CLEAN AIR ASIA

CONTINUOUS EMISSIONS MONITORING

TO ACHIEVE AIR QUALITY TARGETS

POLICY BRIEF

Clean Air Asia is an international non-governmental organization leading the regional mission for better air quality, and healthier, more livable cities throughout Asia. Clean Air Asia's approach is one of science-based, actionable guidance combined with an ethos of partnerships and collaboration to ensure our work has meaningful and sustainable impact.

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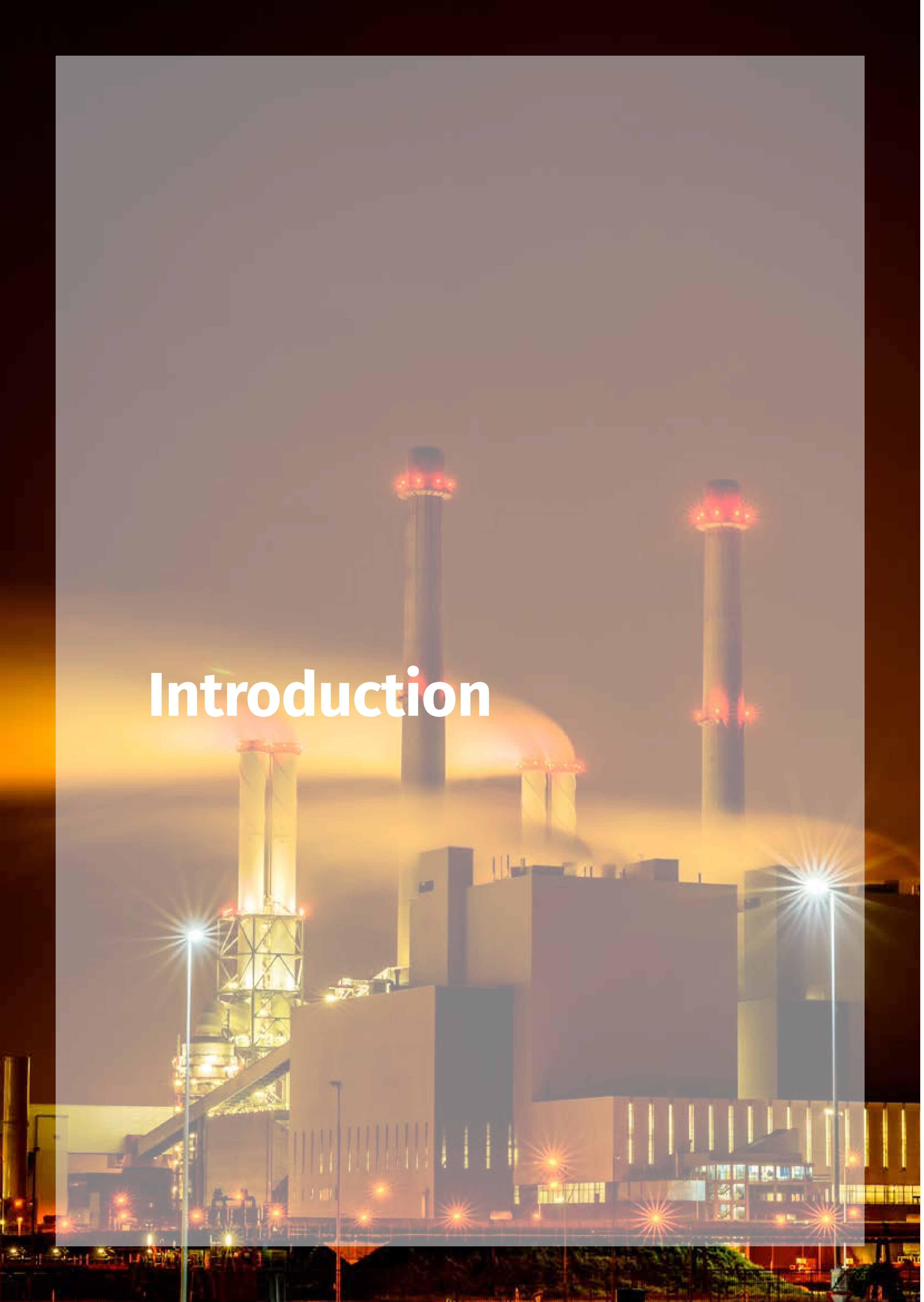


Introduction

Coal-fired power plants (CFPs) are still used to satisfy much of the electricity needs in Asia despite the presence of several policies aiming for the shift towards clean energy. Coal combustion generates air pollutants, which are connected to cardiovascular disease, stroke, acute respiratory illnesses, and cancer. In areas and countries with large proportions of renewable energy installations, the advantages of cleaner air can be observed with the increasing use of renewables for power generation *(Galimova et al., 2022).*

Emerging Asian economies, specifically in Southeast Asian countries, are becoming increasingly dependent on coal-derived energy and electricity to sustain their economic growth. The Global Coal to Clean Power Transition Statement was therefore a crucial outcome of the 26th United Nations Climate Change Conference (COP26). This statement calls for a transition away from unabated coal power generation by 2040 and was signed by 40 countries. The majority of ASEAN members have signed, including Brunei, Indonesia, the Philippines, Singapore, and Vietnam. However, leading global producers of coal such as China and India, who still heavily rely on CFPs to provide the majority of their power and industrial energy needs, did not support the petition *(ASEAN Centre for Energy, 2021).*

In 2020, CFPs were responsible for 11.9 Gt (or 34%) of the world's energy-related CO2 emissions. Asia accounted for the majority of that generation, with China, India, Japan, and South Korea contributing 6.17 Gt, or half of all coal-fired CO_2 global emissions *(Canadian Energy Centre, 2022)*. Air pollutant emissions and greenhouse gases (GHGs) produced by CFPs pose harmful risks to the environment and its ecology, have negative impacts on human health, and worsen climate change *(Clean Air Asia, 2020)* (Table 1). In many countries, these pollutants are being monitored to ensure the compliance of power plants and industrial facilities with the emission standards, which specify the maximum allowable limits for the emission of air pollutants. India and China have few of the most stringent standards in Asia for specific pollutants, such as sulfur oxides (SO_X), nitrogen oxides (NO_X), and particulate matter (PM).

Table 1. Pollutants from CFPs and their Health and Environmental Impacts

PM — Particulate Matter

Health Impact	Environmental Impacts
While PM_{10} can only enter the lung barrier, $PM_{2.5}$ can enter both the lung barrier and the bloodstream PM can either induce or worsen cardiovascular, pulmonary, and cancer conditions by affecting sensitive parts of the respiratory system	By scattering light, PM has a direct effect on climate change. Has the indirect effect of increasing the number of cloud condensation nuclei, which lengthens the lifetime of clouds and raises Earth's albedo. Formation of PM from acidic compounds (NO_X, SO_X) can also acid rain and ecosystem acidification.

CO_2 — Carbon Dioxide

Health Impact	Environmental Impacts
A concentration of 5000 ppm may be hazardous and cause oxygen deprivation, whereas a concentration of 2000–5000 ppm causes headaches, drowsiness, impaired focus, elevated heart rate, and nausea.	Global warming is a result of greenhouse gases like CO_2.

SO_2 — Sulfur Dioxide

Health Impact	Environmental Impacts
Short-term exposure irritates the nose, throat, and airways, which can in turn cause coughing, wheezing, shortness of breath, or a tightening sensation in the chest. Lung function may be impacted by prolonged exposure.	Emission of SO_2 harms forests, causes acidification, and plays a role in PM generation.

NO_2 — Nitrogen Dioxide

Health Impact	Environmental Impacts
Long-term exposure to low levels has been associated with asthma, diabetes, lung cancer, stroke, and acid rain. NO_2 can aggravate airway inflammation and impair lung function in high concentrations.	Soil and water eutrophication and acidification. The formation of O_3 and PM is influenced by NO_2.

HEAVY METALS — Heavy Metals

Health Impact	Environmental Impacts
Depending on distinctive properties such as particle size distribution, water solubility, reactivity, and carcinogenic potency, heavy metals can have harmful impacts on human health . Most of their immediate impacts are linked to workplace exposure; however, even low-level exposure over an extended period can have major negative effects on the population, such as in the form of cancer, kidney disorders, nervous system damage, and cognitive impairment.	They can be dispersed on land or in water, then accumulate in sediments and soil. Land and water ecosystems can be negatively impacted by even low concentrations . Heavy metals persist for a long time and hence frequently biomagnify in food chains and bioaccumulate in organisms.

Source: Kwiatkowski et al., 2020

Several countries in the region, through their Nationally Determined Contributions, have affirmed their commitments on reducing emissions as well as achieving net zero emissions in 30 to 50 years. However, many South and Southeast Asian countries are expected to continue developing new CFPs despite their emissions reduction targets and climate change mitigation pledges. The reported deceleration in the construction of CFPs is also temporary and does not change the operations of already existing CFPs in the region that emit air and climate pollutants. Therefore, policies ensuring that emission standards are as stringent as possible and that pollutants from CFPs are reduced to the lowest possible levels are necessary. In line with this, countries such as Vietnam, Indonesia, and the Philippines are updating or have recently updated their emission standards to become more stringent. Emissions monitoring and data collection also provide regulators with a concrete basis for the strict enforcement of emission standards as well as the validation of compliance by CFPs with these standards and requirements. In addition, accurate measurements of emissions inform the review of environmental policies and contribute to the updating of emission standards, with the goal of benefitting human health and the environment.

Continuous Emissions Monitoring Systems

Monitoring for air quality regulation generally falls under two categories: ambient air quality monitoring and stationary source emissions monitoring. Ambient air quality monitoring is the sampling and measurement of certain pollutants present in the outdoor air for comparison to ambient air quality guideline standards or values. *Stationary source emissions monitoring* is the collection and measurement of specific pollutants from individual stationary sources, such as power plants or industrial facilities, to check their compliance with emission standards.

In the past, the monitoring of emissions from stationary sources had been done through stack emissions sampling. However, this method can be insufficient as it may not fully capture the emissions data of the facilities during their actual operations. Regulators announce when a test is going to be conducted, which allows facilities to prepare and adjust their operations such that the best possible results are presented during testing. By contrast, the application of a Continuous Emissions Monitoring System (CEMS) offers emission sources and regulators a more accurate way of measuring and monitoring emissions continuously and automatically. In addition, CEMS ensures that emissions data observed during stack tests are captured during the actual operations of the facilities.

A CEMS is a system of sampling, conditioning, analytical, and software components designed to provide direct, continuous, and real-time measurements of pollutant concentrations by analyzing representative data of the flue gas. However, these systems must be properly designed, installed, operated, maintained, quality-assured, and inspected to ensure compliance. Experience in the United States has shown that CEMS can provide the most accurate and consistent data required to assess compliance with emission control standards *(Zhang et al., 2011).*

Policy enforcement programs must determine whether emission standards are being met when they are mandated. In this regard, CEMS can provide data with sufficient accuracy and precision to support enforcement programs and allowance trading programs, whereas intermittent manual stack testing appears to be insufficient for these purposes. CEMS have developed to the point where they can now satisfy the most demanding applications, which is advantageous with emission standards becoming progressively stringent and the proper operation of pollution control equipment becoming increasingly important *(Jahnke, 2022).*

The various types of CEMS based on their sampling methods are shown in Figure 1. Additionally, CEMS can be identified based on their methods of sampling, analysis, and emissions measurement.

Types of Continuous Monitoring Method

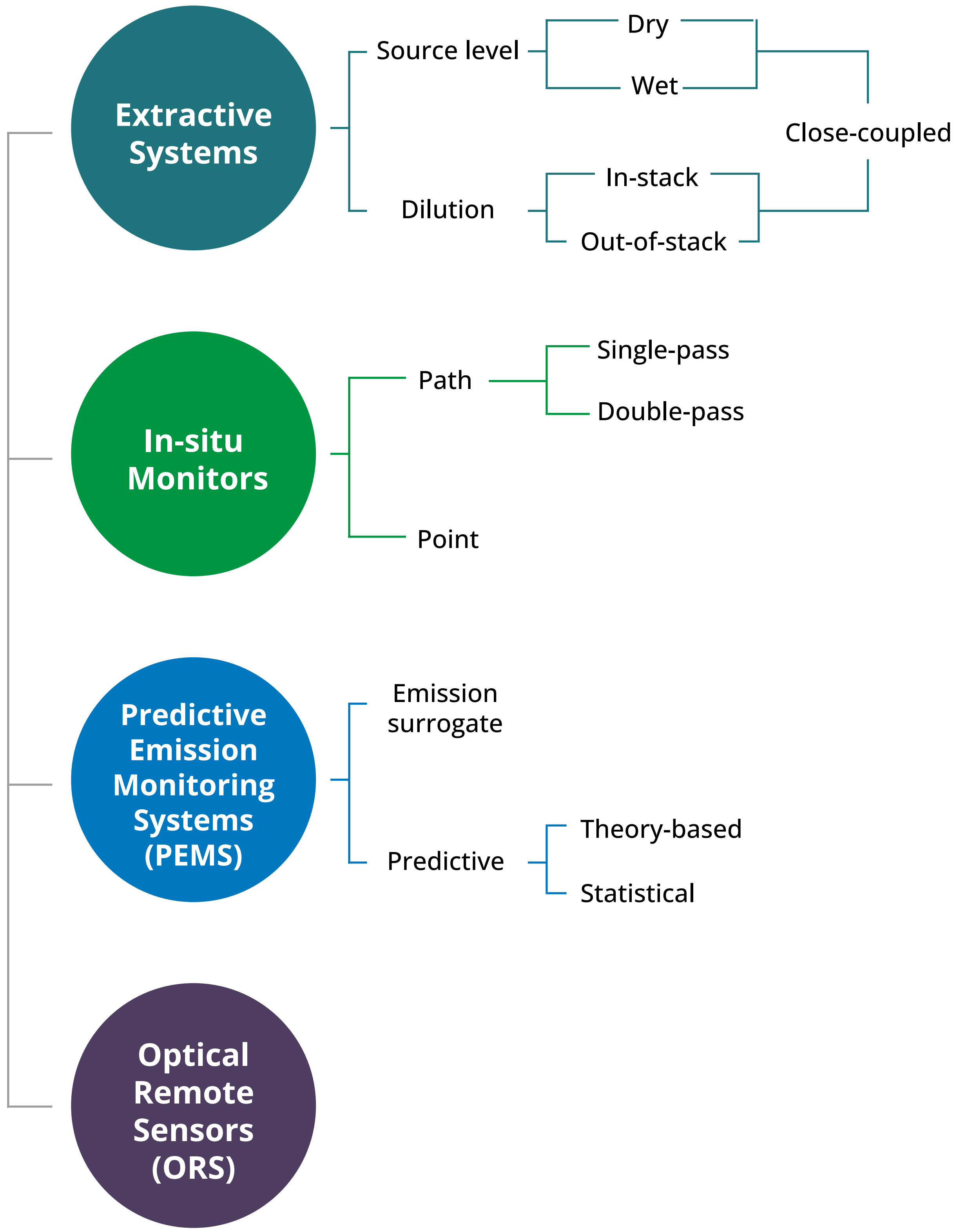


Figure 1. Jahnke, J. A. (2022). Continuous Emission Monitoring. John Wiley & Sons, Incorporated

Extractive systems extract

extract flue gas from a duct or stack and transfer it to an analyzer cabinet or temperature-controlled shelter for analysis. This system has two types: the source-level system and the dilution system. *Source-level extractive systems* transfer the gas for analysis after immediate extraction from the stack or duct and filtering out of particulates. *Dilution systems* draw gas into the probe at low flow rates.

In-situ monitors

are designed to directly measure gas concentrations at the point source in the presence of particulates without affecting the flue gas composition. They have shown promise in process applications, especially for regulating ammonia slip following NO_X emissions control systems. Integrated-path in-situ measurements are conducted throughout a specified path of the emissions stream along the stack, whereas point in-situ measurements are obtained from a single point within the stack. In-situ monitors are typically used in metal treatment, steel and paper manufacturing, and power facilities.

Predictive emission monitoring systems (PEMS)

use process parameters (including temperature, pressure, and flow rate) as inputs into advanced mathematical models to provide real-time emissions estimates. PEMS have been used with a variety of sources and use 3 to 20 input parameters. These systems work well on sources where there are minimal changes in the fuels and the operating conditions. Further development of mathematical emission models based on process parameter data has been done recently. Therefore, PEMS are more cost-effective than measurement-based CEMS technologies.

Optical remote sensors (ORS)

can measure emission concentrations by (i) shining controlled light toward the stack and analyzing the light reflected by the pollutants (active systems), or (ii) by detecting and analyzing the light spectrum emitted by the stack’s energetic pollutant molecules that are activated by combustion gases (passive systems). Compared to data measured by extractive or in-situ systems, the accuracy of gas concentration data from ORS is lower because of an inherent issue with specifying the length of the measuring path in the plume.

Continuous Emissions Monitoring Systems Policies in Asian Countries

Policies on emissions monitoring are essential to reduce CFP emissions and their harmful impacts. Emissions monitoring provides environmental control agencies access to more information, which serves as the basis for regulators to determine whether regulated facilities comply with emission standards. As such, the regular monitoring of emissions from industries and CFPs is mandated in some Asian countries *(Clean Air Asia, 2020)*. Continuous emissions monitoring, when properly used and maintained, can strengthen the regulator's capacity to effectively and efficiently enforce emission standards and would reduce the need for on-site inspection and manual reference method tests *(Jahnke, 2022).*

The major economies and top coal-consuming countries in Asia (specifically in Southeast Asia) implement policies requiring the use of CEMS as part of their emissions regulation programs for power plants and industrial facilities. Governments can regulate point sources of air pollutants by using CEMS data to support pollutant registration, pollutant discharge permitting, and operation regulation, which includes the temporary shutdown of facilities exceeding emission standards. Air pollution regulations in China also use CEMS data to implement a pollution levy system for power and industrial facilities *(Zhang et al., 2011)*. Apart from the regulatory aspect of monitoring, existing policies on the use of CEMS state that the CEMS data are to be used to verify the types and volume of emitted pollutants. This helps in tracking ambient air quality and the component air pollutants.

The CEMS policies of Asian countries have stipulations typically based on guidelines from international and foreign agencies, such as the European Union (EU), European Commission (EC), the United States Environmental Protection Agency (US EPA), and the Organization for Economic Cooperation and Development (OECD). Generally, these specifications detail guidelines on the monitoring of individual pollutants and the performance of the CEMS technologies. In Thailand

and the Philippines for instance, CEMS implementation guidelines (particularly on the data reporting requirements) are based on the specifications from the *US EPA. The Implementing Rules and Regulations of the Clean Air Act (or Department Administrative Order No. 2000-81) of the Philippines' environmental agency even utilizes the Performance Specifications under the US EPA Code of Federal Regulation (CFR) Title 40* as criteria to which the emission sources should adhere.

The reviewed CEMS-related policies of Asian countries also move to establish platforms wherein data can be gathered and stored for use in emissions analyses and regulatory activities. Depending on the policies and technological advancements of the countries, these platforms may already be automated data acquisition and storage systems and, thus, may require sources to submit data more frequently. China, Thailand, and the Philippines are countries with established central data acquisition and management systems, wherein regulated sources equipped with CEMS can regularly submit emissions data. These central data handling systems—China Emissions Accounts for Power Plants (China), Pollution Online Monitoring System (Thailand), and Data Acquisition and Handling System (Philippines)—are already connected to a substantial number of industrial and power facilities in the countries.

In terms of emissions data reporting, policies of the various countries that were reviewed require the CEMS data to be regularly reported. Common to all reviewed policies, regulated emission sources are required to submit full emissions reports at least twice a year or quarterly. In some cases, the frequency of reporting will depend on the pollutant types being reported, as in *Vietnam's Law on Environmental Protection (LEP) 2020 and Decree No. 08/2022.* For the countries with established central data management systems, such as Thailand and the Philippines, the regulated facilities are also required to transmit their CEMS data, as well as the updated closed-circuit television photo capture of the stack, every five minutes or on an hourly basis.

One significant benefit of these policies that require the use of CEMS is the improvement of regulatory process efficiency. With the CEMS data readily available at any given time, regulators and facility operators can be quickly alerted, either by the CEMS or by the regulator's central data handling system, about any exceedances of the monitored facilities over the pollutant emission limits. The regulators can then use this information to send out notifications or warnings, as well as any corresponding penalties, to the facility operators for corrective action.

Further details on the policies can be found in Appendix A.

Best Practices in Asian Countries

Thailand

Agencies in Thailand use CEMS data for several purposes, such as 1) monitoring factory air pollution by government agencies, businesses, factories, and the citizens; 2) serving as a reference for environmental concerns, academic datasets, and providing explanations for complaints about factory air pollution; 3) raising public awareness on the pollution status of specific factories in real time; and 4) acting as a database of industrial emissions to support legal actions.

CEMS data must be measured and reported following the US EPA standard, which is conditioned at 1 ATM 760 mmHg at 25 ^{o}C, dry basis with excess air 50% (or excess O 7%). CEMS data are reported in real-time on an hourly basis and continuously for 24 hours. The percentage of data transmitting daily to the Department of Industrial Works (DIW) must be at least 80% of the daily data (i.e., 80% of 24 records). Any interference needs to be reported to the DIW within the day via online and official report channels. CEMS parameters that are to be reported to the regulator include opacity (%), particulate matter (mg/m^3), sulfur dioxide (ppm), oxides of nitrogen (ppm), oxygen (% by volume), carbon dioxide (ppm), total reduced sulfur (ppm), and temperature (^{o}C).

A website and mobile application called the Pollution Online Monitoring System (POMS) provide the platform for CEMS data transfer and display. According to the POMS website, 71 factories, or the equivalent of 167 stacks, will directly upload data from their database systems to DIW. In addition to CEMS data, POMS incorporates data from various pollution databases, including water pollution monitoring systems; mobile data (periodic measurement for durations with complaints of increased pollution); station data; electronic reports; and lab tests (i.e., results from laboratory tests from Chiangmai, Khonkhean, Chonburi, and Bangkok laboratories). The platform provides real-time monitoring that is easy to use and understand and that helps in the monitoring and inspection of a facility's air pollution management. Users of POMS include civilians, entrepreneurs, provincial industry, and the national government (e.g., DIW).

China

According to a 2010 Chinese study on CEMS, there were over 10,000 CEMS installed in power plants (including state-controlled major power plants) around the country, measuring different air emissions and operational parameters *(Zhang et al., 2011)*. The Chinese government has implemented several policies and programs over the past few decades to lower SO_2 emissions from power plants and to limit adverse impacts on the environment and human health. Analysis showed that the effectiveness of these regulations and programs must be evaluated using precise air emission measurement, which led to the requirement of CEMS installation in the majority of the power plants. To standardize CEMS installation, operation, management, and inspection, as well as enhance the quality of CEMS data, the Chinese government has released several technical recommendations and departmental rules *(Zhang et al., 2011)*.

Data from CEMS have been collected, evaluated, and used to reexamine the emissions from China's coal-fired power sector. Compared to the previous bottom-up strategy, the new approach led to a significant decrease in the sector's emission factors, and a recent analysis anticipated that as a result, yearly emissions for 2015 would be 75%, 63%, and 76% lower for SO_2, NO_X, and PM, respectively *(Zhang et al., 2019)*.

China's Ministry of Environmental Protection mandated thousands of power plants to install CEMS on their exhaust stacks and submit hourly data on pollutant concentrations to a website that had been made accessible to the public in 2007. Both CEMS data and satellite data revealed that most plants were reducing their emission levels. Although some facilities in key regions saw lower compliance rates, this is not surprising given the degree of the required reduction. Furthermore, although some businesses might not have complied, the new criteria nonetheless caused them to lower their emissions. Lastly, generally good agreement has been observed between satellite data and CEMS *(MIT, 2019)*.

Indonesia

In 2017, the Ministry on Environment and Forestry (MoEF) released data on the emissions performance and technology adoption of 23 major coal-fired power generating units totaling 12.1 GW in power capacity. These units only account for 65% of the major generation units and only make up around 50% of the country's total generation capacity. Given that large units make up about three-fourths of the country's total installed capacity, measuring and analyzing their emissions pattern has proven helpful for the MoEF *(Centre for Science and Environment, 2017).*

The MoEF recently published MoEF Regulation No. 13 of 2021 (MoEF Regulation 13/2021), which identified the businesses or activities that are required to track their emissions using CEMS and to integrate their data into the Ministry's *Information on Continuous Industrial Emission Monitoring System (SISPEK)* by January 1, 2023. SISPEK will be operated and managed by the MoEF. The ten industries required to track their emissions and integrate data into SISPEK are pulp and paper, iron and steel smelting, carbon black, synthetic fiber, mining, oil and gas, cement, thermal waste treatment, fertilizer and ammonium nitrate, and thermal power generation *(Enviliance, 2021).*

Policy Gaps, Opportunities, and Recommendations

The policies discussed in this brief reflect the efforts of various Asian countries in reducing their air pollutant emissions through increased emissions monitoring that strengthens data-driven regulatory activities. Although policies increasingly incorporate the strictest international standards, efforts to reduce emissions and improve human health remain hampered by poor and inconsistent implementation.

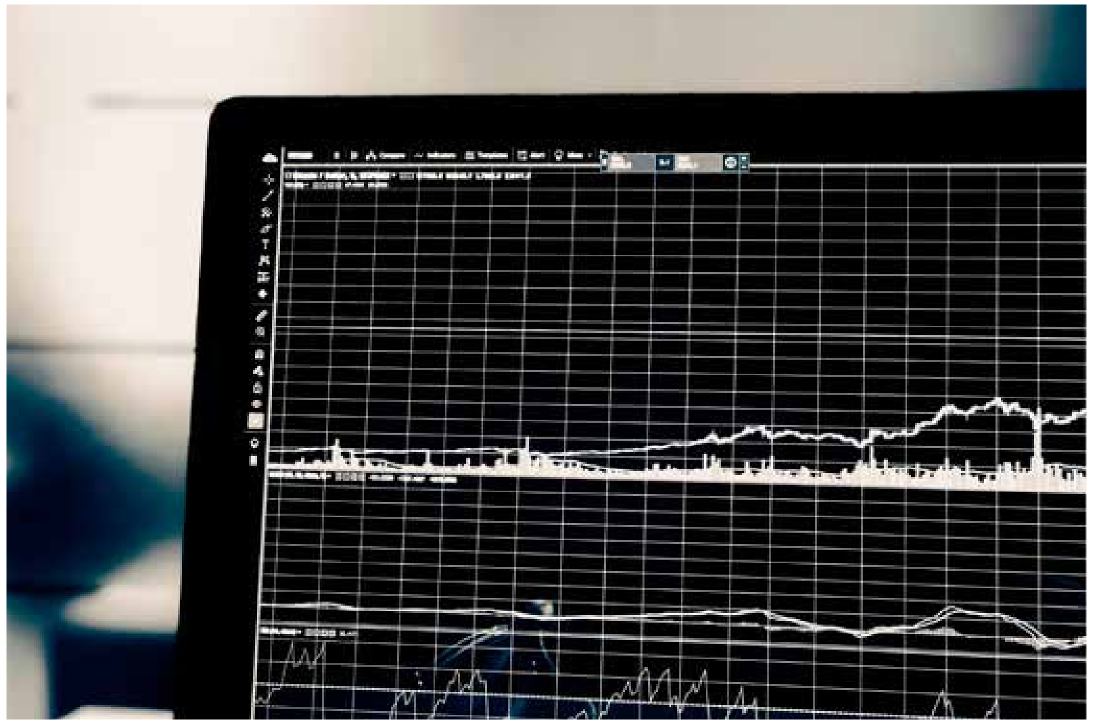
Data Quality and Validity

An important issue regarding the use of CEMS is data quality and availability. Accurate high-frequency information on various air pollutants emitted per source is vital in determining violations of standards. Some of the existing policies may be especially susceptible to poor data quality, especially in developing countries, given that CEMS performance requirements are not fully detailed in their policies and guidelines.

As an example on how to address the issue regarding data quality and availability, the US EPA has established a data substitution policy that permits sources to apply the algorithms for missing data gradually rather than using the block approach. Several missing data algorithms are implemented in sequence under the stepwise methodology. In other words, until the percent monitor data availability (PMA) falls below 95%, the least conservative approach is applied to the missing data hours. The following algorithm is then used until the PMA falls below 90%, and so forth *(GovInfo, n.d.).*

In addition to data quality concerns, CEMS data can be easily modified and reported to be any desired value. It is not difficult, however, to identify such adjustments. Properly trained regulators and inspectors would be able to identify questionable data given the daily calibration verification values, the emissions data record, the maintenance logbook, and other historical records. Spikes in emission values, inaccurate measurements, repeated recalibrations of the instruments, the addition of correction factors, or CEMS downtime during emission surges are all circumstances that call for additional investigation. In such an investigation, a review of both the analog emissions data and the calibration verification quality control charts is extremely helpful. The problem is that someone needs to carry out this task. However, far too frequently, neither the regulated facilities nor the environmental control agencies have the means or the forethought to put in place processes to conduct reality checks *(Jahnke, 2022).*

One approach employed by the US acid rain program to address the issue on modification of data is the submission of all calibration, emissions data, performance evaluation findings, and plant operating data to the EPA's Clean Air Markets database. Using a variety of methods, the data are format- and cross-checked to determine if they are internally consistent and reflect prior results and plant operating conditions. Inconsistent data is identified, and if necessary, requests are made to clarify and correct the data. As another example, the Canadian CEM Guidelines, EPS 1/PG/7, mandate that the CEM QA/QC program at a plant be audited annually by a third-party inspector. When CEM data are fabricated in the United States, which is a rare occurrence, legal action frequently follows. Penalties in these cases are criminal rather than civil (such as those incurred for having excessive emissions), hence serving as a powerful deterrent *(Jahnke, 2022).*



Proper Use of Data

To help regulatory authorities ensure the industries' compliance with policy requirements and reduce the need for manual inspections and investigations of any data manipulation, efforts must be taken to require self-monitoring by the facilities. One such approach is for regulators to build their central online emission and effluent monitoring systems and have the facilities automatically and frequently transfer accurate data. It is also important for regulators to be well-trained in handling and analyzing the data collected to maximize the benefits of the collected data to regulatory activities. In some cases, such as in China, it was found that the collected CEMS data are not being fully utilized to identify violations and the corresponding penalties or corrective actions *(Zhang et al., 2011)*. Regulators can also further utilize CEMS data to identify how well the various policies can reduce emissions from monitored sources.

CEMS Quality Assurance

To fully maximize the advantages of CEMS technology, it must be supported by clear implementation guidelines, accreditation/certification standards, and established quality assurance methods. If any one of these three components is not established, the installed CEMS in facilities could turn out to be of poor quality and may eventually stop functioning or provide corrupted, unreliable data. These components must be present in policies and must be strictly followed to assure that the CEMS data are reliable. The environmental control agencies establishing their monitoring programs can use CEMS rules, protocols, and guidance materials produced over the previous 50 years by the United States, Canada, and Europe as resources or basis *(Jahnke, 2022).*

Appendix A

Country	Policies on the use of CEMS	Summary	Platform
China	Management Regulations of Collection and Utilization of Pollution Levies	Chinese environmental regulations have frequently emphasized the use of CEMS data in regulatory programs during the past decades. Article 10 of the "Management Regulations of Collection and Utilization of Pollution Levies" for instance, states that "the emissions data from the polluting facilities, which use the state-designated mandatory automatic monitoring instruments of pollutant emissions, are used as a basis for verifying the types and quantities of pollutant discharges." The Order #28 also states that the CEMS data can be used in regulatory programs such as pollutant registration verification, pollutant discharge permit issuance, total emissions control, environmental statistics, pollution levies collection, and onsite environmental enforcement *(Zhang et al., 2011).*	China Emissions Accounts for Power plants (CEAP)
Thailand	Factory Act B.E 2535 Amendment *(Handbook of Business Operation in Thailand's Industrial Estate (IEAT))*	The laws governing the usage of CEMs in Thailand have been in place since 2001 to control the manufacturers in the Rayong Industrial Estate, which has a large concentration of factories and requires the installation of the CEMS. Department of Industrial Works (DIW) and Industrial Estates Authority of Thailand (EEAT) are two government agencies that supervises the use of CEMS. The EEAT oversees internal factories inside industrial estates, whilst the DIW is responsible for monitoring Thai factories that are located outside of the EEAT. CEMS data need to report following the U.S. EPA standard.	Pollution Online Monitoring System (POMS)
Philippines	DAO 2000-81 (Implementing Rules and Regulations of the Clean Air Act) and DAO 2020-003	For each applicable pollutant mentioned in Section 4, Rule IX that the source has the POTENTIAL to release in quantities equal to or higher than 100 tons per year, new and modified sources shall install and operate continuous emission monitoring systems (CEMS) in accordance with manufacturer specifications. All sources covered by this rule must install and use a CEMS for carbon dioxide and oxygen that meets Performance Specification 3 of USEPA 40 CFR Part 60 Appendix B. Each source must also adhere to the following criteria, if appropriate: • Particulate matter: Sources must install and operate a CEMS that meets Performance Specification 1 of USEPA 40 CFR Part 60 Appendix B. The owner also has to develop a calibration curve that shows the correlation between mass particulate emission rate as estimated by Method 5 and opacity as measured by the CEMS. • Sources must install and operate a CEMS for sulfur dioxide and nitrogen oxides that satisfies the requirements of USEPA 40 CFR Part 60 Appendix B, Performance Specification 2. • Carbon Monoxide: For this parameter, sources must install and operate a CEMS that satisfies the requirements set forth in USEPA 40 CFR Part 60 Appendix B, Performance Specification 4 or 4A. • Sources must install and run a CEMS for hydrogen sulfide that satisfies the requirements of USEPA 40 CFR Part 60 Appendix B, Performance Specification 7. *(PART I GENERAL PROVISIONS (emb.gov.ph))* DAO 2020-003 states that "All EMB-ROs shall establish a secure infrastructure to receive and store CEMS/COMS data and shall be responsible in ensuring that their respective DAHS, as well as the firm/proponent's DAHS are compatible with the existing DAHS used by the EMB-Central Office (EMB-CO). The DAHS of each RO shall be accessed in the central DAHS of the EMBCO. Furthermore, each EMB-RO shall ensure that tampered or altered CEMS/COMS data sent by the firm/proponent in their respective jurisdiction shall be issued Notice of Violation (NOV)" *(EMB-MC-2020-003.pdf).*	Data Acquisition and Handling System (DAHS)
Vietnam	Decree No. 08/2022	Industries that are specified in the Appendix XXIX published along with this Decree are required to install automated air monitoring systems and make monitoring data available to the public. The deadline for completing the installation of an automatic and continuous industrial dust and gas monitoring system (with monitoring camera) and connecting and transmitting live data to the provincial environmental protection agency is December 31, 2024 (https://www.iaeg.com/binaries/content/assets/iaeg-newsletters/2022/03/vnm_decree_english.pdf).	DONRE Publications
India	Air (Prevention and Control of Pollution) Act, 1981	In accordance with section 18(1)(b) of the Water and Air Acts, the Central Pollution Control Board issued the highly polluting industries and Common Hazardous Waste Incinerators, Common Bio Medical Waste, Common Effluent Treatment Plants (CETP), and Sewage Treatment Plants (STPs) to install online effluent quality and emission monitoring systems in order to help track the emission of pollutants from these units. The instruction proposed: • Installation of online emission quality monitoring systems for measurement of the parameters Particulate Matter, NH3 (Ammonia), SO2 (Sulphur Dioxide), NOX (Oxides of Nitrogen), and other sector-specific parameters in 17 categories of highly polluting industries, as well as in Common Hazardous Waste and Biomedical Waste incinerators before March 31, 2015, and transmitting of online data as generated simultaneously to SPCB/PCC and CPCB. • In the case of industries claiming Zero Liquid Discharge, installation of surveillance system with industrial grade IP (Internet Protocol) cameras featuring PAN, Tilt, Zoom (PTZ) and leased line real-time connection for data streaming and transmission of the same (ZLD). • Maintaining a tamper-proof online system with facilities for online calibration (on-site, off-site, and remotely) requires regular maintenance and operation. • To submit a bank guarantee covering 25% of the cost of online monitoring systems in order to ensure that they are installed within 90 days of the date that the industries received the SPCBs/PCCs' directives; *(Direction_control_of_pollution.pdf (cpcb.nic.in))*	Data Acquisition System (DAS)
Indonesia	Minister of Environment and Forestry Regulation No. 13 of 2021 on Continuous Emission Monitoring System for Industrial Emissions	In regard to the Continuous Industrial Emission Monitoring Information System, the MoEF recently published MoEF Regulation No. 13 of 2021 (MoEF Regulation 13/2021). By virtue of this rule, every business or activity that is required to track its emissions using the Continuous Emissions Monitoring System must integrate its data into the Information on Continuous Industrial Emission Monitoring System (SISPEK) by January 1, 2023, at the latest. SISPEK will be directed and managed by the MoEF. The use of SISPEK is necessary in ten different industries listed below: - pulp and paper - iron and steel smelting - carbon black - synthetic fiber (rayon) - mining - oil and gas - cement - thermal waste treatment - fertilizer and ammonium nitrate - thermal power generation *(https://www.ssek.com/images/publication_file/2555/lexology-getting-the-deal-through-environment-2022-indonesia.pdf)*	MoEF Biennial Update Report (BUR)

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