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Chinese Companies Energy Activities in Emerging Asia

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Abstract

The People's Republic of China ("China") has become one of the major providers of capital, construction services, and equipment to the energy sectors of developing and emerging economies. It has contributed to the power systems as well as the oil and gas sectors in the countries of these regions. Chinese energy and energy infrastructure companies, largely state-owned, are active across the energy sector in most fuels and through diverse modalities.

This report analyses the construction services, equipment, and investments provided by Chinese energy and energy infrastructure companies in the power, coal, oil, and gas sectors in non-OECD emerging Asian countries. It uses an integrated approach to provide a fact-based quantitative overview across the energy sector that complements existing research efforts. It identifies the main Chinese stakeholders, highlights major trends, and analyses strategies and drivers.

Findings reveal that, while the construction services, equipment and investments provided by Chinese companies are significant, they supply only part of emerging Asian economies' energy sector needs; their role remains relatively modest compared to those of other companies.

Highlights

- In non-Organisation for Economic Co-operation and Development (OECD) emerging Asian countries, Chinese companies will contribute to 15% (54 gigawatts) of power generation capacity additions over 2013-22.
- Emerging Asian economies supply a marginal portion of China's oil but an increasing amount of its gas, despite China having recently rapidly expanded natural gas imports from other regions as well.
- Motivations for Chinese company involvement in the emerging Asia region are diverse: primarily business opportunities under the Belt and Road Initiative, but also greater energy security in some cases.
- In the power sector, Chinese energy companies are primarily contractors, providing construction services and supplying equipment. In oil and gas, Chinese companies are investors as well as contractors.
- Companies from China supply their main equipment both from China and from other countries, within a global value chain that offers opportunities to multiple participants.
- Contracted power generation projects and oil and gas investments of Chinese energy companies were worth USD 10.5 billion annually on average between 2013 and 2017.
- The scale of Chinese energy companies' contracts and investments tends to be smaller in riskier countries, except when political ties with the country are strong. Meanwhile, there is no clear correlation between the scale of contracts and investments, and the amount of energy resources these countries supply to China.
- Among Chinese companies, overseas market involvement is undertaken mostly by the top state-owned enterprises (SOEs) for energy and their subsidiaries, while the role of increasingly dynamic private enterprises remains small. Most Chinese SOEs provide integrated services centred on turnkey project delivery.

Executive summary

China has become a major provider of capital, construction services, and equipment to the energy sectors of developing and emerging economies. Chinese energy and energy infrastructure companies, largely state-owned, are active across the energy sector in most fuels and through diverse modes.

This report analyses construction services, equipment, and investments provided by Chinese energy and energy infrastructure companies in the power, coal, and oil and gas sectors in non-OECD emerging Asian economies (referred to in this report as “the region”, “emerging Asia” or “non-OECD Asia”).¹ It uses an integrated approach to provide a fact-based quantitative overview that complements existing research efforts, identifying the main Chinese stakeholders (headquartered or with a parent company in China), highlighting major trends, and analysing strategies and drivers.

Energy demand for all fuels and technologies in developing and emerging Asian countries is set to increase during the 2017-30 period. The region’s share of global energy demand therefore rises by the end of the period most notably for coal, for which demand increases from 20% in 2017, to 29% in 2030.

Activities in the power sector

Chinese company involvement in emerging Asia power sector development is substantial in terms of new capacity, but small in comparison with the scale of China’s domestic market. Chinese companies are expected to contribute to 15% (54 gigawatts [GW]) of power generation development in the region over 2013-22, and although the 160 new Chinese-built power plants are equivalent to half of Spain’s generation capacity, they represent only 1/20 of additions within China during the period.

IEA analysis does not indicate market dominance by Chinese companies in any segment of the electricity generation sector even though they have large market shares in coal, nuclear, and hydropower. The Belt and Road Initiative has raised concerns in the media and governments over Chinese exports of fossil fuel technologies to developing countries. Findings reveal that Chinese manufacturers supply turbines for coal generation to 35% of coal-fired projects built in the region.

Reflecting trends in the region where fossil fuels continue to lead power capacity additions, Chinese added capacity reaches 33 GW in coal-fired generation and 4 GW in gas. Chinese capacity additions from low-carbon sources, including nuclear, represents 30%, led by hydropower (10.4 GW), and followed by waste heat to energy (1.9 GW). This low level of additions in wind and solar power contrasts with the success of these technologies in China.

¹. Southeast Asia (Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Timor-Leste, Thailand, Viet Nam), South Asia (Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, Sri Lanka), Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan) and Northeast Asia (Mongolia, DPRK).

Within emerging Asia, most Chinese-built power projects are in South Asia (53%) and Southeast Asia (42%), followed by Central and North Asia. Pakistan is the primary contractor of Chinese-built additions, followed by Indonesia, Viet Nam, and India.

Activities in oil, gas and coal

Chinese companies are involved in upstream, midstream, and downstream activities in the oil and gas sector; in some projects that secure resources for China; and in others that supply global markets. Their activities are reflective of the wider context and trends.

As a major energy consumer and importer, China's dependence on imported resources exposes it to energy security risks, thus it actively promotes activities outside China while also strengthening domestic production when possible. Despite strong links with Central Asia, Asia is the source of only 3.7% of China's oil supply (but 55% of its gas).

Although most Chinese investment in the Asian oil and gas sector has historically been in oil exploration and production, investment in this area is declining while spending on gas production has increased. The importance of Chinese companies in the region's oil production remains limited and has even declined slightly since 2013, but gas production by Chinese companies in the region is expanding.

Midstream activities consist of building infrastructure linking China with supply sources, as well as addressing oil and gas infrastructure development needs within the host countries. Chinese companies are currently involved in refining projects with a total capacity of 1 million barrels per day (mb/d).

Emerging Asia supplied 57% of China's coal imports in 2017, with Indonesia and Mongolia as the main Asian suppliers. Mergers and acquisitions (M&A) by Chinese companies in coal mining appear to be limited, but some companies are involved in coal mine modernisation projects or mine-mouth power plants.

Stakeholders and modes of involvement

Most Chinese energy companies are state-owned enterprises (SOEs) that receive guidance from the government. Private companies are increasingly active, but their shares in overseas markets are still small. Most Chinese SOEs provide integrated services centred on turnkey project delivery.

Most activities of Chinese energy companies in emerging Asia involve supplying construction services, equipment and investments (with the financial support of Chinese banks that provide credit to companies or concessional loans to host countries). In the power sector, Chinese energy companies are contracted primarily to provide construction services and supply equipment; in oil and gas, they are investors as well as contractors. M&A and direct involvement in project operations happen only occasionally outside the oil and gas sector.

The scale of Chinese energy companies' contracts and investments tends to be smaller in riskier countries, except when political ties with the country are strong. Meanwhile, there is no clear correlation between the scale of contracts and investments, and the amount of energy resources these countries supply to China. Contracted power generation projects and oil and gas investments of Chinese energy companies were worth an average USD 10.5 billion annually between 2013 and 2017.

Introduction

Energy demand for all fuels and technologies in developing and emerging Asian countries is set to increase by 2030. The region's share in global energy demand therefore also rises by 2030 – most notably for coal, for which the share climbs from 20% in 2017 to 29% in 2030 (IEA, 2018a).

Emerging Asia has some of the countries with the most rapidly growing energy consumption. For example, India's demand increases at an annual rate of around 4% for oil, 6% for gas, and 4% for coal to 2030, while global annual growth rates are estimated at 0.7% for oil, 1.6% for gas, and close to zero for coal. Southeast Asia's energy needs also rise significantly, with oil and gas demand projected to expand 2.3% each year to 2030, and coal to increase 3.9% annually. In contrast, demand in Central Asian countries generally remains stable, with only minor increases expected (IEA, 2018a).

Despite substantial progress and encouraging signs of further expansion, persistent efforts are needed to improve energy access in the region, since power shortages continue to constrain economic development in both the industry and services sectors in some countries. Greater access to capital funding and to up-to-date technologies is required to sustain energy sector development. During 2000-17, over 900 million people gained access to electricity in developing Asian economies, with the region's electrification rate increasing from 67% in 2000 to 91% in 2017. Nearly 60% of this progress occurred in India, where households are quickly gaining electricity connections, and achievements in countries such as Bangladesh and Indonesia have also been impressive. Nevertheless, more than 350 million people still lack access to electricity in the region: 168 million in India and 58 million in ASEAN (Association of Southeast Asian Nations) countries. It is estimated that an annual investment of USD 20 billion will be necessary to bring universal access to the region by 2030 (IEA, 2018a).

China has become an important source of financing for energy projects, and a major provider of capital, construction services and equipment to energy sectors in developing and emerging economies. Providing construction services, equipment and investments in energy bolsters the internationalisation of Chinese companies and lends momentum to the government's "Going Out" strategy.

Scope and outline

This report analyses the construction services, equipment and investments supplied by Chinese energy and energy infrastructure companies in the power, coal, and oil and gas sectors in non-OECD emerging Asian countries (referred to in this report as "the region", "emerging Asia" or "non-OECD Asia").² It uses an integrated approach to provide a fact-based quantitative overview of the entire energy sector that complements existing research efforts (Boston University, 2018; AEI, 2018).

². Southeast Asia (Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Timor-Leste, Thailand, Viet Nam), South Asia (Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, Sri Lanka), Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan) and Northeast Asia (Mongolia, DPRK).

The report begins with an overview of the construction services, equipment, and investments provided by Chinese energy and energy infrastructure companies (in power, oil and gas, and coal); it then turns its attention to key stakeholders, main drivers and modes of involvement.

Methodology

This analysis covers projects completed and under construction during the 2013-22 period in non-OECD emerging Asian countries. Most of these countries are also included in China's Belt and Road Initiative. In the area of power generation, only projects larger than 10 MW for which the main contractor, main equipment supplier, or parent company is headquartered in mainland China are included; and in oil and gas, the analysis covers majority and minority shares by companies headquartered in China. These are the companies referred to as "Chinese companies" in this report.

Companies operate as either investors (spending capital to acquire or develop new assets) or contractors (selling construction services and equipment outside China). For the latter, the host country is responsible for investment. Energy projects examined in this analysis involve the provision of construction services, equipment and/or investments. Investment is defined as overnight capital expenditures disbursed for new assets, whereas construction services and equipment supplies are considered as export contracts that entail operational spending and that generate revenues for the Chinese companies involved. In power generation, the value of these contracts is estimated in 2017 USD based on technology capacity costs in the region.

Overview of Chinese energy activities

This section describes the activities of Chinese companies in the power, oil and gas, and coal sectors. In power, Chinese energy companies are primarily contractors that provide construction services and supply equipment. In the oil, gas and coal sectors, Chinese companies are investors as well as contractors.

Power

Electricity demand in developing economies has almost tripled since 2000 because of industrialisation, rising incomes, and increased energy access. Emerging Asia's power capacity is projected to almost double from the 2017 level by 2030, to more than 1 600 gigawatts (GW). Countries with regulated markets and vertically integrated utilities, including India and some economies in Southeast Asia, are facing short-term excess capacity risks and rising generation costs. (Southeast Asia, India and other developing Asian countries had around 20% overcapacity in 2017.) While renewables lead capacity growth, coal-based additions remain significant at close to 160 GW. About 90% of new coal-fired plants under construction worldwide are in the Asia-Pacific region, including 50 GW in India and 30 GW in Southeast Asia (IEA, 2018a).

For the 2013-22 period, Chinese companies have contracted to construct power generation plants in 19 of the 25 countries covered in this analysis. The average size of completed and under-construction power plants of all technologies is 340 megawatts (MW), but they range from very small to 2 200 MW. Including turbines supplied by the China, Chinese companies are involved as main contractors or main equipment suppliers in 294 of the more than 1 300 power generation projects, as well as being involved in grid activities.

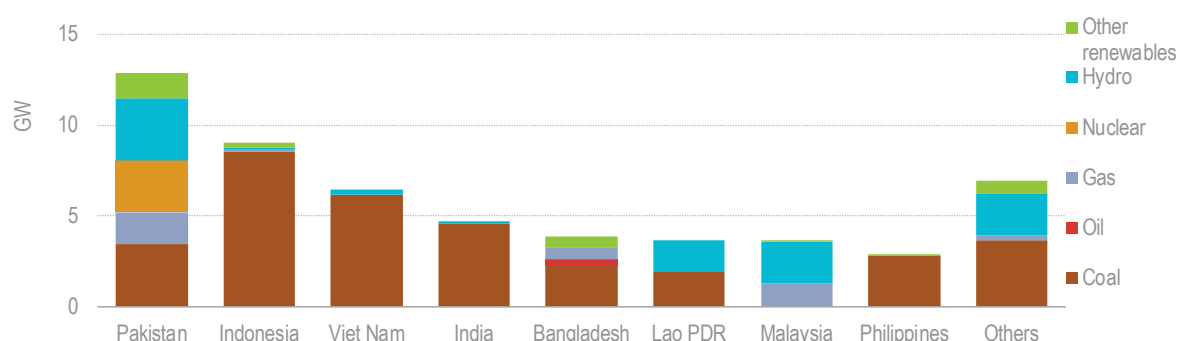
Generation

Chinese company involvement in emerging Asia power sector development is substantial in terms of new capacity, but small in comparison with the scale of China's domestic market. Throughout emerging Asia during 2013-22, Chinese energy infrastructure companies build 54 GW of additional generation capacity – or 15% of the region's total capacity additions. Although these 160 new Chinese-built power plants are equivalent to half of Spain's generation capacity, they represent less than 6% of additions in China over the same period (close to 1 000 GW of new generation capacity additions are expected for China's domestic market) (IEA, 2018a).

Reflecting trends in the region, where fossil fuel-based technologies continue to make up the majority of power capacity additions, 70% of Chinese-added capacity relies on coal (33 GW, of which 15 GW is under construction) and gas (4 GW) (Figure 1). At the same time, more than 240 GW of coal-fired and 85 GW of gas-fired capacity are expected to be added in China. Indonesia contracts the most Chinese-built coal-fired projects, accounting for one-fourth of Chinese coal-based power additions in emerging Asia, followed by Viet Nam and India. With India's economy expected to grow by over 8% per year to 2023 and the process of electrification to continue, Indian power demand is forecast to rise by more than 5% per year by 2023

(IEA, 2018b). Although some countries such as Indonesia and Viet Nam are reassessing their planned coal-based power development to mitigate the effects of climate change in accordance with their Nationally Determined Contributions (NDCs)³ and some projects have therefore been put on hold, coal-based projects currently under construction by Chinese companies amount to a significant 8 GW in Indonesia and Viet Nam together. Because of the abundance and availability of coal in the region, combined with energy demand growth and price competitiveness, coal-based power remains an important source of power capacity growth in Asia.

Figure 1. Chinese-added capacity by technology in emerging Asia, 2013-22



Note: Based on plants larger than 10 MW completed or under construction.

Source: IEA. All rights reserved.

Around 60% of Chinese-added capacity is coal-fired, followed by hydropower (19%). Pakistan contracts the most Chinese-built additions, followed by Indonesia, Viet Nam, and India.

Concerning coal-fired power plant projects, the choice of technology is key. Progress in improving the efficiency and reducing the emissions of China's domestic coal-based power plants has been substantial since the Chinese government raised standards in these areas. Some host countries have not yet implemented higher standards, so the coal-fired power plants that Chinese companies build overseas are often built to meet lower requirements and use subcritical (less efficient) technology. Nevertheless, the share of supercritical technology is expanding (ultra-supercritical is still very rare), reducing local air pollutant emissions.

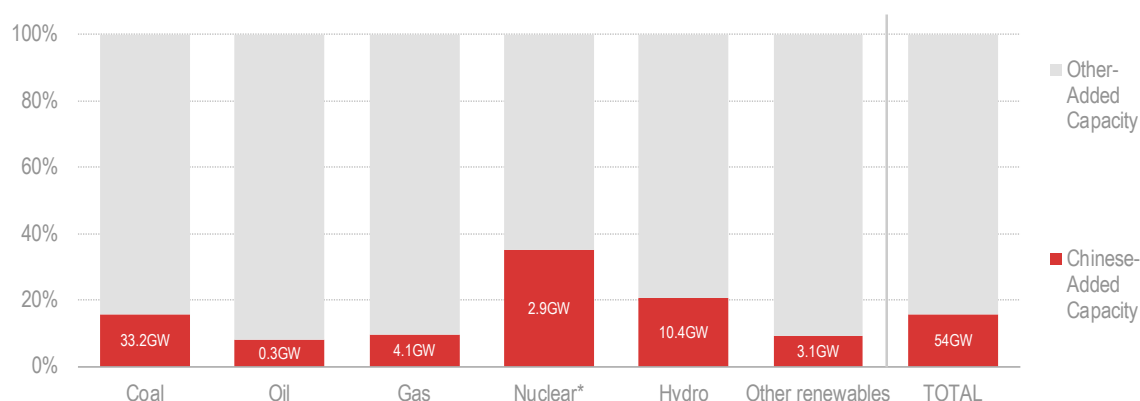
The share of Chinese-built capacity additions that use low-carbon energy sources, including nuclear, is 30%, led by hydropower (10.4 GW) and waste heat to energy technology (1.9 GW), mostly in Pakistan and Bangladesh. Wind and solar projects make up less than 1 GW; this low level contrasts strongly with the success of these technologies within China. Nuclear capacity accounts for 5% of total new Chinese-added capacity (2.9 GW between two plants in Pakistan completed in 2016 and set to come online by 2022).

Most Chinese-built power projects are located in South Asia (53% of total Chinese-added capacity in emerging Asia) and Southeast Asia (42%), followed by Central Asia (4%) and North Asia (1%). The bulk (close to 13 GW) of Chinese-built additions, as well as one-quarter of all Chinese-built electricity generation projects in the region, are in Pakistan, while Indonesia accounts for 9 GW, Viet Nam for 6.4 GW and India for 4.7 GW (Figure 1).

³. NDCs reflect policy action to support the Paris Agreement, reached during the 21st Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC).

In terms of market shares by capacity additions, Chinese companies have higher shares in nuclear (35%) and hydropower (20%), while the coal-fired share is only 16%, mostly because the market is dominated by domestic participants in some host countries, especially India. The involvement of Chinese companies in coal-fired generation is also a result of some Western stakeholders having reduced their coal sector activities. Regarding renewables, Chinese companies show only a 9% market share (Figure 2) and therefore have ample scope to expand low-carbon energy projects in Asia.

Figure 2. Chinese companies' shares of emerging Asia capacity additions by technology, 2013-22



* Nuclear additions consist of two plants in Pakistan.

Note: Based on plants larger than 10 MW completed or under construction.

Source: IEA. All rights reserved.

Despite having large market shares in coal, nuclear and hydropower developments, Chinese company involvement is relatively modest in all segments of the electricity generation sector.

Transmission and distribution

Power grids in the countries examined still face regulatory and technical challenges. In most of Southeast Asia, power utilities are not unbundled. With transmission losses being high (up to 25% in Pakistan), grid upgrading is vital to improve power supply sustainability and security (IEA, 2018a).

Available data indicate at least 7 000 km of Chinese-built transmission lines during 2013-22, with the most extensive additions in Cambodia, Lao PDR and Pakistan. More than 2 000 km are currently under construction in Cambodia, Lao People's Democratic Republic (Lao PDR), Mongolia, Myanmar, and Tajikistan. The majority of projects also involve the construction of substations, and roughly one-third of the projects are of 500 kV and higher. Most projects for which adequate information is available are financed by the Exim Bank and adopt Chinese design and equipment standards – for instance, the two power transmission lines (300 km) in Myanmar. Most of these projects are built under the engineering, procurement and construction (EPC) model, and are owned by utilities of the host countries.

Projects contribute to national grids as well as cross-border transmission lines. In Kyrgyzstan, a 400-km line built by Tebian Electric Apparatus (TBEA) strengthens the domestic network by avoiding routing through Uzbekistan. In Southeast Asia, the 500-kV "Backbone & Sub-region Transmission Line Project" is expected to allow Cambodia and Lao PDR to trade electricity from 2021. Funded by the Exim Bank

(USD 17 million), construction of the line by the China National Heavy Machinery Corporation (Sinomach) begins in 2019. A 500-kV connection between Laos and China is also under review.

Electricity sector value chain

Chinese companies are also involved in industrial projects such as equipment manufacturing, training of energy technicians, and the provision of energy services within the region. For instance, in southern Bangladesh, the Hexing Electrical Company has signed an agreement with a state-owned Bangladeshi firm to develop an assembly line manufacturing prepaid smart meters. Hexing holds a 49% stake in the joint venture and the factory is planned to start operations in 2019 (Energy News of Bangladesh, 2018). In Kazakhstan, Kazatomprom and China General Nuclear Power Corporation (CGN) launched construction of a fuel assembly production line in 2016 with a capacity of 200 tonnes annually. The USD 150-million project, which uses Areva technology, is expected to have a guaranteed market for 20 years; it is expected to be completed by 2020. Half of the investment is provided by Chinese stakeholders (Areva, 2016).

In addition to transmission lines, Chinese companies develop transport infrastructure for energy resources. A 549-km railway line for coal transportation between Erdenet and Ovoot in Mongolia could be built by China Railway Construction and Gezhouba, and similar projects are being reviewed in Indonesia.

Training of local technicians is essential to maintain plant efficiency and performance, as well as to help countries build a strong service industry for maintenance, ensuring plant sustainability and supporting broader industrial development. For example, several training programmes were organised to ensure plant operations as part of the 3 x 300-MW Puttalam power plant project contracted between the China Machinery Engineering Corporation (CMEC) and the Sri Lankan government to meet over 50% of the country's electricity demand. In addition to a ten-week training and exchange programme for over 70 project operators that included theoretical learning, field training and visits to equipment suppliers, CMEC also built onsite equipment training bases, organised six months of training for 10 senior managers and engineers at a Chinese plant of similar scale, and developed a follow-up technology co-operation agreement with the Ceylon Electricity Board (UNDP China, 2015).

Oil and gas

Chinese companies are involved across the oil and gas sector, from upstream to downstream, in some projects that secure resources for China and in others that supply global markets, and their activities reflect the wider context and trends in both oil and gas. Although most Chinese investment in the Asian oil and gas sector has historically been in oil exploration and production, investment in this area is declining while spending on gas production has increased. Chinese companies also continue to develop pipelines to China and within some countries in the region, and to provide construction services and invest in the refining sector.

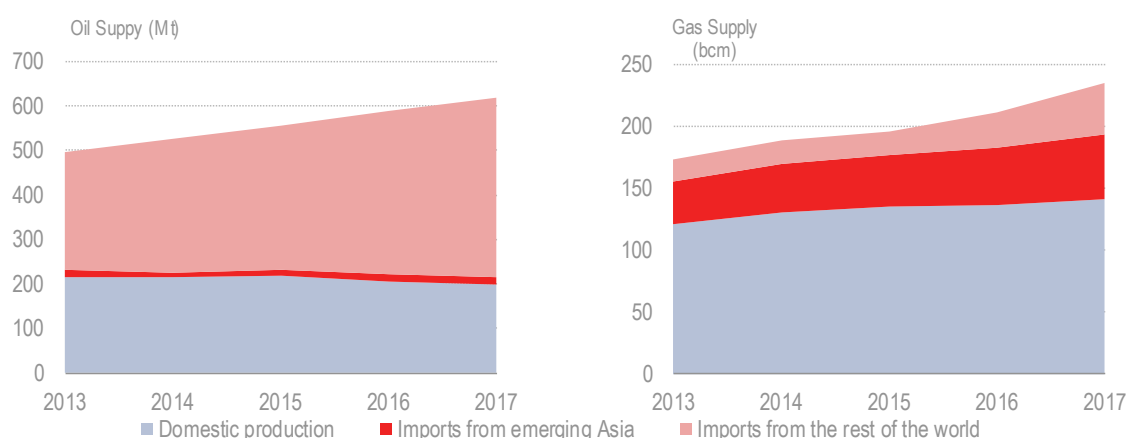
Upstream

China's oil demand increased from 4.7 mb/d in 2000 to 12.3 mb/d in 2017, while its gas demand expanded nearly nine-fold from 28 bcm to 248 bcm. Projected Chinese gas demand reaches 708 bcm in 2040. While China currently relies on imports to meet 69% of its oil needs and 42% of its gas needs, these numbers could rise to 82% (oil) and 54% (gas) by 2040 (IEA, 2018a).

Given China's expected increases in oil and gas dependency, Chinese oil and gas companies have strengthened their overseas activities in recent decades, including in Asian oil- and gas-producing countries. CNPC has been investing in Asia since 1994, when it acquired oil production rights in Indonesia. In 2017, Chinese NOCs invested USD 7.3 billion in production rights in 26 oilfields in 9 Asian countries, for total production of 21 Mtoe, essentially from Indonesia (90%) and Myanmar (CNPC ETRI, 2018). More recently, China and the Philippines signed a memorandum of understanding (MoU) on oil and gas development (Global Times, 2018).

In 2017, China imported 420 Mt of oil and 94 bcm of natural gas (45% of the gas was imported by pipeline). Oil imports are expected to rise by 23% by 2024, and gas imports by 45% by 2023 (IEA, 2019; IEA, 2018f). According to CNPC ETRI, China's natural gas imports will rise by another 14% year-on-year to 143 bcm in 2019 (Reuters, 2018a). Emerging Asia supplied 55% of China's natural gas imports in 2017 but only 3.7% of its oil imports (Figure 3).

Figure 3. China's oil and gas supplies, 2013-17



Source: IEA. All rights reserved.

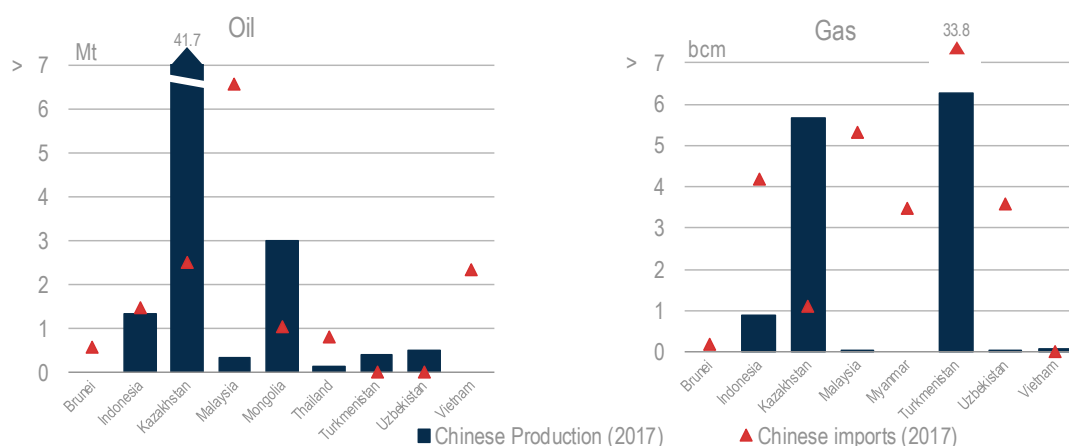
Emerging Asia provides a marginal portion of China's oil supply but an increasing amount of its gas (22% in 2017), even though China has been expanding natural gas imports from other regions more rapidly.

The involvement of Chinese companies in the region's oil production remains limited (about 7% of total production), and it has declined slightly since 2013, reflecting regional trends. Between 2013 and 2017, Chinese companies produced 681 413 kbbl of oil, either through directly operated oilfields or under production sharing agreements (PSAs), mostly in Kazakhstan (89%), Mongolia (5%) and Indonesia (3%) (Figure 4). Almost 23% of this production was operated directly, while the rest was through production entitlements.

Oil production by Chinese companies in the region has declined by 13.5% since 2013, while the region's total oil output decreased by only 2.5%, mostly because of lower production entitlements for Chinese companies in Kazakhstan compared with those for other stakeholders. Nonetheless, Chinese companies still had entitlements in 16% of Kazakhstan's production in 2017 and in almost all of Mongolia's small-scale production (96%; Mongolia's total oil production was less than 22 kbbl/d in 2016 and 2017). Mongolia's crude oil is exploited by CNPC and exported to the Chinese border by truck, but since Mongolia launched construction of its first oil refinery in 2018 with Indian support, it could reduce its exports to China. Chinese

companies have also increased their oil production entitlements slightly in Turkmenistan and Uzbekistan at the same time as high production in Kazakhstan and Indonesia has fallen. Their production in minor fields in Afghanistan and Tajikistan ended in 2014.

Figure 4. Oil and gas production by Chinese companies in emerging Asia and imports from the region, 2013-17



Source: Rystad Energy (2018), Ucube (database).

Upstream activities of Chinese oil and gas companies involve projects that secure resources both for China and for other markets.

Also reflecting the global context, Chinese companies are progressively taking a more active role in gas production in emerging Asia. They produced 52.42 bcm between 2013 and 2017 in the three countries of Turkmenistan (46%), Kazakhstan (45%) and Indonesia (9%), increasing production entitlements by 42% over five years, essentially through higher production in Kazakhstan and Turkmenistan. Shares in gas fields were also acquired in Malaysia in 2014 and in Viet Nam in 2015. In contrast with oil production, Chinese companies are directly operating the majority of their production entitlements. Their directly operated production has almost doubled since 2013, essentially because of increased output in Turkmenistan in 2015.

Central Asia currently remains China's main supplier of pipeline gas, as it provided 92% of its pipeline imports in 2017; the remainder originated from Myanmar (IEA, 2018c). Turkmenistan is China's main gas supplier (34 bcm in 2017), despite contracted amounts were not met in winter 2017-18 or in early 2019. CNPC carried out maintenance at the Amu Darya Basin throughout 2018 to ensure better winter gas supplies, as the Amu Darya gas project accounts for one-third of China's gas imports from Central Asia. In addition, increased production from the Saman Depe and Bagtyyarlyk fields is expected to deliver 5.2 million cubic metres more gas starting in 2019 (Reuters, 2018b).

Although Chinese companies have been actively increasing their natural gas production entitlements in the region, at around 3% in 2017 their overall share remains very low. Compared with other stakeholders, however, their role is expanding, especially in Kazakhstan and Turkmenistan. In Kazakhstan, Chinese companies were responsible for 21% of gas production in 2017 (up from 17% in 2013), and for 9% in Turkmenistan (up from 4% in 2013).

Midstream

The midstream activities of Chinese companies involve not only building infrastructure to link China with its supply sources but addressing oil and gas infrastructure development needs of host countries.

Gas pipelines A, B and C already connect Central Asia with China, offering 55 bcm of transport capacity. Line D, currently the main project under construction by CNPC, is projected to add 30 bcm of capacity by 2024. Designed to transport 85 bcm of natural gas per year, it will extend the Central Asia-China network between Turkmenistan, Uzbekistan, Tajikistan and Kyrgyzstan to China. The 800-km Sino-Myanmar oil pipeline is dedicated to crude deliveries for CNPC's 260-kb/d refinery that came online in 2017 in Yunnan province. While more than half of the unused capacity is in China's landlocked provinces, where crude supply and product movement logistics are complicated, new and better-equipped facilities are being built in the logistically advantageous coastal provinces (IEA, 2018d).

Projects to develop oil and gas infrastructure are also being undertaken under EPC contracts for example. Financed by the Exim Bank, a subsidiary of CNPC built an oil tank farm in Sri Lanka in 2014. The farm has eight fuel bunkering tanks for vessels, three tanks for aero fuel and three for storing LPG; the 14 tanks have an overall capacity of 80 000 m³. In Thailand, a Sinopec subsidiary and a local Thai company completed a domestic natural gas pipeline in 2017. Also with an Exim Bank loan, CNPC is building a 220-km oil pipeline in Bangladesh to link the Bay of Bengal with Dhaka.

Downstream

Emerging Asia has an overall oil product deficit: excluding India, it imported more than 2 mb/d in 2018. Economic growth and rising oil product standards necessitate a more robust domestic refining sector. While China has become the world's second-largest refiner and has close 4 mb/d of unused distillation capacity, it continues to build new refineries in China as well as overseas (IEA, 2019). Chinese companies are currently involved in ten refining projects (total capacity 1 mb/d) in seven emerging Asian countries (Table 1).

Private companies are important in overseas refinery construction services and investment, partly owing to growing competition in the domestic market. In Brunei, Hengyi Group is investing USD 11 billion in a large refining and petrochemical complex. Scheduled to be constructed in two phases, the refinery will ultimately process 450 kb/d of crude oil, producing not only gasoline, diesel and kerosene, but also 1.5 mt of ethylene, 0.5 mt of benzene and 3.5 mt of paraxylene per year as feedstock for Hengyi's chemical plants in China. Private Chinese companies are setting up the first local refineries in some countries: a 16-kb/d refinery is being built in Lao PDR, owned 75% by China's Yunnan Dongyan Industrial. In Tajikistan, a 10-kb/d unit will be completed in 2019, owned by Chinese oilfield service company GI Technologies. Shandong Hengyuan Petrochemical Corporation has acquired a 51% stake in Port Dickson Refinery in Malaysia from Shell – the only international merger and acquisition (M&A) deal for a Chinese independent refiner, and the only example of an M&A of an Asian refining asset by any Chinese company.

In contrast, Chinese SOEs are less active in overseas refinery investments in Asia. The Exim Bank, CNPC and a local SOE from Shaanxi province invested in three small refineries in Kazakhstan and Kyrgyzstan a decade ago, whereas the plan to build a refinery in Myanmar

failed after the primary investor, a subsidiary of Zhuhai Zhenrong, withdrew. Power China signed a MoU with Pakistan State Oil to build a 250-kb/d to 300-kb/d refinery in 2018, but feasibility studies are still ongoing. CNPC and Sinopec act mostly as EPC contractors in Asian refining projects. Sinopec Engineering Corporation signed an EPCC contract with Petronas for the RAPID refinery, which will come online later in 2019 with a 300-kb/d processing capacity. Two CNPC subsidiaries, China Huanqiu Contracting and Engineering Corporation and China Petroleum Engineering and Construction Corporation, are active in greenfield and upgrading projects in Kazakhstan and Cambodia.

Table 1. Refining projects of Chinese companies in non-OECD Asia

Country	Refinery	Type	Status	Capacity (kb/d)	Completion year	Total investment (million USD)	Chinese company	Role
Brunei	PMB Refinery phase I	greenfield	under construction	148	2019	3 450	Hengyi Group (70% share)	Investor
	PMB Refinery phase II	greenfield	planned	280	2023	12 000	Hengyi Group (70% share)	Investor
Cambodia	Refinery Phase I	greenfield	under construction	40	2020	620	Sino Great Wall International Engineering, CNPC	Contractor
	Refinery Phase II	greenfield	planned	60	2023	1 000	Sino Great Wall International Engineering, CNPC	Contractor
Kazakhstan	Atyrau Refinery	upgrading	completed	10*	2018	1 826	Exim Bank (61.9% share), Sinopec	Investor, Contractor
	Shymkent Refinery	upgrading	completed	15*	2019	1 850	CNPC	Investor, Contractor
Kyrgyzstan	Kara-Balta Refinery	greenfield	completed	16	2014	300	Shaanxi Coal and Chemical Industry Group	Investor
	Tokmok Refinery	greenfield	completed	8	2015	60	Xinjiang International Industry Corporation	Investor
Lao PDR	Saysettha Refinery	greenfield	under construction	16	2019	179	Yunnan Dongyan Industrial (75% share)	Investor
Malaysia	Port Dickson Refinery	M&A	completed	156	2016	66	Shandong Hengyuan Petrochemical Corporation	Investor
	RAPID	greenfield	under construction	300	2019	1 329	Sinopec	Contractor
Tajikistan	Dangara Refinery phase I	greenfield	under construction	10	2019	80	GI Technologies	Investor
	Dangara Refinery phase II	greenfield	planned	14	2022	400	GI Technologies	Investor

* Newly added distillate capacity.

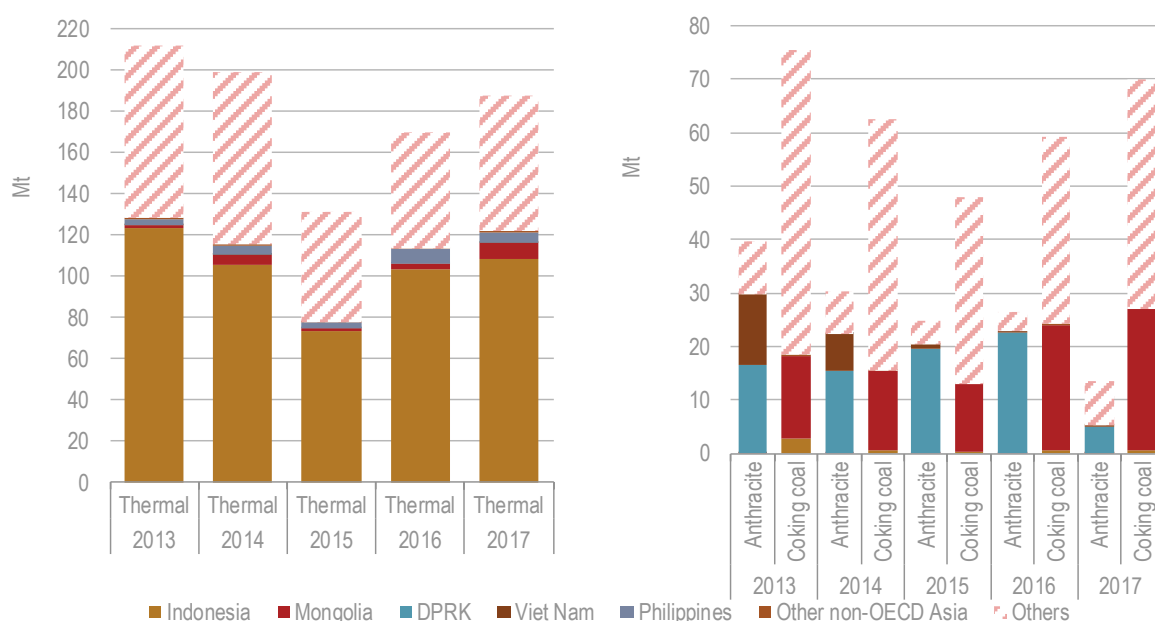
Source: IEA. All rights reserved.

Coal imports and mining

China is the world's largest coal consumer and producer. Although its coal imports are small in comparison with its domestic production, China is also the largest coal importer. China's imports of both thermal and metallurgical (met) coal continued to expand in 2017, with thermal rising by 2% and met by 15% (IEA, 2018b). China imported 271.1 Mt of coal in 2017, 57% (154.2 Mt) of it from emerging Asian countries (Figure 5). Coal trade, along with the acquisition of coal exploration and extraction rights, is therefore important to maintain Chinese supplies. According to China Energy News, all Chinese companies' coal sector projects (including coal-fired power plants) in Belt and Road Initiative (BRI) countries were worth USD 5 billion in 2017 (China Energy News, 2018).

During 2013-17, emerging Asian countries supplied more than half of China's imported coal, oscillating between 54% in 2013 and 63% in 2016. Coal trade within the region reflects the overall trends of China's coal imports, which declined in 2013-15 before resuming in 2016. China's main suppliers in the region are Indonesia (thermal coal) and Mongolia (coking coal). The Democratic People's Republic of Korea (DPRK) supplied significant amounts of anthracite to China until 2016, and China also imports smaller volumes of coal from Malaysia, Kazakhstan, Kyrgyzstan, Lao PDR and Myanmar (Figure 5).

Figure 5. China's coal imports, 2013-17



Note: Anthracite is classified as thermal coal in most IEA publications, but some thermal coal is actually lignite.

Sources: IHS McCloskey, 2018; IEA (2018f), *Coal Information* (database), www.iea.org/statistics.

Emerging Asia provided 57% of China's coal imports in 2017, with Indonesia and Mongolia as the main Asian suppliers.

M&A by Chinese companies in coal mining apparently remain limited, but some companies are involved as contractors for coal mine modernisation and mine-mouth power plant projects. In 2017, the China Investment Corporation (CIC) and China Development Bank (CDB) acquired 22.6% of Bumi Resources, Indonesia's largest thermal coal mining company, for

USD 1.06 billion (CIC) and USD 550 million (CDB) through a debt-to-equity swap. As part of Uzbekistan's efforts to increase coal production, the China Coal Technology and Engineering Group Corporation (CCTEG) and China Railway Tunnel Group are modernising the Surkhandarya coal mine complex with funding from the Exim Bank (USD 90 million) and Uzbek banks (USD 5 million) (Azernews, 2018).

In Pakistan, the Thar coal block, exploited by Sinomach, is coupled with a coal-fired power plant project. Thar is a gigantic, unexploited lignite field (holding over 175 billion tonnes of resources) in Pakistan's Sindh province, discovered by chance 30 years ago during drilling for water. Development of Thar field includes building several power plants (totalling 3 960 MW) and mines to feed them. China Machinery Engineering Corporation, a subsidiary of Sinomach, agreed to a joint venture with Sindh Engro Coal Mining Company (SECMC) to produce 3.8 mtpa from Block II of Thar. Sino Sindh Resources Limited (SSRL, a subsidiary of China's Global Mining Company) is developing a 6.8-Mtpa mine in Block I, and Yanzhou signed a MoU with Oracle to develop a mine to feed another 1320-MW plant in Block VI. The environmental impact of these projects is significant, affecting a large surface area and requiring community resettlements. A proper corporate social responsibility (CSR) policy is essential for these projects to proceed on good terms.

Stakeholder activities reflect China's domestic economic structure

Chinese energy companies are mostly SOEs, the actions of which are encouraged and determined by government policy. Private companies are increasingly dynamic, but their activities currently remain small in scale and limited essentially to renewables, grids, and oil and gas. Among Chinese companies, both the power sector EPC market and oil and gas activities are dominated by the top energy SOEs and their numerous subsidiaries. Except in the wind and solar industry, the manufacture and export of equipment is less monopolised but still largely controlled by SOEs, including provincial and municipal ones.

As contractors, most Chinese SOEs have the ability to provide integrated services centred on turnkey project delivery. For most power plants, they can undertake the entire project cycle: preliminary studies and design, equipment commissioning, construction, and operations and maintenance, although projects are often handed over without involvement in operations. By having close ties with both the Chinese government and those of countries in the region, SOEs also facilitate agreements with banks for funding, including debt management.

The SOE sector is closely integrated with China's political institutions. The Central Committee of the Chinese Communist Party appoints the top executives of major SOEs and state financing is also aligned with government priorities, so there is incentive for these companies to follow government orientations. In the meantime, while the state owns majority shares in SOEs, they are not government-operated and their activities need to be profit-oriented.

In the power sector

Power projects in emerging Asia are undertaken mostly by national-level SOEs, while contracts for provincial or municipal SOEs are still relatively small. National SOEs tend to contract larger projects in a variety of fuel types and countries, whereas local SOEs tend to receive contracts for specific types of projects in one country. These companies are mostly energy infrastructure firms, as well as construction and civil engineering enterprises familiar with energy projects.

Of 40 Chinese energy companies active as contractors in the region, 70% of all contracts undertaken (by capacity added) are received by the top 5 SOEs and their national or provincial/municipal subsidiaries: the Power Construction Corporation of China (Power China), the China Energy Engineering Corporation (CEEC), China National Electric Engineering Corporation (CNEEC), the China Huadian Corporation (Huadian) and the China National Machinery Industry Corporation (Sinomach) (Table 2). While Huadian focuses on large projects in Southeast Asia, the other SOEs contract throughout the region. There is no specific regional distribution; for instance, more than ten different companies are active in Indonesia in various power projects. Other research also shows that the top five companies involved in coal projects in BRI countries operate 68% of all projects (Peng, Chang and Liwen, 2017).

Table 2. Main Chinese energy infrastructure companies contracting construction services in emerging Asia

Company	Projects completed 2013-17	Projects under construction 2018-22	Completed 2013-17 (MW)	Under construction 2018-22 (MW)
Power China	39	12	11 470	4 465
CEEC	14	10	3 570	6 275
CNEEC	8	3	3 275	1 440
Huadian	2	2	1 365	2 440
Sinomach	8	3	1 230	2 010

Source: IEA. All rights reserved.

Chinese turbine and solar photovoltaics (PV) manufacturers are the main equipment suppliers for around 200 projects (82 GW of capacity) in emerging Asia over 2013-22. Around 40 turbine and PV manufacturers export the main equipment for power projects, but the top three – Harbin Electric Corporation (Harbin), Shanghai Electric Corporation (Shanghai) and Dongfang Electric Corporation (Dongfang) – manufacture more than 80% of exported capacity. On a project basis, the market structure is less concentrated, as the top three companies are involved in only 56% of all Chinese-manufactured equipment exported to the region. While thermal, hydropower and nuclear turbines are all manufactured by SOEs, private companies lead in wind and solar equipment, and some foreign hydropower turbine technologies have now been fully indigenised (Table 3). Manufacturers are also energy infrastructure construction companies.

Table 3. Main Chinese manufacturers exporting power equipment to emerging Asia

Technology	Company	Number of projects 2013-22	Capacity 2013-22 (MW)
Coal	Shanghai	22	22 075
	Harbin	32	21 800
	Dongfang	25	19 700
	others	14	2 500
Hydropower	Harbin	6	2 300
	Voith Hydro Shanghai	4	1 350
	Tianjin Alstom Hydro	5	1 075
	Dongfang	12	1 050
	Toshiba Hydro Power Hangzhou	4	950
	Chongqing Turbine Manufacturing	8	550
	others	24	1 400
Nuclear	China National Nuclear Corporation	2	2 880
Biomass and waste	Harbin	8	925
	Dongfang	2	315
	Shanghai	1	75
	Others	4	160

Source: IEA. All rights reserved.

Chinese suppliers of nuclear technologies, which also tend to be state-owned, have become involved in financing nuclear projects in both emerging economies and OECD countries. Nuclear equipment vendors have provided loans to new projects either from their balance sheets or have taken equity stakes (IEA, 2018e).

In the oil and gas sector

Although CNPC is by far the main Chinese company involved in both oil and gas projects, more than a dozen Chinese companies, including non-NOCs, are active in oil and gas exploration and production in emerging Asia (Tables 4 and 5). CNPC directly operates one-quarter of its production and also leads in pipeline operations. The three NOCs still dominate, but their shares have been declining in comparison with those of non-NOCs, SOEs and private companies. In oil, the NOC share of crude production among Chinese companies declined from 87% in 2013 to 84% in 2017. Non-NOCs are increasingly active and include conglomerates such as CITIC Group, Fosun International, local SOEs such as Xinjiang Zhundong Petroleum Technology, Hong Kong-headquartered companies such as Kowloon Development and Polyard Petroleum International, and private companies such as Geo-Jade Petroleum. In gas production, CNPC and Sinopec are the main Chinese companies, accounting for more than 99% (CNPC 95%; Sinopec 4%).

While Chinese NOCs continue to build up their overseas asset management capabilities, private oil companies such as GCL, Kunlun Hongxing and China Rising Energy International Company Limited (CREIC) are increasingly seeking overseas opportunities, especially in oilfield services but also in M&A. For instance, CREIC, established in 2017, is conducting explorations in three oilfields in Kazakhstan and has a majority share in the Koskol oilfield.

Table 4. Main Chinese stakeholders in non-OECD Asia oil production, 2017

Company	Status	Production (kbbbl/d)	Share (%)	Production directly operated (%)
CNPC	NOC / public	252.72	72.9%	27%
Sinopec	NOC / public	34.36	9.9%	8%
CITIC Group	Non-NOC / public	20.76	6%	6%
Kowloon Development Company	Non-NOC / private	17.60	5.1%	none
Geo-Jade Petroleum Corporation	Non-NOC / private	15.12	4.4%	45%
Fosun International	Non-NOC / private	> 3	> 1%	none
Xinjiang Zhundong Petroleum Technology Co	Non-NOC / private	> 2	> 1%	100%
Hong Kong and China Gas Company	Non-NOC / mix	> 2	> 1%	100%
MIE Holdings Corporation	Non-NOC / private	> 2	> 1%	100%
Sinochem	NOC / public	> 1	> 1%	none

Source: Rystad Energy (2018), Ucube (database).

Table 5. Main Chinese stakeholders in non-OECD Asia gas production, 2017

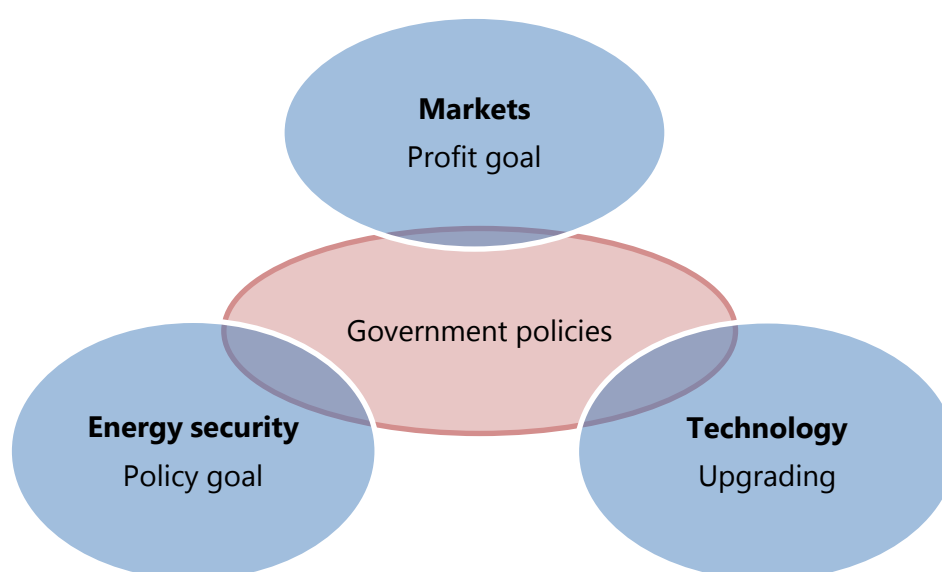
Company	Status	Production (bcm)	Share (%)	Production directly operated (%)
CNPC	NOC / public	12.3	95%	72%
Sinopec	NOC / public	0.6	4%	none
Fosun International	Non-NOC / private	> 0.5	> 1%	none
MIE Holdings Corporation	Non-NOC / private	> 0.5	> 1%	100%

Source: Rystad Energy (2018), Ucube (database).

Key drivers

The overseas activities of Chinese energy companies are spurred mainly by the quest for markets, technologies and support for China's energy security. Given China's slower economic growth and domestic overcapacity, the government encourages state-owned enterprises (SOEs) to become more profit-oriented. The government's industrial upgrading strategy and the push for value chain enhancement stimulate the search for new technologies, and rising oil and gas dependency incites diversification of energy resource access. Drivers vary by region, however: while oil security is the main incentive for energy investment in North America, coal and gas resources are the focus in the Asia-Pacific region. The quest for new technologies and markets, mostly in non-fossil energy, motivates activities in Europe. In emerging Asia, activities are prompted mostly by business opportunities under the BRI, and in some cases by energy security.

Figure 6. Chinese government and companies' overseas energy activity drivers



Source: IEA. All rights reserved.

Business opportunities and energy security drive the construction service, equipment supply, and investment activities of Chinese companies in non-OECD Asia.

Institutional framework

The provision of construction services, equipment and investments by Chinese energy companies in emerging and developing countries is encouraged by government policies and supported by policy banks as well as commercial banks, especially since 2013 under the BRI.

Institutional framework for overseas activities

The Chinese government actively supports and encourages contracting and investment in developing and emerging Asia, in line with the “Going Out” policy that has been promoting Chinese companies’ overseas activities since the opening and reform era in the 1980s. More recently, the BRI has added impetus to the movement, with official documents describing an ambitious vision and plans to connect countries through revived trade routes (NDRC et al., 2015; Eyler, 2015).

China’s “Going Out” policy was incorporated into the development strategies of its 10th Five-Year Plan (2001-05). Since opening up of the economy in the 1980s, Chinese enterprises have been allowed to establish subsidiaries abroad as long as they possess the necessary capital and technical and operational capacity. A cap that initially limited the number of projects Chinese companies could contract abroad was gradually removed, although large investments are still overseen by the State-owned Assets Supervision and Administration Commission of the State Council (SASAC). The “Going Out” policy has partially alleviated domestic overcapacity issues, especially in some areas such as the building of hydropower dams and coal-fired power plants, for which some Chinese energy infrastructure companies had reached the limit to their domestic opportunities.

Launched in 2013 by President Xi Jinping, the BRI has become an overarching umbrella for the overseas activities of Chinese energy companies. In March 2015, the National Development and Reform Commission, the Ministry of Foreign Affairs and Ministry of Commerce jointly issued the reference policy document “Vision and Actions on Jointly Building Silk Road Economic Belt and 21st-Century Maritime Silk Road”. The document expresses the vision of the BRI, including for energy, in encouraging co-operation in “the connectivity of energy infrastructure, the security of oil and gas pipelines and other transport routes, cross-border power supply networks and power transmission routes, and regional power grid upgrading” (NDRC et al., 2015).

Developmental motive

From the perspective of Chinese think tanks and government officials, infrastructure projects built and/or financed by China also help to fulfil a long-term vision of achieving energy access and industrial development in developing and emerging countries, which should be mutually beneficial in the long term to both the recipient countries and China. Addressing infrastructure needs in emerging Asian countries is perceived as a path to higher economic growth, and to the positive spill-over of increased consumption of Chinese goods and services (Djankov and Miner, 2016). To better oversee Chinese development financing, a new agency was created in March 2018: the China International Development Cooperation Agency (CIDCA). Development aid had previously been supervised by the foreign aid department of the Ministry of Commerce (MOFCOM), with co-ordination from the Ministry of Foreign Affairs.

The Chinese government does attempt to address environmental protection in overseas projects, although no mandatory targets have been set. In 2017, the Ministry of Environmental Protection, the Ministry of Foreign Affairs, the National Development and Reform Commission

and the Ministry of Commerce jointly issued “Guidance on Promoting Green Belt and Road”. The document refers to generic principles such as supporting environmental NGOs, formulating environmental protection standards, fortifying environmental management of overseas investments and promoting the concept of voluntary environmental risk management (MEP et al., 2017). Although it recommends compliance with existing norms in host countries, the document is non-binding and limited to general principles.

While energy projects can cement political relationships with host countries (Djankov and Miner, 2016), they are subject to evolving political contexts and at times renegotiated as governments change. In 2018, Pakistan reviewed some BRI agreements (Financial Times, 2018a) and Malaysia cancelled two oil and gas pipelines (Financial Times, 2018b), while Nepal restarted hydropower projects with the China Gezhouba Group Corporation (CGGC) worth USD 2.5 billion (AFP, 2018).

Economic drivers

Gaining access to new markets to complement China’s vast domestic market has become a stimulant for Chinese energy companies to progressively adopt a more market-oriented approach, and some companies have been rewarded with important revenues from overseas contracts and assets.

Need for new markets

Although China’s domestic energy market remains vast, some sectors are confronted with overcapacity, slowdowns and fierce competition because business behaviours have at times been intertwined with political decisions. New coal-fired developments have stalled, notably under the 13th Five-Year Plan for energy. Hydropower development has plateaued and now focuses essentially on smaller and medium-sized pumped hydropower projects rather than large dams. The important share of Chinese-built coal-fired and hydropower projects outside China can therefore be explained by the slowdown in coal-based development and in hydropower investment within China. Similarly, recent policy changes to promote more cost-effective solar PV development in China may encourage Chinese solar companies to seek new markets outside China (IEA, 2018e).

Chinese energy companies’ five-year plans take into account overseas markets. For instance, the China Three Gorges Corporation (CTGC), which has a presence in 41 countries, aspires to build the equivalent of one three-gorge dam (22 500 MW) outside China within the time frame of its plan, and had already completed 60% of this target by 2017.

Furthermore, Chinese companies benefit from favourable financing conditions. Access to Chinese financing, such as loans from Exim or CDB, is conditional on the use of construction services or equipment provided by Chinese companies. Chinese overseas contracting and investments are driven by the need for new markets.

Energy resources and country risk

With the exceptions of Malaysia, India, Indonesia and Thailand, risks related to the business environment in non-OECD Asian economies are considered above-average by both OECD classifications and World Bank index (Table 6). In fact, some countries in the region are among the highest-risk economies in the world according to these indexes. Previous IEA research

shows that although Chinese energy companies used to tend to be less averse to risk than companies from OECD countries, risk levels are increasingly being considered (IEA, 2014).

Table 6. World Bank *Doing Business* and OECD country risk index for non-OECD Asia

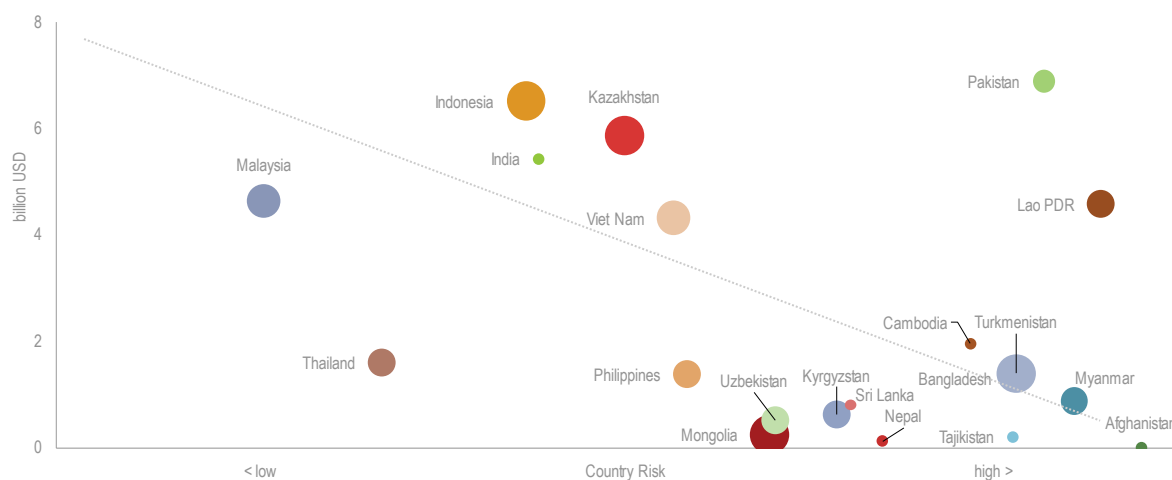
		OECD	World Bank
Central	Kazakhstan	6	28
	Kyrgyzstan	7	70
	Tajikistan	7	126
	Turkmenistan*	6	n/a
	Uzbekistan	6	76
Northeast	DPRK*	7	n/a
	Mongolia	6	74
South	Afghanistan	7	167
	Bangladesh	5	176
	Bhutan	6	81
	India	3	77
	Maldives	6	139
	Nepal	6	110
	Pakistan	7	136
	Sri Lanka	6	100
	Cambodia	6	138
Southeast	Indonesia	3	73
	Lao PDR	7	154
	Malaysia	2	15
	Myanmar	6	171
	Philippine	3	124
	Thailand	3	27
	Timor-Leste	6	178
	Viet Nam	5	69

* Turkmenistan and DPRK are not covered in the *Doing Business* index.

Source: OECD (2018a), "Country risk classifications of the participants to the arrangement on officially supported export credits"; World Bank (2018), *Doing Business 2018*.

Analyses that encompass contract and investment levels by Chinese companies, country risk index and natural resource exports to China demonstrate no clear correlation among these elements. Contracts and investments do, however, tend to be lower in riskier countries (Figure 7). Chinese energy companies generally sell fewer construction services and invest less in countries with higher economic risk, except for countries with which China has strong political ties, such as Lao PDR and Pakistan. Regarding countries that supply China with natural resources (crude oil, natural gas and coal), contract and investment levels are high in Indonesia and Kazakhstan but relatively low in Turkmenistan and Mongolia. In India, a country that does not export resources to China, the number of Chinese power projects is considerable (worth more than USD 5 billion over 2013-17).

Figure 7. Chinese energy contract and investment levels, resources exported to China and country risk, 2013-17



Notes: Bubble size indicates the scale of energy resources exported to China. Contract and investment levels are based on estimates of construction services in power generation projects of above 10 MW, and on oil and gas exploration and production capex by Chinese companies (2013-17). Risk levels are the average of the OECD export credit risk classification and the World Bank Doing Business index.

Source: IEA. All rights reserved.

The scale of contracts and investments of Chinese energy companies tends to be smaller in higher-risk countries, except when political ties with the country are strong. Meanwhile, there is no clear correlation between the value of contracts and investments and the amount of energy resources the host country supplies to China.

Need for increased energy security

China is the world's largest importer of coal, oil and gas. As a major energy consumer and importer, China's dependence on imported resources exposes it to energy security risks, including price volatility and the possibility of supply disruptions. To improve its energy security, China has sought to diversify its energy supplies while also strengthening domestic production when possible.

Increasing import dependency

China overtook the United States to become the world's top oil importer in 2017. China's dependence on oil imports rose to 69% in 2017, and gas import dependency increased to 42% (IEA, 2018a) (Table 7). In view of its limited domestic oil and gas resources, China has supported its major SOEs in pursuing a dual strategy since the 1990s to reform the domestic oil market by attracting foreign investment and broadening technology and management experience. At the same time, it has been actively participating in overseas exploration and development projects to gain a position in the global market (Wang, 2001).

Energy security has been an important driver of investments by Chinese companies in oil and gas activities in emerging Asia. However, although the region's geopolitical significance in the energy security context has attracted Chinese companies to its oil and gas investment portfolios, the share Asia provides of China's overall energy resource supply remains limited.

Table 7. China's energy import dependency and imports from emerging Asia

Energy resources	Total imports 2017	Imports from emerging Asia 2017	Import dependency 2017 (%)	Import dependency 2040 (%)	Share of imports from emerging Asia 2017 (%)	Share in China's energy mix 2017 (%)
Crude oil	419.97 Mt	15.37 Mt	69%	82%	3.7%	18%
Natural gas	94 bcm	52 bcm	42%	54%	55%	5.5%
Coal	271.1 Mt	154.2 Mt	8%	3%	57%	63%

Source: IEA (2018a), *World Energy Outlook*; IEA (2018g), *Coal Information* (database); China Customs (2018).

In Central Asia, which has several oil- and gas-producing countries and is included under the institutional umbrella of the Shanghai Cooperation Organisation (SCO), China has been engaged in oil and gas exploration and production activities while also investing in transportation infrastructure. For example, during Chinese President Xi Jinping's visit to Kazakhstan in 2013, CNPC signed a USD 5-billion deal with the Kazakh state company KazMunaiGas for an 8.33% share in the Kashagan oil project. As for transportation, the 2 228-km Kazakhstan-China oil pipeline has been in operation since the early 2000s. These investments diversify China's oil and gas supplies and reduce its dependence on imports from the Middle Eastern and Indian Ocean trade routes.

Securing access to resources and routes to China

Meanwhile, China's energy security interests in Southeast Asia and South Asia lie mainly in securing and diversifying energy transportation gateways to combat the 'Malacca Dilemma', a term coined by President Hu Jintao in 2003 in reference to the country's overreliance on energy imports coming through the Malacca Straits and the associated risks. In addition to actively promoting 'infrastructure diplomacy' with countries in the region, China has invested in projects such as the China-Myanmar oil and gas pipelines and the China-Pakistan Economic Corridor. Chinese strategists have long worried about the strategic vulnerability of the narrow stretch of water running between the Malay Peninsula and the Indonesian island of Sumatra, through which 80% of China's maritime energy imports pass. One strategy is to build infrastructure, including pipelines, to allow China to supplement the energy supplies it receives through the Strait of Malacca.

Connectivity, which is high on the economic development agendas of most emerging economies in Europe and Asia, could also benefit OECD countries (OECD, 2018b). China has therefore encouraged the development of transport corridors in recent years (the China-Pakistan Economic Corridor and the China-Indochina Peninsula Economic Corridor) as well as regional co-operation frameworks such as the Lancang-Mekong Cooperation. Approximately 3% of the electricity currently consumed by BRI countries is obtained through cross-border trade (Deloitte, 2018).

Modes of Chinese energy involvement in emerging Asia

Most activities of Chinese energy companies in emerging Asia consist of supplying construction services, equipment and investments (with the financial support of Chinese banks that provide credit to companies or concessional loans to host countries). In the power sector, Chinese energy companies are primarily contractors, providing construction services and supplying equipment. In oil and gas, Chinese companies are investors as well as contractors. Outside the oil and gas sector, however, M&A and direct involvement in project operations are infrequent.

Financing methods

Emerging and developing countries in Asia need USD 3.6 trillion investment by 2030 for energy infrastructure investment in power, oil, gas, coal and biofuels (IEA, 2018e). More than 50% of all infrastructure investment needs are energy-related (ADB, 2017). Even though it is a significant foreign contractor and investor, China covers only a limited part of all needs.

In the power sector, engineering, procurement and construction (EPC) are the most common types of project contracting arrangement for construction services. Host country governments issue bids and award projects, and Chinese energy infrastructure companies deliver construction services without having any stake in the projects (Peng, Chang and Liwen, 2017). China's foreign currency reserves, which are the world's largest at around USD 3 000 billion, support the government's internationalisation policy, and financing infrastructure projects is consistent with China's long-term strategy of investing foreign reserves in secure and stable financial returns.

M&A in overseas renewable energy by Chinese enterprises mainly target Europe and America, but some transactions have been finalised in Malaysia, Indonesia, Thailand and the Philippines since 2013 (Deloitte, 2018; IEA, 2018b). Activity has been focused mostly on renewables and networks in the Asia-Pacific region, Latin America and Europe. Within BRI countries, energy financing by Chinese companies through M&A was a scant 1% in 2017 (Deloitte, 2018). Even though China's share of total venture capital investments in early-stage energy technology (cleantech) start-ups has risen dramatically in OECD countries, it remains almost non-existent in emerging Asia (IEA, 2018e). Chinese modes of financing contrast with those of other countries: around 40% of energy investments in Asia originate in the private sector, with independent power producers (IPPs) prominent in some countries (ADB, 2017).

Chinese development aid

Chinese financial institutions have become major supporters of Chinese energy product and service exports, and leading providers of capital for the energy sector (supporting Chinese construction services and equipment supplies abroad, greenfield investments, and M&A to a certain extent). Encouraged by initiatives such as the BRI, state financing provides the main

funding for Chinese energy company projects (both as contractors and as investors), while capital markets are a limited source.

State financing for the globalisation of Chinese energy companies derives essentially from two main policy banks: the Export-Import Bank of China (Exim Bank) and the China Development Bank (CDB), which co-ordinate economic and geostrategic goals and tools (Ferchen, 2018). While the Exim Bank focuses on trade and supports EPC contracts by providing export credits and concessional or low-interest loans in low- and middle-income countries, the CDB provides financing for major bankable deals such as pipeline construction in Myanmar or installation of transmission lines. Founded in 1994 as a policy bank fully owned by the Chinese government, the Exim Bank is the only Chinese bank that provides concessional loans eligible for consideration as official development aid (ODA). CDB is also a shareholder in the Silk Road Fund.

Although no data are available, Chinese commercial banks (also state-owned) are showing increasing interest in supporting energy projects. In Pakistan, the 1.3-GW Sahiwal power plant was financed with loans from the Industrial and Commercial Bank of China (ICBC) with equity participation of a Chinese IPP. These commercial financing initiatives not only provide funding but also facilitate external capital flows from commercial banks by offering loan guarantees and insurance, as well as facilitating participation of the financing country's industrial enterprises as project sponsors and equipment suppliers (IEA, 2018e).

Non-Chinese sources of financing also fund projects obtained by Chinese companies. For example, the 720-MW Karot hydropower dam in Pakistan is co-financed by the International Finance Corporation (IFC). As part of the China-Pakistan Economic Corridor, the project is being developed by Karot Power Company, a joint venture between CTGC and Associated Technologies of Pakistan. It is being financed by the IFC (USD 100 million) and China's Silk Road Fund under the build-operate-transfer (BOT) model for 30 years before being retroceded to the government of Pakistan (IFC, 2018). Exim and CDB issued loans to the Karot Power Company. China Three Gorges South Asia Investment Ltd with the partnership of IFC (15% stake) and Silk Road Fund (15 % stake) has six projects in Pakistan. The total value is USD 6.2 billion with an installed capacity of 2732 MW: Kohala HPP (1 124 MW), Mahl HPP (640 MW), Karot HPP (720 MW), 99 MW TGS and TGP Wind Farm, 49.5 MW TGF Wind Farm and 100 MW solar project (wind hybrid).

Founded in 2014 and initiated by China, the Asian Infrastructure Investment Bank (AIIB) currently supports energy projects only through co-financing with other development finance institutions (DFIs). In 2017, the IMF and the People's Bank of China announced the creation of a China-IMF Capacity Development Center (CICDC). Based in Beijing, the CICDC aims to support government officials from China and other countries, including those in the BRI, in institution-building and policy making (IMF, 2017).

OECD guidelines limit tied aid; regulate credit practices; impose maximum repayment terms, country risk classifications and minimum interest rates; require the exchange of information; and impose social, environmental and governance standards on financing activities. OECD Development Assistance Committee (DAC) countries have a long history of offering development assistance and economic co-operation with Africa. Even though China and the OECD collaborate on and discuss development aid, China is not a member of the DAC and is thus not covered by OECD guidelines (OECD, 2016).

Contracted services and investments in overseas energy projects

Contracted power generation projects and oil and gas investments of Chinese energy companies were worth an average USD 10.5 billion annually between 2013 and 2017, and operational expenditures (opex) for oil and gas production totalled USD 1.5 billion on average. The majority went to power generation (83%), followed by exploration and production of oil (13%) and gas (4%).

According to IEA estimates based on power generation capacity costs, the value of construction services Chinese companies provided to Asian emerging countries in the power generation sector amounted to USD 41 billion over 2013-17. Coal-fired generation accounts for 55% of this amount, gas-fired accounts for 4%, while renewable generation represents 34% (which includes 24% for hydropower) and the rest for Pakistani nuclear plants. Projects in non-fossil fuels, including nuclear, amounted to around USD 17 billion over the five-year period. However, Chinese wind and solar development projects have ample scope for expansion and Chinese banks have begun to develop dedicated financing instruments.

Most power generation construction service projects are located in South and Southeast Asia, with ASEAN (Association of Southeast Asian Nations) countries representing half of total Chinese company contracts in the region during 2013-17. Within the region, six countries dominate in value of contracts with Chinese companies in power generation, hosting three-quarters of Chinese-built projects: Pakistan primarily, followed by Indonesia, India, Lao PDR, Malaysia and Viet Nam.

Because of oil price volatility, Chinese companies have become more selective in their oil investments and have cut spending. The main Chinese oil companies reduced overall upstream oil spending (capex and exploration capex) in emerging Asia from USD 1.736 billion in 2013 to around USD 593 million in 2017; this is a drop of more than 65%. This cut in spending was sharper than in other regions. At the same time, their opex spending in the region declined by 25%, reflecting lower production levels as well as efficiency gains.

In upstream gas, capex and exploration capex by the main Chinese companies in emerging Asia also fell by 65%, from about USD 740 million in 2013 to USD 260 million in 2017, while their opex increased by 27%, reflecting higher production levels. As a result, the share of oil and gas spending dedicated to the Asia region has steadily decreased and now accounts for only 3.5% of total overseas capex spending by Chinese companies.

Value chain integration

Energy projects generate various types of interactions along the value chain, from projects that are fully integrated by one single company to construction contracting, equipment sourcing and export arrangements. Chinese energy companies have a comparative advantage in coal and hydropower, owing to their long experience in construction and equipment manufacturing as well as in exporting in these areas (Figure 8).

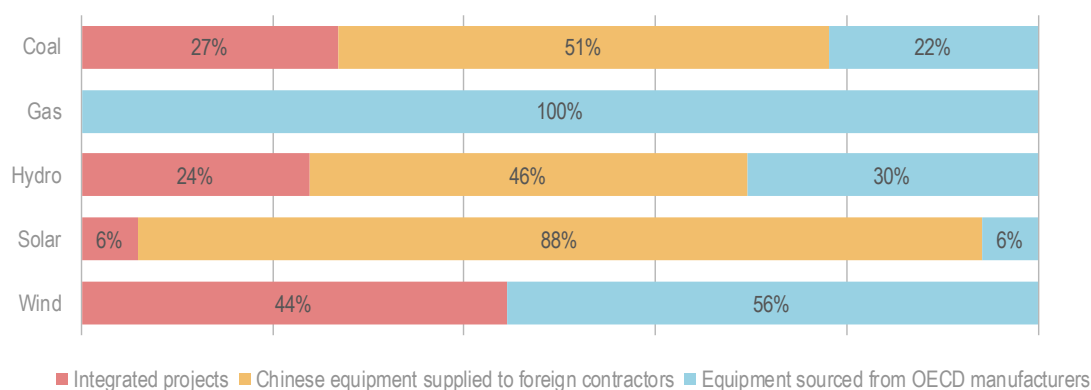
Integrated turnkey projects

Chinese energy companies are able to provide turnkey projects offering options for all stages of the process, including the supply of equipment manufactured to Chinese standards, plant design and construction, and project financing (or financing facilitation).

Of the Chinese-built power projects considered in this analysis, around 45% are integrated and involve several Chinese companies, including both a Chinese turbine manufacturer and a Chinese contractor for plant construction (Figure 8). Out of the 160 new Chinese-built power plants in the region over 2013-22, 62 projects are fully integrated with a Chinese contractor, a Chinese turbine manufacturer and a Chinese plant designer. In Pakistan, CNNC is building a 2 200-MW nuclear plant with Chinese Hualong reactor technology, scheduled to come online in 2022; the Karachi 2 and 3 projects represent the first exports of China's Hualong reactor.

The main turbine manufacturers, such as Shanghai Electric, Harbin Electric and Dongfang, are also able to carry out project construction, but seldom does a single company complete the whole chain for a project. Plant design is often done by the contractor directly.

Figure 8. Distribution of power plant contracting arrangements and equipment supplies for Chinese energy projects in emerging Asia (2013-22)



Notes: Based on plants larger than 10 MW, completed or under construction. Integrated projects are those that have both a Chinese contractor for construction and a Chinese main equipment supplier.

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A globalised value chain offers opportunities for multiple participants.

Export of power generation equipment

Overseas export of power generation equipment such as turbines and solar PV modules is an important market for Chinese equipment manufacturers. Between 2013 and 2022, Chinese manufacturers supply the primary equipment for 18% of all projects contracted to non-Chinese companies in the region, including one-third of all coal and hydropower turbines. This equipment supplies 61 coal-fired plants (42.4 GW of capacity) and 42 hydropower dams (5.1 GW).

For other technologies, less than 10% of primary equipment is supplied by Chinese manufacturers, for instance only about 15 utility-scale solar plants or around 1 GW of capacity (Figure 8). According to the Global Environmental Institute, 30% of coal equipment in BRI countries was supplied by Chinese exports in 2016, while Chinese

outward foreign direct investment affected only 10% of coal projects (Peng, Chang and Liwen, 2017). Exporting equipment is therefore an important component of Chinese energy activities overseas.

Overseas sourcing of power generation equipment for overseas projects

In the meantime, Chinese energy infrastructures companies also source their equipment for overseas projects from at least 15 suppliers from OECD countries. In fact, more than half the power generation turbines for the Chinese-built power projects covered in this analysis were supplied by foreign manufacturers. Chinese contractors sourced the primary equipment for more than 85 projects (representing more than 20 GW of capacity), mostly for hydropower and followed by coal and gas turbines as well as equipment for other renewables, from non-Chinese suppliers (Figure 8). Therefore, Chinese-supported energy projects in emerging Asia, as well as in other developing countries, create direct trade opportunities for companies from OECD countries.

In gas-fired generation, Chinese contractors currently rely fully on foreign turbine manufacturers for their overseas projects; for example, with help from the Asian Development Bank (ADB), the 341-MW Bibiyana II Gas Power Project in Bangladesh was completed in 2015 by the Northeast China International Electric Power Corporation as an EPC contractor, with turbines supplied by General Electric. As China's ability to export power generation and low-carbon energy equipment depends on the indigenisation of foreign technologies (Gallagher and Kong, 2016), Chinese contractors currently rely on General Electric, Bergen and Siemens as some of their key suppliers.

Conclusion

China has become an important source of financing for energy projects, and a major provider of capital, construction services and equipment to energy sectors in developing and emerging economies, including beyond Asia. Providing construction services, equipment and investments in energy bolsters the internationalisation of Chinese companies and lends momentum to the government's "Going Out" strategy, as well as contributing to energy needs in host countries.

This report covered only specific players in a specific region. Despite substantial progress and encouraging signs of further expansion, persistent efforts are needed to improve energy access in the region, since power shortages continue to constrain economic development in both the industry and services sectors in some countries. Greater access to capital funding and to up-to-date technologies is required to sustain energy sector development. Under its "open doors" policy, the Agency will continue to support expanded energy access and clean energy technology development.

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Acronyms, abbreviations and units of measure

Acronyms and abbreviations

ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
BRI	Belt and Road Initiative
capex	capital expenditure
CCTEG	China Coal Technology and Engineering Group Corporation
CDB	China Development Bank
CEEC	China Energy Engineering Corporation
CEG	China Engineering Group
CGGC	China Gezhouba Group Corporation
CGN	China General Nuclear Power Corporation
CIC	China Investment Corporation
CICDC	China-IMF Capacity Development Center
CIDCA	China International Development Cooperation Agency
CNEEC	China National Electric Engineering Corporation
CNNC	China National Nuclear Corporation
CNPC	China National Petroleum Corporation
CNPC ETRI	CNPC Economics and Technology Research Institute
CPEC	China-Pakistan Economic Corridor
CREIC	China Rising Energy International Company Limited
CTGC	China Three Gorges Corporation
DFI	development finance institution
Dongfang	Dongfang Electric Corporation
EPC	engineering, procurement and construction
EPCC	engineering, procurement, construction and commissioning
Exim	Export-Import Bank of China
GE	General Electric
Harbin	Harbin Electric Corporation
Hexin	Hangzhou Hexing Electrical Co.
Huadian	China Huadian Corporation
ICBC	Industrial and Commercial Bank of China
IMF	International Monetary Fund
IPP	independent power producer
LPG	liquefied petroleum gas
M&A	merger and acquisition
MOFCOM	Ministry of Commerce (China)

MoU	memorandum of understanding
NDB	New Development Bank
NOC	national oil company
ODA	official development aid
OFDI	outward foreign direct investment
opex	operational expenditure
PFI	private finance initiative
Power China	Power Construction Corporation of China
PSA	production sharing agreement
SASAC	State-owned Assets Supervision and Administration Commission of the State Council
SCR	social corporate responsibility
SECMC	Sindh Engro Coal Mining Company
Shanghai	Shanghai Electric Corporation
Sinomach	China National Machinery Industry Corporation
SOCB	state-owned commercial banks
SOE	state-owned enterprise
TBEA	Tebian Electric Apparatus Stock Company
UNEP	United Nations Environment Programme

Units of measure

bbl	barrel
bcm	billion cubic metres
Gt	gigatonne
GW	gigawatt
km	kilometre
kW	kilowatt
m	metre
m ³	cubic metre
Mt	million tonnes
Mtce	million tonnes of coal equivalent
MW	megawatt
t	tonne

Emerging Asia country groupings

Central Asia (5):	Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan.
Northeast Asia (2):	Mongolia, Democratic People's Republic of Korea (DPRK).
South Asia (8):	Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, Sri Lanka.
Southeast Asia (10):	Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic (Lao PDR), Malaysia, Myanmar, the Philippines, Timor-Leste, Thailand, Viet Nam.

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