



Chinese coal-fired power plants are leading the race to change

Why Southeast Asian countries are left behind in crackdown on coal

China is making the rest of the region eat dust with its progress on kicking its coal addiction as it eyes shutting down existing old plants, whilst Southeast Asia continues to cling on to coal for power.

When energy experts from the Centre for American Progress visited China late last year, they arrived deeply curious about the steep decline of coal investment in a country with the largest coal generation capacity in the world. What they uncovered was that, despite recent trends, China's energy strategy still hinges on coal-fired plants, but newer, more efficient ones that few in the world can rival. This array of ultra-supercritical power plants should help pave the way for strong economic growth, cleaner cities, and affordable electricity to its 1.3 billion population, at least until China ramps up on renewables in the next decade.

It would be tempting to think that coal is losing momentum in China as investment in new coal-fired capacity plummeted to less than 20 GW in 2016 from 50 GW annually five years prior. But this is merely a transition phase as the government scraps its inefficient coal plants in favor of a new greener coal fleet, said **Melanie Hart**, senior fellow and director, China policy at the Centre for American Progress.

"The nation's coal sector is undergoing a massive transformation that extends from the mines to the power plants, from Ordos to Shanghai. China is indeed going green," she said. "The nation is on track to overdeliver on the emissions reduction commitments it put forward under the Paris climate agreement, and making coal cleaner is an integral part of the process."

China has committed to install 800 to 1,000GW of new renewable capacity by 2030, but it cannot immediately replace coal for renewables due to the large energy requirements involved. So whilst the government spends the next decade building new solar, wind, hydro and nuclear plants to power a

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large portion of the nation, it is also rolling out new technologies for coal plants designed to cut down local air pollution and climate emissions.

"Its humongous population and energy needs means coal remains indispensable," said Hart. "Beijing's solution is to move full speed ahead with renewables whilst simultaneously investing in what may become the most efficient, least polluting coal fleet the world has ever seen." She said China is already shutting down older, lower-efficiency and high-emissions plants to replace them with new, lower-emitting coal plants can be considered some of the most efficient in the world, even beating those operating in the United States.

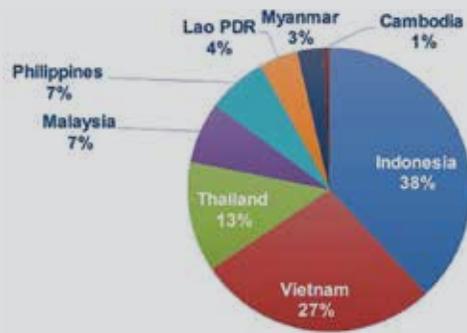
Coal wars

When the Centre of American Progress compared the top 100 most efficient coal-fired power units in China with the top 100 in the US, "the difference is astounding," said Hart. "Compared with the Chinese coal fleet, even the best U.S. plants are running older, less efficient technologies."

She noted the US only has one ultra-supercritical power plant, the most efficient of the three types because they produce more energy with less coal and generate less emissions. The rest of the US fleet is either subcritical or supercritical. In contrast, China is retiring older plants and adding ultra-supercritical facilities replete with advanced technology; out of China's top 100 units, 90 are ultra-supercritical plants.

It is not surprising then that China's top 100 units showed superior efficiency and emissions performance: Their total nameplate capacity reached 82.6 GW (higher than the 80.1 GW

Capacity additions by country



Source: National power development plans

for US equivalents), cumulative annual carbon emissions were at an estimated 342 million metric tons (lower than the roughly 362 million metric tons for the US), and only 286.42 grams of coal equivalent or gce consumed per kilowatt-hour of power produced in China (compared to 374.96 gce consumed per kilowatt hour produced at lower heating value in the US).

As China becomes more committed to coal efficiency, the desire to build more conventional coal-fired power plants is waning, and many of the existing ones in operations “are actually white elephants that Chinese leaders are already targeting in a wave of forced plant closures,” said Hart.

S&P Global Platts research showed that out of the 920GW of total operating coal-fired power capacity in China, roughly 19% uses ultra-supercritical technology, 25% uses supercritical technology, and 56% uses subcritical technology.

“However, the new builds are increasingly ultra-supercritical plants, and Beijing is steadily ratcheting up the emissions requirements and efficiency standards for those older plants as well,” said Hart. “As China’s power plants are becoming more efficient in their energy consumption and emissions, they are also becoming more efficient in terms of labor.”

She recounted a tour of the Shanghai Waigaoqiao No. 3 power station which runs two 1,000MW ultra-supercritical units and supports 250 employees. By comparison, it takes 600 people to run the nearby Waigaoqiao No. 1 power station which runs four 300MW subcritical units.

Guided by its clean energy policy, the Chinese government has recently cracked down on the coal-fired power construction that exploded after local officials were given the authority to approve such projects. “Beijing recognised that local incentive structures did not match national priorities and cracked the whip. Now thermal capacity growth is dropping, and that drop is likely to accelerate going forward.”

Laszlo Varro, chief economist of the International Energy Agency, said the Chinese administration introduced a so-called ‘traffic light’ policy last year to prevent overinvestment in coal capacity, and to increase investment interest in energy efficiency as well as low-carbon electricity supply and networks.

“A year after, we can see that this traffic light policy is proving to be effective,” he said. “This century so far was the century of coal, especially in China and India. This age of coal investment is now coming to an end--or at the very least, it is coming to a pause.”

India’s ‘ultra’ aspirations

Varro observed a similar decline in coal power generation investment in India driven by two factors: Financial difficulties of the Indian electricity sector and the increasing competitiveness of the solar power industry in India.

“Questions are increasingly being raised about the economic necessity of new coal-fired power plants,” he said. Rather than



Yulanda Chung



Melanie Hart

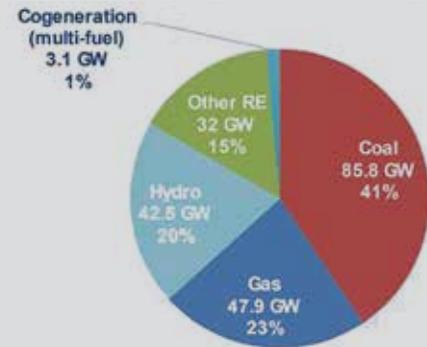


Laszlo Varro



Lars Schernikau

Capacity additions by technology



Source: National power development plans

building more conventional coal-fired plants, India is looking into constructing more efficient ones like those in China. In June, the Indian government announced the mounting of a National Mission on advanced ultra-supercritical technologies for cleaner coal utilisation with a budget of US\$238m. The country will also set up two Centres of Excellence on clean coal technology to the tune of US\$5m each.

India’s largest power producer NTPC is also spearheading the completion of the country’s first ultra-supercritical thermal power plant which will produce 1,000 MW in the first phase. Energy officials reportedly expect the plant to reach full operation by 2020 with four 1,000 MW units, and will complement the country’s line-up of supercritical power plants already in operation.

Southeast Asia’s coal hunger

As China and India both look to reduce their new coal capacity additions, the bustling region of Southeast Asia is expected to the opposite. Governments in the region are keen to build more coal power plants to take advantage of high resource availability and its relative cheapness compared to other available energy sources. But coal efficiency will increasingly become part of the conversation in Southeast Asia, according to energy experts, as renewables become more competitive and the emissions concerns grow louder. Soaring energy demand from growing population, rapid urbanisation and desire to widen electricity access will drive coal growth, said **Dr Lars Schernikau**, president of HMS Bergbau Group, Singapore and Germany. “Coal will be the fuel of choice, he said. “The material is easily available, the cheapest source of power and also the safest. All major Southeast Asian countries are constructing coal-fired power plants at a breath-taking pace,” he said.

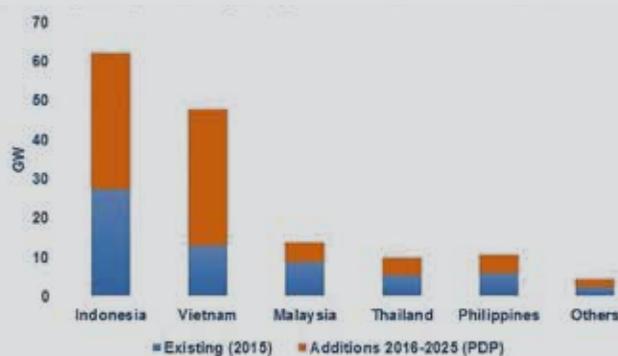
Schernikau forecasts the majority of the 400GW in power generation capacity to be added in Southeast Asia by 2040 will be coal-fired, and will raise coal’s share of the Southeast Asian power market to 50% from about 32% currently.

“The availability of coal in the region, and its lower cost than competing fuels, has made coal the preferred option to fuel rising power demand,” concurred **Sylvie Cornot-Gandolphe**, research associate at The Oxford Institute for Energy Studies in a paper discussing the role of coal in Southeast Asia’s power sector and its implications for coal trade. She noted that Southeast Asia added 25GW of coal capacity from 2012 to 2016, accounting for 42% of total additional generation capacity, notably in a region with more diverse energy options.

“Even the gas-producing countries in the region have introduced more coal in their electricity mix as gas shortages pushed them to diversify their mix. In the short to medium term, this trend is going to continue,” said Cornot-Gandolphe, citing that 29GW of coal-based capacity under construction in the region with most looking to finish by 2020. But even as Southeast

SECTOR REPORT: COAL

Existing coal capacity additions in Southeast Asia



Source: National power development plans

Asia ramps up its coal capacity, governments are still cognisant of their commitments to reduce greenhouse gas (GHG) emissions under the Paris Agreement. This has pushed nations to increase their renewables investment and incorporate coal efficiency initiatives in their energy plans.

“The planned large increase in renewables (including hydro), together with the adoption of clean coal technologies, allow Southeast Asian nations to reconcile a growing coal consumption with national commitments to reduce their carbon intensity compared with a business-as-usual scenario,” she said.

Enabling clean coal in ASEAN

Clean coal technology will be a critical tool for Southeast Asia if it is determined to hit its emissions targets but there are obvious barriers to adoption such as investment cost and technology availability, said **Han Phoumin**, energy economist at Economic Research Institute for ASEAN and East Asia (ERIA), in a commentary for the Asian Development Bank Institute blog. “Policy approaches must be reviewed, therefore, so that emerging Asia can afford clean coal technologies and to allow for more sustainable green growth across ASEAN and emerging Asia,” he said. Citing an ERIA study he co-wrote last year on the strategic use of coal in ASEAN, Han said the application of inefficient technologies and ineffective environmental standards and regulations would lead to a waste of valuable coal resources. But the problem is that most ASEAN countries still cannot afford the most efficient technologies, such as ultra-supercritical.

“The use of highly efficient technologies, such as ultra-supercritical, would provide better economic returns in any coal price scenario - \$60/ton, \$80/ton, and \$100/ton - and that the electricity produced by ultra-supercritical plants was more affordable than the electricity produced with supercritical or other conventional technologies,” he said. “Although USC technology is one of the best options for raising plant efficiency and reducing carbon dioxide and local pollution, such as nitrogen oxides and sulfur oxides, many developing Asian countries still cannot afford the technology because the upfront investment costs are higher than those of supercritical and conventional technologies.” The likely scenario is Southeast Asia countries like Myanmar and Cambodia will likely build low-efficiency subcritical plants if they do not get access to ultra-supercritical technology or receive poor financial support from developed countries. “The higher upfront costs of clean coal technologies have been an issue for developers and investors,” said Han. “Failure to reduce these costs will mean falling public financial support for clean coal technologies in emerging Asia.”

Lower costs are needed, according to ERIA’s Han, and these can be achieved through policy framework, such as attractive finance/loan schemes for ultra-supercritical power plants or through strong political institutions that can provide public

financing for clean coal technologies for emerging Asia; and international cooperation framework to ensure the deployment of clean coal technologies, which are crucially important for abating greenhouse gas emissions. Han said in Southeast Asia, Thailand has shown success in clean coal technologies by retiring their old conventional coal power plants and replacing them with ultra-supercritical coal power plants. But community protests continue to rail against coal-fired power plants, and it will be a challenge for countries in the region to convince the public on the merits of using clean coal technologies instead of other options. “Seeking public acceptance on the cleaner use of coal through clean coal technologies will be crucial,” he said. “People are skeptical of the new technologies as they associate any use of coal with strong pollution.” “Experiences in developed nations, such as Japan, could provide good examples for achieving public consensus on coal use by showing that clean coal technologies uses coal more efficiently, that they are much cleaner than conventional plants, and that the emissions of plants using clean coal technologies are very close to those of gas-fired power plants.”

Higher efficiency plant isn’t the answer

But Yulanda Chung, energy finance consultant, Institute for Energy Economics and Financial Analysis warned that in the case of Indonesia, investing in higher efficiency plants may not necessarily be the best way forward. She explained that given the current capacity payments to coal-fired power plants in Indonesia, further commitments to coal-fired power plants will only saddle the state utility PLN with costly 25-year power purchase agreements and payment for potentially unneeded power from underutilised plants. “If a coal-fired plant does not operate at a high capacity factor, the cost of generating each unit of electricity increases. Investments in these plants, especially ones with higher efficiency boilers, are commercially viable only when the plant is optimised at full load with high capacity factor,” said Chung.

Whilst capacity payments are important to woo investors, “the more entrenched these commitments are and the farther they stretch into the future, the likelier they will serve the interest of aging and under-utilised thermal power plants at the expense of better investments,” she said. “An economical alternative to national energy security exists through the development of renewable energy and the diversification of energy sources in Indonesia’s power generation portfolio.”

In recent years, China has been imposing increasingly tight emissions regulations on existing plants to rein in the country’s coal-fired power bubble, said Hart from the Centre for American Progress. Unable to meet the stringent standards - which have become stricter than the comparable US standards - many older Chinese coal-fired power plants are being steadily shut down. “One of the levers that Beijing is pulling to move China’s coal-fired power fleet toward the cleanest, most efficient technologies on the market is steadily tightening pollution emissions standards,” said Hart.

In November 2016, China issued a target to reduce sulfur oxide and nitrogen oxide emissions from coal-fired power plants more than 300 MW in size by at least 50% by 2020, and reducing carbon dioxide emissions to no more than 865 grams per kilowatt-hour. Low emissions have become such an important factor in the Chinese regulatory regime that cleaner plants are advertising their technical superiority. “Some coal-fired power facilities display real-time emission levels for key local air pollutants on large billboards outside the main gate,” said Hart, citing a visit late last year by the Centre for American Progress in Chinese plants. “Beijing is primarily concerned with tightening emissions standards for conventional air pollution, since that is the primary concern of the Chinese public. The next round of regulatory tightening will target carbon dioxide,” she added.

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