

The 2nd Malé Declaration Webinar Highlights Emission Inventory for Air Quality Management, 27 April 2026

Brief Overview

The Regional Resource Centre for Asia and the Pacific at the Asian Institute of Technology (AIT RRC.AP), in collaboration with the South Asia Co-operative Environment Programme (SACEP), successfully organized the 2nd Webinar in the Malé Declaration Webinar Series on “*Air Quality Management – Science and Investment for Sustainable Development in Malé Declaration Member Countries*”. The webinar was held under the topic “*Emission Inventory for Air Quality Management: Latest Development and Pathway towards Regional Database*” on 27 April 2026, from 13:00 to 15:00 Colombo/Delhi Time.

A total of 146 participants attended the webinar, with 51% female and 49% male participation. Participants represented a diverse range of institutions, including academia and research institutions, government agencies, international organizations, NGOs and civil society organizations, the private sector, and students. Most participants were from South and Southeast Asian countries, with additional participation from East Asia, Central Asia, the Pacific, Africa, Europe, and North America, including Republic of Korea, Taiwan, Tajikistan, Turkmenistan, Federated States of Micronesia, Niue, Somalia, Nigeria, Turkey, and the United States.

Opening

The webinar was opened by Dr. Vanisa Surapipith, who serves as the moderator, welcomed participants to the 2nd Webinar “*Malé Declaration Series on Air Quality Management – Science & Investment for Sustainable Development in Malé Declaration Member Countries*”, under the topic: “*Emission Inventory for Air Quality Management: Latest Development and Pathway towards Regional Database*”. She highlighted that this webinar series supports the ongoing revitalization of the Malé Declaration, which is an intergovernmental platform adopted in 1998 to address air pollution and its likely transboundary effects in South Asia. The Declaration brings together eight countries: Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, and Sri Lanka.

Dr. Surapipith emphasized that the webinar series aims to promote dialogue, knowledge sharing, and learning, particularly for young learners, practitioners, and stakeholders working on air quality management. She noted that emission inventories are highly relevant for South Asia due to the region’s significant air pollution challenges and transboundary dimensions. She then introduced the speakers namely Dr. Zbigniew Klimont from International Institute for Applied Systems Analysis (IIASA), Dr. Chris Malley from Stockholm Environment Institute (SEI), and Dr. Sarath Guttikunda from UrbanEmissions.Info, India and noted that the session would conclude with remarks from Dr. Ram Lal Verma of the Clean Air Fund.

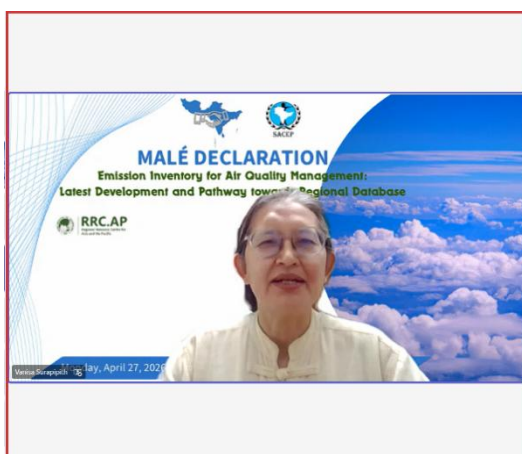


Figure 1: Dr. Vanisa Surapipith opening the webinar

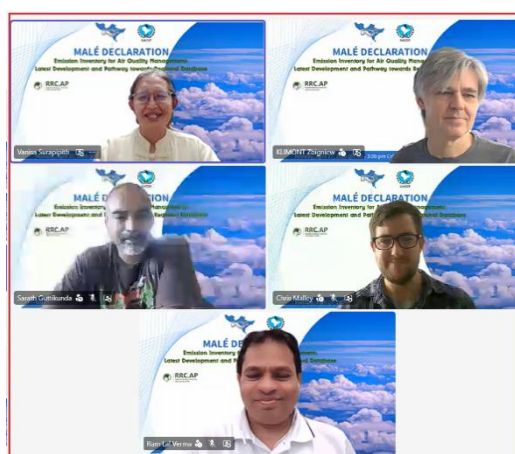


Figure 2: Group photo

Presentation Session

Dr. Zbigniew Klimont from International Institute for Applied Systems Analysis (IIASA), Austria, presented on “*Development of the GAINS Model in South Asia and the Latest Applications for Air Quality Management (AQM).*”

Dr. Klimont introduced the GAINS (Greenhouse Gas and Air Pollution Interactions and Synergies) model as an integrated tool for emission inventory development, scenario analysis, and policy support. He explained that GAINS uses a bottom-up approach, combining activity data, emission factors, and control technologies, and links emissions with atmospheric modelling and impact assessment to derive cost-effective pathways reducing impacts. The model can support the design of policies to meet air quality and health targets.

Dr. Klimont highlighted that GAINS is widely used in European policy processes, including under the UNECE Convention on Long-range Transboundary Air Pollution and the European Union. He also emphasized that GAINS applications require close collaboration with national experts and stakeholders to improve data, refine assumptions, and reflect local conditions.

Dr. Klimont presented findings from the Uttar Pradesh Clean Air Program, supported by the World Bank and implemented with IIASA, IIT Delhi, TERI, and the Government of Uttar Pradesh. The analysis showed that about 60% of PM_{2.5} pollution originates within Uttar Pradesh, while the rest comes from natural dust, neighbouring states, and transboundary sources. It also identified key sectors such as residential cooking, waste burning, small industries, transport, and agriculture, highlighting the need for source apportionment and regional cooperation.

Dr. Klimont referred to the World Bank’s South Asia regional assessment report, “Striving for Clean Air,” and also presented results from the other similar study for ASEAN region, which showed that current policies are not sufficient to significantly reduce PM_{2.5} exposure, but several proven mitigation measures exist that could support development of more ambitious climate and pollution policies and substantially improve air quality.

In conclusion, Dr. Klimont emphasized that GAINS links emission inventories, atmospheric processes, impacts, and policy scenarios, and that emission inventories remain essential for tracking progress, evaluating policies, and supporting evidence-based decision-making.

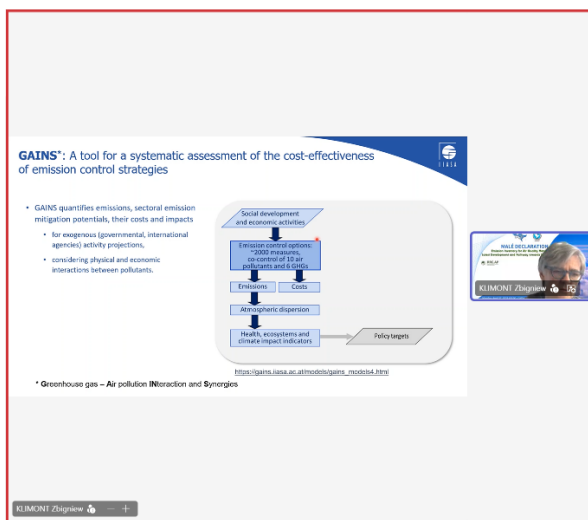


Figure 3: Dr. Zbigniew Klimont’s Presentation Session

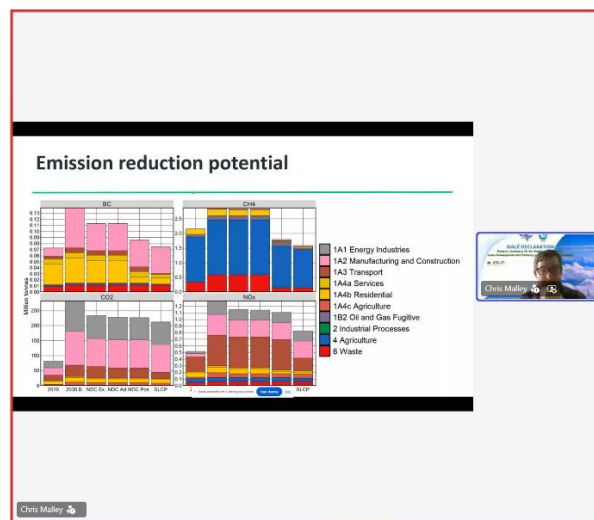


Figure 4: Dr. Chris Malley’s Presentation Session

Dr. Chris Malley from Stockholm Environment Institute (SEI) presented on “Synergies and Co-benefits of Air Quality and Climate Change Action.”

Dr. Malley introduced the LEAP (Low Emissions Analysis Platform) as a flexible, user-driven tool for integrated air pollution and climate change assessment. He explained that LEAP supports emission inventory development, scenario analysis, and evaluation of mitigation strategies, allowing users to assess how emissions, exposure, and impacts may change under different policy pathways. He also noted that LEAP is not a fixed model, but a software platform that can be used to build customized models across sectors such as energy, waste, industry, agriculture, and transport, depending on data availability and policy needs.

He emphasized that LEAP analysis should be embedded within a broader institutional and planning process, rather than used in isolation. This includes coordination by ministries, engagement with stakeholders, and alignment with national strategies. He also highlighted the co-benefits of integrated action, noting that climate mitigation can deliver substantial reductions in air pollution and related health impacts.

Dr. Malley presented two case studies from South Asia. In Bangladesh, LEAP supported the development of the National Short-Lived Climate Pollutant Action Plan by building a historical emission inventory and assessing NDC policies and additional measures targeting black carbon and methane. The analysis showed that these measures could reduce black carbon by about 50% and methane by about 40% by 2030, while also reducing CO₂ and NO_x emissions. Using the Impacts Benefits Calculator (IBC), the results indicated that implementation could improve air quality and avoid around 12,000 premature deaths from ambient air pollution.

In Pakistan, LEAP supported the development of the National Clean Air Policy, which was linked to the country's 2021 NDC. The analysis developed a historical emission inventory for 2010-2021 and projected emissions to 2050. It identified five key emitting sectors such as agriculture, households, transport, industry, and waste and showed that emissions would continue to increase without intervention. The work also supported provincial-level planning and showed how targeted mitigation measures could reduce particulate matter emissions.

Finally, Dr. Malley highlighted that LEAP could support analysis beyond air pollution and climate change by linking mitigation actions to broader development priorities, including energy, health, gender, agriculture and land use, waste, transport, and macroeconomic outcomes. He emphasized that LEAP could help countries explore wider climate and development linkages and support more integrated planning.

Dr. Sarath Guttikunda from UrbanEmissions.Info, India presented on "*Data Resources to Keep Bottom-up Emission Inventories Current in India.*" He emphasized that while models are important for pollution analysis, health impact assessment, and scenario development, the quality of these analyses depends strongly on the input data used to build emission inventories.

Dr. Guttikunda highlighted, using India as an example, the strong link between fossil fuel consumption and air pollution. He showed that coal, diesel, and petrol consumption have increased significantly over time, while satellite observations from TROPOMI also indicate increasing SO₂ and NO₂ column densities. This reinforced the message that rising fuel use without adequate controls will be reflected in pollution levels, making emission inventories essential for tracking sources and trends.

Dr. Guttikunda also referred to his recent publication titled "landscape review of air quality modelling in India" noting that most published studies focus on monitoring, while fewer studies develop primary emission inventories or conduct detailed pollution modelling. He stressed that there is still strong potential to expand primary emission inventory development, although this requires technical capacity, data processing, and modelling experience.

Dr. Guttikunda introduced the APnA City Program, which supports city and regional air quality assessments through airshed analysis, baseline emission inventories, source contribution assessment, and knowledge sharing. He also highlighted the UrbanEmissions.Info repository, where model-ready emission inventories, including All-India and city-level inventories, are made available as raw datasets for modelling and analysis.

Dr. Guttikunda highlighted several sectoral data sources, including power plant data from National Power Portal and transport data from the VAHAN dashboard. For the transport sector, he noted that vehicle registration data alone are not sufficient and emphasized the value of Fuel Station Surveys to better understand in-use vehicle characteristics, such as vehicle age, mileage, and actual fleet activity.

Dr. Guttikunda presented the case of Mumbai (Bombay) as an example, how city-level emission inventories can be developed by defining an airshed, compiling bottom-up data, and mapping activity hotspots such as port-related truck movement and brick kiln areas. He also presented the Delhi cost of inaction and cost of delay tool, a simple Excel-based tool that uses pollution trends and source apportionment results to show how much sectoral emission reduction is needed to meet air quality targets and how delayed action increases the difficulty of achieving them.

Finally, Dr. Guttikunda highlighted online resources developed for India's National Clean Air Program (NCAP), covering 131 non-attainment cities, including road density data and other city-level inputs. His presentation emphasized that emission inventories are practical tools for identifying sources, supporting modelling, guiding mitigation actions, and improving air quality planning.

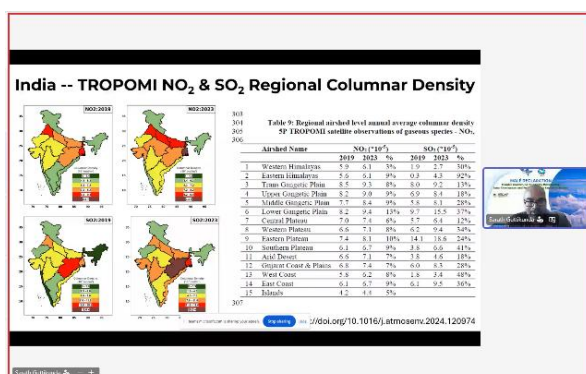


Figure 5: Dr. Sarath Guttikunda's Presentation Session



Figure 6: Dr. Ram Lal Verma Delivering Closing Remarks

Q&A Highlights

Q&A by Dr. Zbigniew Klimont

Q1: Why was 2020 selected as the base year, given COVID-19 disruptions?

A1: The speaker explained that 2020 was used as a calibration year because a significant amount of measurement data was available during that period. Due to COVID-19, there was actually increased monitoring activity, which provided useful data for model calibration. The study also evaluated other years, and 2021 was ultimately used as the reference year for developing future policies. In addition, the analysis considered future scenarios up to 2035, while the calibration itself was specifically based on data from 2020.

Q2: Were agricultural fires considered in the Indo-Gangetic Plain (IGP) region?

A2: The speaker confirmed that agricultural fires were included, using a combination of bottom-up estimates (based on crop production, residue generation, and field practices) and remote sensing products to provide the best possible representation.

However, the speaker noted that understanding of agricultural fires remains challenging by giving the example of agricultural fires in Thailand that despite the temporal distribution is relatively well understood, there is still significant uncertainty in estimating the total emissions and their contribution to air pollution concentrations.

Q3: How can countries address data gaps and uncertainties in emission inventories?

A3: The speaker explained that models such as GAINS are designed to include all known emission sources, even when data are not readily available, by using proxy estimates. While this introduces some uncertainty, it often results in a more complete representation of emissions. These estimates are then compared with monitoring data, and the growing use of low-cost sensors, which have become more robust, is a key asset in reducing uncertainties and filling data gaps.

At the same time, the speaker emphasized that there is no substitute for collecting data on the ground, and countries need to establish systems for continuous data collection. This is also critical for tracking policy implementation and understanding changes in activities and emissions over time, where emission inventories play a central role.

The speaker further noted that while emerging tools, including AI, can support better spatial and temporal analysis, fundamental data still needs to be collected. Finally, differences in capacity across countries were highlighted, underscoring the importance of capacity building, knowledge sharing, and regional collaboration, with platforms such as webinars and conferences providing valuable opportunities for exchange.

Q&A by Dr. Chris Malley

Q1: Can LEAP be seen as focusing on the “energy/emissions story,” while GAINS focuses more on pollution, health, and cost-effective outcomes?

A: The speaker explained that LEAP can indeed capture the energy story, which is often its primary use. However, it can also be extended to include non-energy sectors, allowing users to build a more complete emissions story. LEAP can incorporate cost information for mitigation measures and, through the Impacts Benefits Calculator (IBC), estimate health impacts, particularly changes in premature mortality. However, he noted that the health assessment in LEAP is less detailed than in GAINS, which includes more advanced analysis of health outcomes.

Q2: Is the emission inventory methodology in LEAP comparable to GAINS, and can LEAP outputs be integrated with GAINS?

A: The speaker emphasized that LEAP is highly flexible, with methodologies defined by the user depending on data availability and national context. This allows countries to represent specific local sources (e.g., waste burning in the Maldives, rice parboiling in Bangladesh, or provincial-level data in Pakistan) in detail. Because of this flexibility, LEAP models can vary significantly in structure and purpose. The speaker noted that he was not certain to what extent LEAP datasets can be integrated with GAINS, as many LEAP datasets have been developed across countries for different purposes and may have very different structures.

Closing

Dr. Ram Lal Verma from Clean Air Fund, delivered closing remarks. He summarized the key messages from the three renowned speakers and emphasized the importance of emission inventories for policy development and air quality management.

Dr. Verma highlighted that GAINS is widely used for policymaking, including in the Uttar Pradesh case, while LEAP-IBC supports emission scenario development and policy planning, as shown in the Pakistan example. He also recognized the long-term effort behind UrbanEmissions.Info and the APnA City Program, which support emission inventory development and India’s National Clean Air Program.

Dr. Verma stressed that emission inventory improvement remains critical, particularly in the Global South by referring to recent studies that emissions may be underestimated in regions such as India, Africa, and Southeast Asia, which can affect assessments of health, climate, and policy impacts. He also stressed that better emission data are essential for more accurate analysis and decision-making.

Dr. Verma also emphasized the need to decouple development from air pollution, noting that experiences from countries, for example, China shows that development can proceed while emissions are reduced through strong policies and technologies. This was

linked to the importance of revitalizing the Malé Declaration as a regional platform for South Asia.

Finally, Dr. Verma noted that ongoing efforts to revitalize the Malé Declaration include revisiting the original declaration, developing a vision paper, and strengthening regional cooperation. He emphasized that tools such as GAINS, LEAP-IBC, and emission inventory platforms can support future evidence-based planning under the Malé Declaration.