



CEMS VOYAGE FOR INDIA'S ENVIRONMENTAL GOVERNANCE

Much before 2014, when real-time pollution monitors were first mandated for industries in India, these were already installed in some industries such as cement, power and iron & steel making etc., primarily for internal use as opacity monitor for dust emission and SO₂ and NO_x monitors for gaseous emission monitoring. Regulatory mandate to adopt real-time pollution monitoring and data reporting using continuous emission monitoring system (CEMS), continuous effluent quality monitoring system (CEQMS) and continuous ambient air quality monitoring system (CAAQMS) came in February 2014 and flourished rapidly afterwards.

So much so, it makes up nearly USD 800-900 million market in India, growing further and involving most of the world's leading technology providers. Presently, CEMS installation mainly covers dust, SO₂ and NO_x beside accessory CO₂, O₂ parameters, CEQMS installation focuses on pH, BOD, COD, TSS and Flow, whereas, CAAQMS installation covers 5 to 12 ambient air quality parameters as guided by India's national ambient air quality standards. CEMS, however, dominates the Indian real-time monitoring regime and the market, and therefore, this article primarily focusses around it.

What India adopted in the last decade, the US and Europe have experienced it for over four to five decades, continuously improved to make it best suited and productive. Experiences around the world have clearly shown that the use of continuous monitors significantly helps in environmental governance with sufficient and credible data needed for quicker corrective actions, resource use optimisation, self-regulation, improved compliance and better policy framework. India did eye these benefits aligned with its policies towards sustainable development. Initial installations of CEMS and CEQMS were made in "17 categories of highly polluting industries" and later on, in industries located in Delhi-National Capital Region. CEQMS installation was also initiated in grossly polluting industries, that generated at least 100kg of BOD per day. As per the regulatory requirements, these industries were to install continuous monitor and supply real-time data to the central pollution control board (CPCB) and respective state pollution control board (SPCB). Presently, there are over 30,000 monitors installed across over 6000 industries which supplies data to the CPCB and SPCBs both. Additionally, the SPCBs have further instructed installation of CEMS and CEQMS into Red category industries, beyond 17 categories of highly polluting ones, and these industries are supplying real-time data only to SPCBs.

Hybrid system of Quality Assurance and Control

Credibility of real-time data is the most important feature which CEMS provides and this requires strict quality assurance and control systems either alike European system or the USA system. Whereas, the European system permits only certified CEMS system to be used for monitoring, the USA system allows non-certified CEMS but with performance test to be carried during installation. Both types of systems have own provisions for quality assurance during installation and quality control during operation. The European system follows Quality Assurance Level- based provisions for quality assurance and control and the USA system follows detailed performance tests provisions including 7-day drift test, correlation tests, and relative accuracy tests among others.

India adopted a hybrid system where it recommended the certified CEMS to be installed, and at the same time, allowed non-certified CEMS with mandated performance tests during installation, in order to encourage the indigenous manufacturing market. The post-installation quality control measures were also recommended respectively following the European and the USA system.

Unlike CEMS, there is no exclusive and established quality assurance and control system for CEQMS, though the MCERTS does carry tests and certification for CEQMS equipment, but this practice is not so prominent around the world. Similarly, for CAAQMS, the USEPA has a system to approve the monitoring technologies tested against standard reference methods and list them in the Federal register which is followed globally, including in India.

Challenges persists

Recognising the importance of quality assurance and control, India also announced the development of indigenous certification system for CEMS, however, it is still not in place. Although some initial attempts were made, the accreditation or recognition system for laboratories which can serve as a third-party quality assurance, control and testing agencies are also to be put into place. It is

Table: EU Vs the USA system of Quality assurance and Quality Control for CEMS

	EU	USA
Selection of equipment	QAL-1/EN15267 relates to certification of appropriate CEM systems	No certification. The onus is on the operator to demonstrate that the CEM installed is fit for purpose
Installation	Must meet standard EN15259	As above
Stability before calibration	QAL-3	Seven-day drift test
Valid calibration	Functionality test and QAL-2 assessment	Correlation tests over 3 days
Ongoing equipment stability	QAL-3 plus annual linearity	Zero and span plus quarterly linearity
Ongoing calibration stability	Functionality test and annual surveillance tests	Annual correlation test and relative accuracy test audits

Source: ICSC, 2020-21

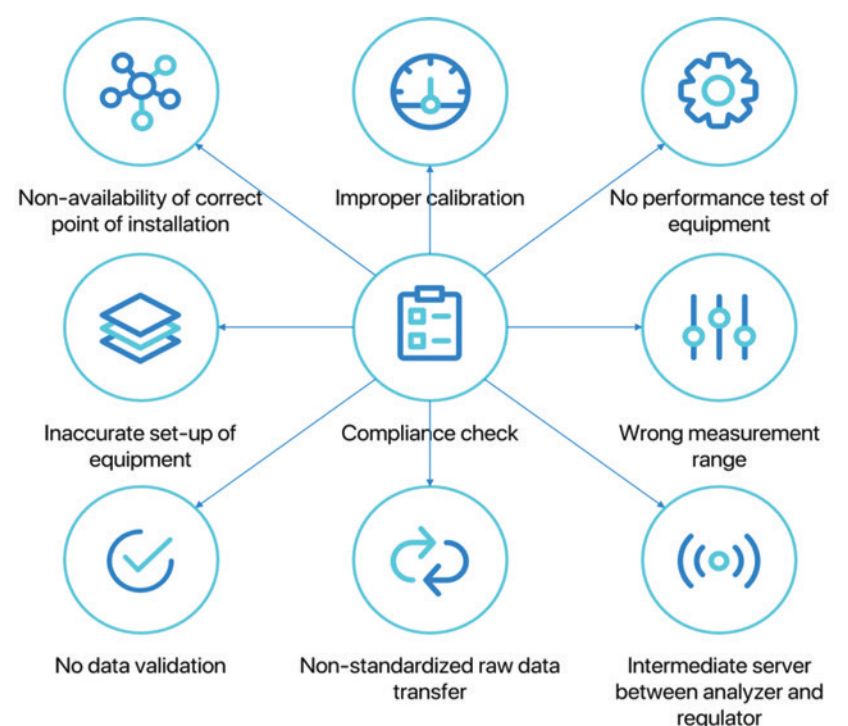


Figure 1: CEMS implementation challenges in India

Source: Sanjeev K Kanchan

important to mention that the guidelines for CEMS were published with over three years delay after mandating the CEMS installation which allowed multiple mistakes right from selection of CEMS to installation, set-up, operation & maintenance and data handling to ingress which can still be found in many industries. Moreover, missing two above key infrastructures- indigenous certification and lab empanelment or accreditation for CEMS, further added the reasons for poor data quality which the environmental regulatory system currently suffers from.

A 2021 study by International Centre for Sustainable Carbon (ICSC), UK named "Status of Continuous Emission Monitoring System at Coal-fired Power Plants in India" brings similar findings. Merely 50% of the coal fired power plants were found to supply regular data to the regulators despite the fact that almost all of them have CEMS installation in place. Poor data quality, especially for SO₂ and NO_x were also noted. There were almost no data for mercury emission monitoring in the plants.

Transparency at the bay

The challenges CEMS implementation faces in India are not surprising and the lower confidence in data is also known to all the stakeholders including regulators which restrain them from making the data public despite the judicial interventions. Various reports also highlight that the CPCB washes their hand from publishing the CEMS data claiming it's not its proprietary and right whereas most of the SPCBs choose various means to either hide, restrict or partially publish the data merely to comply the judiciary order. These denials from reality have not helped till date, and infact, kept the government from using the CEMS data for legal compliance check system. It is of great respite that some SPCBs such as Madhya Pradesh Pollution Control Board (MPPCB) has been noted taken proactive steps for regular data quality check, online vigil, training and publishing of relevant information and CEMS data to the public. Similarly, the Odisha Pollution Control Board (OSPCB) also publishes CEMS data on its website. These SPCBs not only receive appreciation from the stakeholders but also experience better control on CEMS implementation, however, majority of the SPCBs have shown reluctance only. The lack of transparency has been one of the barriers in experiencing real benefits from real-time monitoring system in India.

Indigenous innovations

Efforts in dealing with the poor data quality have led Indian CEMS regulatory system to innovate new ideas and adopt new practices beyond the USA and EU experiences. An advance data acquisition and handling system is one of them. This system allows direct data transfer from monitors, through internet of things (IoT) and data logger, parallelly to the central server of CPCB and respective SPCB without any intermediate server, PC or any device to avoid any possible tampering. The industry can only have authorised online access of its data from the central server. This common data acquisition and handling system is capable of handling data from all the CEMS, CEQMS, and CAAQMS without any manual intervention, and are customised to carry all the analysis, generate reports, send alarms and record calibration and maintenance events.

Development of remote calibration system for gaseous CEMS is another key innovation in India. The regulators upon observation of repeated abnormal data reporting choose to verify the CEMS operation at the industry. Using this system, a regulator randomly chooses to trigger remote zero and span drift test from its office and assess the gaseous CEMS responses to identify any mishandling. Since there is no intermediate device in the data acquisition and handling system, the response from CEMS gives the regulator upper hand in keeping the vigil.

India has been exploring and improving the ways to bring-up the data credibility. Developing a brand-new data acquisition and handling system with more automation and artificial intelligence are planned. News ways of automation of operation

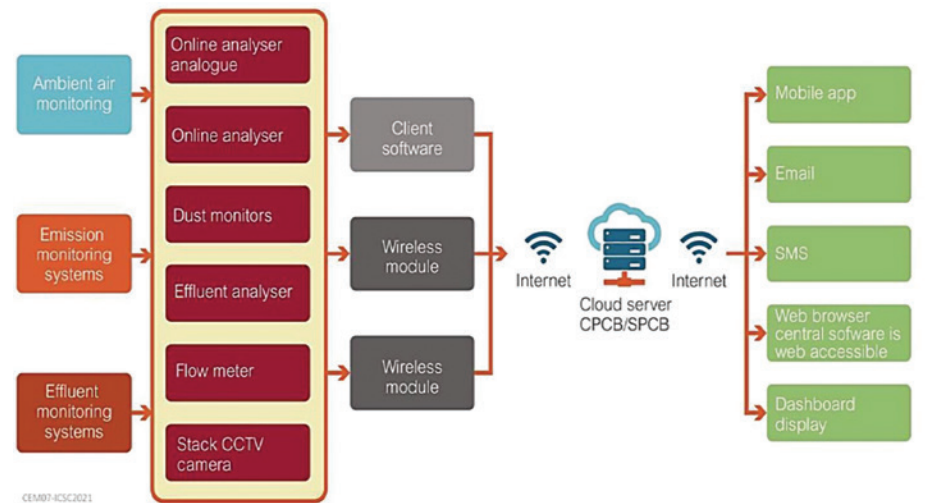


Figure 2: CEMS Data Acquisition and Handling System in India

Source: Sanjeev K Kanchan, ICSC, 2020-21

control in the wake of non-compliance on CEMS data are also being explored.

Towards the development of indigenous certification system, although, the union Ministry of Environment, Forest and Climate Change (MoEFCC) have authorised India's National Physical Laboratory but it is still to be realised. Similarly, the debate on setting-up laboratory accreditation or empanelment system and initiate amendment to utilize CEMS data for legal compliance check are also rising. These developments indicate a great demand for expert agencies to support the development of indigenous certification system and laboratory experience for CEMS in India.

Presently, the CEMS and CEQMS installation are also being instructed in medium and small industries by the SPCBs which opens a large market beside existing replacements and maintenance work requirement in the industries. In addition, CAAQMS market demand has also boost-up recently after the Indian government's initiative to expand the ambient air quality network significantly across the country. Along with these, there has been a persistent requirement of experts for training and capacity building of stakeholders on real-time monitoring. Undeniably, India needs to fast-track the proper implementation of real-time monitoring and its best use for which a lot has yet to be done, and it surely opens a vast pool of opportunities credible manufacturers, agencies and experts from India and overseas.

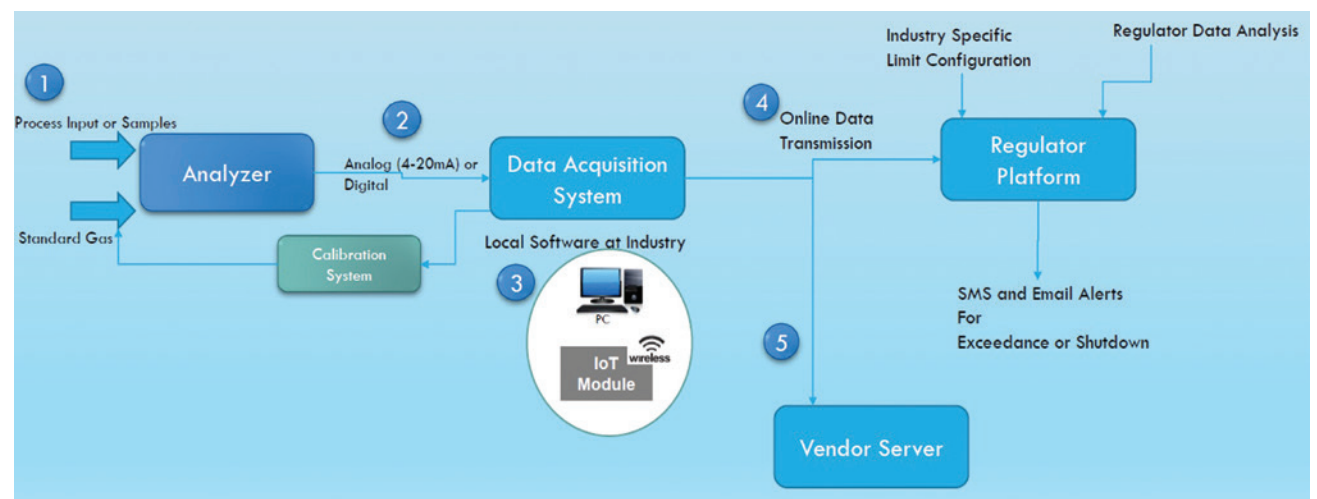


Figure 3: Remote calibration system

Source: Source: Sanjeev K Kanchan, ICSC, 2020-21

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