Why is India betting on coal gasification and could progress be a slow burn?

India recently approved a US$3.9 billion scheme to turn more of its vast coal reserves into gas. Even as its energy security ambitions gather pace, experts warn that scaling up the centuries-old technology will likely be a slow burn.

Collin Furtado | 18 Jun 2026 06:00AM

Jindal Steel & Power currently operates India's sole active commercial-scale coal-gasification plant, located in Odisha state. (Photo: Facebook/Jindal Steel & Power Limited)

SINGAPORE: India is ramping up efforts to turn coal into gas, joining several other Asian economies such as China and Indonesia in turning to the centuries-old technology to reduce dependence on imported fuels.

New Delhi's push has gained fresh urgency as shipping disruptions through the Strait of Hormuz during the US-Israel war on Iran threaten supplies of crude oil, liquified petroleum gas (LPG) and fertiliser feedstock to import-dependent economies such as India, say analysts.

For India, coal gasification seems an obvious answer given its vast reserves of the fossil fuel.

Yet experts say it may face the toughest challenge among regional peers, with obstacles ranging from the characteristics of Indian coal and water-intensive operations to financing constraints and fragmented policymaking.

TURNING COAL TO GAS

Unlike conventional coal-fired power generation, coal gasification converts the resource into synthetic gas (syngas) rather than burning it directly. The process, which dates back several centuries, heats and reacts

coal with oxygen and steam to produce syngas, which is made mainly of carbon monoxide and hydrogen.

The syngas can then be cleaned and converted into many molecules to make fertilisers, methanol, dimethyl ether (DME), synthetic natural gas and hydrogen. DME can also be used as a substitute for liquefied petroleum gas (LPG). And even the residual carbon dioxide can be further captured and converted to more products.

Coal gasification can substitute some imports but not fully replace them, because industrial demand is large, varied and difficult to displace quickly, experts said.

Atanu Mukherjee, CEO of energy-transition advisory firm Dastur Energy, described it as a way to create "optionality" and energy resilience, rather than a route to stop reliance on imported fuels altogether.

Experts said coal gasification has remained niche because projects are costly, technically complex and slow to scale.

Mukherjee pointed to China as an example, saying its coal-gasification buildout was a "long haul" that took "10 to 15 year runs" to reach large-scale deployment.

But the technology is drawing renewed interest as oil- and gas-import-dependent economies look for a cushion from fossil-fuel shocks, experts said.

India is among the countries accelerating its coal-to-gas push.

Last month, the country approved a US$3.9 billion scheme to support coal gasification, with incentives covering up to 20 per cent of plant and machinery costs for new projects.

Authorities expect the programme to attract large-scale private investment, adding that the projects would be selected through a competitive bidding process.

Officials framed it as a way to strengthen energy security, make greater use of domestic coal and reduce reliance on imports of fuels, fertilisers and chemical feedstock.

Other Asian economies have already taken similar steps.

China has 13 new coal-to-gas projects under construction or in planning, as Beijing looks to tap domestic coal and reduce its exposure to natural gas imports, Bloomberg reported in April. The push has gained urgency as the war in Iran disrupted its energy shipments from the Middle East and exposed China's dependence on imported oil and gas, the report added.

These projects could potentially provide syngas equivalent to 12 per cent of the country's gas supply, said the report, citing Chinese consultancy OilChem.

Meanwhile, Indonesia reportedly announced the launch of six coal gasification projects in early February, before the Iran war erupted, with US$9.8 billion in investment for DME production to replace LPG supply.

Crude, oil products and LNG account for about a quarter of India's import bill and around 15 per cent of Indonesia's, according to local government data. China's wider fuel import bill, including mineral fuels, accounts for about 20 per cent of imports, according to World Bank data.

The appeal of coal gasification is clear for India, which holds the world's fifth-largest coal reserves yet remains heavily dependent on imported energy - sourcing about 88 per cent of its crude oil and roughly half its natural gas, according to local media reports and government data.

In 2021, the country launched its National Coal Gasification Mission, setting an ambitious target to gasify 100 million tonnes of coal per annum by 2030. However, the government has not said how much this target would

reduce India's overall energy import bill.

Dastur Energy's Mukherjee told CNA that US$55 billion to US$78 billion of coal-gasification investment over 10 to 15 years could reduce India's import bills by about US$20 billion.

A TOUGH MIX OF CHALLENGES

Yet analysts pointed out that India's coal-to-gas ambitions face a layered set of challenges, ranging from physical constraints in its coal and water resources to structural barriers in scaling up the technology.

A key hurdle is gasifying Indian coal, which has a high ash content. The large amount of ash creates challenges, lowers efficiency and requires customised gasifier designs, experts said.

Indian coal often contains 30 to 45 per cent ash, according to a report by Indian government think tank NITI Aayog. In comparison, the ash content of coal in places such as China and Indonesia is below 20 per cent, analysts noted.

"You have plenty of gasification technologies on the market and you can find most of them in China and buy them directly off the shelf. However, the technologies from China cannot one-to-one be directly used in India," said Martin Grabner, head of the Department of Energy and Process Engineering at German applied research institute Fraunhofer IKTS.

China is the global leader in coal gasification technology. Over the past two decades, it has built large coal-to-chemicals clusters backed by state planning, patient capital, industrial scale and domestic technology adaptation, experts told CNA.

China is also the leading supplier of entrained-flow gasifiers, the dominant coal-gasification technology used around the world. However, they operate at very high temperatures and are not proven for raw Indian coal with such high ash content, Grabner said.

India's indigenously developed coal-to-methanol pilot plant. (Photo: Ramakrishna Sonde)

"Nobody dares to build a world-scale entrained-flow gasifier and guarantee it can run with 35 or 40 per cent of ash stably," he told CNA.

India has taken steps to overcome the issue. The NITI Aayog report highlighted the "landmark success" of an indigenous coal gasification technology that produced high-purity methanol from high-ash Indian coal at a coal-to-methanol pilot plant in February 2022.

While noting its potential, Grabner said most technologies still need further demonstration at a commercial scale.

Ramakrishna Sonde, a senior energy scientist who led the development of the pilot plant, told CNA that past coal-gasification failures in India were caused by the use of imported technologies designed for low-ash coal.

Sonde, who is also a former professor at the Indian Institute of Technology Delhi, added that India needs to develop indigenous gasification technology better suited to such coal.

"The recent success of coal-to-methanol technology demonstrated after several years of R&D and technology development has made India ready now to scale up coal-to-energy and industrial feedstocks at commercial level with minimum risks," he added.

Water use is another key challenge.

Depending on the final product and gasification technology, coal gasification can require significant volumes of water, and in India the burden can even be higher due to the high ash content, noted Fraunhofer IKTS's Grabner.

Lydia Powell, head of the New Delhi-based Observer Research Foundation's (ORF) Centre for Resources Management, said this is a major concern because many Indian coal reserves are in inland and water-stressed regions.

Sonde, the senior energy scientist, said that water use can be reduced through better technology design, but it cannot be eliminated.

While systems could be put in place to capture and recycle used water, such arrangements add to costs, experts noted.

Technical constraints aside, India faces broader difficulties in scaling up its coal gasification efforts.

At present, India has only one commercial-scale coal-gasification plant in operation, with the capacity to gasify nearly 2 million tonnes of coal a year, according to local media reports.

To meet its 2030 goal, India would have to scale up from one major commercial plant today to dozens within four-and-a-half years - a target experts told CNA is unlikely to be achieved.

ORF's Powell said it will be "very difficult" for India to meet its 2030 goal, adding that she would be surprised "even if just 10 per cent of that target is achieved" in that timeframe.

One reason is the slow pace at which large energy and industrial projects move in India, she and other experts said.

After launching its National Coal Gasification Mission in 2021, it took the Indian government three years before committing to its first major package of 85 billion rupees (US$890 million) for coal gasification projects, according to local media reports.

Even after incentives are announced, projects still need private financing, environmental approvals, coal supply linkages, technology selection, buyer-seller contracts and construction, experts said. Each step can slow the rollout of commercial-scale plants.

Mukherjee from Dastur Energy told CNA that building a coal-gasification ecosystem is not a "two-year, three-year haul", but a long-term effort that could take 10 to 15 years to reach meaningful scale.

CAN INDIA POWER THROUGH?

India has developed pilot and demonstration coal-to-gas projects through domestic institutions and companies, but experts said it now needs commercial-scale plants that can prove reliability, economics and environmental controls in order to scale up deployment.

Mukherjee said smaller commercial projects gasifying around 500,000 to 1.5 million tonnes of coal a year could be a practical starting point, allowing developers to learn and then replicate.

A 1.5 million tonne project could probably be built in "three to four years", he said, while larger projects could take "five to eight years".

Building a commercial-scale coal gasification plant typically requires capital expenditure of US$2 billion to US$4 billion, depending on project scale, according to media reports.

Mukherjee said the new US$3.9 billion scheme could help draw in about US$35 billion in total private investment over time.

However, incentives are only a signal, he said. India will also need mechanisms such as sovereign-backed loan guarantees or other credit-enhancement structures that provide a limited backstop in the unlikely event of project default, he added.

By reducing perceived credit risk, such mechanisms can lower borrowing costs, expand the pool of private debt capital, attract banks and institutional investors, and create a deeper, more liquid financing market to accelerate the scale-up of India's coal gasification ecosystem, Mukherjee said.

Experts said investors will also need assured coal supply, clear pricing rules and long-term contracts between buyers and sellers for downstream coal-to-gas products such as methanol, ammonia, DME, synthetic natural gas and fertiliser feedstock.

Grabner said two things must be fixed before any gasification project can be properly designed: the exact raw coal being used and the final product.

A labourer sorts coal after unloading it at a coal depot in Ahmedabad, India, on Mar 27, 2026. (Photo: AFP/Shammi Mehra)

Developers need to know which mine the coal will come from - as each mine has a different coal and ash composition - and who will buy which exact end product. Changing either variable can disrupt project costs and technology design, he added.

For example, a plant designed to turn coal into methanol cannot easily switch to producing synthetic natural gas or fertiliser feedstock, because each product requires a different gas composition, equipment setup and buyer.

Ensuring proper coordination between governing bodies and ministries is also key in powering India's coal-to-gas ambitions, observers said.

Coal gasification cuts across different ministries in India, including coal, petroleum, fertilisers, chemicals, steel, power, water and the environment.

"There is not one single nodal agency currently which is going to take a decision quickly," said Sonde, the senior energy scientist.

Sonde said India needs to run coal gasification in "mission mode", because the sector is currently split across several ministries. He said an example of a structured model that the government can follow is India's Atomic Energy Commission where complex nuclear technology was developed and commercialised.

India's Atomic Energy Commission oversees the country's nuclear programme through a centralised institution structure overseen by the prime minister, coordinating everything from research and technology development to fuel resources and industrial deployment.

A similar model for coal gasification, Sonde said, would help avoid fragmented decision-making across

different ministries.

ORF's Powell made a similar point, saying a dedicated government institution or unit would help if the country wants to reach scale.

Maintaining momentum is also crucial.

Powell said India's coal-gasification plans could lose urgency if Middle East gas flows resume and crude oil prices fall.

Already, oil prices on Monday (Jun 15) settled at a three-month low after the US and Iran said that they had reached an agreement to end their war and reopen the Strait of Hormuz.

Indonesia offers a lesson. According to a January 2022 report by the Institute for Energy Economics and Financial Analysis (IEEFA), a research institute that examines energy markets, trends and policies, the Southeast Asian country's coal-to-DME gasification projects would only make economic sense when LPG prices were unusually high.

In many months, imported LPG was cheaper than DME produced from coal gasification, weakening the case for the projects and helping explain why such plans had previously stalled, the report said.

Ghee Peh, the independent analyst who authored the IEEFA report, told CNA that cost and guarantees are the two central issues stalling Indonesia's coal gasification projects. Foreign gasification technology providers want assured returns, while the government wants to avoid creating a new subsidy burden, he said.

That is why India's strongest case may be to treat coal gasification not as a short-term response to one crisis, but as long-term energy insurance, experts said.

"It will take a very long time for India … China succeeded where we haven't, and China was very patient," ORF's Powell said.