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Foreword

Demand for coal has been rising in many economies. Coal is affordable and plentiful, particularly in the Asia-Pacific region, where it remains the backbone of numerous economies' power systems, despite its high carbon emissions.

The release of the second edition of the APERC Coal Report reflects both the ongoing importance of the coal sector to the APEC region and the state of flux the sector currently finds itself in. Coal is an important pillar of the power and industry sectors, and will remain a sizable component of the energy mix in most APEC economies for many years to come. On the other hand, decarbonisation, smog and environmental concerns, market oversupply, and competition from lower-priced renewables all pose challenges to coal, in economies at all stages of development.

I would like to express my sincere gratitude to the authors and contributors for their effort in writing and publishing this report. I would also like to note that the views expressed in this paper are those of the authors and not necessarily those of APERC.

A handwritten signature in black ink that reads "Kazutomo Irie". The signature is written in a cursive, flowing style.

Dr. Kazutomo IRIE
President
Asia Pacific Energy Research Centre
April 2019

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We would like to thank to the 56th Energy Working Group, for their feedbacks and advice. We also wish to thank to the 7th Edition APERC Outlook Team for their projections and data, the administrative staff of APERC and IEEJ for the joint work.

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Abbreviations and Acronyms

Abbreviations

GW	Gigawatts
kWh	Kilo-Watt hour
Mt	Million tonnes
Mtoe	Million tonnes of oil equivalent
TW	Terawatts
USD	US Dollar

Acronyms

2DC	2 Degree Scenario
AAGR	Average Annual Growth Rate
AER	Australian Energy Regulator
AESO	Alberta Electricity System Operator
APEC	Asia-Pacific Economic Cooperation
APERC	Asia Pacific Energy Research Centre
BAU	Business As Usual
CCS	Carbon Capture and Storage
CO ₂	Carbon Dioxide
CTL	Coal-to-Liquid
EFI	Energy Futures Initiative
EIA	Energy Information Administration, USA
EOR	Enhanced-Oil-Recovery
EPA	US Environmental Protection Agency
EU	European Union
f.o.b.	Free on Board
FYP	Five Year Plan
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GNS	Government of Nova Scotia
GOC	Government of Canada
IEA	International Energy Agency
IEEJ	Institute of Energy Economics Japan
INDC	Intended Nationally Determined Contribution
IPPs	Independent Power Producers
LNG	Liquefied Natural Gas
MATS	Mercury and Air Toxics Standards
NDRC	National Development and Reform Commission
NEA	National Energy Administration

NEB	National Energy Board
NEM	National Electricity Market
OECD	Economic Co-operation and Development
TPES	Total Primary Energy Supply
UNFCCC	United Nations Framework Convention on Climate Change
USA	United States of America
WB	World Bank
WSA	World Steel Association

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Summary and key trends

- › Nearly 71% of global coal consumption occurred in APEC member economies in 2016. The APEC region is home to 6 of the world's 10 biggest net coal exporters. Similarly, 6 of the top 10 net coal importers are APEC members.
- › Global coal demand declined 2% to 3 755 Mtoe from 2015 to 2016. With declining demand, global coal production faced a decline of 5% from 2015 to 2016.
- › Nearly 71% of global proved coal reserves are located in APEC economies.
- › From 2005 to 2016, coal demand in APEC economies increased by 26%, from 2 232 Mtoe to 2 817 Mtoe. In 2016, China accounted for 68% of total APEC coal demand, 14% higher than 2005 levels, followed by USA (12%).
- › China was still the world's largest coal consumer by far in 2016 (68% of global consumption). China's coal consumption declined consecutively for three years beginning in 2014.
- › In 2016, APEC's total generation was 7 171 terawatt-hours (TWh), an increase of 42% from 2005. Coal accounts for 45% of generation followed by gas (22%), renewables (21%), nuclear (10%) and oil (2%) Per-capita coal demand declined in eight APEC economies —Australia; Canada; Chinese Taipei; Hong Kong, China; Mexico New Zealand; Russia and USA.
- › Four major economies have reduced the use of coal-fired plants, either through policy goals or market operation. Some of the other economies plan to phase out coal plants after 2021.
- › APEC as a region produces enough coal to meet its demand, a total of 2 892 Mtoe in 2016. Five economies accounted for 92% of APEC's coal demand. In 2016, coal production in the APEC region decreased 8% compared with 2015, because of a decline in the demand in the region.
- › In 2016, APEC members imported 470 Mtoe of coal, 62% higher than 2005. Some 79% of total APEC imports went to four economies: China (136 Mtoe); Japan (114 Mtoe); Korea (81 Mtoe); and Chinese Taipei (41 Mtoe) (Figure 1.12). Along similar lines, four economies constituted 94% of total APEC coal exports: Australia (248 Mtoe); Indonesia (208 Mtoe); Russia (115 Mtoe) and the USA (41 Mtoe). APEC coal exports increased from 398 Mtoe from 2005 to 638 Mtoe in 2016, an increase of 61%.
- › Global thermal coal consumption is expected to slightly increase by 2021. Thermal coal demand for power generation is projected to continue to rise amid increasing electric power demand in non-OECD economies, mainly the Asia region including India and South-East Asia. Furthermore, APEC's coal consumption in the electric power sector is expected to decline slightly by 2021.
- › Global thermal coal consumption is expected to slightly increase by 2021. This is because the declining trend seen in the USA, China and European economies since 2015 is projected to ease. Thermal coal demand for power generation is projected to continue rising amid increasing electric power demand in non-OECD economies, mainly in Asia, including India and South-East Asia. Furthermore, APEC's coal consumption in the electric power sector is expected to decline slightly by 2021.

- › Lignite consumption has remained around 200 Mtoe but has declined in recent years (Figure 2.6). Up to 2021, lignite consumption in India is projected to increase owing to growth in electric power demand. Meanwhile, lignite consumption is expected to decline in OECD economies that consume lignite for power generation.
- › Global thermal coal production increased gradually after the start of the 2010s and later declined in 2015 and 2016 (Figure 2.7). These declines were caused by a drop in domestic consumption in China, a decline in domestic consumption and exports in the USA, and fewer exports from Indonesia.
- › Global metallurgical coal production increased up to 2014, but in 2015 declined as production fell in China, the United States and Canada. Declines in China were marked by a drop in domestic consumption, while the United States and Canada had fewer exports. However, metallurgical coal production in 2017 increased once again, as was the case with thermal coal.
- › Prices for both thermal coal and metallurgical coal fell consistently until early 2016 after peaking in early 2011. Major factors behind this trend included the large investments in coal made during the coal boom in the latter half of the 2000s and the fact that demand has not grown since 2011, contrary to forecasts, leading to prolonged oversupply. Currently, prices remain at elevated levels, with thermal coal in the USD 90-100/tonne range and metallurgical coal in the USD 190-210/tonne range
- › The spot price of thermal coal (Newcastle f.o.b price; NEWC Index) declined following its peak of USD 136/tonne in January 2011. By January 2016, the price had fallen to USD 48/tonne. Later the price hovered in the lower USD 50/tonne range until June 2016. However, the spot price of thermal coal soared in July 2016 and thereafter, reaching as high as USD 110/tonne in November. The main factor behind this skyrocketing price was China.
- › In 2018, the spot price of thermal coal broke through and remained above the USD 100/tonne mark from winter procurement, but prices retreated to USD 90/tonne at the end of March when seasonal demand waned. Afterwards, procurement ahead of the peak summer demand caused the spot price of thermal coal to rise to over USD 120/tonne. Factors behind soaring prices include China's imports remaining strong even after the start of 2018 as well as year-on-year gains since the start of 2018 in India's imports, which had consistently declined since peaking in 2014. Afterwards, the spot price of thermal coal fell and is currently sitting in the USD 90-110/tonne range.

Table 1.1: Summary of latest policies and market trends related to coal in APEC (as of June 2018)

Economy	Current policies	Future trends in supply, demand and trade
Australia	No specific policy on coal.	Will remain the world's largest exporter of coal – Australia's second-largest commodity export.
Brunei Darussalam	No specific policy on coal.	Does not use or produce coal. Global shift towards cleaner energy provides opportunities to maintain or expand LNG exports.
Canada	The government plans to phase out coal-fired generation sources.	Coal-fired power production will be phased out by 2030. Demand is expected to decrease, and be replaced by natural gas. Coal will continue to be used for metallurgical processes.
Chile	The Energy 2050 plan was launched in 2015 with targets of having at least 60% of its electricity generated from renewable energy by 2035 and 70% by 2050. Since June 2018 a decarbonisation process has been under discussion with the power industry.	Net imports of coal will continue.
China	<p>Specific targets are included in the 13th Five-year plan (2016-2020) and other plans:</p> <ul style="list-style-type: none"> - Keep total energy consumption below 3500 Mtoe (5 billion tonnes of coal equivalent [tce]); increase the share of non-fossil energy consumption to more than 15%; decrease the share of coal consumption to less than 58%; increase the share of coal used for power generation to more than 55%. - Accelerate transformation and upgrading of coal-fired power and promote clean and orderly development. 1) cancel or postpone coal-fired power construction projects with a total capacity of over 150 GW, cap coal-fired power capacity at 1 100 GW; 2) eliminate more than 20 GW of inefficient coal-fired power; 3) average coal consumption rate of coal-fired power units in operation decreases to 310g/kWh after renovation and newly built coal-fired power units below 300g/kWh; 4) total emissions of sulphur dioxide and nitrogen oxides of coal-fired power units decrease by more than 50%, and all coal-fired power units with capacity over 300 MW achieve ultra-low emissions. - Optimise energy consumption structure and Implement substitution of electricity for coal and oil. Substitution of electricity for bulk coal burning and fuel oil reaches 91 Mtoe (130 million tce). Shut down about 800 Mt/year inefficient coal mining capacity by 2020 (at least 150 Mt/year in 2017) and increase about 500 Mt/year, of advanced coal mining capacity by decrement capacity replacement and layout optimisation. 	China is the world's largest importer.

Economy	Current policies	Future trends in supply, demand and trade
Hong Kong, China	Does not produce coal and consumes very little.	Continues to import coal, mainly from mainland China.
Indonesia	<ul style="list-style-type: none"> - A target to increase the energy sector contribution to emission reduction from 6% to 38% was specified in the INDC, submitted to the UNFCCC in November 2016. - Government policy prioritises domestic market over exports. Coal production will gradually be capped at 400 Mt. 	Currently the world's second largest coal exporter, but exports may decline because of current policies.
Japan	The latest strategic energy plan published in July 2018 reaffirms the importance of coal.	Currently the world's third largest importer; this trend continues.
Korea	The Energy Transition Roadmap released in October 2017 aims to replace nuclear and coal with renewables and natural gas. The target for renewables in power generation by 2035 is 20%.	Currently the world's fourth largest importer. Large uncertainties remain as nuclear and several coal plants will be shut down. Imports of both thermal and metallurgical coal continue.
Malaysia	The first ultra-supercritical coal plants in South-East Asia were commissioned in 2017. Based on future power capacity planning documents issued by the Energy Commission, coal demand in the power sector is expected to increase in the future as generation capacity is expanded.	Continues to be one of the largest coal importers in the world.
Mexico	No specific policy on coal.	<ul style="list-style-type: none"> - Clean generation goals (35% by 2024) and inexpensive gas supplies are seen to decrease the already low coal consumption. - Production will not increase significantly and imports are projected to continue, but may decrease in the next years.
New Zealand	No specific policy on coal.	Coal imports will continue.
Papua New Guinea	Does not consume coal.	The global shift towards cleaner energy provides opportunities to maintain or expand LNG exports.
Peru	No specific policy on coal.	Coal remains a marginal fuel and is projected to remain below 3% of TPES. Production is not projected to increase significantly and imports may remain at a similar level.
Philippines	To reduce dependency on imported coal, there has been ongoing governmental effort to expand the utilisation of indigenous coal. Alternative uses of local coal are also being considered by assessing the coalbed methane potential of selected coal fields.	A significant portion of local coal production is exported, mostly to China.

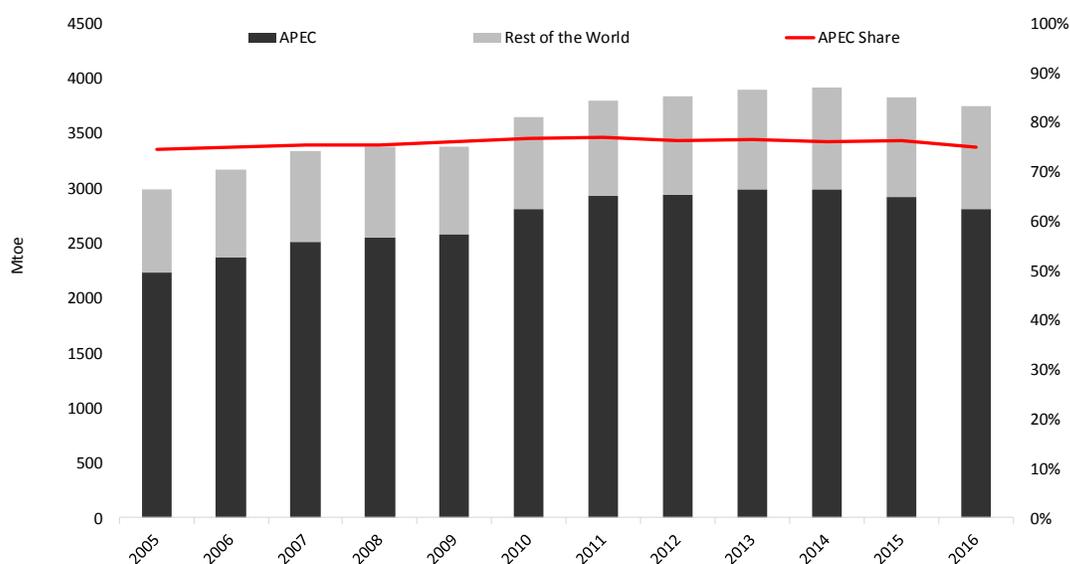
Economy	Current Policies	Future trends in coal supply, demand and trade
Russia	<ul style="list-style-type: none"> - The draft of Russia’s Energy Strategy 2035 plans to encourage local companies to make full use of domestic resources as well as to expand energy exports, including coal, to the Pacific region. - The industry-level development strategy for 2030 reflects challenges and opportunities, including key objectives: <ul style="list-style-type: none"> • All coal mining plants to be upgraded by 2030; • Increase productivity five times by 2030; • Increase competitiveness, and return on investment; • Increase the integral safety and pollution management performance indicators by two to three times; • Increase budget revenues by five times. 	Russia is the world’s third largest coal exporter.
Singapore	No specific policy on coal.	The global shift towards cleaner energy provides opportunities for the economy to expand LNG trade.
Chinese Taipei	No specific policy on coal.	Thermal coal demand is expected to stabilize in the near term. The economy will continue to import all of its coal.
Thailand	The largest coal mine in Thailand (Mae Moh) that produced lignite was shut down because of health concerns. The coal power plant located near the mine is in the process of upgrading.	Coal imports are expected to increase. Continues to be one of the largest coal importers in the world.
USA	On 1st June 2017, President Trump announced a withdrawal from the Paris Climate Accord.	The 4th largest exporter among APEC economies in 2017, and sixth-largest exporter in the world. Coal exports amounted to 45 Mt in 2017, a decrease of 2% from 2016.
	The administration plans to improve (or revive) the domestic coal industry.	<ul style="list-style-type: none"> - Imports have declined from a peak of 23 Mt in 2006 to 4 Mt in 2017. - In 2016, coal demand declined by 38% compared with 2005, as gas overtook coal in power generation.
Viet Nam	The National Energy Development Strategy to 2020, and the Vision to 2050 have set coal production targets of 47–50 million tonnes by 2020 and 55–57 million tonnes by 2030. Development of the Red River Delta coal basin in the period 2021–30 is also envisioned, with a commercial coal yield of 0.5–1.0 million tonnes per year by 2030	Coal imports are predicted to increase significantly beyond 2017 to meet fuel requirements for more than 41 GW of new coal-fired power capacity that the government has planned to build during 2016–30 in central and southern Viet Nam.

Chapter 1: Historic trends in the APEC coal market

Global context

The APEC region is a major coal consumer in the global coal industry. According to the *International Energy Agency's (IEA) World Energy Statistics*, 75% of global coal consumption occurred in APEC, a huge jump from 62% in 1990¹ (Figure 1.1) (IEA, 2016a). Economic growth, urbanisation, market development and technology breakthroughs underpin the steady increase in coal demand. As it is relatively abundant and low-cost, coal is the fuel of choice for meeting energy demand in many APEC economies.

Figure 1.1: APEC and global coal consumption, 2005-2016



Source: (IEA, 2016a).

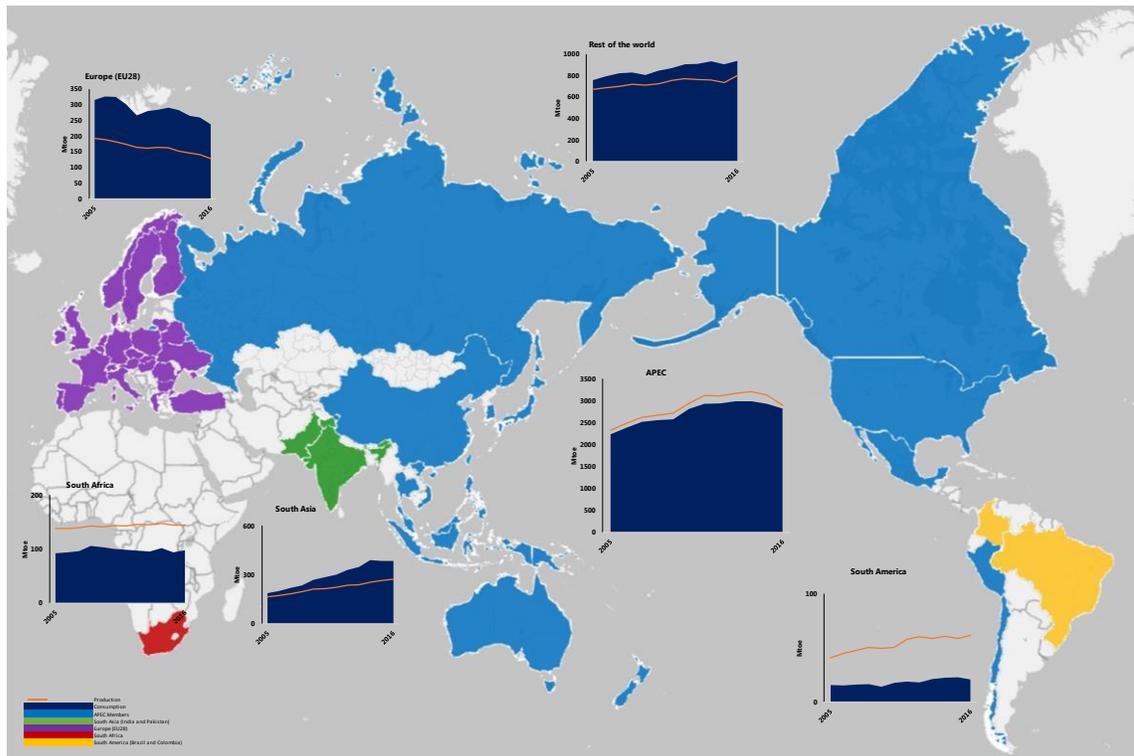
The increasing demand is not a result of consistent growth across the region. Rapidly growing, such as China and those in south-east Asia were overwhelmingly responsible for the largest increases, particularly compared with developed APEC members. Besides rapidly growing APEC economies, India, another fast-growing Asian economy with GDP growth of 160% from 2005-15, has recorded rapid increases in coal demand over the past decade (World Bank, 2018). The economy increased its coal consumption by 106%, from 184 Mtoe in 2005 to 380 Mtoe in 2016 (Figure 1.2) (IEA, 2016a). Despite its huge coal resources, India has become a significant importer, mainly from Australia and Indonesia, as domestic production struggles to keep up with soaring demand.

On the other hand, Europe, which used to be a major coal producer and consumer, has declined in recent years. Coal consumption across the European Union (EU) peaked in 2006 at 327 Mtoe,

¹ Two APEC members, Brunei Darussalam and Papua New Guinea, based on the APEC 7th Edition Outlook, do not consume any coal.

decreasing to 237 Mtoe in 2016 (a 27% decrease) (IEA, 2016a). Other major coal consumers, such as South Africa and Brazil, recorded almost flat demand over the past decade. Despite that, coal production in South Africa and Colombia, another major coal producer, increased (4% and 53% each from 2005-16) because of export growth.

Figure 1.2: Global coal consumption and production by region, 2005-16



Source: (IEA, 2016a).

A number of APEC members continue to be major coal importers and exporters. According to the IEA's *Coal Information 2017: Overview*, the APEC region was home to 6 of the world's 10 biggest net coal exporters in 2016: Australia; Indonesia; Russia; United States of America (USA); Canada and China. Similarly, 6 of the top 10 net coal importers were APEC members in 2016: China; Japan; Korea; Chinese Taipei; Malaysia and Thailand (IEA, 2017).

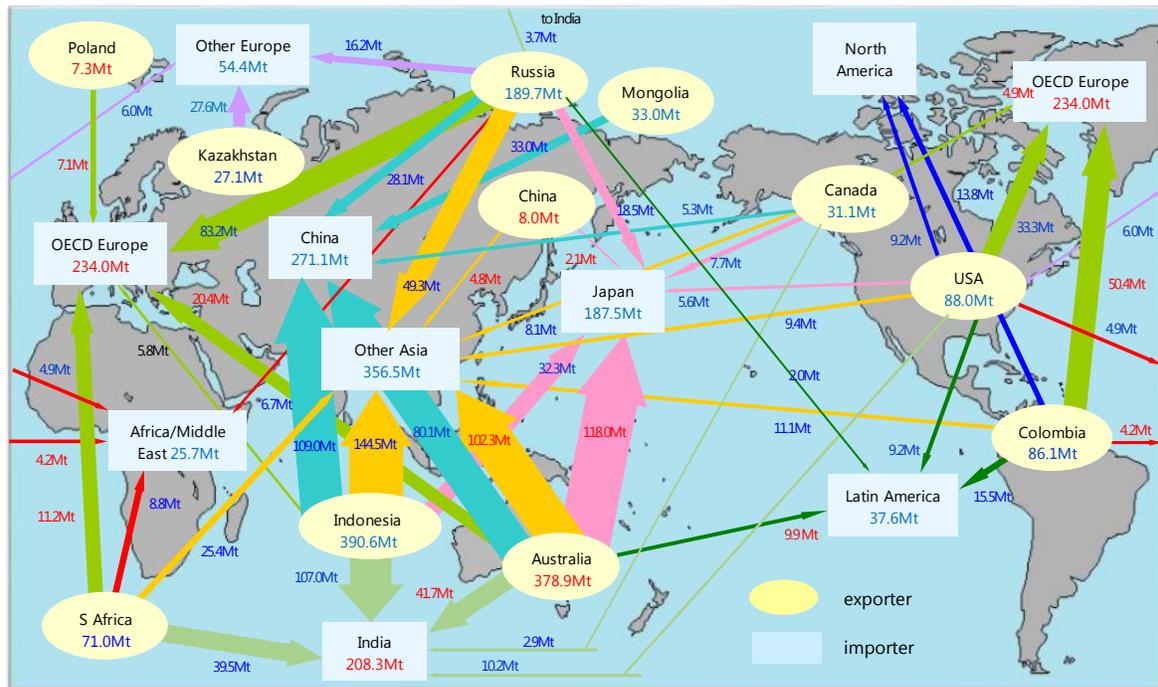
Despite its falling coal consumption, the EU remains one of the major import destination. In 2017, the European members of the Organisation for Economic Co-operation and Development (Europe-OECD) cumulatively imported 234 Mt of coal, mainly from Russia (83 Mt), Australia (20 Mt) and South Africa (71 Mt) (Figure 1.3).

In 2017, India (208 Mt) imported less coal than China (271 Mt) because of higher production and lower domestic demand. Indonesia has been the main source of coal for India, supplying nearly 51% of India's total imports (107 Mt), followed by Australia (42 Mt) and South Africa (40 Mt).

Global coal demand declined 2% to 3 755 Mtoe during 2015-16 (IEA, 2016a). With declining demand, global coal production faced a decline of 5% from 2015-16.

Nearly 71% of global proved coal reserves are located in APEC economies: USA, Russia, Australia and China have the largest reserves (BP, 2018). USA, Australia and Russia are expected to have a positive reserves-to-production ratio for more than 200 years. In China, coal reserves are expected to last around 39 years, and New Zealand is expected to have more than 500 years of reserves (BP, 2018).

Figure 1.3: Global coal trade, 2016



Note: 2016 estimated data
Source: (IEA, 2017) and IEEJ analysis.

Economic growth in APEC

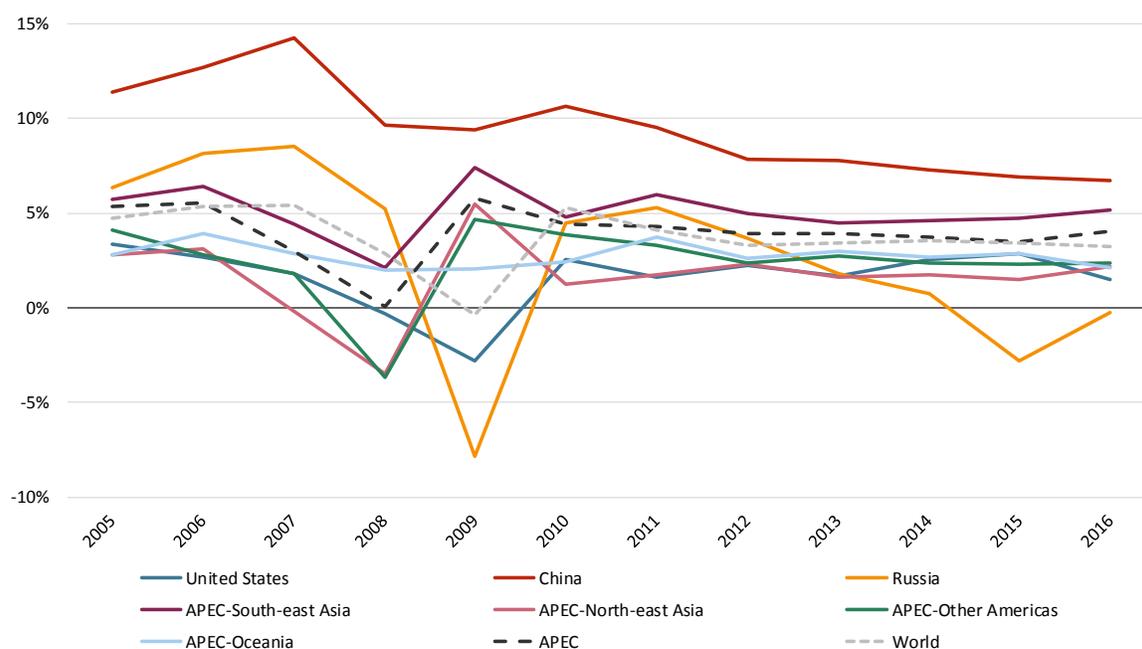
Over the period 2005-16, the APEC region's GDP had a robust growth of 51%, higher than the global average of 47% (Figure 1.4).

Among APEC sub-regions, China had a growth of 166% over 2005-16 and recorded the highest economic growth in 2007 before declining through 2016. The APEC south-east Asia region had growth of 71%, and all its economies recorded a growth above 65%, except Brunei Darussalam (0.3%). APEC Other Americas,² APEC north-east Asia³ and USA members had growth of 28, 18%, 17%, respectively. Russia, a large energy exporter, was hit during the global financial crisis of 2007-08 as its coal consumption and production decreased. However, it had a higher GDP growth than the USA at 29% over the period 2005-16.

² APEC-Other Americas: Canada, Mexico, Peru and Chile

³ APEC-Northeast Asia: Hong Kong, Japan, Korea and Chinese Taipei

Figure 1.4: GDP growth in APEC sub-regions and world, 2005-15



Source: (APERC, 2019).

Demand and supply trends in APEC

Demand continues to increase in APEC

From 2005 to 2016, coal demand in APEC economies increased by 26%, from 2 232 Mtoe to 2 817 Mtoe. In 2016, China accounted for 68% of total APEC coal demand, 59% higher than 2005 levels, followed by the USA (12%) (APERC, 2019). South-East Asia, another region undergoing rapid economic growth, has been the other major contributor to increased coal demand in APEC with a growth of 65 Mtoe from 2005 to 2016 (Figure 1.5).

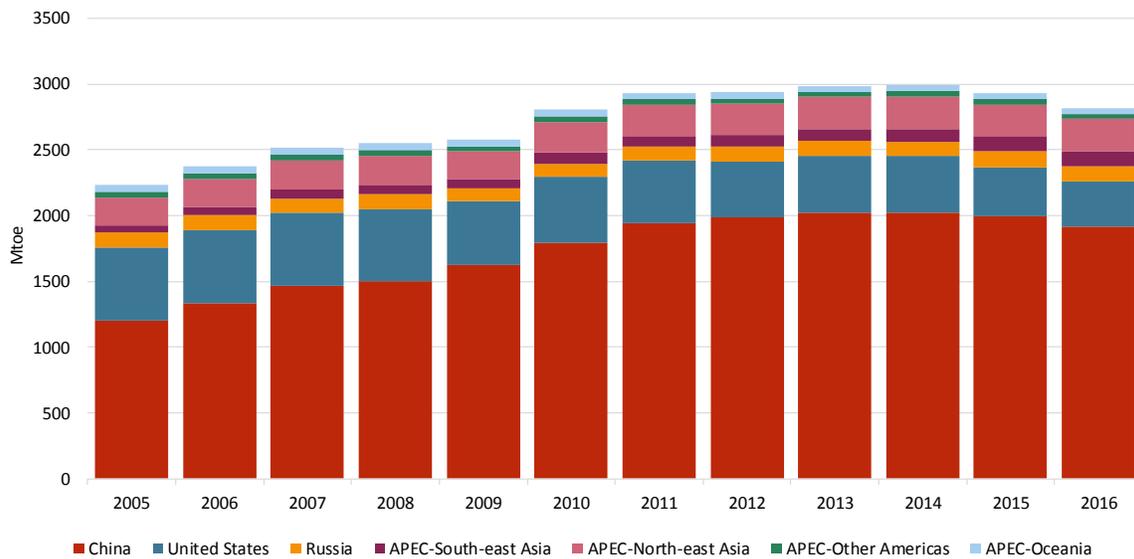
Two of the 21 APEC economies – Brunei Darussalam and Papua New Guinea – do not consume any coal, while seven economies above the 1% share of APEC coal consumption – Canada; China; Indonesia; Japan; Korea; Russia and the USA – accounted for 94% of APEC coal demand in 2016. Unsurprisingly, these seven economies also represented 81% of total APEC Gross Domestic Product (GDP) (APERC, 2019).

Coal demand in 10 APEC economies increased from 2015 to 2016, led by the Philippines with 13% growth followed by Viet Nam (11%); Chile and Mexico (both 8%); Malaysia and Peru (both 7%); Indonesia (6%); Singapore (5%); Chinese Taipei and Australia (both 2%); and Korea (1%). This trend certainly does not indicate that coal demand is independent of broader economic conditions but it does reflect the resiliency, especially in Asia, of cheap fuel resources.

- › China was still the world’s largest coal consumer by far in 2016 (68% of global consumption),

- China’s coal consumption declined consecutively for three years beginning in 2014. In 2016, coal consumption decreased 4% compared with 2015, but it was still lower than that of 2013 and 2014. China’s coal consumption peaked in 2013, mainly because of China’s structural reform, cutting overcapacity in the industrial sector and shifting away from energy-intensive construction and manufacturing to the service sector; high investment and rapid deployment of clean energy including renewable and nuclear energy in power sector, and efficiency improvement in coal-fired power plants; and China’s ‘blue sky action’ policy replacing coal with electricity and gas in the residential, commercial and small-scale industrial sectors.

Figure 1.5: Coal demand in APEC, 2005-16



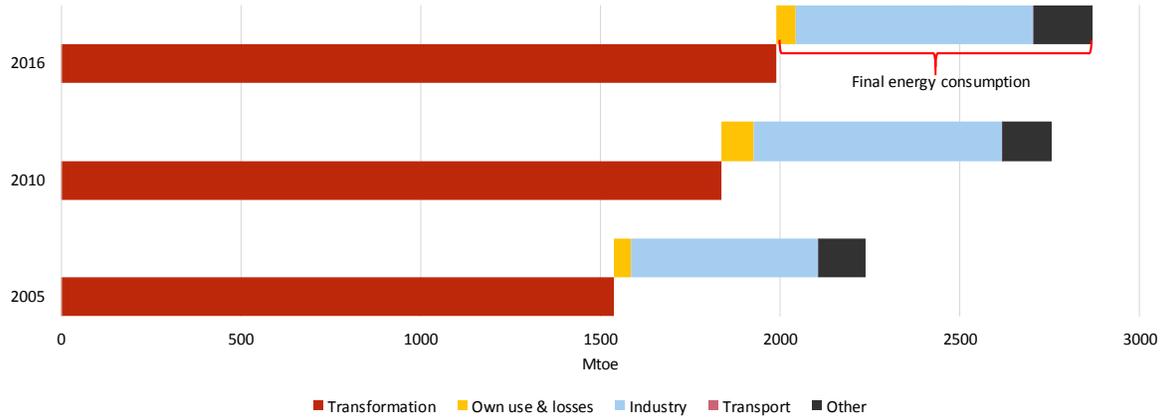
Source (APERC, 2019).

Demand in the power sector has consistently accounted for more than half of the total coal consumption in APEC (69%), followed by industry (23%) and others⁴ accounting for 6% (APERC, 2019) (Figure 1.6). The transformation sector⁵ has increased from 1 539 Mtoe to 1 989 Mtoe, a growth of 27% from 2005 to 2016.

⁴ This comprises buildings, agriculture, and non-energy use

⁵ Transformation sector includes power, heat and refineries.

Figure 1.6: Coal demand in APEC by sector, 2005-2016

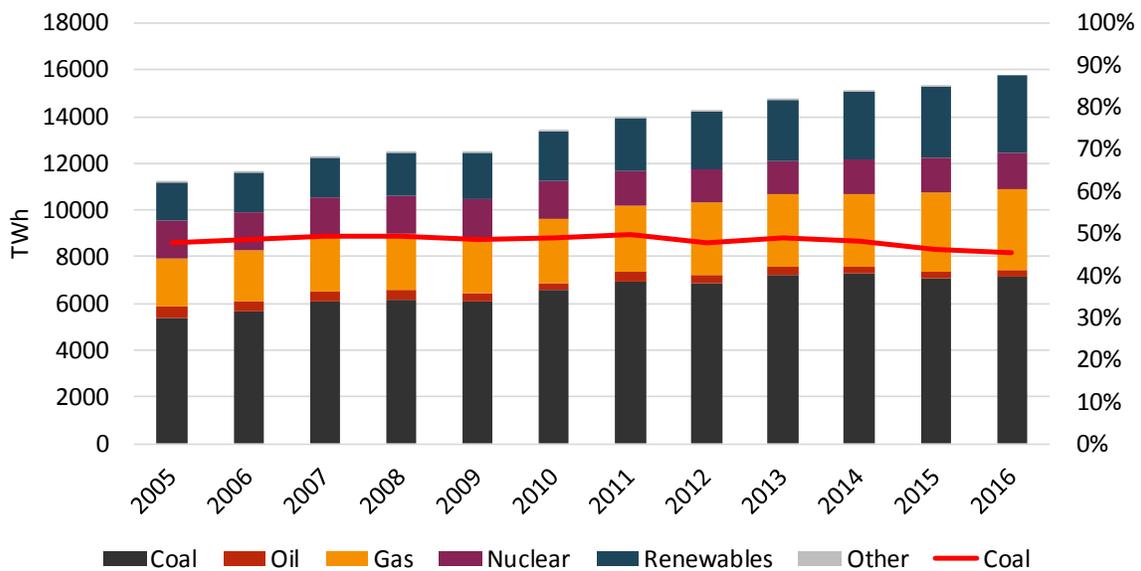


Source: (APERC, 2019).

Power Sector

In 2016, APEC’s total generation was 7 171 terawatt-hours (TWh), an increase of 42% from 2005. Coal accounts for 45% of generation followed by gas (22%), renewables (21%), nuclear (10%) and oil (2%) (Figure 1.7). Coal generation declined in four OECD economies from 2005 to 2016, led by New Zealand with a decrease of 84%, followed by Canada (-38%), the USA (-37%) and Australia (-10%). On the other hand, non-OECD members’ economies increased their use of coal in their power sector. Viet Nam recorded the highest increase of 341%, followed by Malaysia (243%), the Philippines and Indonesia (184%), China (115%) and Thailand (93%).

Figure 1.7: Power mix in APEC and coal share, 2005-16

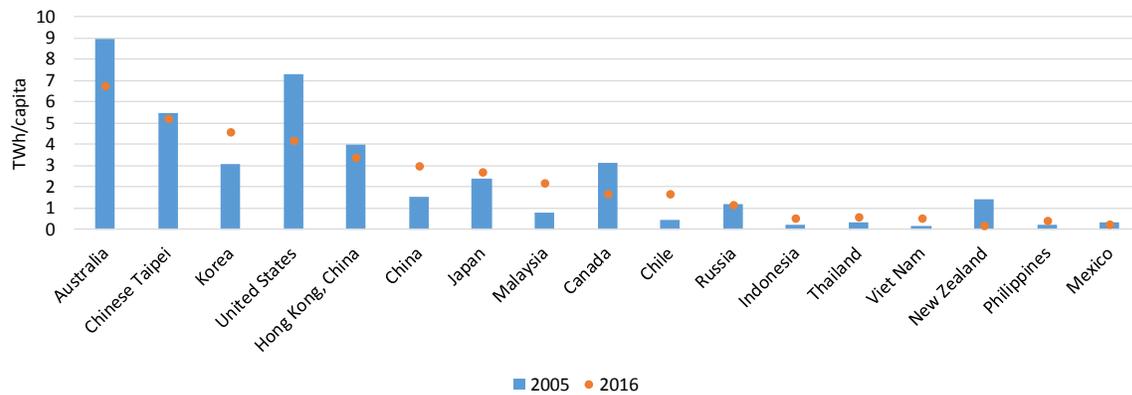


Source: (APERC, 2019).

APEC’s coal generation in the power sector rose from 5 351 TWh in 2005 to 7 135 TWh in 2016, an increase of 34%. Nevertheless, some economies showed a decrease in the use of coal, for example, US coal generation decreased 37%, from 2 154 TWh in 2005 to 1 365 TWh in 2016. The decrease reflects increased electricity generation from natural gas and renewable energy sources. The shale gas revolution increased the supply and reduced the prices of natural gas significantly enough to displace large quantities of coal-fired generation in the power mix (EIA, 2018a). On the other hand, Chile showed more use of coal in their generation from 7 TWh in 2005 to 30 TWh in 2016, an increase of 319%. As outlined in the Energy Roadmap 2018-2022, Chile has initiate an energy sector decarbonisation process through preparation of a timeline for the withdrawal or conversion of coal-fired power plants (Gobierno de Chile, 2018).

Per-capita coal demand declined in eight APEC economies – Australia (-24%); Canada (-45%); Chinese Taipei (-5%); Hong Kong, China (-14%); Mexico (-10%); New Zealand (-86%); Peru (-11%) and the USA (42%) (Figure 1.8). Four main factors can explain the decrease in these economies: retirement of outdated capacity, low natural gas prices, lower electricity demand, and environmental regulations.

Figure 1.8: Coal per-capita electricity demand, 2005 and 2016



Source: (APERC, 2019).

On the other hand, 11 APEC economies registered growth in coal consumption. Five South-East Asia economies recorded a combined increase of 163% in the use of coal for electricity generation. This was a result of the strong economic growth in the region, as well as expansion programs to improve electrification rates (Table 1.2). Since coal is one of the cheapest forms of reliable energy, particularly in a region with abundant resources, most governments opt to use coal to provide electricity.

Table 1.2: Access to electricity for selected APEC members, 2005 and 2016 (percent of population)

Economy	2005	2016
Chile	98	99.6
China	97	100.0
Indonesia	87	91.0
Malaysia	98	99.0
Mexico	99	99.1
Papua New Guinea	12	14.5
Peru	77	95.0
Philippines	79	88.8
Thailand	91	99.7
Vietnam	96	98.2

Source: (APERC, 2019).

Box 1: China Coal to Liquids Industry

China is rich in coal, but relatively poor in oil. With proved coal reserves of 1.3 trillion tonnes and high dependence on crude oil imports (65.5% of total demand in 2016), China developed its coal-to-liquids (CTL) industry with three aims: reducing crude oil import dependency, improving energy security, and reducing coal production overcapacity.

According to China's 13th Five Year Plan (13th FYP) and the 13th FYP for Energy Development, the Chinese government intends to keep the rate of energy self-sufficiency, which was 84% in 2015, above 80% in 2020, and reduce the rate of dependence on foreign crude oil. Although the Chinese government started a "Supply-side Reform" to reduce coal production in 2016, pressures persist from the existing coal inventory and the imbalance of supply and demand. Developing CTL can not only increase domestic coal consumption, but also increase the supply of refined oil in China. In 2015, the total CTL capacity in China was 2.54 Mt (less than 0.1% of total coal demand) and 1.15 Mt oil production, with targets for CTL capacity to reach 13 Mt/yr by 2020 (NEA, 2017).

In order to regulate the CTL industry and prevent overcapacity, the National Development and Reform Commission (NDRC) and the State Council have issued guidelines and/or circulars. In China, only a few large conglomerates are allowed to invest in CTL with minimum capacity for CTL facilities set at 1 million tonnes. In 2006, the NDRC banned CTL projects with an annual output less than 3 Mt and suspended all coal liquefaction project approvals until the government could finalise a development plan for the industry (NDRC, 2006). On 22 July 2014, the National Energy Administration (NEA) issued the Circular On Standardizing The Scientific And Orderly Development Of Coal-To-Liquid And Coal-To-Gas Industries. This circular banned local governments from constructing CTL projects with an annual output of less than 1 Mt and banned CTL projects not on the National Model Projects List. This circular also emphasised that CTL facilities must adhere to existing law regarding energy efficiency, energy consumption, water consumption and CO₂ emissions (NDRC, 2014).

While coal price plays a key role in China's CTL viability, return on investment is also greatly influenced by the international crude oil price and the domestic refined oil consumption tax. The government uses the consumption tax to reduce demand for gasoline and diesel, but the high consumption tax on refined oil products has substantially increased the tax bill for CTL enterprises and reduced their profit. The breakeven point for most CTL plants is USD 50-60 per barrel, but it can reach USD 70 per barrel for some plants. Under the conditions of continuous low international crude oil prices in recent years, many CTL firms face a net loss situation.

Box 2: Financing a coal-fired power plant with CCS in Indonesia's single-buyer electricity market

In the 2-Degree Scenario (2DC) of the 7th APEC Energy Demand and Supply Outlook, to meet greenhouse gas (GHG) emissions reduction targets, more than 46 gigawatt (GW) of newly installed fossil fuel power plants in South-East Asian economies would need Carbon Capture Storage (CCS) technology by 2050, even though supercritical or ultra-supercritical technologies dominate new coal power investments (which constitute 40% of total installed capacity additions). Indonesia alone adds 22 GW of new coal-fired plants over the Outlook period.

As the 2DC requires that all new coal power plants have CCS after 2030, a looming question is whether private financing arrangements can be secured for future coal-fired projects with CCS.

Electricity markets in APEC south-east Asian economies (with the exception of Singapore) use single buyer models in which private electricity generators, known as independent power producers (IPPs), sell electricity to the state utility company through power purchase agreements (PPAs), typically under long-term contracts (25 to 30 years). Financing of recent coal-fired projects in Indonesia faced environmental opposition even though they applied ultra-supercritical technologies. The projects eventually acquired financial support from international and domestic banks, but financial closures were delayed.

It appears that future coal-fired power projects may need to include carbon capture to attract private financing. Experience to date suggests that securing investment for deployment of CCS requires comprehensive market and capital support policies. As CCS technologies are currently at the demonstration stage, they have many associated perceived and actual risks related to technology maturity, investment cost and operating performance (WB, 2015).

This case study evaluates the financial viability of IPP investment in coal power plants in South Sumatera (Indonesia) under two scenarios: CCS under a carbon price policy and CCS under a carbon market for enhanced-oil-recovery (EOR). A World Bank study on potential CCS found that depleted gas fields in South Sumatera have sufficient storage capacity for storing captured CO₂. It also estimated potential demand of 243 million tonnes of CO₂ (MtCO₂) for EOR up to 2045. The study then used net present value (NPV) to calculate the present monetary value for each scenario to understand the returns on investment (1).

$$NPV = -Initial\ investment + \sum_{t=1}^n \frac{net\ cash\ flow_t}{(1+i)^t} \quad (1)$$

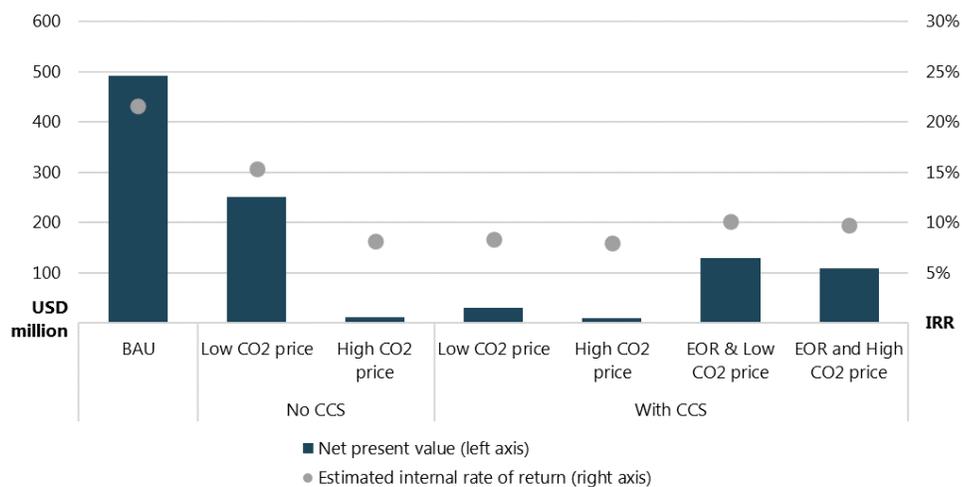
At present, there is no established carbon price in south-east Asia. Singapore, however, is taking the initiative to introduce one from 2019 at a price of USD 7.42/tCO₂ to USD 11.14/tCO₂. This range is applied to evaluate how a carbon price influences the commercial viability of private investment in future coal power projects. The scenarios use post-combustion capture technology to capture 90% of CO₂ emissions, which has 12% own-use electricity consumption (4% higher than conventional coal power plants). Additionally, the technology is estimated to increase the initial capital cost by 58% (Rubin, et al., 2015).

RESULTS AND DISCUSSION

Financial assessment of this case study on seven cases (one being the BAU with no carbon price, the other six testing various prices) shows that when carbon prices (whether low or high) are applied, projected financial returns are substantially lower than in the BAU (Figure 7.8). Overall, the application of a carbon price reduces the financial viability of conventional coal power without CCS equipment. When a higher carbon price of USD 14.69/tCO₂ is implemented, the estimated internal rate of return (IRR)—at 7.8%—of the coal power IPP is just over the discount rate threshold. Low returns on investment may prompt IPPs that traditionally developed coal power plants to seek alternative investment strategies, including coal with CCS or renewable energy.

Conversely, the project cash flow improves when a CO₂ market for purchasing CO₂ is available: the market creates a value for the captured CO₂ by allowing it to be used for other activities such as EOR (rather than just being stored). In this study, use of CO₂ for EOR creates opportunities for IPP developers to secure a higher NPV and expected IRRs than under a scenario without a carbon market. Revenues from the sales of captured CO₂ partly offset the capital investment needed to add CCS equipment, enabling IPP developers to fulfil their debt service obligations. This study assumes the government builds necessary CO₂ transportation and storage infrastructure.

Figure 1.9: Financial analysis for coal-fired power project under different investment scenarios



Source: (APERC, 2019)

CONCLUSION

Overall, the financial returns of coal power plants without CCS are severely undercut with a carbon price policy, highlighting the risk of such projects in a CO₂-constrained future energy system. Without a carbon market to facilitate sale of captured emissions and thereby offset some of the required capital investment, installation of CCS is not financially feasible, primarily due to the high investment and operating costs of CCS systems. This analysis confirms that, under the current IPP business model in Indonesia, government support is needed to develop CO₂ transport and storage infrastructure and creation of CO₂ markets that can be useful for EOR (Kendell, James M; Atmo, Gigih Udi; Otsuki, Takashi, 2018).

Reducing the use of coal in the power generation sector

Coal-fired plants faced several challenges in the last decade. Low natural gas prices, declining electricity demand and policy goals aimed at fewer emissions are some of the challenges that the industry is facing. Four major economies have retired coal-fired plants, either through policy goals or market operation. Some of the other economies plan to phase out coal plants after 2021.

Australia

Australia electricity demand declined or remained flat for six consecutive years through June 2015. The continued decline in electricity demand drove some generators to withdraw plants from the market, through either temporary mothballing (removal from service for a specified or indefinite period) or retirements (AER, 2015).

While industrial energy demand has weakened since 2008, residential and commercial consumers have also reduced their electricity consumption by adopting energy efficient measures. They have installed solar water heating and energy efficient air conditioning, refrigeration and electronics. Moreover, some consumers shifted to generating their own electricity with rooftop solar PV panels.

Coal generation plants are being retired and not being replaced, removing significant capacity from the market and leaving a tighter supply-demand balance. These closures withdrew more than 3 600 megawatts (MW) from the market, equivalent to around 50% of South Australia's generation capacity (AER, 2017). A gradual recovery in electricity demand and generator retirements is likely to raise wholesale electricity costs from their current historically low levels. Rising demand and a contraction in supply contributed to tight market conditions, with gas powered generation often setting dispatch prices.

Since 2012–13, capacity additions to the National Electricity Market (NEM) have largely been in wind and solar plants. Most plant retirements over this period have been coal-fired plants, but some gas-powered plants have also been taken out of operation.

Coal-fired generation rose by 7% in 2015–16. The rise was most apparent for black coal generation in Queensland and New South Wales. However, this rise may be temporary, with significant coal-fired capacity being retired from the market in 2016 and 2017:

- The closure of Alinta's Northern Power Station in May 2016 marked the end of coal-fired electricity generation in South Australia, removing 546 megawatts (MW) of capacity from the NEM.

Canada

Canada has been increasing its share of renewables, including hydroelectricity, for electricity generation since 2000. Some provinces have introduced policies and programs to promote renewable energy while discouraging the continued use of coal-fired power plants. In 2013 and early 2014, Ontario, Canada's largest energy consumer, shut down its remaining coal-fired power plants (NEB, 2014).

In November 2015, Alberta also announced a new policy to accelerate the 2012 federal plan to phase out coal-fired power generation. Alberta's plan would result in the retirement of six coal-fired electricity plants or their conversion to natural gas plants by 2030; the original federal schedule would have allowed the plants to retire according to a pre-determined schedule ranging from 2036 to 2061 based on the end of useful life (approximately 50 years) (Alberta Energy, 2015) (GOC, 2012).

In 2016, the federal government additionally announced its plan to accelerate the phase-out of coal-fired electricity generation in Canada by 2030. Flexibility in achieving this goal would be allowed through the negotiation of equivalency agreements with the provinces (GOC, 2017). For example, an agreement-in-principle was reached with the federal government that would allow Nova Scotia to burn some coal after the deadline during periods of high demand in exchange for deeper sectoral reductions elsewhere in the economy (GNS, 2016).

In November 2016, Alberta announced the addition of a capacity market to co-exist with the current energy-only market. The Alberta Electricity System Operator (AESO) had recommended the implementation of a capacity market to provide greater revenue certainty for generators, thereby encouraging investment in new generation capacity while maintaining the competitive market structure used to set wholesale prices (AESO, 2018). A capacity market would serve to support the recommendations of the Climate Leadership Plan as the province moves to phase out coal-fired generation by 2030 and increase the penetration of renewable generation in the electricity mix. The AESO will be responsible for designing and implementing the capacity market. This process began with stakeholder engagement and market design in 2017 and would be followed by the first round of procurement in 2019 with contracts awarded by 2020–21 (AESO, 2018).

China

Coal accounts for 60% of China's total energy consumption. Based on China's resource endowment, coal will maintain a dominant position in the future energy structure. Therefore, the clean and efficient use of coal is of great significance in China. In recent years, China has worked on reducing emissions from fossil fuel power plants based on a strategy of "Building large capacity units while shutting down small ones". Emission standards for air pollutants from coal-fired power plants have also been tightened. China's ultra-low emission standards are among the most stringent in the world.

In addition, China's 13th FYP (2016-2020) established goals to ensure a cleaner and more efficient use of coal. China's plan is to optimise the development of national comprehensive energy centres and step up efforts to ensure the cleaner and more efficient use of coal. To ensure this, they will restrict coal resource development in the east, limit it in the central and north-eastern regions, and optimise it in the west. China plans to make progress in achieving more eco-friendly exploitation and transformations of large coal production centres and encourage the application of new technologies in the development of coal-based power generation.

Clean and efficient coal utilization has the following goals:

- › Implement the upgrading action plan for energy conservation and emissions reduction in coal-based power generation;

- › Carry out nationwide upgrades of coal-fired power units to achieve ultra-low emissions and energy efficiency;
- › Ensure average coal consumption per kilowatt-hour is kept below 310 grams in existing power plants and below 300 grams in newly built power plants;
- › Encourage the use of backpressure thermal power units for heating and develop combined multi-source heating, cooling, and power systems; and
- › Increase the proportion of coal used for power generation.

United States

Coal-fired power plants in the USA have been under significant economic and political pressure in recent years. Coal's share of electricity generation has been falling, largely because of competition with natural gas. Coal-fired plants faced several challenges, which drove coal capacity retirements. These retirements are sensitive to natural gas prices. Lower natural gas prices make coal-fired generation less competitive with natural gas-fired generation. Owing to that, natural gas has taken the lead in the competition between fuels for electricity generation, surpassing coal for the first time in 2016 (EIA, 2017a).

Coal-fired power plants are subject to the Mercury and Air Toxics Standards (MATS), which require significant reductions in emissions of mercury, acid gases, and toxic metals. Between January 2015 and April 2016, about 87 GW of coal-fired plants installed mercury controls to meet compliance deadlines and nearly 20 GW of coal-fired capacity was retired for not meeting the standards (EIA, 2017b). The MATS regulates acid gases and mercury from coal-fired plants of 25 MW or greater. Under the MATS, mercury emissions must be 88% below their uncontrolled levels (EPA, 2012). In 2018, EPA proposed that the costs of the rule outweigh the benefits and that regulation of hazardous air pollutants is no longer "appropriate and necessary," but did not propose repeal of the rule (EPA, 2018a).

Nearly 11 gigawatts (GW) of utility-scale electric generating capacity was retired in 2017. The units retired from 2008 through 2017 were fossil fuel plants, and coal-fired plants accounted for 47%, the highest of all fuel-types. In the past decade, the eastern region shut down 19% of their total installed coal-fired capacity, Texas 2%, and the western region 33% (EIA, 2018b).

Consistent with President Trump's 2017 Executive Order on 'Promoting Energy Independence and Economic Growth', in 2018, the EPA proposed the Affordable Clean Energy (ACE) Rule to replace the Clean Power Plan (CPP). Analysis shows ACE would cut CO₂ emissions at existing power plants by 33-34% from 2005 levels by 2030, the same as a no-CPP case (EPA, 2018b). In late 2018, EPA proposed to revise greenhouse gas emissions standards for future fossil fuel-fired power plants by replacing the 2015 rule, which identified partial CCS as the best option for emissions reduction (EPA, 2018c).

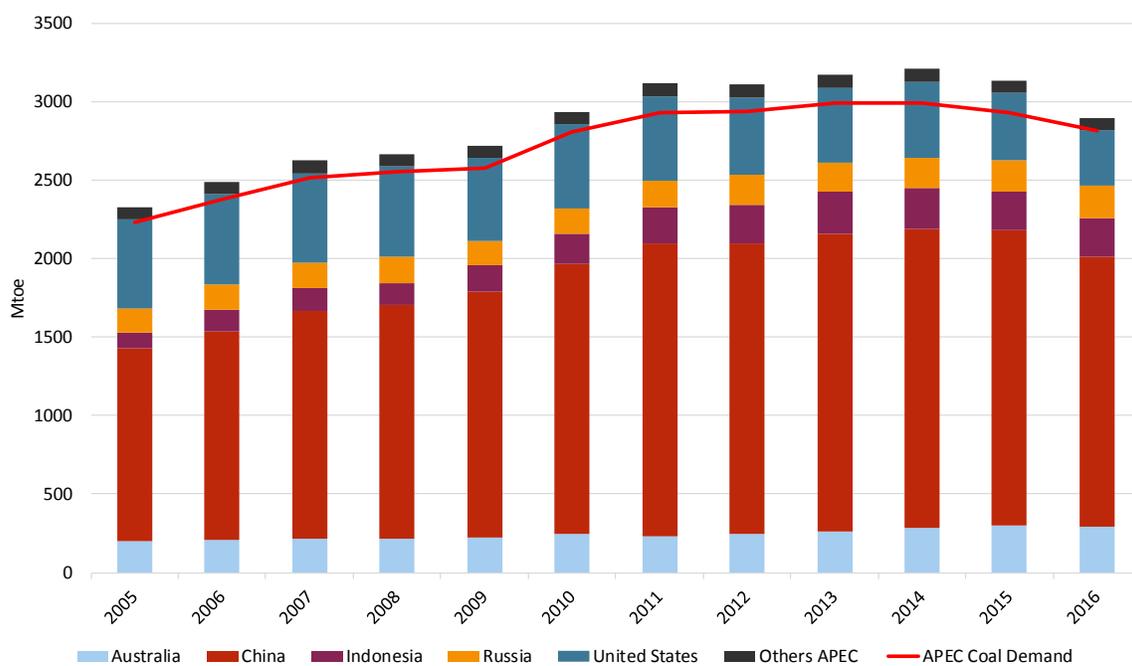
Despite efforts to repeal the CPP, Congress enhanced the 45Q coal tax credit to support CCS technology in coal plants and other facilities in the February 2018 Budget Act. Any new fossil fuel power plant that commences construction before 2024 is eligible for tax credits for up to 12 years. Through 2026 tax credits will be raised linearly from \$17-28 per tonne to \$35-50. Lesser payments are for storage via EOR and other utilization processes; greater payments are for dedicated geological

storage (US Congress, 2018). The tax credit is expected to benefit ethanol producers and natural gas processors, in addition to oil and gas drillers. IEA estimates that the tax credits will add 10-30 million tonnes of CO₂ capture capacity (IEA, 2018a), while the Energy Futures Initiative, led by former US Energy Secretary Ernest Moniz, estimates that up to 100 million tonnes of CO₂ capture capacity could be added (EFI, 2018).

Coal production meets APEC demand

APEC as a region produces enough coal to meet its demand, a total of 2 892 Mtoe in 2016. Five economies accounted for 97% of APEC’s coal demand: China (59%), USA (12%), Australia (10%), Indonesia (9%) and Russia (7%). In 2016, coal production in the APEC region decreased 8% compared with 2015, because of a decline in the demand of 4% in the region (Figure 1.10).

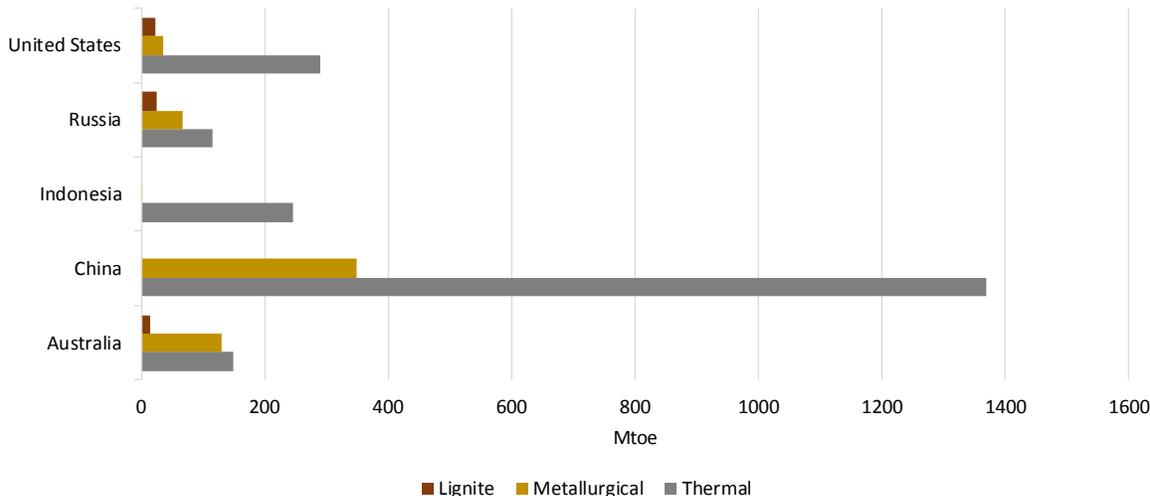
Figure 1.10: Coal production by economy, 2005-16



Source: (APERC, 2019).

Coal production in the APEC region comes from five economies, which produce 97% of its thermal coal, metallurgical coal, or lignite (Figure 1.11). The remaining 3% comes from the other economies, some of which do not produce coal at all.

Figure 1.11: Coal production by type, 2016



Source: (APERC, 2019).

Australia

Australia is a significant producer of both thermal coal (51% of total in 2016) and metallurgical coal (44%) and was the world’s largest coal exporter by volume in 2016 (Figure 1.11). Increasing export demand led to consistent growth in coal output, from 151 Mtoe in 2005 to 248 Mtoe in 2016; this was despite domestic consumption falling to 44 Mtoe in 2016, 14% lower than in 2005 (APERC, 2019).

China

As the largest coal producer and user in the world, China’s coal production is driven by local demand. For the period 2005 to 2011, coal production increased 52%, from 1 227 Mtoe to 1 864 Mtoe, but flattened because of a significant slowdown in domestic demand. From 2011 to 2016 China decreased its production by 7.8%, reaching 1 719 Mtoe by 2016.

Thermal coal continues to dominate coal production in China with a share of 80%, which accounted for 47% of APEC total coal production. Metallurgical coal accounted for 20% of coal production in China and 12% of APEC total coal production (APERC, 2019).

Indonesia

Indonesia, another large coal exporter, recorded a growth of 173% during 2005-15. Coal consumption increased from 22 Mtoe in 2005 to 43 Mtoe in 2016, which is equivalent to 17% of total production. Its coal production comes from thermal coal, which totaled 247 Mtoe in 2016 (APERC, 2019). Most coal resources and production facilities are located in Kalimantan and Sumatra islands.

Russia

Russia produced 209 Mtoe of coal in 2016, 33% increase from 2005 levels. In 2016 production came from thermal coal (54%), metallurgical coal (32%) and lignite (13%). Coal supply maintained flat over the period 2005-16, with values around 113 Mtoe (APERC, 2019). Most of Russia’s coal mines are

located in Siberia, which produced more than 80% of the total. Since Russia has a large land area and production sites are often located far from ports, there are challenges in transporting coal to demand centres.

United States

Coal production declined significantly in the last 11 years, from 565 Mtoe in 2005 to 348 Mtoe in 2016 (38% decrease) (Figure 1.10) (APERC, 2019). Since reaching a high point in 2008 (579 Mtoe), coal production in the USA has been declining steadily. In 2016, most of its production came from thermal coal (83%), followed by metallurgical coal (10%) and lignite (6%). The USA produced 291 Mtoe of thermal coal by 2016, which accounted for 10% of APEC total production of coal.

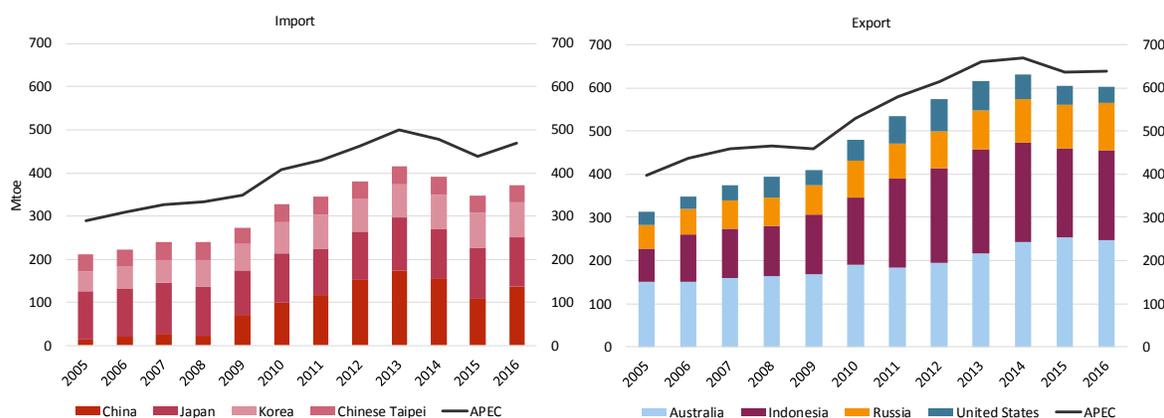
Coal trade in APEC

In 2016, APEC members imported 470 Mtoe of coal, 62% higher than 2005. Some 79% of total APEC imports went to four economies: China (136 Mtoe); Japan (114 Mtoe); Korea (81 Mtoe); and Chinese Taipei (41 Mtoe) (Figure 1.12). Along similar lines, 4 economies constituted 94% of total APEC coal exports: Australia (248 Mtoe); Indonesia (208 Mtoe); Russia (115 Mtoe) and the USA (41 Mtoe). APEC coal exports increased from 398 Mtoe from 2005 to 638 Mtoe in 2016, an increase of 61%.

Northeast Asia has been the major coal importer in the APEC region. In 2016, imported 243 Mtoe, which accounted for 52% of APEC imports. More recently, south-east Asian economies such as Malaysia (160%), the Philippines (173%) and Thailand (164%) have experienced strong growth in coal imports to meet expanding their coal power capacity. Viet Nam, traditionally a coal exporter, is projected to become a net importer after 2020 because of rapid growth in domestic demand. Indonesia is becoming the dominant exporter to this region for reasons of proximity.

Australia is the major coal exporter of the world, with production being highly correlated to demand from rapidly growing economies (such as China, India and south-east Asia [except for Indonesia]), with a market share of more than 58%. Indonesia has slightly recovered from the decline in 2010 in the last five years. In 2016, Indonesia exported 208 Mtoe, an increase of 173% from 2005 to 2016.

Figure 1.12: APEC coal import/export by economy and APEC total import/export, 2005-16



Sources: (APERC, 2019).

Since many major coal importers and exporters are located in the region, intra-APEC⁶ coal trade has long been a significant component of the international coal market.

In 2000, the value of total APEC imports of fossil fuels⁷ reached USD 464 billion, of which oil accounted for the majority (76%), followed by gas (21%) and coal (3.5%). By 2016, total fossil fuel imports had almost doubled to USD 741 billion, with the share of oil falling (65%) while shares rose for gas (27%) and coal (8.6%) (UN Comtrade, 2018). In terms of coal trade in the region, intra-APEC trade represented 9% of the total in 2016 and extra-APEC trade represented 87% in 2016 (APERC, 2019).

⁶ Intra-APEC trade is defined as trade between APEC economies and extra-APEC trade is trade between APEC members and economies outside of APEC. To avoid double counting, only data reported by importing economies are considered. All trade value is converted to USD 2016.

⁷ Fossil fuel trade includes coal and coal products, oil and petroleum products, and natural gas. The Harmonized Commodity Description and Coding System code used to explain the trade is HS2701 to HS2715.

Chapter 2: Coal Demand and Supply Outlook to 2021

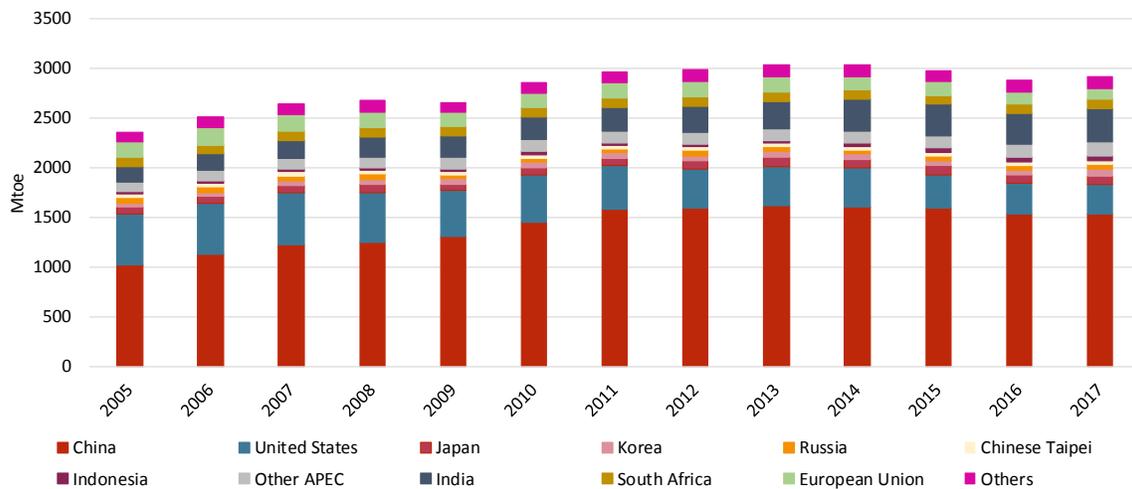
The following chapter examines global coal demand, production and trade qualitatively up to 2021 based on current conditions.

Demand Outlook

Thermal Coal

Thermal coal consumption has increased mainly in China, India and other parts of Asia, but the pace of this growth is easing gradually, as consumption has declined since peaking in 2014 (Figure 2.1). This is mainly attributed to declining thermal coal consumption in China (air pollution problems), the USA, and European economies over environmental issues (air pollutant regulations and measures to lower CO₂ emissions). In addition, the drop in natural gas prices caused by the emergence of shale gas has also become a major factor behind the drop in thermal coal consumption in the USA. Meanwhile, thermal coal consumption is increasing in emerging regions such as India and South-East Asia mainly owing to growing electric power demand as a result of economic growth. During 2015 and 2016 the increases in consumption in emerging regions was outpaced by declines in China, the USA and European economies. However, in 2017, the decline in consumption stopped in China, and global coal consumption rose slightly again.

Figure 2.1: Global thermal coal consumption, 2000-17



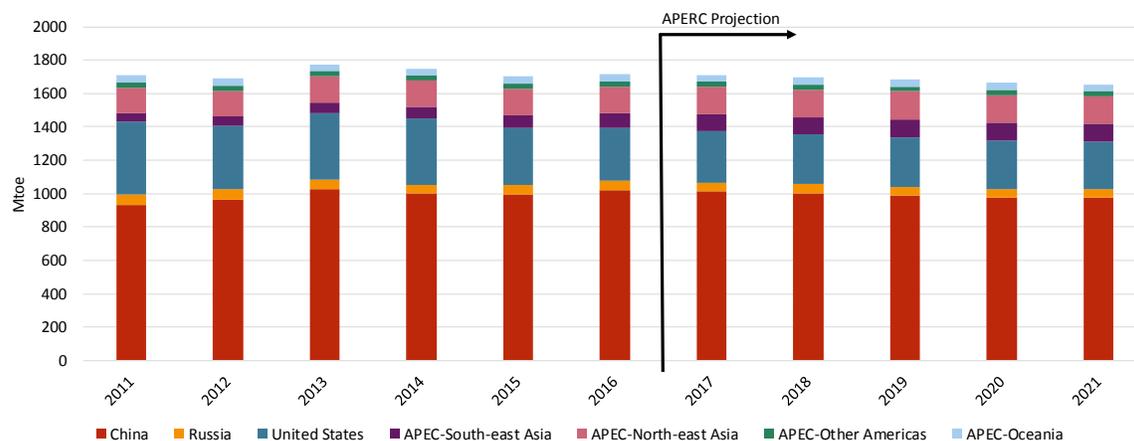
Note: 2017 estimated data

Source: (IEA, 2018b)

Global thermal coal consumption is expected to slightly increase by 2021. This is because the declining trend seen in the USA, China and European economies since 2015 is projected to ease. Thermal coal demand for power generation is projected to continue rising amid increasing electric power demand in non-OECD economies, mainly in Asia, including India and South-East Asia. Furthermore, APEC's

coal consumption in the electric power sector is expected to decline slightly by 2021 (Figure 2.2). Trends in major coal consuming economies (regions) are as follows.

Figure 2.2: Historic and projected coal consumption in the power sector in APEC, 2011-2021



Source: (APERC, 2019).

China

China’s coal consumption rose slightly in 2017 after three years continual drop, largely because of growth in power sector. Aborted hydropower generation because of weather conditions, an especially cold winter and a natural gas shortage drove up the coal demand. In the first half of 2018, thermal coal consumption in the electric power sector reportedly increased by 100 million tonnes compared with the same period in 2017. However, China is implementing a policy to curtail coal consumption for environmental reasons. Therefore, thermal coal demand is expected to decline gradually up to 2021. Specifically, thermal coal demand would be held in check by the operation of large-scale high-efficiency coal-fired thermal power plants, the closure of small- and medium-sized power plants, the closure of power plants with aging facilities that fail to meet environmental standards, and the improvement of generating efficiency.

South-East Asia

Additional coal-fired thermal power plants are coming online in South-East Asia as electric power demand increases, causing thermal coal demand to rise strongly. Ahead of 2021, new coal-fired thermal power plants are projected to begin operating in Indonesia, Viet Nam, Malaysia, and the Philippines, resulting in increased demand for thermal coal. For example, Malaysia is currently building two 1 000 MW power plants that are slated to commence operation in 2019 (Toshiba Energy Systems & Solutions Corporation, 2017). Viet Nam Electricity plans to begin operating a 600 MW plant and a 300 MW plant in 2018 and also plans to begin operating four other 600 MW plants in 2021 and beyond. In addition, according to the economy’s medium-term power plan (RUPTL 2018-2027), Indonesia plans to add 12 GW worth of coal-fired thermal power plants by 2021.

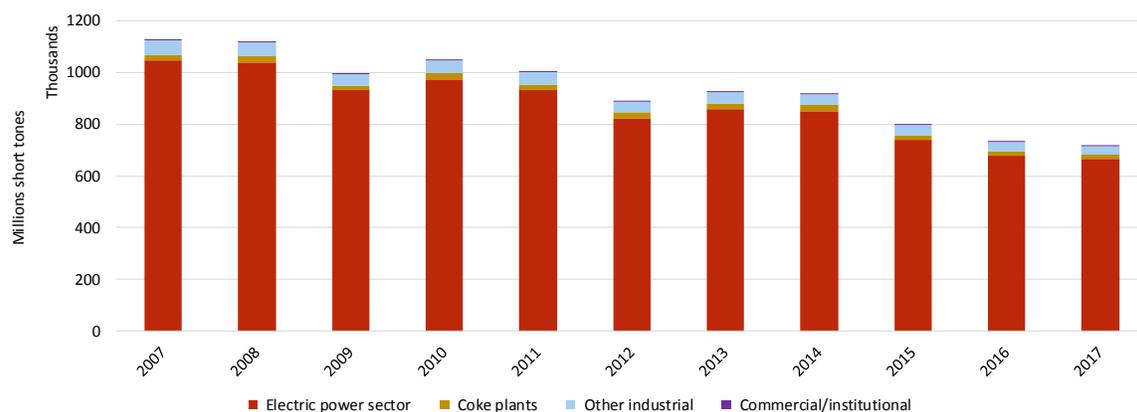
East Asia

Thermal coal consumption in Korea increased considerably in 2017 following the start of operations at a new coal-fired thermal power plant, but in the first half of 2018 consumption growth has been stuck at around one million tonnes which is a decrease compared with the same period in 2017. The Government of Korea announced an energy transformation roadmap in October 2017 that contained a policy to shift away from nuclear and coal-fired thermal power in favour of renewable energy and gas-fired thermal power. For this reason, Korea’s thermal coal consumption is expected to remain flat or decrease slightly through 2021. In Chinese Taipei, thermal coal consumption is on the rise as new coal-fired thermal power plants start operations, with plans for the final power plant (800 MW) to begin operations in 2019; therefore, consumption is expected to increase going forward. In Japan, consumption was up in 2017 because of the start of operations at small-scale coal-fired thermal power plants. Japan is currently constructing several large coal-fired thermal power plants that are slated to come online in 2020 and 2021. Therefore, thermal coal demand is expected to increase slightly for a while, depending on the restart of nuclear power plants and the increase of renewable energy.

United States

With a total of more than 50 GW worth of aging coal-fired thermal power plants closed over the past five years because of regulations on hazardous emissions and competition with low gas prices, thermal coal consumption in the electric power sector has declined since 2014 (Figure 2.3). It is expected to decline going forward, too, but the pace is expected to be moderate because closures of coal-fired thermal power plants have slowed down.

Figure 2.3: Coal consumption in the United States categorised by usage, 2007-17



Source: (EIA, 2018c)

European Union

Coal-fired thermal power plants and coal-consuming companies in the EU are moving ahead with the reduction of coal consumption because of air pollution standards and measures to lower CO2 emissions. The United Kingdom has announced a policy to close all coal-fired thermal power plants by 2025; the Netherlands announced a similar policy to be implemented by 2030, and Germany, too, is beginning to examine the elimination of coal-fired power generation. This indicates there is a

movement in the EU to transition away from coal, and going forward, thermal coal demand is expected to decline in the electric power sector.

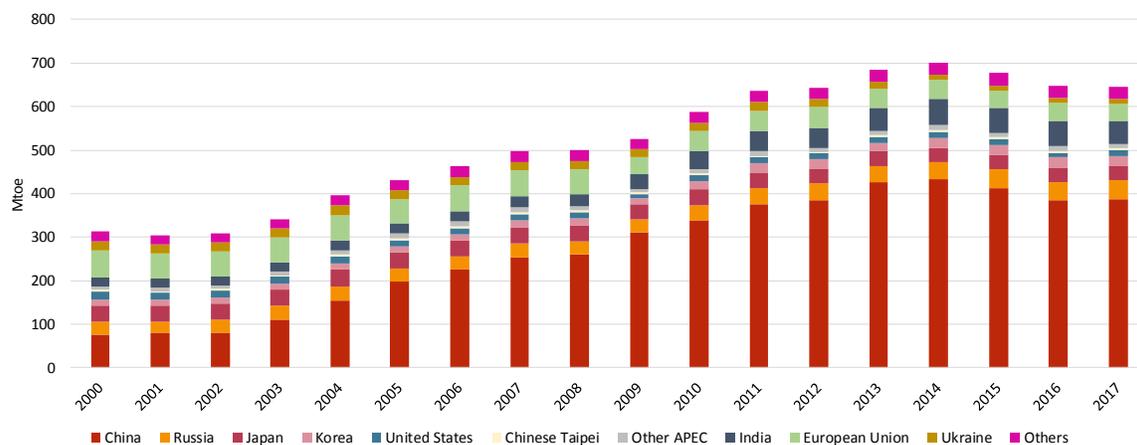
India

Generated output from coal-fired sources is projected to increase in the future together with rising demand for electric power. The Government of India is focusing efforts on the introduction of renewable energy, and in the Draft National Plan on energy policy released in June 2017, it calls for a long-term reduction in the share of coal-fired thermal power to the total generated output. At present, however, coal-fired thermal power is a core power source in India occupying more than 75% of total generated output. As such, thermal coal demand ahead of 2021 is projected to grow together with increases in electric power demand.

Metallurgical coal

Global coking coal consumption has increased steadily, but in 2015 pig-iron production in China slowed, causing coking coal consumption to decline. Additionally, China is moving ahead with closures of low productivity or small-scale steel mills, which contributed to the decline in coking coal consumption. Pig iron production increased in 2016 and 2017, but coking coal consumption did not grow because of the closure of less efficient small-scale steel mills and improvements in consumption intensity (coal consumption per one tonne of iron).

Figure 2.4: Global metallurgical coal consumption, 2000-17



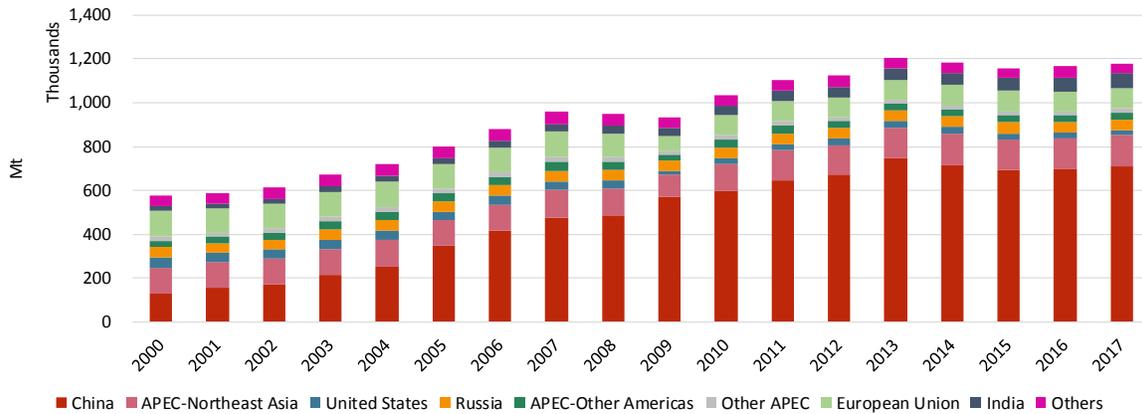
Note: 2017 estimated data

Source: (IEA, 2018b)

Looking ahead to 2021, India’s metallurgical coal consumption, which had remained stagnant for several years, is projected to increase. On the other hand, metallurgical coal consumption in Japan, Korea, USA and the EU is expected to be affected by economic trends and the US tariffs on imports. Pig iron production is projected to be roughly flat, while metallurgical coal demand is expected to experience a similar trend. In China, pig iron production in 2018 increased year on year and metallurgical coal consumption was also on the rise. However, many believe that China’s pig iron production has peaked, and it is expected to decline moderately ahead of 2021. In other locations,

metallurgical coal demand is projected to increase in Brazil, and metallurgical coal consumption is projected to increase slightly in Indonesia and Viet Nam, which began production of pig iron on a small scale. Demand growth in India and these economies is projected to nearly offset waning demand in China. For this reason, metallurgical coal demand is expected to be flat to slightly higher leading up to 2021.

Figure 2.5: Blast furnace iron production, 2000-17

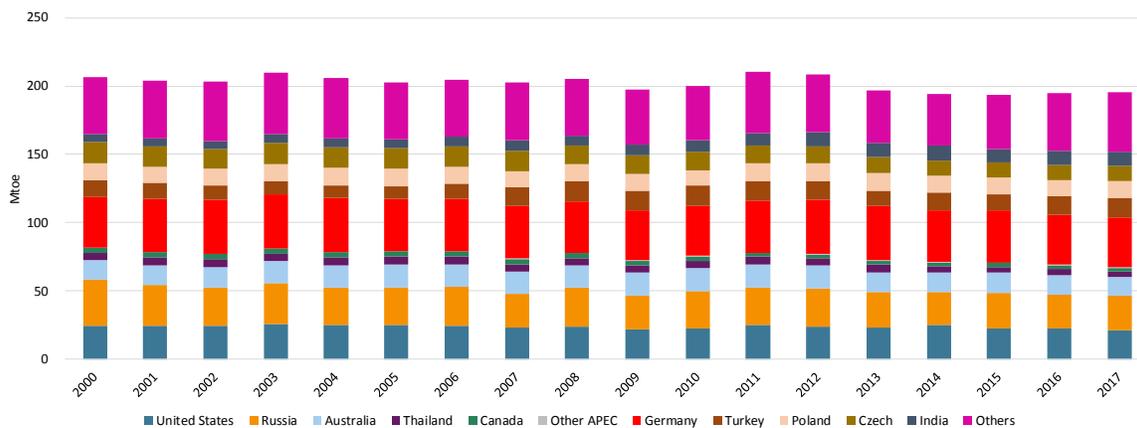


Source: (WSA, 2017)

Lignite

Lignite consumption has remained around 200 Mtoe but has declined in recent years (Figure 2.6). Up to 2021, lignite consumption in India is projected to increase owing to growth in electric power demand. Meanwhile, lignite consumption is expected to decline in OECD economies that consume lignite for power generation. For example, Germany, the largest consuming economy, made a cabinet decision in October 2015 to shut down some lignite-fired thermal power plants and place them in power reserves. Global lignite consumption is seen to decline slightly.

Figure 2.6: Global lignite coal consumption, 2000-17



Note: 2017 estimated data

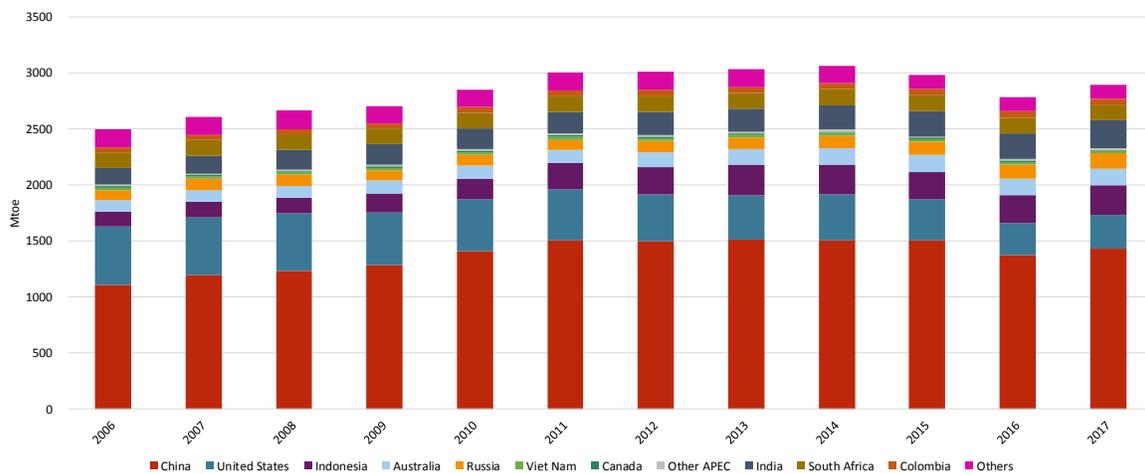
Source: (IEA, 2018b)

Production Outlook

Thermal and metallurgical coal

Global thermal coal production increased gradually after the start of the 2010s and later declined in 2015 and 2016 (Figure 2.7). These declines were caused by a drop in domestic consumption in China, a decline in domestic consumption and exports in the USA, and fewer exports from Indonesia. However, thermal coal production in 2017 rose once again owing to an increase in thermal coal production in China following consumption growth, to growing exports despite lower domestic consumption in the USA, and to the end of declines in Indonesia. In addition, production increased in Russia owing to growth in exports.

Figure 2.7: Global thermal coal production, 2000-17

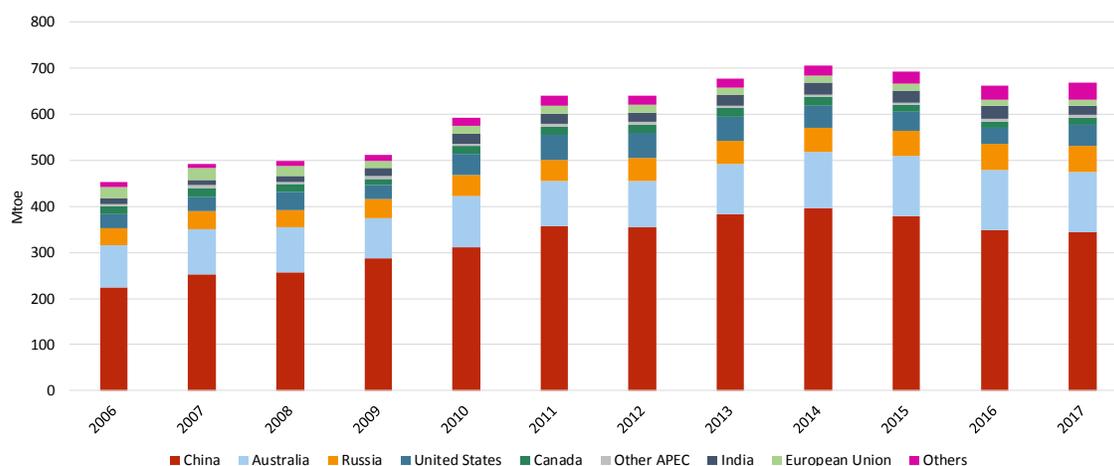


Note: 2017 estimated data

Source: (IEA, 2018b)

Meanwhile, global metallurgical coal production increased up to 2014, but in 2015 declined as production fell in China, the USA and Canada (Figure 2.8). Declines in China were marked by a drop in domestic consumption, while the USA and Canada had fewer exports. However, metallurgical coal production in 2017 increased once again, as was the case with thermal coal. This increase is mainly attributed to increased exports seen in the USA, Mongolia, and Mozambique. On the other hand, production increased only slightly in Australia because Cyclone Debbie, which struck Queensland at the end of March, caused major damage to a railway that is the keystone of coal transport.

Figure 2.8: Global metallurgical coal production, 2000-17



Note: 2017 estimated data

Source: IEA, "World Energy Balance 2018"

Trends in major coal producing economies ahead of 2021 are discussed below.

China

In 2016, with China's economic growth slowing and its energy mix restructuring, coal demand declined, while coal supply continued to be overcapacity. The imbalance of coal supply and demand led to widespread losses of coal mining firms, chaotic market competition, and increased production safety risks, which had adverse effects on economic development, employment of workers and social stability. To solve these problems, In April 2016 China reduced mine operating days from 330 to 276 a year to curtail over production. However, domestic coal supply tightened causing domestic coal prices to soar. In response, in November China went back to allowing 330 working days a year. The economy is moving ahead with production capacity cutbacks by closing coal mines with low productivity and those that violate regulations, and by consolidating production around larger mines. Chinese coal production rose in 2017 following higher domestic demand. Coal production in 2018 was up 4.5% year on year, 53% growth from 2007 to 2017. However, looking to 2021, demand for both thermal coal and metallurgical coal is expected to see moderate declines, which should also cause production to decline moderately.

United States

Coal production in the USA has fallen over the past several years because of declines in domestic consumption and exports. In 2017, however, exports recovered considerably (increasing 34 million tonnes over 2016), and production increased, too. Since the start of 2018, production has been increasing. US coal is known for its high free on board (f.o.b) cost, and until now exports increased whenever international prices soared and declined whenever prices were weak. Prices of both thermal coal and metallurgical coal have recovered since 2016. As a result, exports increased in 2017. Exports are increasing in 2018, however, it is unlikely exports will continue growing in the future. For this

reason, production of thermal coal is expected to decline as domestic demand falls and production of metallurgical coal remains flat.

Australia

Production over the past several years has been nearly flat for both thermal coal and metallurgical coal because of weak export growth, but in 2017 metallurgical coal production fell by 10 million tonnes because of Cyclone Debbie. Looking ahead, thermal coal production is expected to increase because of growth in Asia's thermal coal market mainly in India and South-East Asia and an expected decline in Indonesia's exports. Metallurgical coal production is expected to increase slightly following higher imports in India, but it is likely to be affected by growing competition from Mozambique. In Australia, there are plans to restart operations at idled coal mines and expansion plans for existing mines given the recovery in coal market conditions. This would make it possible to increase production to meet increased demand. However, the development of new coal mines is likely to face even greater difficulties than before because of opposition by local residents, opposition of environmental groups, and divestments in coal development.

Indonesia

Production declined in 2014 and 2015 because of weak prices from 2012 through early 2016 and a drop in exports. Since 2016, though, production is growing once again. The Government of Indonesia announced a production adjustment policy in early 2015 (slight reduction from 425 million tonnes in 2015 to 400 million tonnes in 2019) to protect domestic coal resources and assure their more efficient use, given the sharp increase in production from the second half of the 2000's. Production in 2017 greatly exceeded the production plan at 461 million tonnes, and the target set for 2018 is 485 million tonnes. However, the Government of Indonesia has not changed its basic policy on capping production. Therefore, production is not projected to increase by a large margin through 2021.

India

India's coal production is growing as coal consumption increases. However, domestic production alone cannot meet increased consumption, causing imports to increase. Given this situation, the Government of India announced a plan to increase domestic production with a production target of 1 500 million tonnes in fiscal 2022 (India's fiscal year) and reduce imports in order to effectively utilize its wealth of coal resources domestically and prevent the exodus of foreign currency. However, India's coal production was around 700 million tonnes in fiscal 2017. This suggests the target is rather ambitious. Furthermore, India faces issues of land expropriation for development of new coal mines, productivity, and production capacity, as well as the fact that its coal is low in quality because of high ash content. For this reason, the conventional approach of boosting production to meet growth in demand is improbable.

Lignite

Lignite contains a high moisture content and low heat value. For this reason, power plants are generally built in close proximity to coal mines, with nearly all of the lignite consumed at the site of

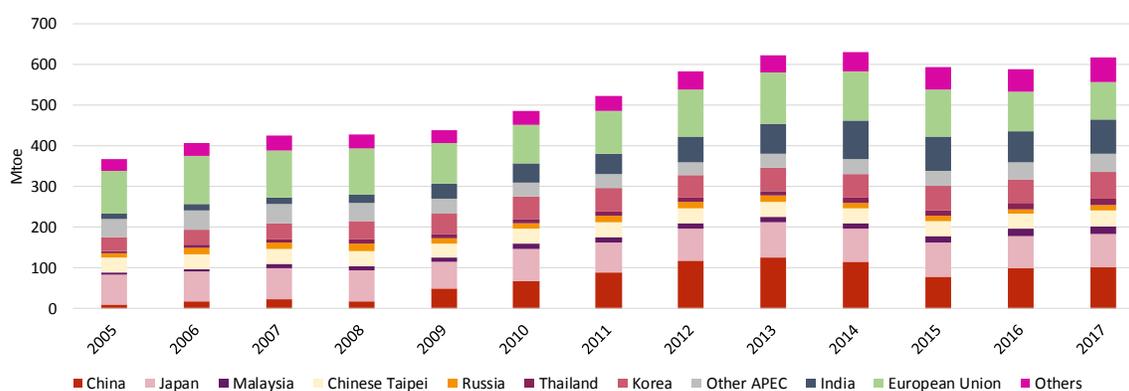
production. Therefore, nearly the same amount of lignite is produced in lignite consuming economies. Global lignite production is projected to decline ahead of 2021 together with declining demand.

Trade Outlook

Thermal coal imports

Looking at trends over the past several years, global thermal coal imports declined 6% in 2015 and 1% in 2016, but increased 5% in 2017 again. China's imports declined for two consecutive years in 2014 and 2015 but increased in 2016 and 2017. The EU's imports declined consecutively in 2014, 2015, 2016, and 2017. India's imports declined in 2015 and 2016 but increased in 2017. South-East Asia's imports increased gradually as new coal-fired thermal power plants started operations (Figure 2.9).

Figure 2.9: Global thermal coal imports, 2005-17



Note: 2017 estimated data

Source: (IEA, 2018b)

Thermal coal import trends in major economies/regions up to 2021 are discussed below.

China

Thermal coal imports in 2017 continued to increase as of 2016, and this trend is continuing even after the start of 2018 and thermal coal imports in 2018 increased 7.6 million tonnes over 2017. However, the Government of China is implementing a policy to curtail demand and production. If demand declines as planned and supply-demand adjustments are a success, thermal coal imports would fall in 2019 and continue to decline moderately thereafter.

India

Thermal coal imports in 2017 increased. Since the autumn of 2017, monthly imports have been increasing compared with the previous year, and this trend is continuing even after the start of 2018. The Government of India is seeking to increase domestic production and to reduce thermal coal imports, but thermal coal imports are expected to continue rising with better quality, lower costs and the start of operations at imported coal-fired thermal power plants under construction in the coastal area.

European Union

Thermal coal imports in 2017 continued to decline. Thermal coal imports are projected to fall looking ahead, too, following the closure of coal-fired thermal power plants. But by 2019, subsidies are expected to end and coal production in the region is projected to decline further. For this reason, there is a possibility that thermal coal imports could increase temporarily.

South-East Asia

This region is an importer of thermal coal, with the exception of Indonesia. In 2017, thermal coal imports increased in Malaysia, Viet Nam, the Philippines, and Thailand. Imports are projected to continue to increase mainly in Viet Nam, the Philippines and Malaysia following the start of operations at new coal-fired thermal power plants.

Korea, Chinese Taipei and Japan

Thermal coal imports in 2017 in Korea increased more than 15 million tonnes over 2016 following the start of operations at coal-fired thermal power plants. However, the Government of Korea has announced a policy to shift from coal-fired thermal power to gas-fired thermal power and renewable energy. As such, thermal coal imports would remain steady or slightly decline. In Chinese Taipei, too, thermal coal imports in 2017 were up around 10 million tonnes compared with the previous year. Thermal coal imports are expected to increase in the future, too, because of the start of operations of new coal-fired thermal power plants. In Japan, thermal coal imports in 2017 increased slightly. Going forward, coal imports are expected to increase slightly because of the planned start of operations at several major coal-fired thermal power plants in 2020 and 2021, but this will depend on the restart of nuclear power plants and the introduction of facilities that generate electric power from renewable energy.

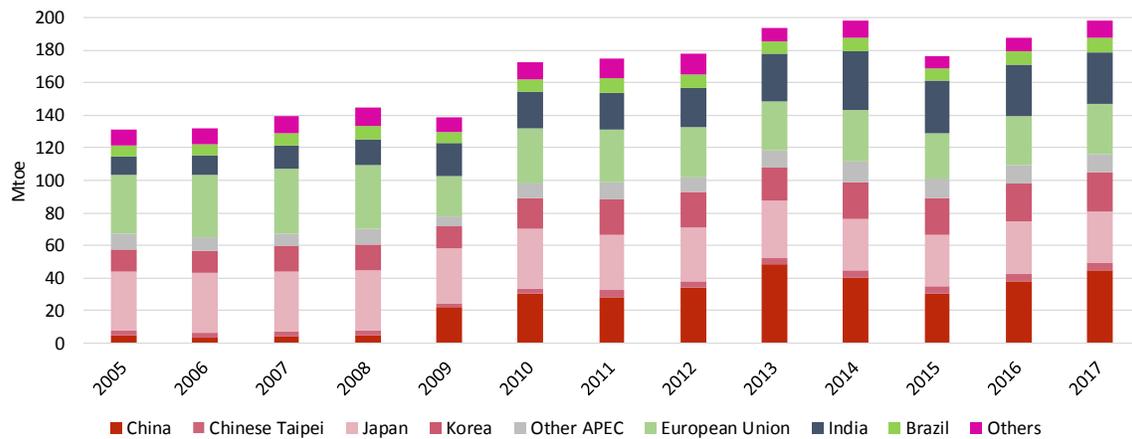
Other regions

In Africa, Latin America and the Middle East, there are plans to build coal-fired thermal power plants, and thermal coal imports are expected to increase ahead of 2021.

Metallurgical coal imports

Looking at trends over the past several years, global metallurgical coal imports declined 11% in 2015 but increased once again in 2016 and 2017 (6% and 5% respectively). China's coal imports declined 17% in 2014 and 23% in 2015 but increased 24% in 2016 and 18% in 2017. The EU's coal imports remained roughly flat, while India's coal imports increased steadily until 2014, but stayed at roughly the same level thereafter. Imports were nearly unchanged in Japan, Korea and Chinese Taipei (Figure 2.10).

Figure 2.10: Global metallurgical coal imports, 2005-17



Note: 2017 estimated data
 Source: (IEA, 2018b)

Metallurgical coal import trends in major economies up to 2021 are discussed below.

China

Metallurgical coal imports in 2017 increased around 10 million tonnes over 2016. In addition to growing domestic consumption, another major factor was the increase in imports as supply temporarily fell because of heavy rains in Shanxi Province, a major producer of metallurgical coal. Metallurgical coal imports in 2018 dropped 4.4 million tonnes year on year. Many believe that China’s pig iron production will peak, and if supply-demand adjustments are successful for metallurgical coal, similar to thermal coal, imports are expected to remain steady or show a slight decline up to 2021.

India

India’s customs statistics indicate that metallurgical coal imports in 2017 increased by three million tonnes and continued to rise even after the start of 2018. India is expected to see increased metallurgical coal demand following growing demand for steel. However, India’s high-grade metallurgical coal reserves are limited. This would result in metallurgical coal imports rising in the future, too, because of rising demand.

Korea and Japan

Metallurgical coal demand is expected to stay at roughly the same levels, and metallurgical coal imports are expected to remain flat up to 2021.

European Union

Metallurgical coal demand is seen as flat or showing a slight decline, but imports should increase slightly because production inside the EU is projected to decline.

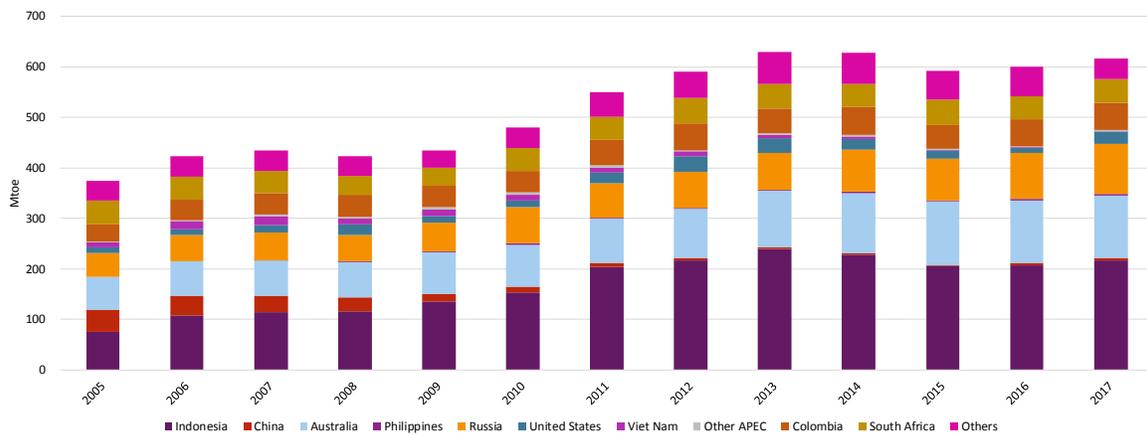
Other

Metallurgical coal imports in Brazil are projected to increase slightly. Metallurgical coal imports in Asia are expected to increase, albeit in a small amount, even in Indonesia and Viet Nam which operate small-scale steel mills.

Thermal coal exports

Looking at thermal coal exports by major economies, Indonesia’s exports have declined since peaking in 2013 but this trend ended in 2016 and the US exports have declined for three consecutive years since peaking in 2012 but increased in 2017. In contrast, Australia’s exports had been increasing gradually until 2015 and remained almost flat in 2016 and 2017. Russia’s exports increased gradually, but exports of Colombia and South Africa remained mostly unchanged (Figure 2.11).

Figure 2.11: Global thermal coal exports, 2005-17



Note: 2017 estimated data

Source: (IEA, 2018b)

Trends in major economies up to 2021 are discussed below.

Australia

Thermal coal exports in 2018 increased year on year. Australia’s thermal coal is mainly destined for Asian markets, and Australia’s exports are expected to make up for the decline in Indonesian exports and meet growth in the Asian market. In recent years, Russia and Colombia are increasing exports to Asia. As a result, growth in Australia’s thermal coal exports would be capped at a moderate level.

South Africa

Export destinations have shifted from Europe to Asia (half of all exports were bound for India in 2017). In the future, South Africa’s exports bound for Asia are projected to increase mainly for India. However, in recent years total exports have declined slightly. Currently, reserves are declining in the economy’s major production area, and the quality of the coal is deteriorating. Thermal coal exports in 2017 were up five million tonnes compared with the previous year, but since the start of 2018 production problems have been reported at times and thermal coal exports fell by two million tonnes. Coalfield

development is progressing in the north, but higher domestic demand is expected. For this reason, a major uptick in exports is unlikely. Future thermal coal exports are seen as remaining about the same.

Indonesia

Exports increased once again in 2017. The Government of Indonesia has announced a production target of 485 million tonnes for 2018. As a result, exports increased. However, the Government is pursuing production adjustments (capping production) from the standpoint of resource protection and effective use. Exports are expected to decline in the near future based on future growth in domestic demand.

Russia

Thermal coal exports in 2017 increased by 14 million tonnes compared with 2016, and exports in 2018 is estimated to increase. Exports to Asia are expected to increase as Russia looks to expand supply to Asian markets. However, railway capacity is expected to become a fundamental bottleneck to efforts to increase exports substantially.

Colombia

Thermal coal exports in 2017 increased 20 million tonnes compared with 2016 but in 2018 decreased by 18 million tonnes. The main export destination is European markets, but in 2017 there was significant growth in exports bound for Asia. Looking ahead, Colombia can be expected to increase exports to Asia and other markets such as South America. Colombia coal is competitive because of its low f.o.b. cost, but the distance to Asia is quite long for seaborne shipping. However, Colombia coal has a high heat value and there is a possibility that Asian users will import this as part of their efforts to diversify sources of imports.

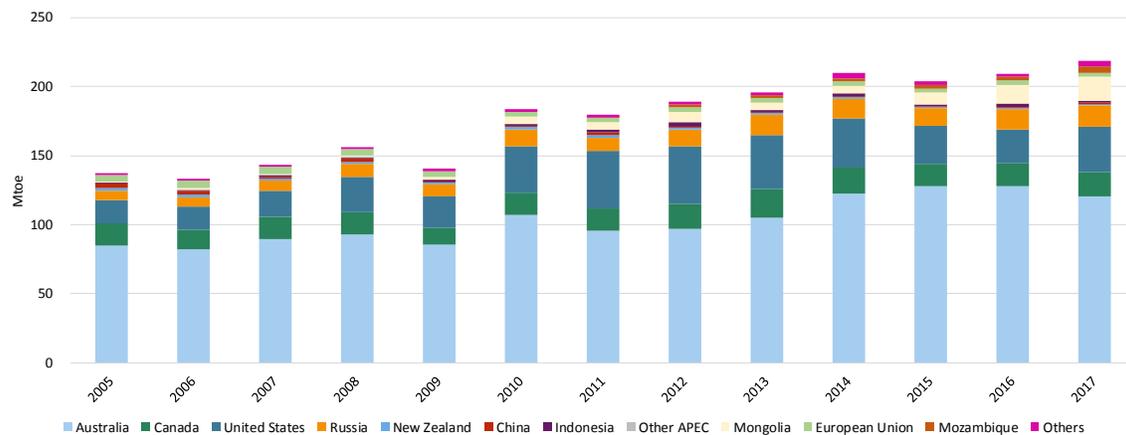
United States

Thermal coal exports in 2017 increased greatly given elevated international prices, even exceeding exports in 2014, and thermal coal exports in 2018 is estimated to increase by more than 10 million tonnes. However, US coal is in a poor competitive position because of high f.o.b. cost and exports are expected to fluctuate based on future international prices. Furthermore, exports destined for Asia mainly involve coal from the Powder River Basin exported from Westshore Coal Terminal in Vancouver, making large-scale exports difficult. There were plans to build coal terminals in several locations on the West Coast, but these plans have been cancelled one after another because of environmental concerns and weak prices through 2016.

Metallurgical coal exports

Looking at metallurgical coal exports by major economies, Australia's exports increased in 2014 and 2015 but decreased in 2017. US exports continued to decline since 2013 but increased in 2017. Canada's exports were declining since 2014, but were almost flat in 2016 and 2017, and Russia's exports have been unchanged. Meanwhile, exports from Mongolia to China increased in 2016 and 2017 (Figure 2.12).

Figure 2.12: Global metallurgical coal exports, 2005-17



Note: 2017 estimated data

Source: (IEA, 2018b)

Trends in major economies up to 2021 are discussed below.

Australia

Metallurgical coal exports have increased 34% from 2007 to 2017. In 2017, coal production fell due to closures and to significant railway damage caused by Cyclone Debbie, which struck Queensland in March. After the railway was restored, exports largely returned to normal, and since the start of 2018, have been increasing year on year. Australia is expected to be able to respond to future demand growth by increasing production at existing coal mines and restarting operations at idled coal mines. However, exports from other metallurgical coal exporting countries such as Mozambique are projected to increase, meaning Australia’s exports would increase only slightly.

Canada

Metallurgical coal exports in 2017 only increased slightly. Currently, only Tech Resources has been operating since 2015 but an idled mine has restarted in the second half of 2018. The company’s increased production and restart of operations at other idled mines is expected to cope with increased demand.

Mozambique

Development of coal mines and other infrastructure is moving forward. Exports are expected to increase in the future, mainly bound for India.

Russia

Metallurgical coal exports in 2017 increased by only one million tonnes over 2016. Coal mine and transportation infrastructure development is moving forward in the Far East. As a result, exports from the Far East can be expected to rise. However, similarly to thermal coal, railway capacity is a bottleneck when it comes to increasing coal exports significantly.

United States

Metallurgical coal exports had been declining because of weak prices through the end of 2015, but in 2017 prices remained at elevated levels, causing exports to increase 13 million tonnes over 2016, recovering to levels seen in 2014, and exports in 2018 are estimated to increase by around six million tonnes over 2017. Exports bound for Asia increased, too. Like thermal coal, US metallurgical coal has a high f.o.b. cost. Thus, future metallurgical coal exports are expected to vary based on international market prices. Nevertheless, US metallurgical coal is high-grade hard coal, so exports bound for Japan and Korea should remain steady.

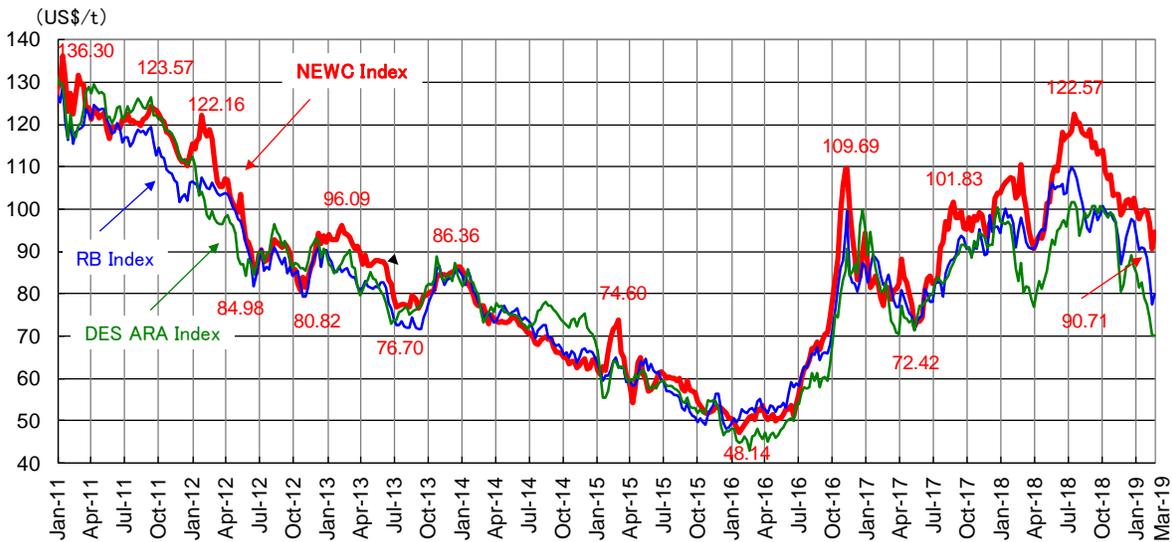
Mongolia

Mongolia is a landlocked economy and currently, nearly all of the coal it produces is exported to China. Hard metallurgical coal produced in the southern Gobi Desert is exported at a low price. In the future, metallurgical coal exports would be determined based on import trends in China. Producers are looking at tapping into Asian markets by exporting metallurgical coal via Russia and China.

Chapter 3: Coal price

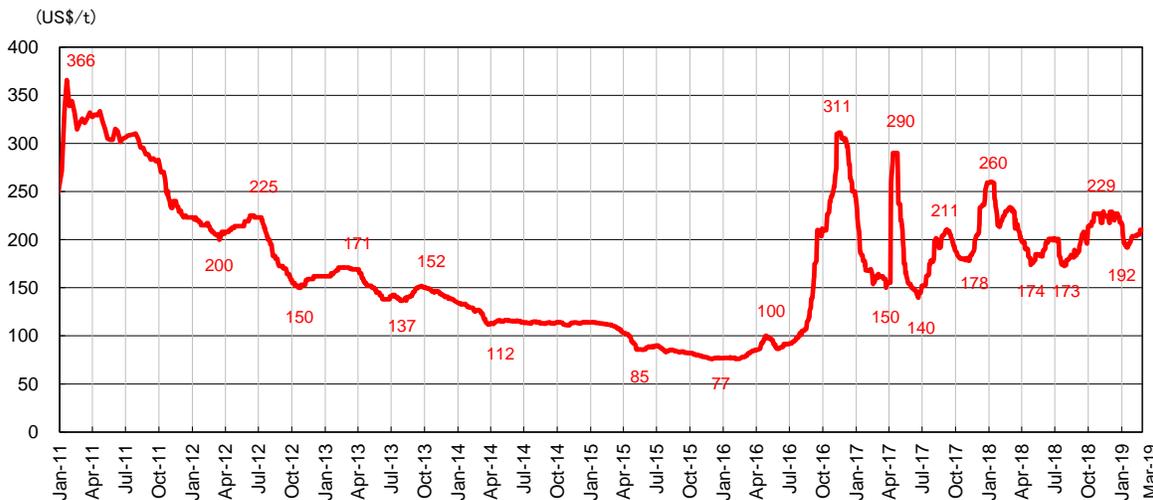
Prices for both thermal coal and metallurgical coal fell consistently until early 2016 after peaking in early 2011. Major factors behind this trend included the large investments in coal made during the coal boom in the latter half of the 2000s and the fact that demand has not grown since 2011, contrary to forecasts, leading to prolonged oversupply. During this period, however, supply capacity was curtailed by coal mine closures and cessations along with production adjustments, resulting in a gradual easing of this oversupply. In this situation, China’s coal imports, which had largely declined two years running in 2014 and 2015, recovered around the end of 2015, and as a result, coal prices stopped tumbling in early 2016. Since the second half of 2016, prices of thermal coal and metallurgical coal both fluctuated violently mainly because of changes in China’s coal procurement and the impacts of natural disasters. Currently, prices remain at elevated levels, with thermal coal in the USD 90-100/tonne range and metallurgical coal in the USD 190-210/tonne range (Figure 3.1 and 3.2).

Figure 3.1: Thermal coal spot price, 2011-February 2019



Source: (globalCOAL, 2018)

Figure 3.2: Australian Premium hard coking spot price, 2011-February 2019



Source: (IHS, 2018)

Thermal coal

The spot price of thermal coal (Newcastle f.o.b price; NEWC Index) declined following its peak of USD 136/tonne in January 2011. By January 2016, the price had fallen to USD 48/tonne. Later the price hovered in the lower USD 50/tonne range until June 2016. However, the spot price of thermal coal soared in July 2016 and thereafter, reaching as high as USD 110/tonne in November. The main factor behind this skyrocketing price was China.

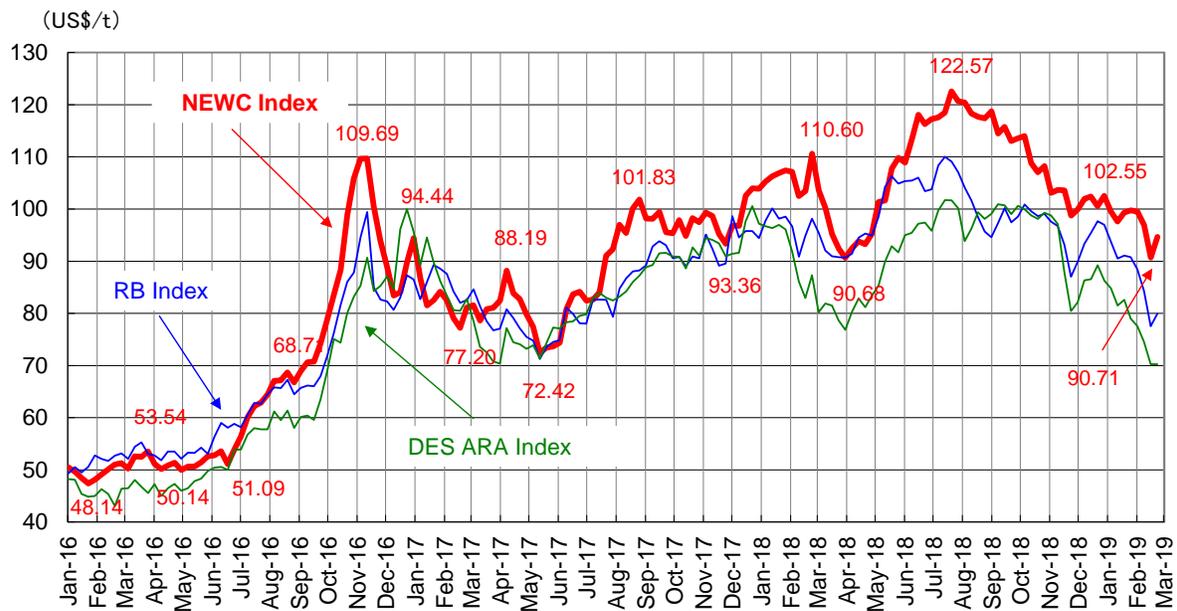
China saw higher generated output from thermal power plants following an increase in electric power demand after the start of 2016, and coal consumption increased year on year. However, production capacity was reduced (closures of low productivity coal mines and closures of coal mines failing to satisfy environmental standards) to ease overcapacity and to facilitate a restructure of the coal industry. Production adjustments were carried out in which the number of annual operating days of coal mines was reduced from 330 days to 278 days effective April 2016. As a result, there was a shortage in domestic coal supply and thermal coal imports increased year on year, ahead of peak summer demand causing coal prices to rise to USD 70/tonne in August. Even after this, Chinese users and traders rushed to procure coal imports ahead of the peak winter demand based on the view that coal supply shortages would persist, causing coal prices to reach USD 110/tonne by the middle of November 2016. The price of Chinese domestic coal also soared. As such, the Government of China returned the number of operating days to 330 from November, resulting in the spot price of thermal coal falling back to around USD 80/tonne.

In 2017, the spot price of thermal coal temporarily rose at the beginning of April following the after-effects of the cyclone that struck Queensland, but the price was fundamentally in decline, falling back to the lower USD 70/tonne range in May. Later, in June prices crept higher following a rise in

procurement by China and Korea ahead of the peak summer demand. Prices remained in the upper USD 90/tonne range owing to strong China's imports even after the start of autumn.

In 2018, the spot price of thermal coal broke through and remained above the USD 100/tonne mark from winter procurement, but prices retreated to USD 90/tonne at the end of March when seasonal demand waned. Afterwards, procurement ahead of the peak summer demand caused the spot price of thermal coal to rise over USD 120/tonne. Factors behind soaring prices include China's imports remaining strong even after the start of 2018 as well as year-on-year gains since the start of 2018 in India's imports, which had consistently declined since peaking in 2014. Afterwards, the spot price of thermal coal price was falling and currently sitting in USD 90-110/tonne range.

Figure 3.3: Thermal coal spot price, 2016-February 2019



Source: (globalCOAL, 2018)

Metallurgical coal

The spot price of metallurgical coal (Australian premium hard coking f.o.b price) has fallen consistently since peaking at USD 366/tonne in January 2011, dropping as far as below USD 80/tonne in December 2015. Later, the spot price of metallurgical coal rose from USD 80/tonne to USD 100/tonne until August 2016, but since then the price rapidly shot higher reaching USD 311/tonne in November. The main factor behind this rapid increase in metallurgical coal prices was also the demand and supply situation in China. Since the start of 2016, pig iron production increased because of rising steel demand, and following this metallurgical coal demand rose year on year. The spot price of metallurgical coal, which was in the upper USD 70/tonne range at the beginning of 2016, reached USD 100/tonne at the end of April. Afterwards, in June 2016 the price fell back to the mid USD 80/tonne range, but supply of domestic metallurgical coal became tight as China's production adjustment policy (reducing the number of operating days) coupled with the impacts on coal

transport caused by heavy rain from the end of July in Shanxi Province, a major producer of metallurgical coal. Furthermore, production was shut down by accidents at two metallurgical coal mines in Australia, resulting in the price sharply spiking to USD 311/tonne in November.

Afterwards, the end of production adjustments in China, and the restart of production at metallurgical coal mines in Australia that were shut down by accidents along with plans to restart operations at coal mines that were sitting idle or plans to increase production at existing coal mines caused the price of metallurgical coal to drop. The price stayed around USD 150/tonne after February 2017. However, the cyclone that struck Queensland at the end of March caused major damages to the railroad, causing coal prices to suddenly bounce to USD 290/tonne. In May railway transport returned to normal, and coal prices retreated back to USD 140/tonne, but even after this coal prices fluctuated largely because of changes in metallurgical coal procurement in China (spot procurement by traders, etc.). Prices currently sit in the USD 190-200/tonne range. The soaring nature of prices since December 2017 is blamed on the increase of vessel queue at the Port of Dalrymple Bay and reduced supply from Russia and Canada since the start of the harsh winter. And the soaring nature of prices since October 2018 is caused by a metallurgical coal mine accident in Queensland and vessel queue at port of Dalrymple Bay with the strong Indian imports and Chinese demand expected to rise toward winter.

Figure 3.4: Australian Premium hard coking spot price, 2016- February 2019



Source: (IHS, 2018)

Projection

As noted above, currently coal prices remain at elevated levels. Yet, the global coal market has not seen tightening conditions that should cause prices of both thermal coal and metallurgical coal to remain this high. For this reason, the price of both thermal coal and metallurgical coal is expected to drop.

Looking at the global coal market during the projection period, coal demand is projected to grow in emerging economies mainly in Asia, namely India and South-East Asia, and coal imports are projected

to rise. In contrast, coal supply is expected to remain in line with import demand based on the plans to restart operations at idled coal mines and expansion plans for existing coal mines, driven by the recovery in market conditions. In addition, Russia and Colombia, both of which greatly increased coal exports in 2017, are looking to boost their ability to supply to Asian markets.

Given these conditions, the global coal market is expected to see supply outpace demand, and coal prices during the projection period are predicted to trend as follows. The spot price of thermal coal is projected to fundamentally drop with fluctuations based on seasonal demand changes (prices rise prior to peak demand in summer and winter, and prices fall in spring and autumn) and reach USD 80/tonne range at lowest demand. The spot price of metallurgical coal, too, is projected to meander lower. After falling back to USD 170/tonne range, the price is expected to remain flat at that level.

Furthermore, coal prices since 2016 have fluctuated violently in the face of Chinese factors, natural disasters and accidents. Looking ahead, special attention should be paid to the possibility that coal prices could head higher because of temporary supply shortages caused by natural disasters, such as cyclones in Australia or rainfall in other supply economies or accidents at coal mines, and to procurement trends in China, where most buying is on a spot basis.

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