Steam Turbines Can Play Key Role In Enhancing Energy Efficiency

BY **ARUN MOTE** NOVEMBER 27, 2023

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Globally, India is one of the fastest-growing renewable energy nations.

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As a global platform for economic cooperation, recent G20 summit has put forward an ambitious vision for energy transition, which includes energy efficiency in manufacturing sector. The successes of the summit include consensus on the climate change challenges, the pace of the climate change, and the need to curb greenhouse gas (GHG) emissions with renewed urgency.

Among other steps, the G20 Energy Transition Committee covers plans for lowering the cost of financing energy transition, doubling rate of energy efficiency improvement, and promoting renewable energy, such as solar, wind, hydro, and thermal renewables.

In the current context, the recent G20 Leaders' Declaration emphasised the need for a sustainable, responsible, and diversified supply chain for the transition to renewable energy sources. Here, India's incredible progress in renewable energy capacity makes it a

worldwide role model, having risen from barely 15 GW in 2010 to more than 173 GW in mid-2023.

Globally, India is one of the fastest-growing renewable energy nations. Its ambitions are even more expansive, as India intends to harness 500 GW of clean energy capacity by 2030, in line with its 2030 UN SDGs (sustainable development goals).

The Potential of Steam Turbines in Manufacturing

The policy consensus achieved at recent G20 and India's own progress towards energy transition are laudable. However, for energy efficiency in manufacturing, the portfolio of offerings must be expanded to include steam turbines. Across the globe, as countries transition from conventional energy sources to renewable ones, the turbine industry is simultaneously embracing the use of renewable thermal sources, backed by its extensive manufacturing infrastructure.

For more than a century, steam turbines have played a key role in energy generation across the globe. Energy efficiency in manufacturing is crucial, as it can ensure cost savings while enhancing the competitiveness of Indian enterprises in global markets.

For years, steam turbines have been a reliable source of heat and power generation, utilised to gain several benefits in varied industrial applications. This lowers operational costs and GHG emissions, thereby reducing air pollution while also limiting water consumption.

Steam turbines now find increased adoption in Waste-to-Energy [includes Biomass, Bagasse, etc.], Waste Heat Recovery [Steel, Cement, Refinery] & Pulp & Paper [Wood Waste as fuel] applications. The flexibility in terms of fuel for steam production makes the steam turbine technology uniquely universal.

The steam turbine industry is also a strong use case for implementation of new digital technologies. By embedding the Internet of Things, or IoT, devices into these turbines, users can obtain valuable data-linked insights vis-à-vis power generation and consumption patterns, helping utilities make prudent decisions.

Besides lessening the environmental impact, it enables a stable, dependable energy supply and reduces the susceptibility of production processes to price fluctuations or energy shortages.

Steam turbines also produce limited vibrations and need fewer resources, which makes them ideal for numerous industrial applications. As the country seeks to position itself as a global manufacturing hub through its 'Make in India' mission, steam technology is well aligned to advance its objective of a more sustainable, eco-friendly manufacturing landscape.

Meanwhile, the central government can play a critical role in creating a more conducive regulatory environment by encouraging energy efficiency through policy incentives and regulations in the manufacturing segment.

In the past few years, India has been promoting its manufacturing domain via the PLI (Production-Linked Incentive) programme. As a result, as of March 2023, it had attracted investments of Rs. 62,500 crore in the manufacturing industry.

Manufacturing also contributed to around 17 percent of its GDP in 2022, while providing employment opportunities to more than 27.3 million persons. By 2025, the government expects this segment will account for one-quarter of the economic output. By 2030, it is anticipated that the industry will generate $1 trillion of export commodities.

Overcoming Obstacles with Incentives

Nonetheless, multiple obstacles have hindered the expansion and output of the manufacturing space. A major challenge is the heavy reliance on labour-intensive practises and limited automated operations. Reliable power supply is another is another core concern, along with the need to reduce energy costs, which invariably affect the market pricing of goods.

If the industry is expected to align with India's global commitment to meeting its net-zero economy target by 2070, a swift shift is required towards environment-friendly manufacturing practises. One way to achieve this is by curbing energy consumption, which could be managed by boosting the efficiency of machines and using green alternatives to meet energy needs.

These include renewable energy sources such as biomass, bagasse, and process waste heat, which can be instrumental in aiding the manufacturing segment's sustainability shift.

Since upfront capital investments also increase the resistance to change, financial incentives and other enabling policy measures should also be implemented by the government.

The Importance of CO2 Alternatives

An IEA (International Energy Agency) report reveals that cooling needs are slated to rise threefold, from 12 TW to 36 TW by 2050. This jump in energy demand could potentially double CO2 emissions by 2050, triggering a significant rise in global warming. Therefore, to achieve net zero by 2050 while meeting heating needs, half of the heating demand should be met through heat pumps.

However, existing cooling needs mainly rely on refrigerants that possess a much higher potential for global warming compared to CO2. Significantly, carbon dioxide is itself an eco-friendly and cost-effective alternative to synthetic refrigerants. Supercritical CO2 (sCO2) technology is another efficient, compact replacement for the steam-Rankine cycle, with additional benefits that

comprise operational flexibility regarding quick start/stop and improved overall lifecycle costs.

A size reduction by a factor of five (5) can be expected with the sCO2 power blocks. Given the advantages, Indian R&D companies are developing both sCO2 and tCO2 cooling skid and heat pump technology.

As the manufacturing segment accepts the challenge of the ongoing energy transition, the industry is anticipating timely announcements pertaining to fiscal incentives and other institutional support measures to accelerate the adoption of energy-efficient, eco-friendly technologies.

(Mr. Arun Mote, Executive Director & CEO of Triveni Turbines.)

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