. This approach has led to challenges in the Indian context. For example, Section 21(5) of the Air Act requires plants to install pollution control equipment to limit emissions. Yet capital equipment can be both costly to maintain and to operate. Hence, the equipment mandate prescribed in the law has not guaranteed that air pollution is held under control.

Furthermore, regulatory action hinges on the availability of reliable, high frequency emissions data. Traditionally, industrial smokestacks were monitored manually. An inspector would periodically visit a stack, extract a sample of emissions, and then transport the sample to a laboratory for analysis. Manual stack monitoring simply does emissions vary over the course of a day. In addition, as documented in Duflo et al. (2013), manual stack monitoring is not always accurate. In Gujarat, researchers have documented systematic underreporting of emissions under a manual sampling regime, resulting in false compliance with emissions standards.⁷



SPCB, Odisha officials and EPIC's team during visit to an industry

In 2014, the CPCB mandated the installation of CEMS in 17 highly-polluting industry sectors. The idea was that the high frequency data collected remotely through CEMS could vastly improve the ability of regulators to enforce pollution abatement. Soon after the CPCB mandate, many SPCBs, including the SPCB, Odisha, transitioned from manual stack monitoring to real-time monitoring. However, the installation of more sophisticated technologies does not guarantee reliability or better compliance. There are a number of reasons for this, ranging from the failure to enforce usage of CEMS to the manipulation of the data.

Moreover, the existing air pollution laws do not permit CEMS data to be used as legal evidence in the court of law. This prevents the SPCBs from using such data to take necessary and difficult legal actions against industrial polluters. This also limits adoption of the technology on the part of the industries.

2.2 Institutional Capacity of the Pollution Control Board

Increasingly, policymakers and researchers are taking note of the resource and capacity constraints faced by the SPCBs. For instance, inadequate manpower and finances to conduct inspections leads to lower levels of compliance and forces regulators to allocate resources or make decisions with imperfect information.

Establishing a Star Rating Program requires specialist knowledge in instrumentation, electronics, and database management. At the outset of the project, EPIC India established a “Knowledge Cell” inside the SPCB, Odisha headquarters in Bhubaneswar in order to help bridge the capacity gap at the SPCB, Odisha. This Knowledge Cell included staff with domain expertise in program management, data analysis, and communications, who then assisted the SPCB, Odisha in the day-to-day activities required to operate the Program.

2.3 Public awareness and engagement on air pollution issues

Over the past several years, there has been a rise in the national media coverage of the impact of air pollution on human health. At the same time, there are still gaps in public awareness and engagement on air pollution issues, particularly in the smaller Indian cities and towns.

At the outset of the Program in Odisha, it was generally believed that a large share of the public lacked an understanding of the harmful effects of air pollution on health. In order for the Star Rating Program to be effective (as a tool to encourage industries to reduce their pollution), public awareness and engagement needed to be much higher. As is described later on in this report, numerous air pollution workshops were carried out in across Odisha in order to increase awareness about air pollution, engender public support for the Program, and create pressure on low-performing industries to improve their performance.

3 PROGRAM DESIGN, IMPLEMENTATION, AND PROGRESS

This section presents the design and implementation features of the Program. The number of new industries enrolled since the launch of the Program is used as a measure to track program progress.

3.1 Program Design

The Program uses CEMS particulate matter (PM) data to rate industries every month. CEMS is a monitoring technology that records and transmits emissions data in real time, allowing regulators to track pollution trends in detail. PM emissions refer to fine inhalable particles that are known to cause large negative health impacts.

Each industry enrolled in the Program is connected to SPCB, Odisha’s Real Time Data Acquisition System (RT-DAS). Ratings are a function of average monthly emissions and data availability. The average monthly emissions are compared to the permissible limits prescribed as per the emission standards. The data availability criterion requires that the mean data availability transmitted by an industry to the SPCB, Odisha server is at least 85 percent at 15-minute averages on a daily basis.

Ratings are assigned based on the worst performing stack of an industrial plant. This decreases the possibility of an industry diverting its pollution across different stacks. 5-star industries are the most compliant, and 1-star industries are the least compliant. Industries are assigned a 1-star rating if data availability is less than 85 percent. See Table 1 for additional details.

Based on these data, industries receive a monthly report card. Emphasizing transparency, report cards are uploaded on the official Program website, frequently. The public can easily access this information and learn about the environmental performance of industries located in nearby areas.

Table 1: Star Rating Criteria

Rating	Range of mean PM Emissions compared to prescribed standard	Data Availability from Monitors	Rating Key	Representation
5 Star	<=50%	> 85%	Very Good	
4 Star	50%- 75%	> 85%	Good	
3 Star	75%- 100%	> 85%	Moderate	
2 Star	100%- 125%	> 85%	Poor	
1 Star	>125%	< 85%	Very Poor	

3.2 Program Implementation

For successful Program implementation, the SPCB, Odisha adopted a three-pronged approach. First, capacity building efforts were made to support and further strengthen the technical capacity of the regulator. Second, sensitization workshops and one-on-one interactions with industry owners were held to encourage adoption of new and complex technologies like CEMS and real time data transmission. Third, a systematic outreach and awareness campaign was mounted to generate public awareness and galvanize support for the Program.

Table 2 provides a glimpse of the key milestones achieved over the course of the Program’s implementation.

Table 2: Key Milestones of the Program

Timeline	Key Milestones
April 2017	Government of Odisha signs Statement of Intent with the University of Chicago
May 2017	EPIC India Knowledge Cell is established at the SPCB, Odisha headquarters
July 2017	High-level meetings between the SPCB, Odisha and EPIC India to identify data issues
August 2017	EPIC India visits industries and meets with regional offices to gather information about existing CEMS infrastructure
November 2017	EPIC India submits a report on CEMS status and preparedness for the Star Rating Program
January 2018	SPCB, Odisha employs a more capable IT vendor to oversee the functioning of the new RT-DAS infrastructure. This process took more time than anticipated leading to project delays
February 2018	Development of internal dashboard for CEMS data visualisation
March 2018	Finalisation of Standard Operating Protocols and capacity building for SPCB, Odisha officials
April 2018	Phase I of recalibration drive across ten SPCB, Odisha regional offices
August 2018	SPCB, Odisha establishes a dedicated IT cell to manage the Program
August 2018	EPIC India recommends the installation of IOT devices, such as data loggers, which could store data on-site for industries. Adoption of these devices by the industries was a time-consuming process, leading to project delays

Timeline

Key Milestones

September 2018	Hon'ble Chief Minister of Odisha, Shri Naveen Patnaik, officially launches the Odisha Star Rating Program
November 2018	EPIC India and the SPCB, Odisha host a capacity-building workshop on CEMS and the Star Rating Program for industry stakeholders
December 2018	The Comprehensive Action Plan for Clean Air for the six non-attainment cities of Odisha recognizes the Star Rating Program as a pollution-control measure to curb industrial air pollution in Odisha
February 2019	SPCB, Odisha deadline for all industries to complete CEMS validation
June 2019	Participation in the "Air Quality Management in Non-attainment cities of Odisha: Building Strategies for Clean Air" orientation conclave held in Bhubaneswar
July 2019	EPIC India and the SPCB, Odisha host a workshop on the "Role of Information Disclosure in Improving Environmental Performance and Compliance" in Angul
October 2019	EPIC India hosts two public awareness workshops to sensitize the public on air pollution and its health impacts in Bhubaneswar and Dhenkanal
March 2020	EPIC India hosts additional workshops on issues related to air pollution, involving roughly 350 people, held between October 2019 and March 2020
June 2020	EPIC India completes its involvement in the Odisha Star Rating Program, with a complete handover of operations to the SPCB, Odisha

The following section describes the key activities undertaken and major milestones achieved between April 2017 and June 2020, the start and end of EPIC India's implementation support.

3.2.1 Capacity Building and Technical Assistance

The EPIC India Knowledge Cell became operational in May 2017, and its first task was to undertake a rigorous assessment of the historical online monitoring data stored on the SPCB, Odisha server. The findings of this assessment focused on data quality and data availability issues and were presented to senior officials at the SPCB, Odisha, including the Chairman, in July 2017. During this meeting, Cynthia Giles (United States Environmental Protection Agency) shared best practices on environmental regulations from other countries.



Inauguration of the EPIC India Knowledge Cell at the OSPCB in Bhubaneswar by Mr. Pranab Prakash Das

Between August 2017 and September 2017, site visits to the SPCB, Odisha's 12 regional offices and local industries were conducted to gauge the level of preparedness to adopt the Program. By November 2017, a report on the design of the Program for Odisha and an in-depth assessment of the readiness of the SPCB, Odisha's system was submitted. Based on the findings of this assessment and on discussions with SPCB, Odisha officials and industry owners, the following steps were taken over the course of the implementation phase to help address the technical and knowledge gaps.

Calibration Drives to Ensure Data Validation

In July 2012, the SPCB, Odisha had directed all 17 categories of polluting industries to install CEMS. Most industries had followed this directive. However, very few industries calibrated or re-calibrated these CEMS instruments, ostensibly due to a lack of awareness. Calibration of CEMS devices is a crucial step because this mechanism ensures that the subsequent emission information reported by the industries is reliable and accurate. Misreporting of the initial calibration parameters can result in falsified CEMS data.

EPIC India researchers observed large variations in emissions data on the SPCB, Odisha server compared to the CEMS analyzers installed at the industries, raising concerns about the reliability of the data. In April 2018, the first phase of a calibration drive was carried out. 25 industries were visited for training on the CEMS calibration guidelines issued by the regulator. To ensure that all industries in the 17 categories of polluting industries would comply with the calibration and recalibration protocols, the SPCB, Odisha prompted each industry to sign on to guarantee compliance by the end of July 2018.



EPIC's team industry visit

In addition, the OSPCB designated a nodal person at each of the 12 regional offices to ensure data reliability standards are met by the industries.

Creation of Standard Operating Protocols (SOPs) for Monitoring Data

EPIC India and the SPCB, Odisha collaborated to develop Standard Operation Protocols (SOPs) for data monitoring. A CEMS checklist protocol was also developed for the regulators to ensure standardization of the calibration process across regional offices.

Information Technology Cell at SPCB, Odisha

Implementing a large-scale public data disclosure and transparency initiative requires additional infrastructure and skills. The Information Technology (IT) cell at the SPCB, Odisha was established to support a robust infrastructure around data acquisition and data processing. Currently, the IT cell employs two full time officials to coordinate with the regional offices and the industries to ensure data availability and reliability.

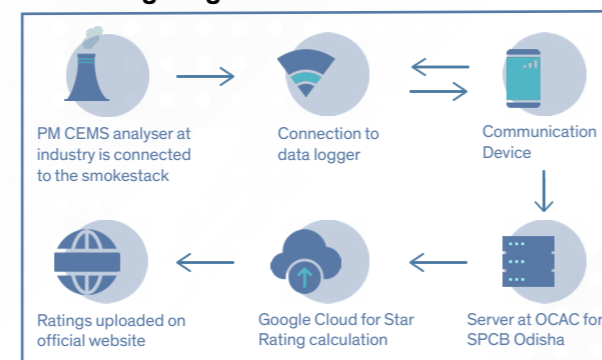
Strengthening data collection regime at SPCB, Odisha

Industries were initially required to transmit real-time data directly to the SPCB, Odisha's RT-DAS, with no requirement to store data. Intermittent internet connectivity or occasional power outages at plant locations caused the system to reset, resulting in data loss. EPIC India recommended the installation of IOT devices, such as data loggers, which could store data on-site. Subsequently, the SPCB, Odisha directed industries to install data loggers. However, the adoption of this technology by industries was time-consuming.

In order to strengthen IT and data storage systems, the SPCB, Odisha server was moved to a more secure state-level data center, the Odisha Computer Application Centre (OCAC). A more capable IT vendor was employed to oversee the functioning of the new RT-DAS infrastructure. This process of transitioning to a new vendor was time-consuming leading to project delays. A dedicated internal dashboard was created with login IDs for regional offices to access the server. This activity is being

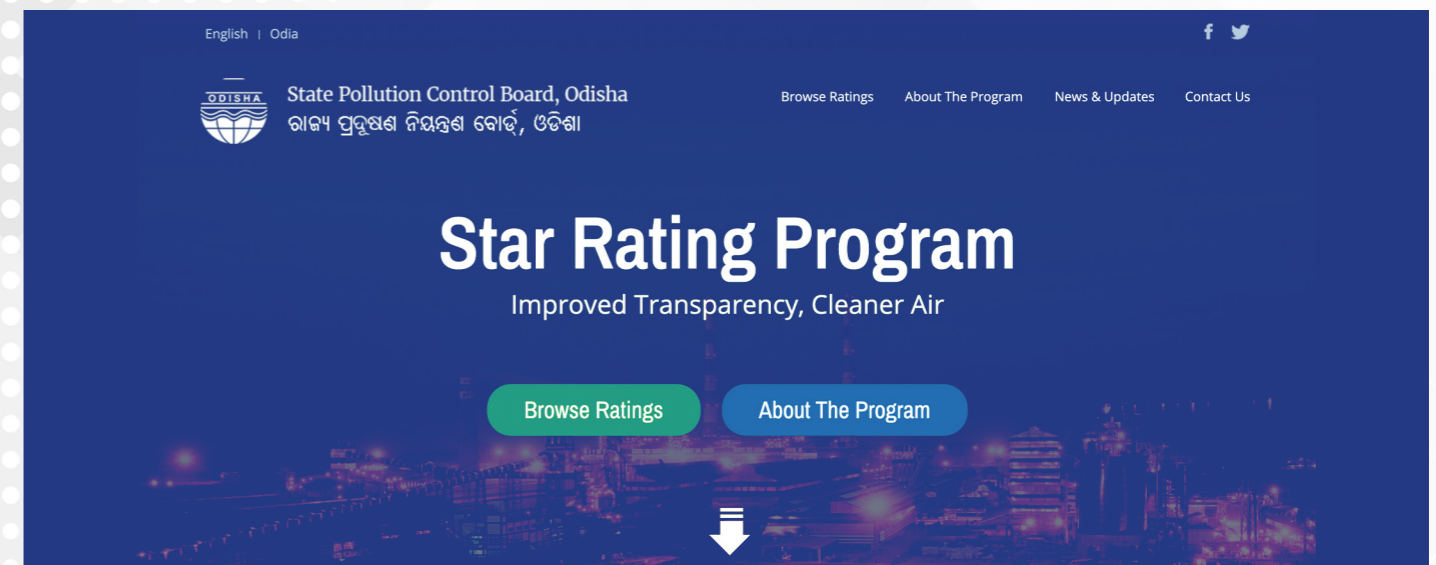
carried out by a dedicated Online Monitoring cell within the SPCB, Odisha, supported by a System Administrator and supervised by a Chief Environmental Engineer. SPCB, Odisha is planning to recruit additional technical staff to strengthen the IT cell. Further, a dedicated control room for online data analysis and communication with industries is under construction inside the expansion wing of the SPCB, Odisha headquarters in Bhubaneswar. The flowchart in Figure 1 illustrates the data transmission process from the plant locations to the OCAC.

Figure 1: Flow of data from the industry to the SPCB Odisha server to the official website for the Star Rating Program



Creation of a dedicated online web dashboard to host the Star Rating

A dedicated web-dashboard, accessible at www.ospcb.info, was designed to host the Program.



3.2.2 Industry Sensitization

Our assessment indicated that there were knowledge and capacity challenges which could hinder the successful adoption of CEMS by the industries. Recognizing the need to build capacity around the CEMS regime, a series of in-person workshops were conducted between August 2017 to March 2018 with various stakeholders, including regulators, industry owners, and technology vendors. At these workshops, participants were trained on various aspects of the CEMS technology and the regulatory guidelines governing its adoption.

Efforts were also made to encourage more industries to enroll under the Program as well as to adopt CEMS. A full-day workshop was conducted in November 2018 in Bhubaneswar. At this workshop, training was imparted on topics like CEMS monitoring, calibration, and data validation protocols. More than 80 industries participated in this event, along with SPCB, Odisha officials from the regional offices, and other sector experts.



SPCB, Odisha officials, stakeholders from industry and other experts convene for the one-day workshop on CEMS and Star Rating Program in November 2018

3.2.3 Public Awareness and Citizen Engagement

A systematic outreach campaign around the Program was undertaken to reach out to a wide spectrum of people and encourage them to create awareness about air pollution in their respective communities. Between October 2019 and March 2020, about 350 people, including civil society leaders, students, and local journalists had attended a series of workshops and other outreach activities. These workshops were organized in cities categorized as non-attainment cities under the National Clean Air Program, including Cuttack, Angul, Balasore, Rourkela, and Kalinga Nagar. The Program also received media coverage from Odisha's leading media outlets, and has been mentioned over 200 times in all of the state's leading newspapers, news portals, and news channels. In addition, six opinion pieces, published in The Sambad, The Samaja, The Dharitri, The Nitidin, and The Prameya, discussed the importance of the Program.



Experts interact with participants during the public awareness workshop in Rourkela held in February, 2020.

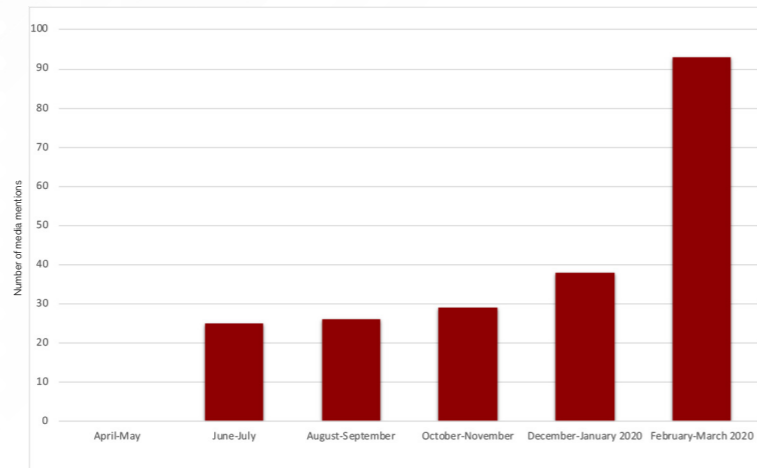


Experts interact with students during an awareness workshop in Kalinga Nagar held in March, 2020

Popular social media platforms like Facebook and Twitter were leveraged to broaden the reach of the Program. The Odisha Chief Minister's Office (CMO) retweeted tweets from the Odisha Star Rating Program Twitter handle twice during this period. In addition, more than 20,000 people were reached through the Odisha Star Rating Program Facebook page.

As a result of this multi-dimensional outreach strategy, the Program website attracted more than 1,800 new users between April 2019 and March 2020. Google Analytics suggest that each user, on average, spent approximately 2.55 minutes on the website. Figure 2 illustrates the distribution of coverage in print and electronic media between April 2019 and March 2020.

Figure 2: Odisha Star Rating media mentions from April 2019 to March 2020

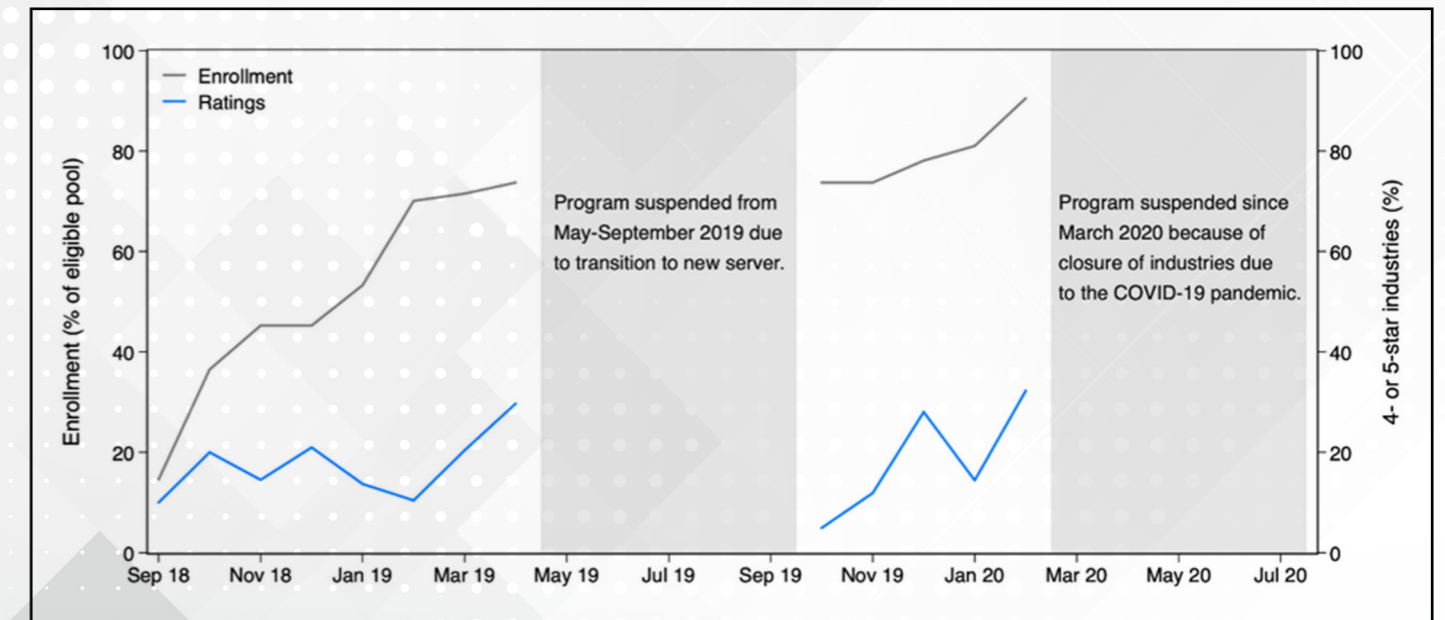


3.3 Progress

At the time of its launch in September 2018, 20 industries had officially enrolled into the Star Rating Program.⁸ At present, 124 industries with more than 400 stacks are enrolled into the Program. These industries cover nine major industrial sectors in Odisha, including cement, power plants, sugar and distilleries, iron and steel, pulp and paper, aluminum, fertilizers, and oil refineries.

Figure 3 shows that enrollment has increased steadily over the course of the Program. It also shows that the percentage of 4 and 5-star rated industries has varied between 10% and 30%. Note that nearly 70% of industries are, on average, rated 1-star, indicating there is considerable room for improvement in terms of data transmission rates and compliance with standards.

Figure 3: Program Enrolment and Ratings over time



4 KEY LESSONS

Our experience setting up the Odisha Star Rating Program has shed light on a few lessons that may be helpful for other SPCBs seeking to set up public disclosure programs of their own.

Lesson 1

New initiatives like the Star Rating Program will require expanding the institutional capacities of the SPCBs

In general, Indian SPCBs tend to be capacity constrained, especially in terms of staffing. In order to operate a Star Rating Program, an SPCB would require technical experts across the domains of environmental engineering, instrumentation, computer science or information technology, and data analysis and management. This would require hiring new staff or training existing staff to handle the additional roles and responsibilities associated with the program.

In the case of the SPCB, Odisha, the capacity gap was addressed through the internal establishment of an IT cell that was placed in charge of implementing the Program. This group consisted of two trained employees who worked full-time to manage and analyze incoming data, coordinated with the SPCB, Odisha's regional offices, and along with the System Administrator, provided troubleshooting on any software or hardware issues faced by the industries. Additional support from researchers at the EPIC India Knowledge Cell was required to bridge any remaining capacity constraints.

Lesson 2

Ensuring high data quality and integrity is essential, and will require numerous solutions

The quality and integrity of emissions data are foundational to the Star Rating Program. Remote monitoring saves time and resources, but it also requires sensors and other equipment to remain on site, leaving open the possibility for industries to disrupt the quality and integrity of the data, by either selectively switching off their equipment, or even tampering with the data.

In the current context, in which industries are permitted to procure and operate CEMS on their own, there is no perfect solution to this problem. However, in our experience in Odisha, several actions were beneficial.



R Balakrishnan, Former Development Commissioner shares insights with industry officials in a one-day workshop on CEMS and Star Rating Program in Bhubaneswar

A) Strengthening CEMS protocols

The SPCB, Odisha was one of the early adopters of the CEMS guidelines, which were issued by the CPCB in 2011. By July 2012, the SPCB, Odisha had directed all industries to install a CEMS. As a result, by December 2017, 141 industries were connected to the online portal through the RT-DAS.

Despite this high adoption of CEMS by industries, it was observed that the protocols around calibration, a critical step to ensure data reliability, were not being followed. Multiple regional offices reported that disparities were often observed between CEMS data and manual stack samples collected during on-site inspections. In the current context, calibration is often outsourced to third-party, private sector technology vendors, or carried out by the industry's instrumentation personnel on-site. As a result, we cannot rule out the opportunities to manipulate data in order to under-report emissions.

Unless this fundamental conflict of interest is broken, this problem cannot be solved. However, we learned that standardizing protocols for calibration, combined with regular training to sensitize officials are some pragmatic measures that can result in a better understanding of the technology and increased vigilance of possible malpractices. In addition, hosting awareness sessions were useful to establish communication channels between regulators and industries, which helped in addressing queries or grievances.

B) Creating a more robust data transmission and collection infrastructure

Data availability is one of the two main criteria for calculating Star Ratings. As noted above, data availability must be greater or equal to 85 percent on a daily basis. Industries failing to meet this criterion automatically receive a 1-star rating.

In our experience, the majority of industries (around 70%) were rated 1-star. For many industries, meeting the minimum data availability requirement was a key challenge, especially due to the poor internet connectivity in many remote areas. Some of the actions that were helpful included installing data loggers, which has been done by many industries in Odisha. In addition, the SPCB, Odisha also strengthened its data collections servers and hired an experienced IT vendor to support the Program. Establishing and distributing Standard Operating Protocols for data acquisition and monitoring also helped improve the availability of data.

Finally, at a much broader level, the quality and integrity of CEMS data should improve once there is a legal environment in which CEMS data can be used as evidence of excessive pollution in the court of law. This type of change will elevate the importance of ensuring high quality and integrity CEMS data, which will in turn allow CEMS to reach its full potential as a regulatory tool for the SPCBs.

Lesson 3

Ongoing public participation and pressure is necessary to translate an information disclosure program into actual improvements in environmental performance

The Star Rating Program translates emissions data into a format that is easily understood by the public and other non-technical stakeholders. By doing so, it provides an opportunity for the public to engage with and exert pressure on local industries to improve their environmental performance. For this reason, an outreach and communications campaign can be highly beneficial. In addition, there is also a virtuous circle. With higher citizen engagement, there is an added sense of accountability and an incentive to improve the reliability of the information underpinning the Star Ratings.

In Odisha, the SPCB, Odisha can continue its momentum to drive citizen engagement by leveraging social media channels, which have amassed a notable following (over 1000+ Facebook page followers and over 100+ Twitter followers of Odisha's Star Rating Program) over the last several months. Periodic opinion pieces by SPCB, Odisha leadership on the Program, as well as other innovative reforms, will build confidence in the types of improvements that can be obtained through better data systems. Informing the media each time ratings are updated can also keep the public informed and engaged. Active public participation in the Program will also increase the likelihood that the Program is sustained will into the future.

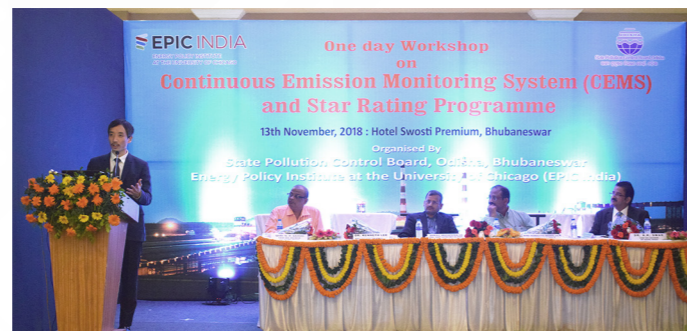
Lesson 4

Instill a sense of healthy competition between industries

Many industries value their public image. The Star Rating Program provides an opportunity for industries to display their environmental performance, relative to their peers. Moving forward, the SPCB, Odisha may wish to consider hosting public events to distribute industry report cards, encouraging improvement in environmental performance.



Varied group of stakeholders including those from industries convene for a one-day workshop on CEMS and Star Rating Program in Bhubaneswar



Dr Ken Lee, EPIC India joins SPCB, Odisha officials and other experts in sharing insights during a one-day workshop on CEMS and Star Rating Program in Bhubaneswar

5 CONCLUSION

The Odisha Star Rating Program proves that it is feasible to set up information disclosure and transparency initiatives to complement existing regulatory efforts to control industrial air pollution. From our experience in Odisha, it is critical that a robust data regime must be in place in order to produce high levels of transparency and accountability. For this reason, Odisha and other state governments should endeavor to strengthen their CEMS programs. Although new initiatives like the Star Rating Program can place additional strains on capacity constrained SPCBs, the improved information and data systems that emerge can support more innovative and ambitious efforts such as emissions trading schemes. The public is an important agent for change, and pollution control measures can be more effective with their support. Thus, sustained efforts must be taken to galvanize public awareness of air pollution and their harmful impacts on human health. Finally, political buy-in at the highest level of government is advantageous as it sends a clear signal to stakeholders to take these new initiatives seriously.

¹Air Quality Life Index (AQLI). <https://aqli.epic.uchicago.edu/>

²Peng Zhang, Olivier Deschenes, Kyle Meng, and Junjie Zhang. 2018. Temperature effects on productivity and factor reallocation: Evidence from a half million Chinese manufacturing plants. *Journal of Environmental Economics and Management*.

³Jonathan Colmer, (forthcoming). Temperature, Labor Reallocation, and Industrial Production: Evidence from India. *American Economic Journal: Applied Economics*.

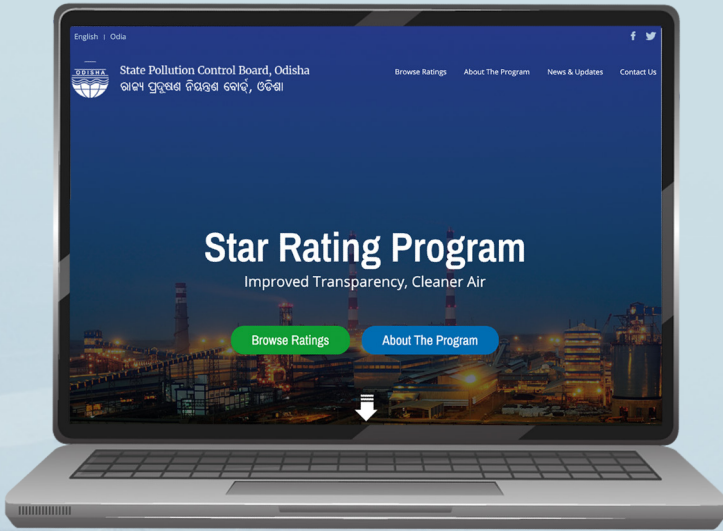
⁴Allen Blackman, Shakeb Afsah, and Damayanti Ratunanda. 2004. How Do Public Disclosure Pollution Control Programs Work? Evidence from Indonesia. *Human Ecology Review*.

⁵Hua Wang, Jun Bi, David Wheeler, Jinnan Wang, Dong Cao, Genfa Lu, and Yuan Wang. 2004. Environmental Performance Rating and Disclosure: China's Green Watch Program. *Journal of Environmental Management*.

⁶Michael Greenstone, Rohini Pande, Nicholas Ryan, and Anant Sudarshan. 2017. American Economic Association RCT Registry. <https://www.socialscienceregistry.org/trials/2197>

⁷Esther Duflo, Michael Greenstone, Rohini Pande, and Nicholas Ryan. 2013. Truth-telling by third-party auditors and the response of polluting firms: Experimental evidence from India. *The Quarterly Journal of Economics*.

⁸Although the Program was officially launched in September 2018, star ratings were issued retrospectively for the months of May, June, July, and August of 2018.



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