OPINION: Exploring New Options to Electrify Process Heating in MSMEs

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The micro, small, and medium enterprises (MSMEs) have emerged as an integral part of the Indian economy. Because of their ability to employ substantial semi-skilled and unskilled workforce, they are today playing an important role in India's post-pandemic economic rebound.

A large number of businesses under the MSME sector rely on heat for various processes. These include baking, sintering of refractories and bricks, forging, casting of metals, etc. About half of the industrial heat in the sector is used for low-temperature processes (at less than 250°C), such as steam generation, drying, etc., and the other half is used for high-temperature processes (at greater than 1000°C) in refractories, bricks foundries, etc. According to The Report of The Working Group on Power for Twelfth Plan (2012-17) by the Ministry of Power, 85 per cent of the energy consumed in the MSME sector is thermal, indicating the sector's heavy dependence on fossil fuels. Also, the thermal equipment used in process heating are not very energy efficient.

The benefits of switching to electric process-heating technologies are evident. Traditionally, process heat is provided at temperatures well above the required levels, while electrical process-heating technologies deliver heat at precise temperatures. Further, since many of the electrical heating technologies can be installed in smaller units (owing to smaller space requirement), their scope of use in MSMEs is quite high. Thus, electrification of process heat can reduce energy input, enhance energy efficiency, reduce operational costs, as well as reduce greenhouse gas emissions. Energy cost accounts for a significant share of the product manufacturing cost in the MSME sector— 20-25 per cent in most businesses. Since electricity is more efficient than diesel and LPG (largely used in thermal process-heating technologies), a shift to electric process-heating technologies can translate into significant savings as well.

There are several electrification technologies available in the market today, such as electric arc furnace, infrared heating, electric induction heating, etc. However, some other technologies with a promising potential have not yet been explored for adoption in India. Two such electrification technologies are heat pumps and microwave-assisted heating.

Heat pumps work on the principle of vapour compression to transfer heat from a low-temperature heat source (outside air or waste heat) to a high-temperature heat output. They have remarkable energy efficiency, and produce 3 to 7 times the thermal energy for a given electrical input. The currently available heat pumps can supply steam up to 165°C, or hot air up to 120°C. Heat pumps can provide heat for a wide range of MSME processes such as baking, drying, and steam generation in boilers.

A simple analysis performed for comparing the operational costs of heating 1 tonne of water from 40°C to 90°C using heat pumps and conventional boilers (powered by wood, HSD, furnace oil), shows that the cost of heating water using heat pumps is 69 per cent lower than that of HSD-powered boilers, 54 per cent lower than furnace-oil-powered boilers, and 63 per cent lower than LPG-powered boilers. The efficiency of the steam boiler is assumed to be 60 per cent and the coefficient of performance (COP) of the heat pump is taken as 4.

Some heat pumps are also capable of providing heating and cooling simultaneously. In bakeries with both heating and refrigeration requirements, for instance, industrial heat pumps can be a great fit.

A study by the International Energy Agency (IEA) shows that while the investment required for industrial heat pumps is higher than that for steam boilers (2 to 3 three times higher), heat pumpscan have shorter payback periods (less than 2 years).

Another electrification technology that can be suitable especially for higher-temperature processes in MSMEs is the dielectric heating system. In this heating system, the material is placed in a high-frequency electromagnetic field, causing the molecules to agitate rapidly. This heating technique works well with non-conductors of electricity, making it suitable for a wide range of processes such as sintering, drying, pre-heating in refractories, ceramics, textile, brick sectors, etc.

A vast majority of units in the brick and refractory business use downdraft kilns, which are highly inefficient (20-25%). The firing process in the kiln takes 48-72 hours, and the firing temperature in the kilns is around 1200°C. The time and energy required to fire bricks can be halved by using microwaves to supplement or complement the conventional kiln firing. This is significant, given that energy costs form 20-40 per cent of the manufacturing costs in brick and refractory businesses.

A UK-based company, C-Tech Innovation, retrofitted the tunnel kiln with two 60 kW microwave emitters, in addition to the conventional gas firing system. They found that the energy consumption reduced by 50 per cent, the firing time decreased from 46 to 16.75 hours, and the production speed increased by 174 per cent. This was achieved with the microwave emitters supplying only 10 per cent of the total energy. Such microwave emitters can be retrofitted to an existing brick/refractory kiln.

To promote these technologies in India, a conducive environment needs to be created for their uptake, in addition to addressing the challenges present in this area.

Both the technologies require local expertise in heat pumps and microwave heating technologies, which can be achieved through technology transfer and partnerships with other nations. Further, while some local service providers are available for heat pumps in India, there are hardly any available for microwave heating systems. To boost local manufacturing, the government can provide financial incentives to manufacturers by including them in schemes like the Production Linked Incentive (PLI) scheme. To address the high initial investment cost, capital subsidies can be provided by the government

to the MSMEs willing to adopt these two technologies. Organisations like the Bureau of Energy Efficiency (BEE), along with State Designated Agencies (SDAs) and NGOs can promote heat pumps and microwave heating technologies in the awareness creation workshops conducted for MSMEs and Energy Service Companies (ESCOs). SDAs can also facilitate demo projects of heat pumps and microwave heating technologies using the Revolving Investment Fund (RIF) available under the State's Energy Conservation Fund.

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