Training seminar on Japanese low carbon technologies and best practices: Compressed Air System and Steam Management

23 January 2024 | Chennai, India

IGES and TERI, together with Tamil Nadu Energy Development Agency (TEDA), organized a training seminar on 'Japanese low carbon technologies and best practices: Compressed Air System & Steam Management' in Chennai (Tamil Nadu, India) on 23rd January 2024 with support from the Ministry of the Environment, Government of Japan (MoEJ). The objectives of the seminar were: (1) to strengthen the capacities of energy auditors/managers and industry personnel on low carbon technologies (LCTs) and practices in compressed air and steam management systems; and (2) generate awareness regarding the JITMAP initiative. The training seminar was attended by about 55 participants from diverse backgrounds in industry and energy efficiency.

Inaugural session

Initiating the program, Ms Mihoko Nagai, First Secretary, Embassy of Japan in India, and Mr Girish Sethi, Senior Director-Energy Program, TERI, welcomed the participants and briefed them on the objectives of the training seminar. They went on to outline the advantages and benefits offered by LCTs in terms of energy savings and reduced energy costs and emissions at plant level. The adoption of LCTs also enables companies/industrial units to improve their business profiles through better environmental, social and governance (ESG) performance—a key yardstick used in national and global markets for assessment of business responsibility and sustainability—and to help India achieve its target of becoming a net-zero emissions economy by 2070.

Mr Prosanto Pal, Senior Fellow & Associate Director, TERI, and Mr Toshinori Hamaguchi, Program Manager, IGES, Japan outlined the efforts by IGES and TERI under JITMAP to promote Japanese LCTs in India through activities such as seminars and workshops,

feasibility studies, awareness and training programs, and stakeholder meetings covering a number of LCTs for various industrial sectors and applications. They also presented a few case studies to highlight the benefits brought by adoption of the LCTs.

Technical sessions

Session 1: Compressed air system

Mr Tsukasa Saito, Compressed Air System Expert and IGES Fellow, made a detailed presentation on 'Optimization of compressed air system – Japanese experience'. His presentation highlighted the improved operating practices that can be applied in compressed air systems to achieve significant energy efficiency improvements and reduced CO_2 emissions. For example:

- Lowering of compressed air generation pressure 0.1 MPa can reduce emissions by almost 8%.
- Proper pipe sizing and piping layout can reduce pressure loss in piping and bring down emissions by about 5%.
- Arresting compressed air leakages could reduce emissions by up to 20%.
- Using inverter system (VFD/ VSD) could reduce emissions by about 20%.
- In case of booster compressors, controlled consumption and usage of compressed air has a potential to reduce emissions by about 30%.

He underlined the importance of regular measurement and monitoring of power consumption and performance of the compressed air system, and the procedures to be followed. Some of the measures for improving the efficiency of compressed air system include:

- Adopting Ideal system configuration (layout) of air compressors.
- Installing oil-free compressors.
- Installing inverter-based (VSD/ VFD-driven) air compressors.
- Ensuring that pipelines do not have multiple bends, multiple partitions (such as check valves and other valves), small bores and large lengths.
- Selecting proper 'material of construction' (MOC) for pipelines and sizing according to the application.
- Installing air flow meters on major headers to monitor the air consumption in different sections/ machines of the plant.
- Using booster air compressors for localized high pressure requirements
- Regular air leakage detection and pressure drop monitoring.

Session 2: steam system

Mr Daiki Tanaka, Consulting Engineer, CES Division, Consulting & Engineering Department, TLV Co, LTD. a presentation was made on 'Steam management system – Japanese experience'. He explained that steam carries significant quantities of latent heat energy, and transfers most of this latent energy rapidly upon condensation; hence, steam is used widely in industry for fast and even heating

applications. As some of the latent heat remains in the condensate, there is scope for improving energy efficiency and reducing water consumption in steam systems through the recovery and reuse of heat and water from the condensate. He outlined the different designs of condensate heat recovery systems, and elaborated on the key principles for efficient operation of steam systems:

- Supply dry, saturated steam to improve heat transfer and avoid the problems caused by the presence of any condensate droplets in the steam.
- Ensure stable steam pressure and remove all air from the steam. This helps stabilize the steam temperature and enables even heating, leading to better product quality.
- Deliver steam at high pressure but use the steam at low pressure. This increases the latent heat content and reduces steam consumption. It also allows tighter control of temperature of the heated material/object.
- Most importantly, ensure rapid and continuous removal of condensate discharge through the use of appropriately designed steam traps. The right choice of steam trap greatly determines the overall energy efficiency of the steam system as well as productivity and product quality.

He outlined the different types of steam traps and their operating principles, and presented a few case studies on industrial plants to illustrate the efficient management of steam systems.

Practical demonstrations

Thereafter, the participants moved to Dr Ambedkar Institute of Productivity—the training wing of the National Productivity Council (NPC) located in Ambattur, Chennai—where they witnessed practical demonstrations of compressed air systems and steam systems. Also present during this session were Mr Hans Raj Verma, I.A.S, CMD, TEDA; and Mr D Sreenivasulu, Director, National Productivity Council. The demonstrations and the discussions that followed provided the participants with knowledge and insights on the advantages of VFD-driven air compressors over fixed-speed air compressors; and on various kinds of steam systems including the different types of steam traps (e.g., float, ball, thermodynamic traps), and their respective advantages and disadvantages.