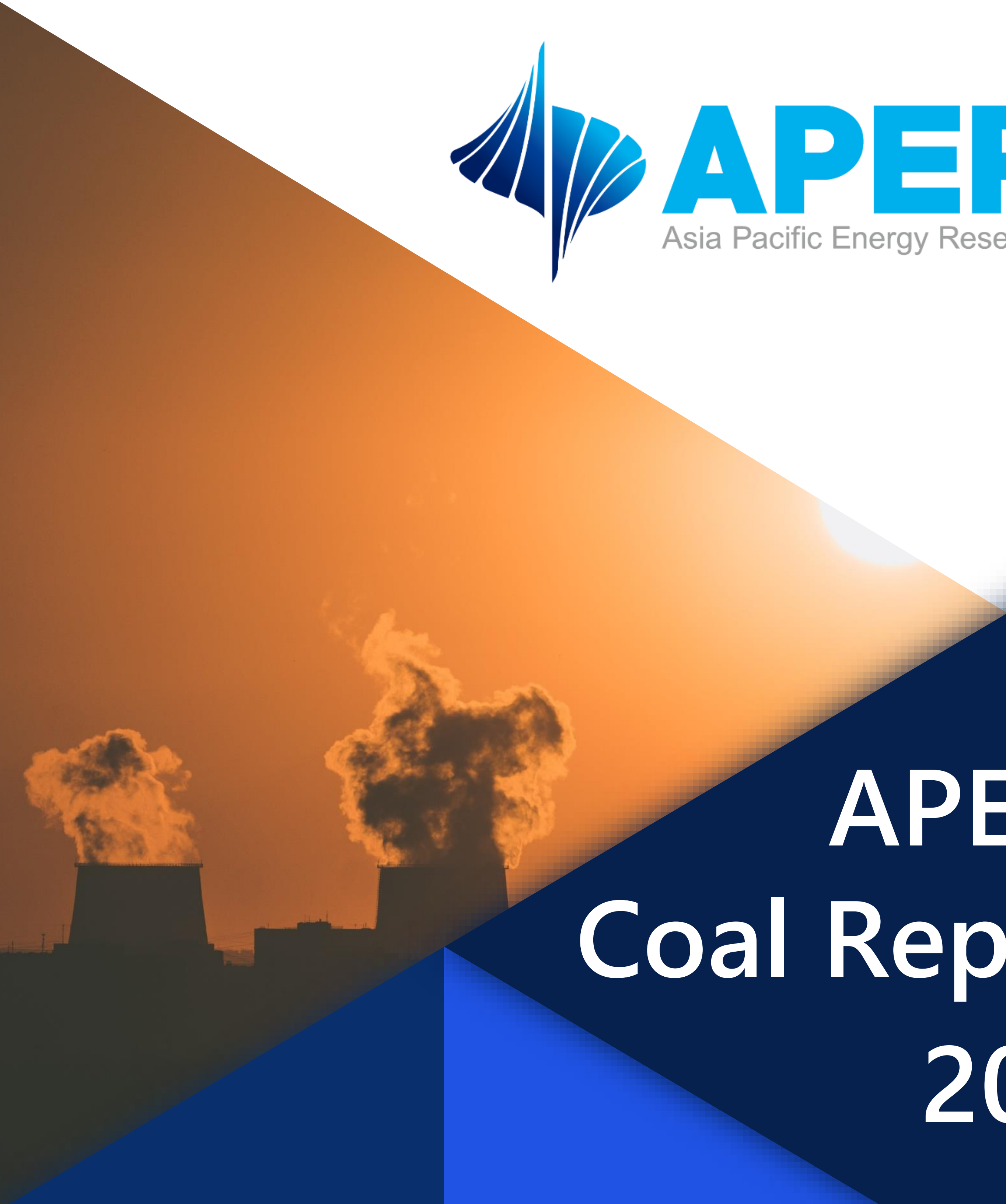

Asia Pacific Energy Research Centre

APERC Coal Report 2020

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Foreword

The world is in the grips of a health crisis and economic shock that has caused high levels of uncertainty and turmoil in all energy markets. Even in best case scenarios moving forward, the impacts from the COVID-19 pandemic are likely to resonate for years. Coal's place in the energy mix is almost certain to decline over the long-term, owing to the need to decarbonise and bring about improved air quality in many regions. However, the pace of the transition is now even more uncertain due to the pandemic.

The Asia Pacific region is home to the largest coal producing economies in the world. It is also home to many of the major coal consuming economies. Coal's relative abundance and cost competitiveness throughout the upstream and downstream supply chain mean that it holds a prominent place in the energy system in the region.

Thermal coal, for power generation, accounts for the largest share of the market for coal in APEC. However, metallurgical coal, for steel production, is growing in relative share. An increasing number of economies are transitioning away from thermal coal. These trends are clear for APEC developed economies, but the trends are apparent in APEC emerging economies as well. Plans for new thermal coal power plants are not as prominent today as they were just a few years prior. This is driven by fast changing economics, particularly for renewables, and a declining willingness for many financial institutions and governments to provide finance for thermal coal projects.

While diminishing prospects are widespread, coal is still instrumental in meeting the current energy requirements of most APEC economies. Coal may even see a renaissance if carbon capture, utilisation and storage (CCUS) technologies become cost competitive. Such technologies may be particularly important for the large fleet of relatively young coal fired power plants throughout APEC economies in Asia.

This year's coal report incorporates EGEDA energy data that we are grateful to APEC member economies for providing. We are also grateful to individuals from APEC member economies who aided with delivery of this report.

Dr Kazutomo IRIE
President
Asia Pacific Energy Research Centre
September 2020

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Contents

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	Organisation for 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

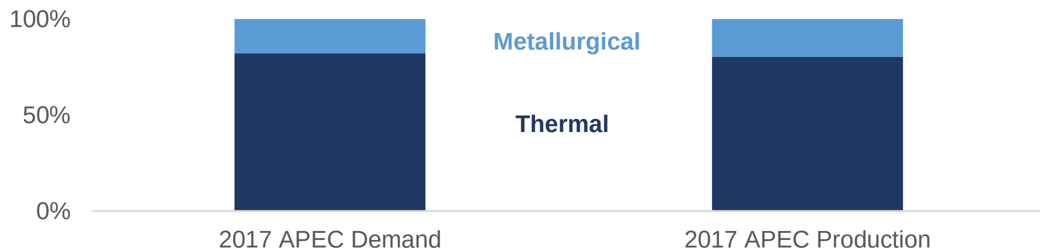
List of Figures

List of Tables

List of Boxes

Executive Summary

- APEC coal demand increased in 2017 to 2,859 Mtoe. This maintains a high plateau of APEC coal consumption between 2,800 Mtoe and 3,000 Mtoe since 2010.
- Within APEC, coal consumption trends are disparate. The US, Canada, Australia and New Zealand have all seen decreasing coal consumption over the 2007 to 2017 decade. In contrast, many of the APEC southeast Asian economies have relied on thermal coal to fuel recent rapid rates of economic growth.
- China remains the most influential coal producer and consumer, accounting for 59% of APEC coal production and 68% of APEC coal consumption in 2017.
- APEC coal production was 5.4% larger than coal demand in 2017, which continues a longstanding trend of APEC being a net exporter of coal to the rest of the world.
- Thermal coal (including lignite) accounted for 82% of APEC coal demand, and 80% of APEC coal production in 2017. Metallurgical coal accounts for the remainder.



- Thermal coal is facing increasing competition from alternative electric and heat generating fuel technologies. Metallurgical coal does not face these same competitive pressures and is likely to increase in relative share in the total market for coal.
- China, the US, Indonesia, Australia and Russia accounted for most of APEC thermal coal (including lignite) production in 2017. China, Australia, Russia, the US, and Canada accounted for almost all APEC metallurgical coal production in 2017.
- In 2017, APEC economies exported 460 Mtoe of thermal coal, which was 20% of APEC thermal coal production, up from 12% in 2000. APEC economies also imported 364 Mtoe of thermal coal in 2017, which was 16% of APEC thermal coal demand, up from 12% in 2000.
- APEC economies exported 190 Mtoe of metallurgical coal in 2017, which was 32% of production. APEC economies also imported 113 Mtoe of metallurgical coal, which was 22% of APEC metallurgical coal demand in 2017.
- Securing financing for new thermal coal projects is becoming increasingly difficult, and divestment of thermal coal is gathering pace in many economies in APEC.
- There is increasing development of CCUS projects in APEC. Policies such as the 45Q tax credit in the US are incentivising the development of these technologies.
- Projected prices for both thermal and metallurgical coal are likely to remain depressed for the foreseeable future. Any short-term price developments will be largely influenced by the unfolding COVID-19 pandemic.

APEC coal policies and developments

Economy	Policies and notable developments related to coal	Coal trade
Australia	The Australian government is supporting a project to produce hydrogen using lignite, in collaboration with Japan. Australia is also funding research and development into low-emitting coal technologies (ANLEC).	Net exporter
Brunei Darussalam	Brunei's first coal plant began operating in 2019 to provide power for a new petrochemical refinery.	Net importer
Canada	Emissions pricing has increased the marginal cost of coal-fired generation in Alberta, encouraging coal-to-gas conversions.	Net exporter
Chile	Chile has developed decarbonisation policy for the electricity system, including retirement of 1.73 GW of coal-fired power plants by 2024, equivalent to 31% of capacity. Thermal coal plants will cease operations by 2040, at the latest. The current trend is for these closures to occur sooner than planned. Coal contributes 20% of the TPES.	Net importer
China	The 13th Five-Year Energy Development Plan limits coal-fired capacity to 1,100 GW and 58% of primary energy by 2020. China achieved the primary energy target, with 57% primary coal energy in 2019. Coal-fired heating has been replaced extensively by natural gas, particularly in Northern China cities. Large power generation companies can only emit 550 grams of CO2 per kWh, on average, across all their plants in 2020.	Net importer
Hong Kong, China	Plan to stop investing in coal-fired capacity additions and to phase-out coal by 2050.	Net importer
Indonesia	Indonesia has allocated 550 Mt of coal production in 2020 with 75% to be exported. Indonesia will curb coal exports in order to prioritise domestic demand. Annual coal production will eventually be capped at 400 Mt. The Indonesian government is planning to retire and replace some of the older coal-fired power fleet.	Net exporter
Japan	The New International Resource Strategy (2020) reaffirms the importance of coal for Japan. The Ministry of Environment has held expert review meetings for publicly supporting export of high-efficiency coal-fired power plants (2020).	Net importer
Korea	Korea's Energy Transition Roadmap (2017) aims to reduce nuclear and coal, replacing them with renewables and natural gas.	Net importer
Malaysia	The Energy Commission is planning for new coal-fired power plants to meet much of Malaysia's growing energy demand.	Net importer
Mexico		Net importer
New Zealand	Target to decrease industrial emissions intensity by at least one per cent per annum, on average, between 2017 and 2022. Coal contributes 20% to current industry sector emissions.	Net importer
Papua New Guinea		N/A
Peru	In 2017, only 2.9% (706 ktoe) of the TPES was from coal, with its primary role in the industry sector (68%) and electricity production (32%).	Net importer
Philippines	To reduce dependency on imported coal, the government has been pursuing efforts to expand the exploitation of indigenous coal.	Net importer
Russia	Russia’s Energy Strategy 2035 encourages local companies to make full use of available energy domestically as well as to expand exports (including coal) to the Pacific region. Coal industry development strategy to 2030 has various objectives for coal including improved profitability, safety and pollution management.	Net exporter

Singapore	Two Singapore-based banks. DBS and OCBC, announced future financing will cease for coal-fired generation. They will continue to finance projects from existing agreements.	Net importer
Chinese Taipei		Net importer
Thailand	Thailand's latest Power Development Plan 2018 encourages clean coal, including lignite. It is expected that coal/lignite capacity will grow by approximately 5 GW during 2018-2037.	Net importer
USA	In 2019, the EPA issued the Affordable Clean Energy (ACE) Rule with new standards for reducing CO_2 emissions at existing coal-fired electric utility generating units. The EIA projects that ACE can reduce 2050 CO_2 emissions from the power sector by 2%. The US submitted formal notification of its withdrawal from the Paris Agreement on Climate Change to the United Nations. The withdrawal will take effect on November 4, 2020. The EPA proposed amended regulations for the disposal of coal ash, effectively relaxing current requirements. In 2019, the DOE announced USD 100 million in planned investments in the Coal FIRST (Flexible, Innovative, Resilient, Small, and Transformative) initiative, which aims to develop 50 MW to 350 MW units with high efficiency, near-zero emissions, minimised water consumption, that are capable of high ramp rates and minimal loads.	Net exporter
Viet Nam	The National Energy Development Strategy sets a coal production target of 47 to 50 Mt by 2020 and 55 to 57 Mt by 2030. Exploitation of the Red River Delta coal basin will begin during 2021–30 with a targeted commercial coal yield of 0.5 to 1.0 Mt per annum by 2030. Gas-fired power is being prioritised ahead of coal-fired power, but for those coal plants that do proceed, ultra-supercritical technology is preferred. Domestic demand will be ensured via a coal reservation policy.	Net importer from 2020

Chapter 1: Historic trends in the APEC coal market

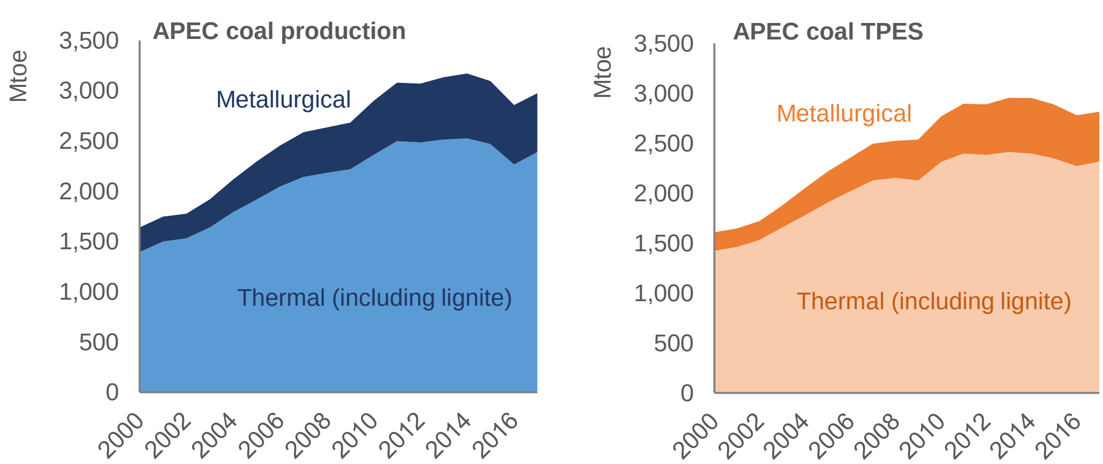
Coal is primarily used for power generation. Higher energy coal is also used as a foundational input in the production of steel. These two uses define the two main and distinct markets for coal: thermal (or steam) coal for power generation (and heating applications), and metallurgical coal for steel production.

Thermal coal continues to be a reliable source of affordable energy for most countries in the Asia Pacific Economic Cooperation (APEC) region, and the world. The share of thermal coal in the overall electricity generation mix is beginning to decline, but this is not a consistent trend across all economies. The evolution is largely a story of relative prices (the price of thermal coal relative to alternative power and heat generation technologies). Technological change (especially for alternative generation technologies) and climate change mitigation are the main factors that are influencing these relative prices and constraining growth in the demand for thermal coal.

The role of relative prices is less influential in the market for metallurgical coal. This is because there are no viable, at-scale, alternatives for metallurgical coal in the production of steel. Some of the demand for steel is met through the supply of scrap metal. But most of the demand for steel requires new production, and a steady supply of metallurgical coal.

Thermal coal (including low energy content lignite) production in APEC reached 2,389 million tonnes of oil equivalent (Mtoe) in 2017. Demand, as approximated by total primary energy supply (TPES), was lower, at 2,316 Mtoe.[1] This reflects that APEC is a net exporter of thermal coal to the rest of the world.

Figure 1.1: APEC thermal and metallurgical coal production (supply) and TPES (demand), 2000–2017



Source: (IEA, 2019a), APERC calculations

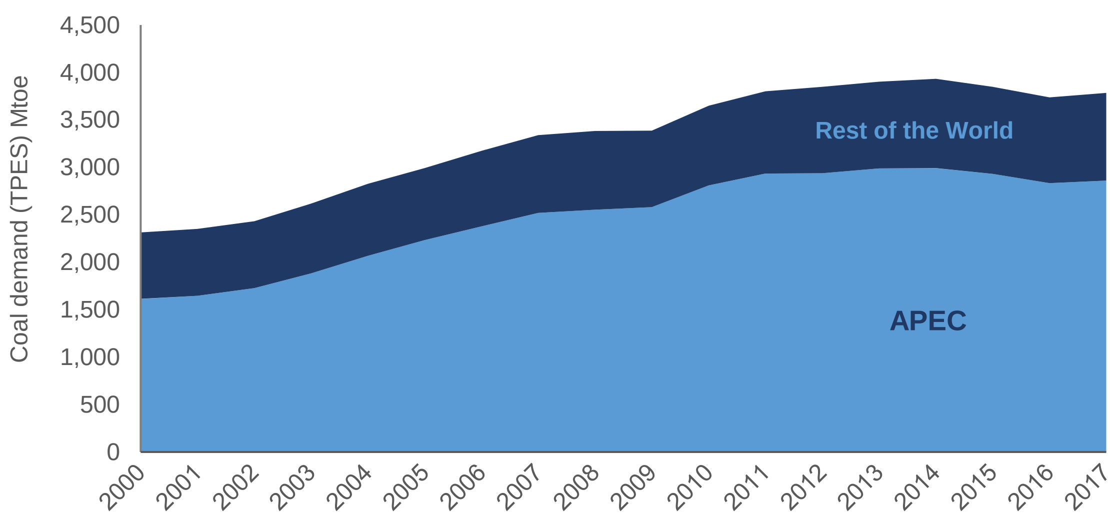
[1] TPES is production and imports minus exports and storage changes. It is the total amount of energy that is available to meet demand.

Figure 1.1 shows that thermal coal accounts for more than 80% of APEC coal production and demand (TPES) in 2017. Figure 1.1 also shows that the proportion of metallurgical coal supply and demand has been increasing. Metallurgical coal increased from 14.8% of total coal production in APEC in 2000 to 19.7% in 2017. The relative share of metallurgical coal demand increased from 11.6% to 17.8%over the same period.

Lignite (brown coal) is almost exclusively consumed in the location where it is extracted (via brown coal power plants). Production (and accompanying consumption) has decreased from 181 Mtoe in 2011 to 142 Mtoe in 2017. China (74 Mtoe), Russia (25 Mtoe), the US (21 Mtoe), and Australia (13 Mtoe) accounted for the bulk of lignite production, and consumption, in 2017. Lignite production was 4.7% of total APEC coal production in 2017 (EGEDA, 2019).[2]

The APEC region accounted for 76% of world coal demand (TPES) in 2017 (Figure 1.2). This has remained steady for more than a decade, though is considerably higher than the 62% share in 1990. In absolute terms, global coal demand (TPES) increased by 1.3% (0.9% increase in APEC) in 2017. This was the first increase in coal demand since 2014.

Figure 1.2: Total primary energy supply of coal for APEC and the world, 2000–2017



Source: (IEA, 2019a).

Economic growth and increasing urbanisation are two key drivers of the demand for both thermal coal and metallurgical coal in rapidly emerging economies like India and China, and regions like southeast Asia. Abundance of coal reserves across the globe, combined with technologically efficient upstream extraction, transportation, and delivery, combine to mean that coal is a competitively priced source of fuel, and one of the least cost options for power generation.[3]

[2] The APEC Expert Group on Energy Data and Analysis (EGEDA) notes that the IEA accounts for China's lignite production as other bituminous coal.

[3] Thermal coal is less competitive when considering the costs of building new power generation assets, but for already built power plants, the marginal cost of thermal coal is low and competitive against alternatives in most regions.

Coal has a high carbon content. Use of both thermal and metallurgical coal produces a large amount of associated carbon dioxide (and other greenhouse gas emissions). Emissions manifest as a negative externality via pollution and contribution to climate change. Most coal markets do not adequately account for the costs that these externalities have on society. However, the expectation that these costs will be borne is already affecting coal investment decisions. Climate change impacts are increasingly observable (see for example,(Kolstad and Moore, 2020)). Chapter 2 discusses how market interventions to address the emissions problem and pollution is affecting supply and demand trends for coal.

Thermal coal financing is becoming increasingly difficult to secure in many economies. Certain jurisdictions are also instituting legislated phase outs of thermal coal fired power plants. The economics of both thermal coal and metallurgical coal will continue to be affected by interventions that attempt to account for the cost of carbon dioxide (and equivalent) emissions and pollution.

Carbon capture and storage (CCS) and carbon capture, utilisation and storage (CCUS) technologies are being developed and implemented at an increasing rate. Support from governments and institutions is driving development of CCS and CCUS to lower emissions. Both CCS and CCUS are crucial for achieving net zero emissions goals, particularly where coal cannot be easily substituted for low (or zero) GHG emissions alternatives, such as with steel production.

There were over one trillion tonnes of global proved coal reserves at the end of 2018 (BP, 2019).[4] These reserves are enough for 132 years of current global coal production. The US has the largest share of these coal reserves, at 24%. Fellow APEC economies Russia, Australia and China follow with 15%, 14% and 13% of global coal reserves, respectively.

Coal demand and supply trends in APEC

Economic growth context

For the period 2007 to 2017, the APEC region grew at a compound annual real growth rate of 2.8% (Figure 1.3). This period included the Great Recession, with the APEC region contracting 1.1% in 2009. Beneath the aggregate rate of real growth, there was significant variability from economy to economy.

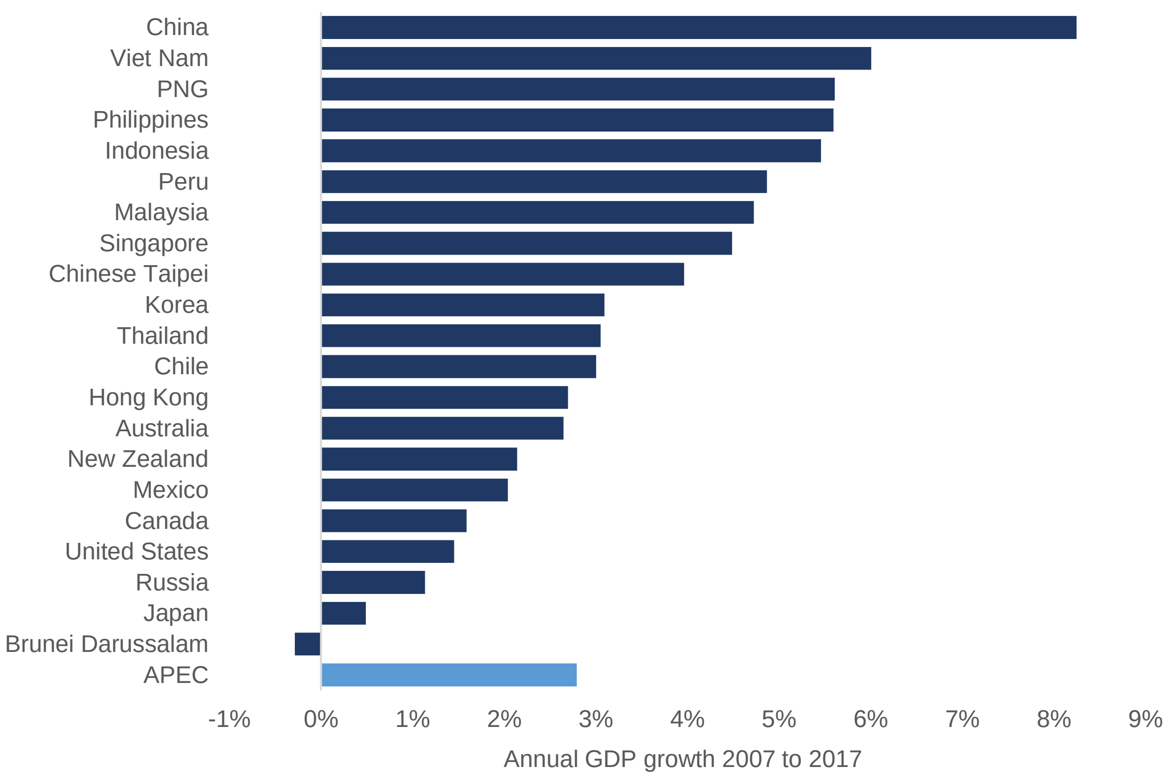
China was the clear stand out, growing at a compound annual real growth rate of 8.2%. This translated into China's economy being 121% larger in 2017 relative to 2007. Viet Nam recorded the next highest growth rate of 6.0% (79% larger in 2017 relative to 2007). Developed APEC economies, such as the US, Canada, Australia, and New Zealand, did not grow to the same extent as these rapidly emerging economies.

Economic growth has clear implications for energy demand—growing economies demand more energy. In past decades, there was close to a one-to-one relationship for many economies. If economic activity increased by 1%, energy demand also increased by (close to) 1%. More recently,

[4] Proven reserves are those quantities that can be recovered from known reservoirs under existing economic and operating conditions.

energy demand has decoupled from economic growth for many economies (Kendell, 2020). The energy intensity of an economy typically declines when an economy transitions to more services-based activity. Improvements in how energy is used—energy efficiency—also mean that less energy is needed for incremental increases in output. The increase in economic output for the APEC region of 2.8% per annum for 2007 to 2017 was accompanied by an increase in overall energy demand (TPES) of only 1.4% per annum.

Figure 1.3: Compound annual real economic growth rate for APEC economies, 2007–2017



Source: (World Bank, 2020).

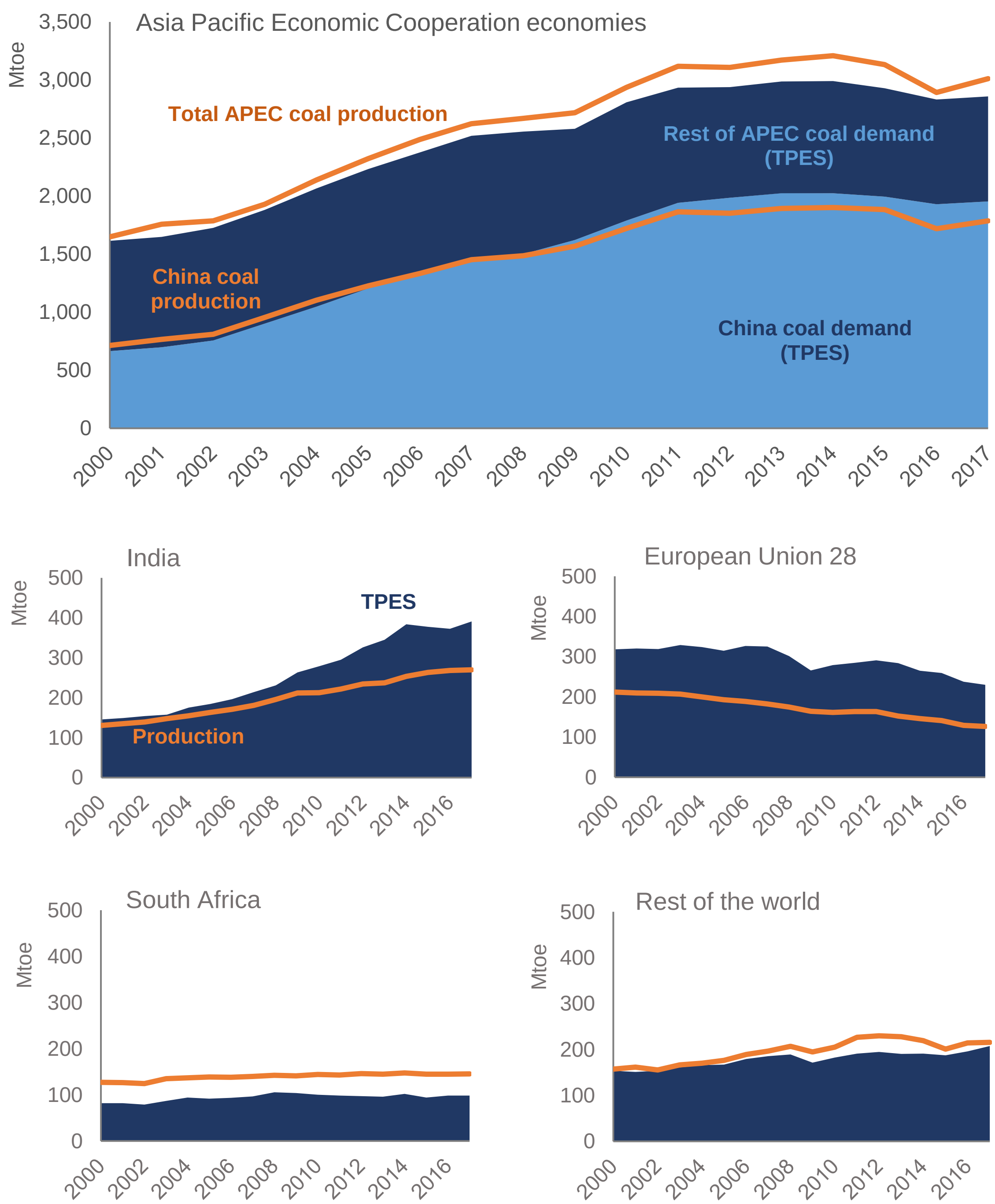
Coal demand (TPES) in the APEC region almost kept pace with overall energy demand for 2007 to 2017. The compound annual growth in coal demand (TPES) was 1.3% versus overall energy demand (TPES) of 1.4%. A breakdown of this trend is provided in subsequent sections.

Coal demand trends are region dependent

Australia, Canada, New Zealand, Hong Kong, and the United States have all experienced a decline in coal demand (TPES) for the most recent decade of data (2007 to 2017). These declines have been more than offset by large increases in coal demand from other APEC economies. China's demand (TPES) for coal increased 33% over the same period and represents 52% of global coal demand (TPES) in 2017, at 1,953 Mtoe. This level of demand dwarfs all other economies and represents 68% of all APEC coal demand in 2017.

Figure 1.4 displays the magnitude of China's coal consumption and coal production relative to the rest of APEC. China's large appetite for coal has outpaced its ability to produce enough coal domestically since 2006. The shortfall in 2017 amounted to 167 Mtoe (8.6% of China's coal demand), which was met via imports, and residual inventories.

Figure 1.4: Global coal demand (TPES) and production by region, 2000–2017



Source: (IEA, 2019a). APERC calculations

The prominence of metallurgical coal in China's overall demand for coal has increased markedly since 2000. China's metallurgical coal demand (TPES) was 9.8% of its total coal demand in 2000 and has since doubled to 19.2% in 2017. In absolute numbers, metallurgical coal peaked in 2014 in China at 432 Mtoe and has since declined to 372 Mtoe in 2017. Chinese demand for thermal coal peaked in 2013 at 1,595 Mtoe, though it has remained at a high plateau since, at 1,571 Mtoe in 2017.

Coal demand in the southeast Asian economies Viet Nam, Malaysia, Indonesia, and the Philippines for the period 2007 to 2017 has been strong, though is on a much smaller scale than in China. Viet Nam's coal demand (TPES) has tripled from 9.5 Mtoe in 2007 to 28.2 Mtoe in 2017. Indonesia's coal demand (TPES) has grown by 70% for the same period, but is much larger in absolute terms, hitting 48 Mtoe in 2017. In 2017, the largest annual growth in coal TPES for APEC economies has been in Singapore (111%; from a small base to reach 0.9 Mtoe in 2017), the Philippines (17.7%), Indonesia (11.7%) and Malaysia (10.2%). Coal demand growth is discussed in more detail in the subsequent thermal coal and metallurgical coal sections.

Outside of the APEC member economies, the biggest story for coal is in India, where demand (TPES) increased from 214 Mtoe in 2007 to 391 Mtoe in 2017 (Figure 1.3). Thermal coal accounts for 86% of India's primary energy supply. Europe provides the largest counterpoint to many of the trends in southeast Asia, China and India. European coal demand (TPES) declined by 22%, from 499 Mtoe in 2007 to 390 Mtoe in 2017 (Figure 1.4).

Coal production consistently exceeds coal demand in APEC

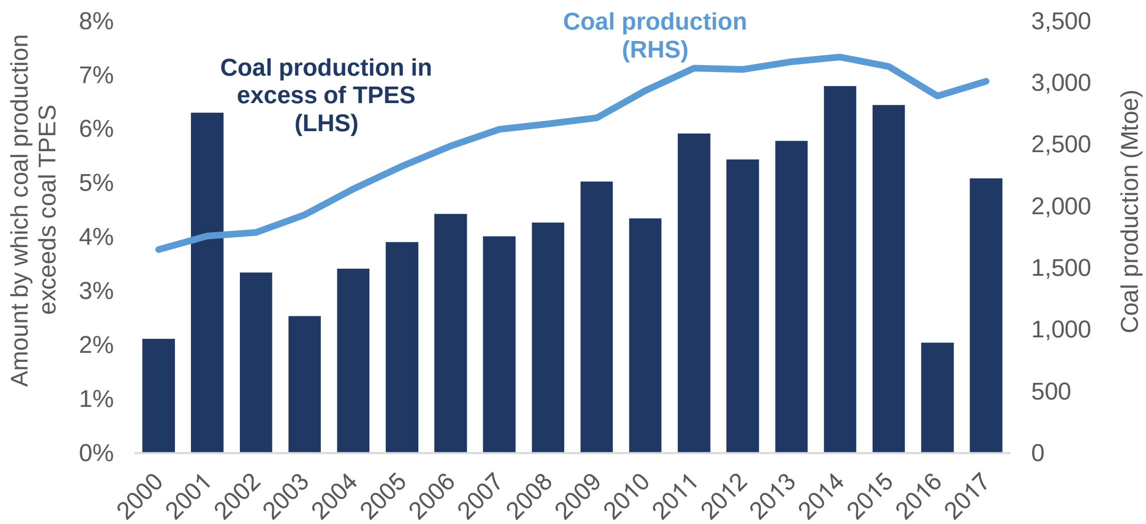
APEC coal production trends have moved in parallel with APEC coal demand (TPES), as shown previously in Figure 1.1 and Figure 1.4. Coal production in the APEC economies has been consistently higher than APEC coal demand for the preceding two decades. Figure 1.5 shows that for the 18-years between 2000 and 2017, APEC coal production has been between 2% and 7% higher than APEC coal demand. These parallel trends are not surprising. There is a dynamic equilibrium at play, with responsive coal prices (discussed in Chapter 3), mostly ensuring that supply meets demand, and *vice versa*.

In 2016, APEC coal production fell by 7.7%, but even so, coal production was still in excess of coal demand by 2.1% (coal demand, or TPES, fell by 3.3%). Price spikes brought on by the large decreases in coal production effectively tempered coal demand. In 2017, APEC coal production rebounded, with surplus APEC coal production (relative to demand) returning to previous higher levels.

Excess APEC coal production is either exported to non-APEC countries or contributes to increased coal inventories, to be consumed or exported later.

For the APEC economies, China accounted for 59% of APEC coal production in 2017. The US, Australia, Indonesia, and Russia accounted for 12%, 10%, 9%, and 7% of coal production, respectively. Combined, these five APEC economies accounted for over 97% of APEC coal production (IEA, 2019).

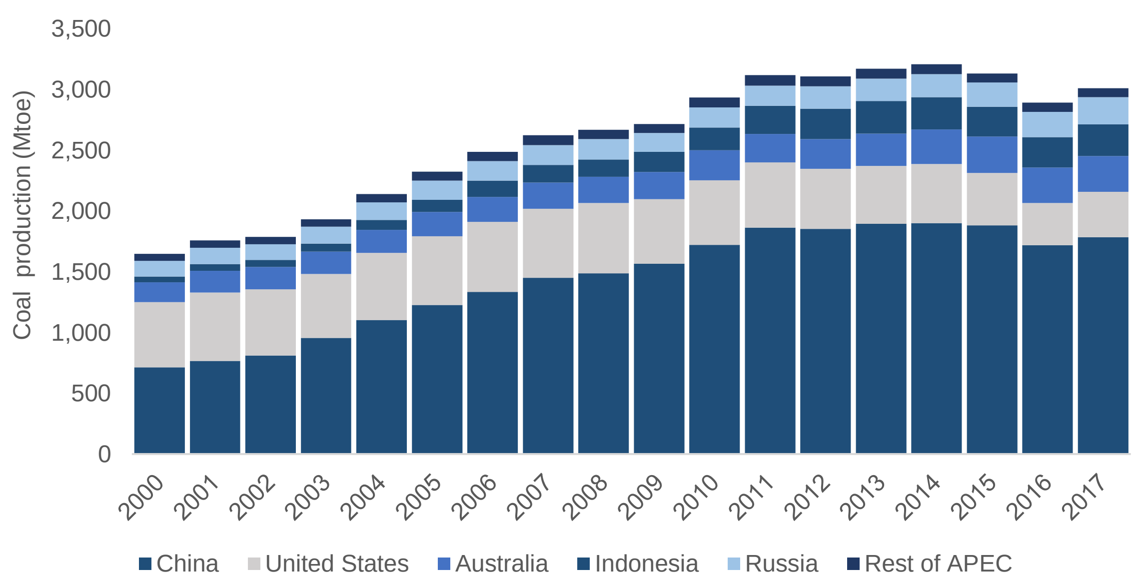
Figure 1.5: The proportional amount by which coal production exceeds coal demand (TPES), APEC, 2000-2017, and APEC coal production, 2000–2017



Source: (IEA, 2019a) APERC calculations

China's coal production peaked in 2014 at 1,902 Mtoe (Figure 1.6). In 2017, China's production of 1,786 Mtoe was 150% higher than its production in 2000. In contrast, US coal production has declined 30% from 2000 to 2017. The other largest APEC coal producers have posted large increases in coal production. Australia, Indonesia and Russia have grown their production by 78%, 478%, and 73%, respectively.

Figure 1.6: Coal production in APEC, by major producing economies, 2000–2017



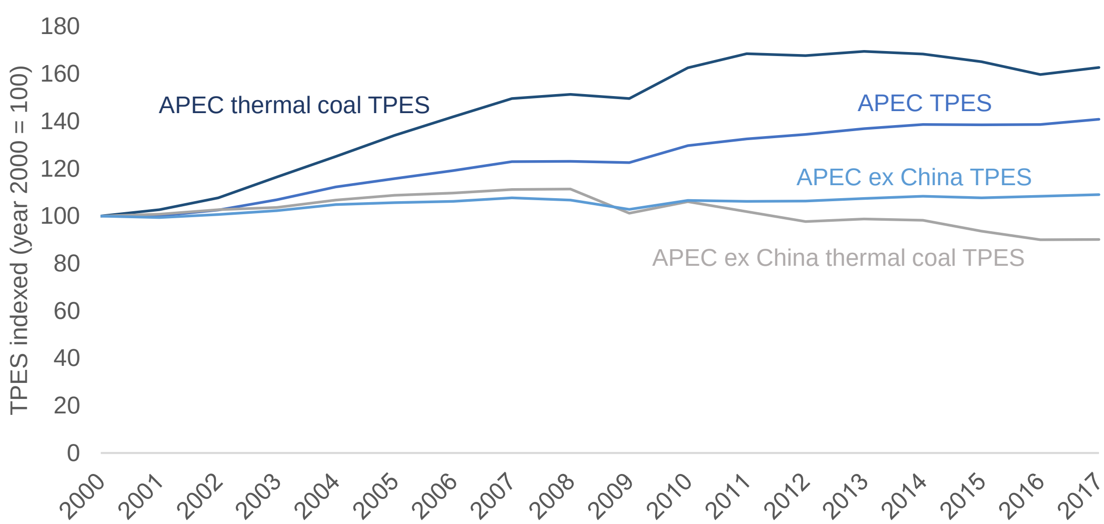
Source: (IEA, 2019a) APERC calculations

Thermal coal (including lignite) demand and supply in APEC

Energy demand (TPES) for APEC economies grew 41% from 2000 to 2017. Within this energy demand, APEC thermal coal (including lignite) demand has grown even more, peaking at a level 69% higher in 2013 relative to 2000. From 2013 onwards, thermal coal (including lignite) demand has declined, though is still 63% higher than it was in 2000. Figure 1.7 shows the growth in APEC energy demand (TPES), alongside APEC thermal coal (including lignite) demand.

The growth in thermal coal demand in the APEC economies is largely due to the growing use in China. China accounted for 68% of APEC thermal coal (including lignite) demand in 2017, up from 42% in 2000. China's thermal coal (including lignite) demand increased by 163% from 2000 to 2017. While large, this rate of increase was slightly lower than China's demand for all energy (TPES), which increased 171% from 2000 to 2017.

Figure 1.7: Thermal coal (including lignite) demand (TPES) compared with energy demand (TPES) for APEC, including and excluding China, 2000–2017, indexed



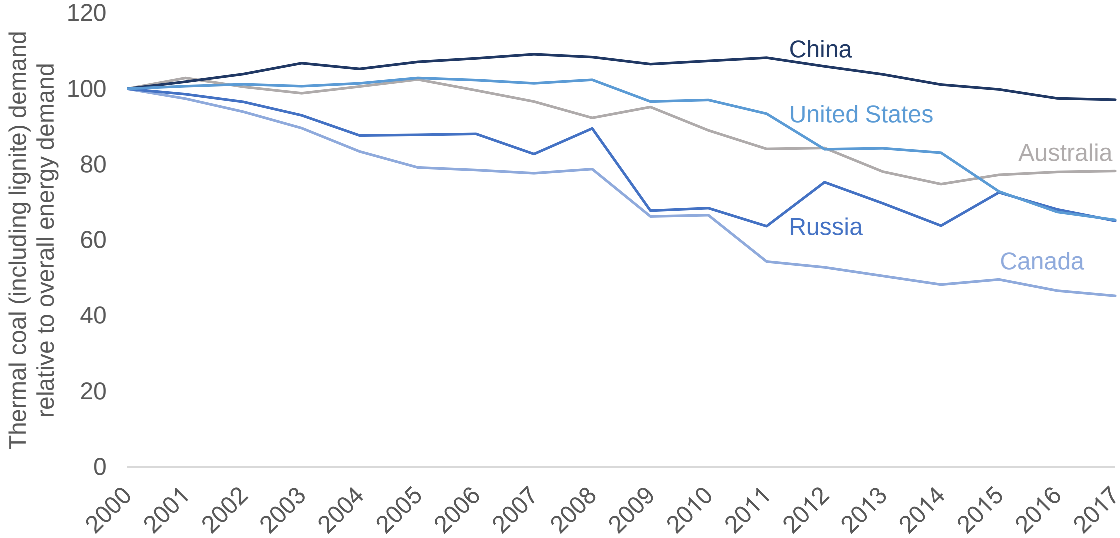
Source: (IEA, 2019a) APERC calculations

The relative price of thermal coal to alternative generation technologies (accounting for entire energy product supply costs and policy interventions) determines whether the proportional share of thermal coal to total energy demand is increasing, decreasing or remaining at similar levels. For many APEC economies, other energy sources have displaced thermal coal. For the US, the decline in thermal coal (including lignite) is mostly due to the shale gas boom; low natural gas prices have led to a transition from coal-fired power plants to natural gas fired power plants.

Different relative price forces are evident when looking at the growth in thermal coal (including lignite) demand relative to the growth in overall energy demand for individual economies. Figure 1.8 shows that China's thermal coal (including lignite) growth is occurring at a similar pace to overall growth in energy demand, though began to decline after 2008. For Australia, Canada, Russia, and the US, thermal coal (including lignite) demand is becoming a smaller share of overall energy demand. For

Australia, growth in coal demand from 2000 to 2017 is 22% lower than growth in overall energy demand (TPES). For the US, Russia, and Canada these declines are 35%, 35%, and 55%, respectively.

Figure 1.8: The proportional share of thermal coal (including lignite) demand to total energy demand (TPES), for select APEC economies, 2000–2017, indexed (2000 = 100)

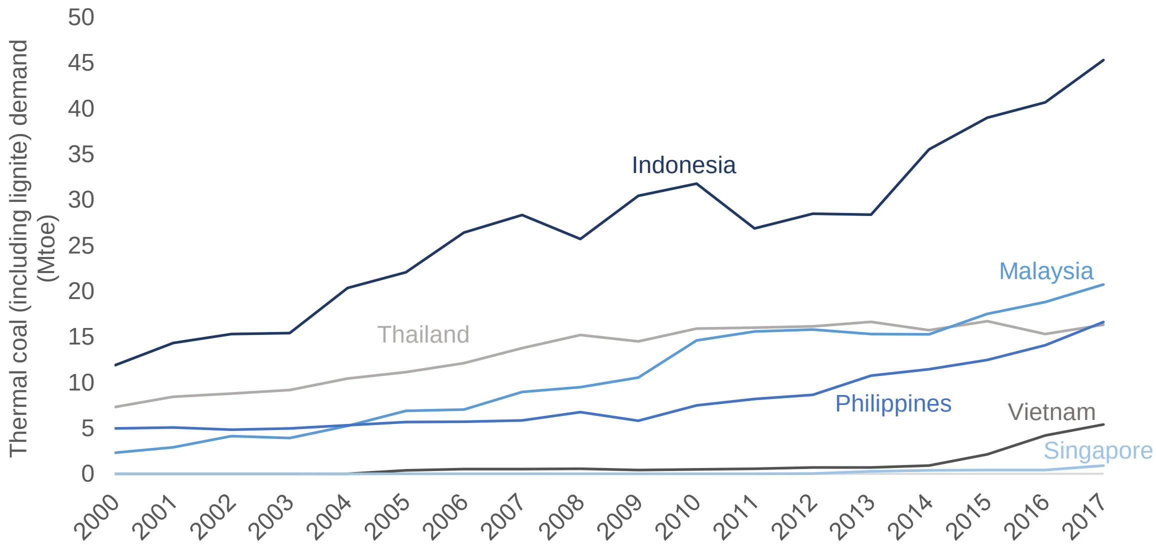


Source: (IEA, 2019a) APERC calculations

The relative decline shown in Figure 1.8 also corresponds with an absolute decline in thermal coal (including lignite) for Australia (8% fall from 2000 to 2017), Canada (48% fall), Russia (23% fall), and the US (38% fall). In contrast to the declining demand for thermal coal in these economies, 15 APEC economies recorded an increase in thermal coal demand (including lignite) from 2000 to 2017. The southeast Asian APEC economies recorded some of the largest growth in thermal coal demand for most recent years.

Figure 1.9 shows the increase in thermal coal (including lignite) demand (TPES) for southeast Asian economies, from 2000 to 2017. Energy demand in southeast Asia has increased from 364 Mtoe in 2000 to 640 Mtoe in 2017 (76% increase). Within this overall energy demand, thermal coal (including lignite) demand has almost quadrupled (297% increase), to 105 Mtoe in 2017. Though a significant increase, the share of thermal coal (including lignite) in southeast Asia's TPES remains relatively small at 16.5% in 2017 (up from 4.5% in 2000). The APEC southeast Asian economies accounted for 4.5% of APEC thermal coal demand in 2017.

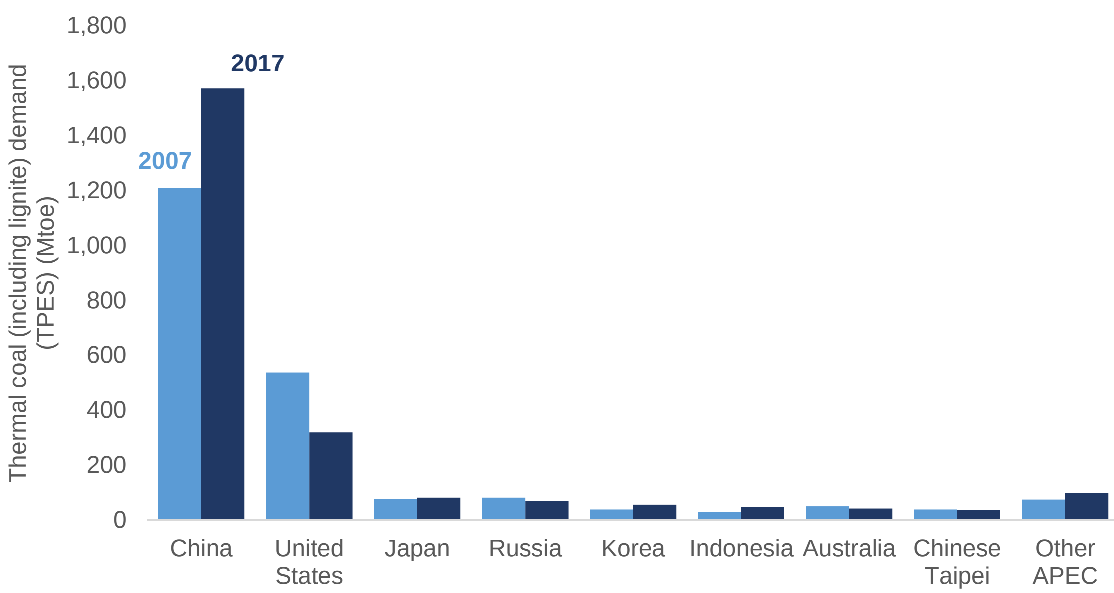
Figure 1.9: Thermal coal (including lignite) demand (TPES), for APEC southeast Asian economies, 2000–2017



Source: (IEA, 2019a) APERC calculations
Notes: Brunei Darussalam does not consume coal before 2019.

Figure 1.10 shows the magnitude of different levels of thermal coal demand for APEC economies for 2007 and 2017. China's level of thermal coal demand (including lignite) is much larger than all other economies and the chart illustrates why China has such a large influence on the overall APEC statistics.

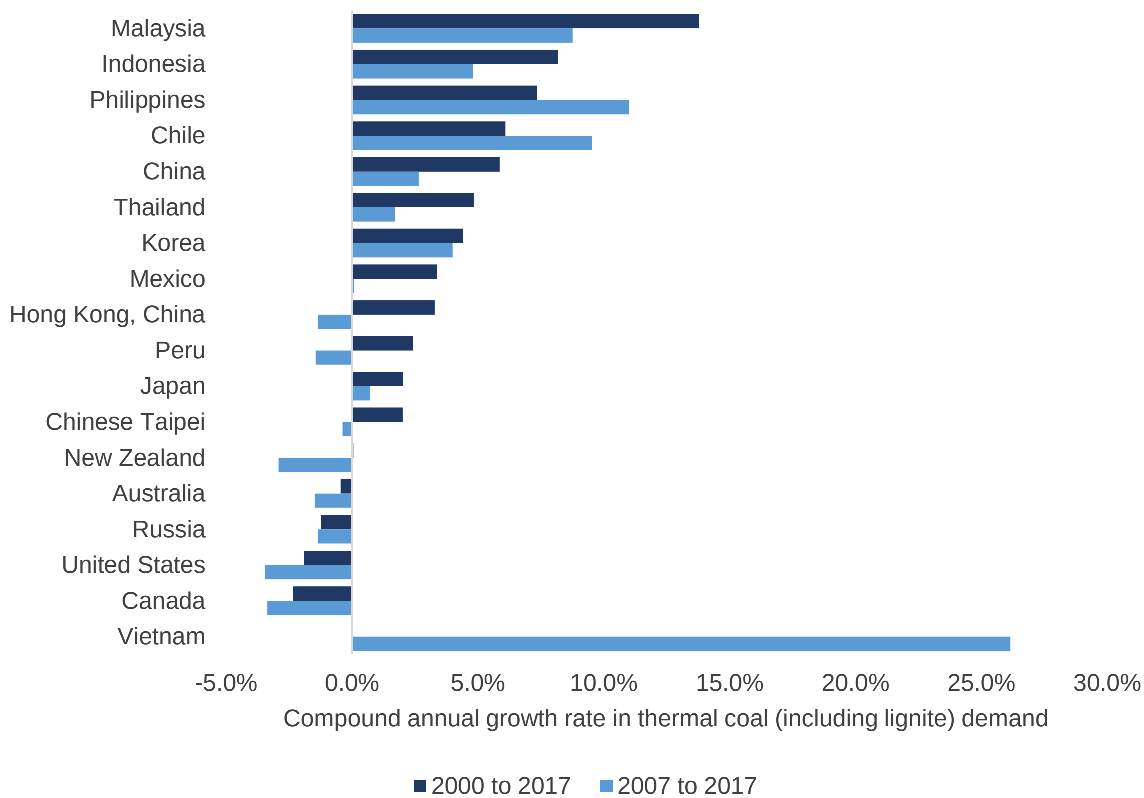
Figure 1.10: Thermal coal (including lignite) demand (TPES) for APEC economies, 2007 and 2017



Source: (IEA, 2019a) APERC calculations

Most other APEC economies have demand for thermal coal (including lignite) that pales in comparison to China. However, the rate of increase of thermal coal demand is rapid in certain APEC economies (as discussed for southeast Asia and shown in Figure 1.9). Figure 1.11 shows the compound annual growth rate in thermal coal (including lignite) demand for all APEC economies for the periods 2000 to 2017 and 2007 to 2017.

Figure 1.11: Compound annual growth rate in thermal coal (including lignite) for APEC economies, 2000–2017 and 2007–2017



Source: (IEA, 2019a) APERC calculations
Note: Viet Nam's coal demand was mostly zero before 2007, and so no growth rate is available for 2000-2017. Brunei Darussalam and PNG do not consume thermal coal; Singapore's demand for thermal coal was close to zero for the entire period.

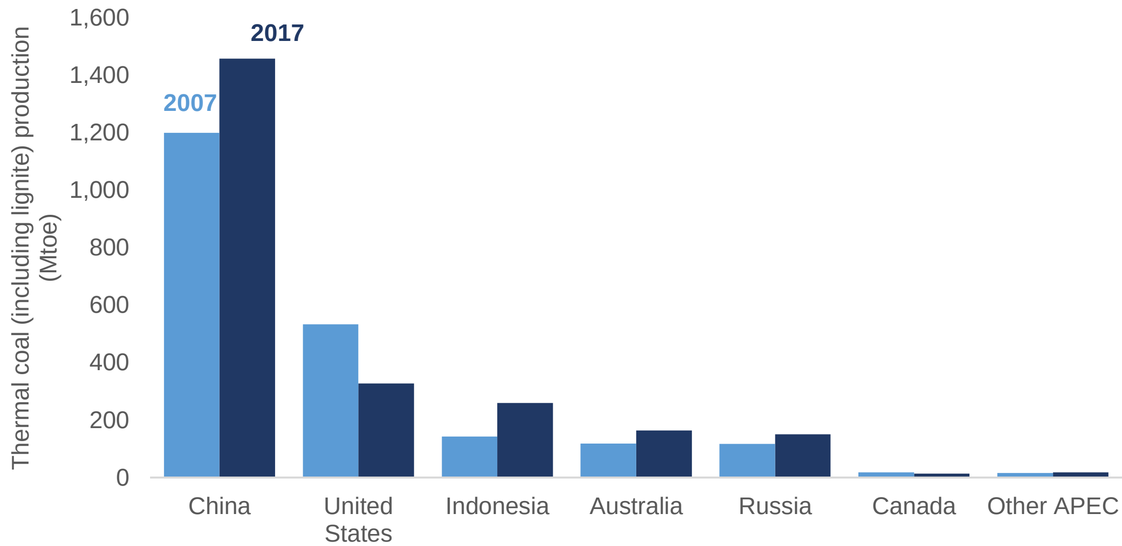
Malaysia's demand for thermal coal (including lignite) increased by an average of 14% for the entire 2000 to 2017 period, with this growth rate slowing to 8.8% for the most recent decade. Because thermal coal demand for Viet Nam was zero in 2000, no growth rate is available for the 2000 to 2017 period. But for the most recent decade of data, Viet Nam's thermal coal demand increased grew at a compound annual growth rate of 26.2%. This is partly a function of Viet Nam pursuing coal-fired power plants to meet their increasing demand for energy, and partly because coal demand was close to zero in the early 2000s (Figure 1.9). For most other APEC economies, thermal coal demand has slowed in the most recent decade to 2017. The exceptions are the Philippines and Chile, with 11% and 9.5% compound annual growth for 2007 to 2017, respectively.

As a marker for slowing demand for thermal coal (including lignite) in certain economies, eight APEC economies recorded negative growth in thermal coal demand for the more recent 2007 to 2017 period. For completeness, Brunei Darussalam and PNG had zero thermal coal demand for the entire

2000 to 2017 period (IEA, 2019a). While there is a slowing trend in thermal coal demand in APEC, thermal coal is meeting much of the rapidly increasing energy demand in southeast Asia. These trends are likely to continue in the short- to medium-term due to additional thermal coal power plants currently under construction.

China is also a standout producer of thermal coal (including lignite) in APEC, as shown in Figure 1.12. China's production was 1,457 Mtoe in 2017, up 22% from 2007. This level of production was 61% of all APEC thermal coal (including lignite) production in 2017, up from 56% in 2007. China's production of thermal coal was insufficient to meet its demand of 1,571 Mtoe in 2017, meaning China was a net importer of thermal coal. The US (327 Mtoe), Indonesia (260 Mtoe), Australia (164 Mtoe) and Russia (150 Mtoe) accounted for almost all remaining thermal coal production in APEC.

Figure 1.12: Thermal coal (including lignite) production for APEC economies, 2007 and 2017



Source: (IEA, 2019a) APERC calculations.

The growth in thermal coal will continue to be determined by its relative price in the market for power generation and industrial heat applications. In the short term this relative price is mostly tied to variable fuel costs. Over the medium- to longer-term, the relative price incorporates power plant investment costs, and other costs associated with the power generation, and industrial heat requirement, supply chains (Zweifel, Praktiknjo and Erdmann, 2017). These costs are influenced by the amount of time that a plant is operating; the capacity utilisation rate.

Multiple factors determine whether a new thermal coal-fired power plant is economically viable. Policy interventions (for example, a price on pollution or GHG emissions) and market conditions will be influential in determining the attractiveness of coal-fired power plants. In certain jurisdictions, coal fired power plants are not viable, due to legislated phase outs.[5] But even without government

[5] For example, there are legislated phase outs of coal fired power plants in Chile and Washington, US, and a commitment to aggressive renewable energy targets in New Zealand and Canada.

intervention, obtaining coal fired power plant financing is becoming difficult. This will be discussed in Chapter 2.

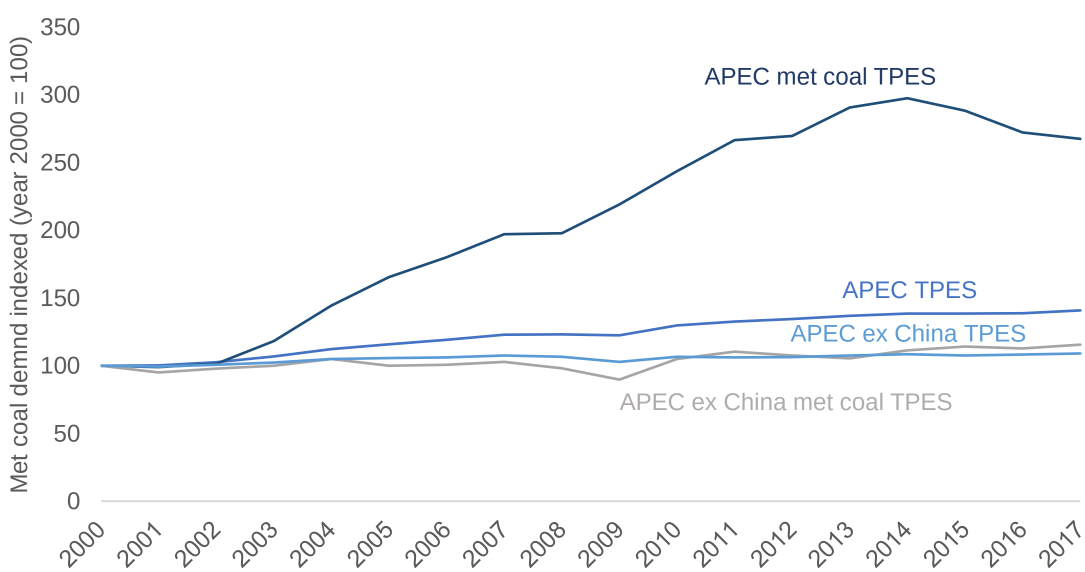
For those coal-fired power plants already operating, thermal coal fuel costs are still low in comparison to alternative generation technologies in most regions. Already built thermal coal power plants will continue to be an important source of power supply due to the current cost competitiveness of thermal coal, relative to available alternatives. This competitiveness will diminish if policy interventions intensify to address pollution and lower emissions, or if technological innovation leads to reductions in cost of alternative technologies below the costs for coal-fired power.

Metallurgical coal demand and supply in APEC

Metallurgical coal demand is tied closely to steel demand. A certain proportion of steel demand is met via recycled ferrous (iron) scrap. There are also experimental, small-scale steel production technologies that forego metallurgical coal (Pooler, 2019). But for the most part, metallurgical coal is a foundational input for global steel production that is not easily substitutable.

Figure 1.1 shows that the market for metallurgical coal is much smaller than thermal coal, on an energy basis. In 2017, metallurgical coal accounted for 19.7% of APEC coal production and 17.8% of APEC coal demand (TPES). This share has grown in recent decades because metallurgical coal demand is less substitutable and less responsive to emissions and pollution policies than thermal coal demand. Metallurgical coal demand is likely to track construction and infrastructure demand, with this tied to economic growth more broadly.

Figure 1.13: Metallurgical coal demand and overall energy demand (TPES) for APEC, including and excluding China, 2000–2017, indexed (2000 = 100)



Source: (IEA, 2019a) APERC calculations.

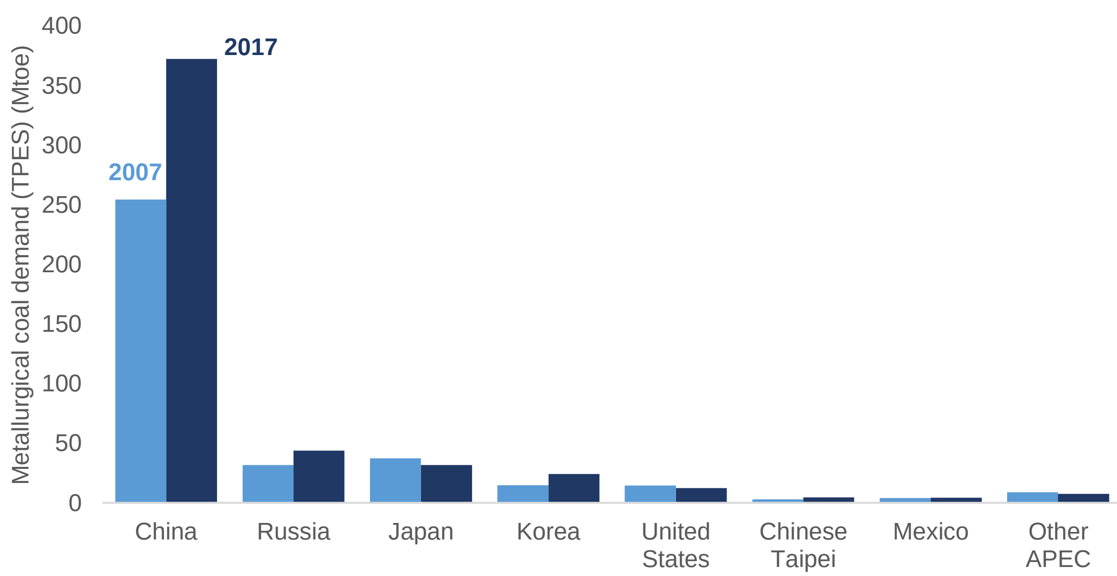
Figure 1.13 shows the very large increase in metallurgical coal demand in the APEC economies from 2000 to 2014. Demand for metallurgical coal has recently declined, down 10% in 2017 compared with the peak in 2014. Metallurgical coal demand in the APEC economies almost tripled from 2000 to 2014 (197% increase). In contrast, the increase in APEC thermal coal demand was only 69% higher at its peak in 2013 (relative to 2000).

The very large increase in APEC metallurgical coal demand since 2000 is mostly attributable to China. China's rapid economic growth of the past few decades has relied on a commensurate amount of steel. China's domestic demand for steel is also complemented by significant growth in its export-driven steel industry. In 2019, China accounted for 53% of global steel production and exported 64 million tonnes of the global 436 million tonnes of steel trade, making it the world's largest steel exporting economy (WSA, 2020).

APEC metallurgical coal demand outside China has increased yearly since the Great Recession to now be 29% higher in 2017 relative to 2009. The slowdown in metallurgical coal demand in China since 2014 aligns with a slowdown in Chinese heavy and primary industries (Sandalow, 2019).

China's metallurgical coal demand peaked in 2014 at 433 Mtoe. Metallurgical coal demand has since decreased 14% to 372 Mtoe. China's demand for metallurgical coal in 2017 is still 46% higher than in 2007 (Figure 1.14) and accounted for 74% of APEC metallurgical coal demand in that year. The next largest metallurgical coal demanding economies were Russia (44 Mtoe), Japan (32 Mtoe), Korea (24 Mtoe) and the US (12 Mtoe). Nine APEC economies have no steel industry and zero demand for metallurgical coal.

Figure 1.14: Metallurgical coal demand (as measured by TPES) for APEC economies, 2007 and 2017

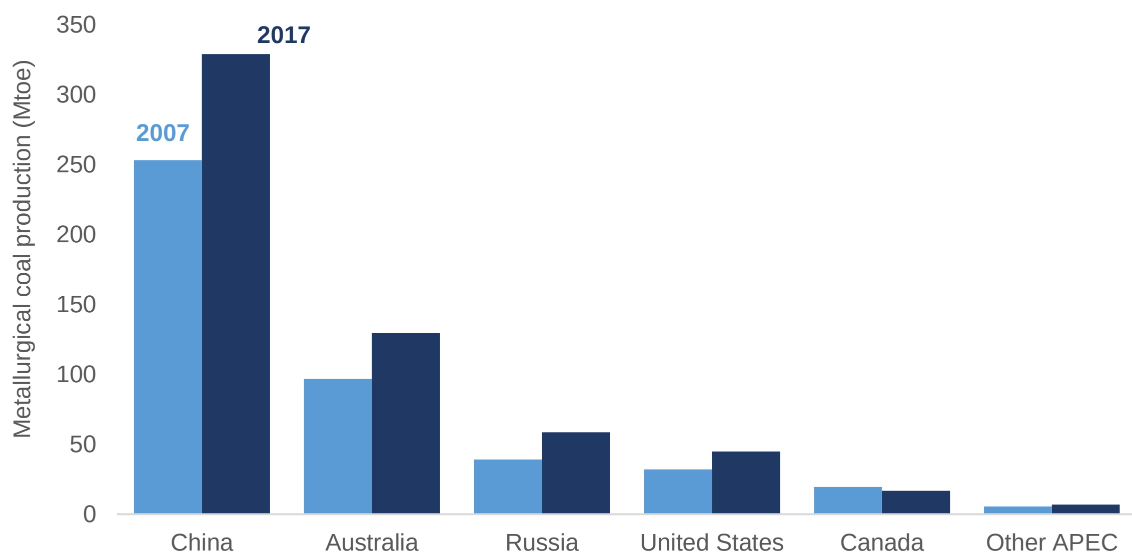


Source: (IEA, 2019a) APERC calculations.

In 2017, APEC metallurgical coal demand (TPES) was 501 Mtoe. Nine APEC economies produced 585 Mtoe of metallurgical coal to more than meet this demand. China was the largest producer of metallurgical coal in 2017, producing 329 Mtoe (Figure 1.15). While large, this level of production was insufficient to meet its domestic demand (372 Mtoe), meaning China was a net importer of 43 Mtoe of metallurgical coal.

Australia was the second-largest metallurgical coal producer in 2017. Of the 129 Mtoe of metallurgical coal Australia produced in 2017, only 3 Mtoe was consumed domestically. The large remainder supplied export markets throughout the world. Russia (59 Mtoe), the US (45 Mtoe) and Canada (17 Mtoe) accounted for almost all the remaining APEC metallurgical coal production in 2017.

Figure 1.15: Metallurgical coal production for APEC economies, 2007 and 2017



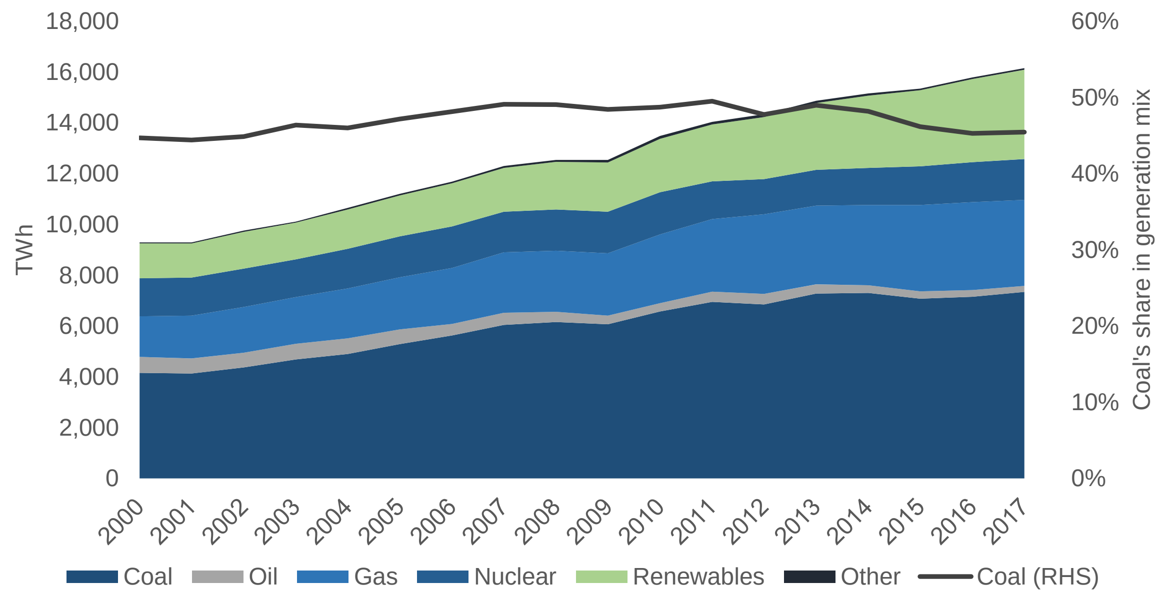
Source: (IEA, 2019a) APERC calculations.

Sectoral trends

Coal-fired electricity generation in APEC

Coal fuelled 7,344 terawatt hours (TWh) of electricity in the APEC economies in 2017 (Figure 1.16). This level was 2.7% higher than in 2016 and is consistent with the uptick in thermal coal demand (TPES). The increase in coal-fired power generation outpaced the increase in total power generation for the first time since 2013. This meant that coal's share in the APEC generation mix stabilised at 45.5% in 2017, as shown in Figure 1.17.

Figure 1.16: Power generation mix in APEC, including coal's proportional share, 2000–2017



Source: (EGEDA, 2019), APERC calculations.

Coal's share of power generation peaked in 2011 at 49.5%. Since then, the share has been gradually declining; the combined growth of other power generation technologies has outpaced the growth of coal consumption in the power sector. In absolute numbers, thermal coal has continued to increase from 6,041 TWh of generation in 2007 to 7,344 TWh in 2017. This growth is not a consistent trend across all APEC economies.

The largest fall in absolute terms was in the US, with coal-generated power falling 38% from 2,118 TWh in 2007 to 1,321 TWh in 2017. Much of this fall in the US is due to the shale gas boom, with lower cost gas-fired generation displacing coal-fired power generation. For this same period, coal-fired power generation was also lower in Canada (41 TWh lower; 41% lower), Australia (25 TWh; 14%), Hong Kong, China (14 TWh; 38%), Chinese Taipei (2.6 TWh; 2.0%), New Zealand (1.9 TWh; 62%), Mexico (0.6 TWh; 1.9%) and Peru (0.1 TWh; 7.8%). All other APEC economies generated an increased amount of coal-fired power. China led the way with coal-fired power generation reaching 4,437 TWh in 2017, an increase of 1,809 TWh (69%) since 2007. Other large increases for the same period were from Korea (85 TWh; 50%), Indonesia (84 TWh; 132%), Japan (54 TWh; 18%) and Viet Nam (53 TWh; 376%).

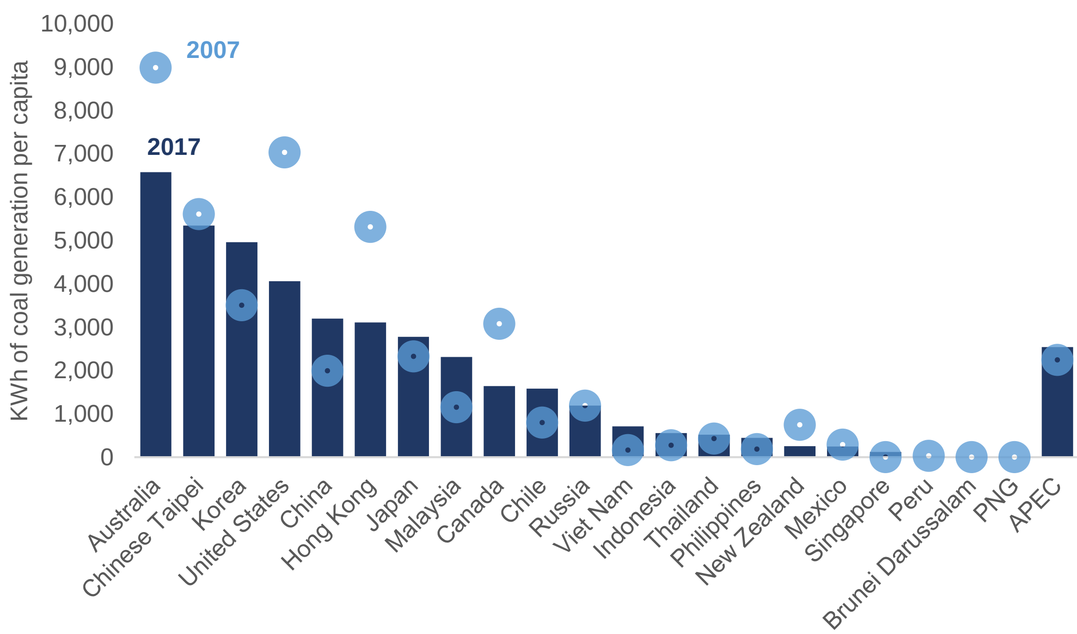
The large increase in southeast Asia coal-fired generation reflects strategies to meet rapidly increasing energy demand with relatively low-cost thermal coal. However, the growth in coal capacity is beginning to slow. This recent slowdown is due to the increased difficulty in securing thermal coal power plant financing, increased competitiveness of alternative generation technologies, and shifting political will.

Coal-fired generation was 2,544 kilowatt hours (KWh) for every person in the APEC region in 2017, as shown in Figure 1.17. This represents an increase of 13.4% since 2007. But this increased per capita demand for coal fired electricity generation is again, not consistent across all APEC economies. Australia had the highest per capita demand for coal-fired electricity generation in 2017 at 6,578 KWh per person. While high, this was 27% lower than their coal fired electricity demand in 2007 (8,989 KWh per person).

Multiple APEC economies recorded even larger proportional decreases in per capita demand for coal fired electricity over the period 2007 to 2017. New Zealand, Canada, the United States, and Hong Kong reduced their per capita coal-fired electricity demand by 66%, 47%, 42%, and 42% respectively.

In contrast, China's per capita coal fired electricity demand, increased 61% to 3,201 KWh per person in 2017. This per capita demand remains smaller than Australia, Chinese Taipei, Korea and the United States. Korea's per capita thermal coal growth was 42% for the same period and now places the economy in the number three position with 4,965 KWh of coal-fired electricity generation per person.

Figure 1.17: Coal per capita electricity generation in KWh, 2007 and 2017



Source: (EGEDA, 2019), APERC calculations

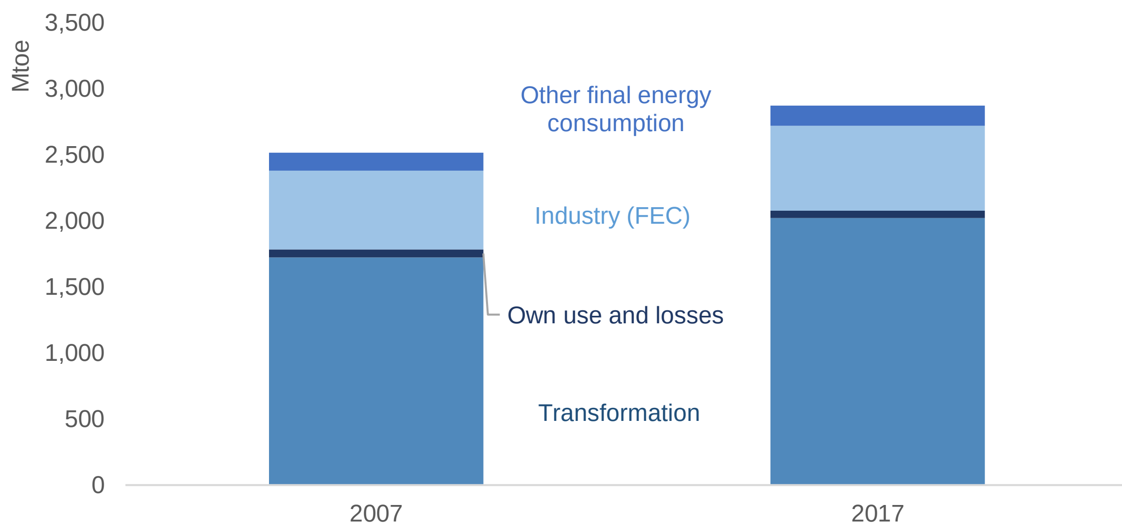
In southeast Asia, per capita coal fired electricity generation growth for 2007 to 2017 has been very high. This reflects the rapid economic growth of these economies and investment in low cost thermal coal to meet rising energy demand. Malaysia has the highest per capita coal demand out of APEC southeast Asian economies, at 2,313 KWh in 2017. This level of per capita demand is double what it was in 2007.

The growth in per capita coal-fired electricity generation for the decade to 2017 was even higher in Viet Nam (330%), the Philippines (137%) and Indonesia (104%). Even with these considerable growth rates, these economies are all consuming considerably less than the highest coal per capita consuming economies in APEC. Thailand's per capita growth in coal-fired electricity between 2007 and 2017 is modest in comparison at 19% (517 KWh of per capita thermal coal demand). Thailand has relied on natural gas, rather than coal, to meet its increasing demand for electricity.

Coal is primarily used in the transformation sector

The transformation sector accounted for 70% of coal demand (TPES) in the APEC economies in 2017 (Figure 1.18). The transformation sector consumes both thermal coal (in power plants) and metallurgical coal (in coke ovens). This represents a slight increase from 68% a decade earlier. Final energy consumption by industry accounted for 22% of coal demand (TPES) in 2017, which is down from 24% in 2007.

Figure 1.18: Coal demand (TPES) in APEC by sector, 2007 and 2017



Source: (IEA, 2019a) APERC calculations.

Coal's relatively low cost and consistent heating properties make it an ideal fuel for producing cement, an industry that is a large coal consumer. China's rapid economic growth has relied heavily on cement to build cities and infrastructure. Even with large demand for cement, there has been considerable overcapacity in China's cement industry. In response to this overcapacity, China enacted policies to consolidate the industry in 2013, which led to significant falls in capacity and production (Saunders and Edwards, 2016). This partly explains why the proportional share of industry use of coal fell in 2017 relative to 2007. Other final consumption and energy own use and losses accounted for the remaining share of coal demand (TPES).

Coal trade in APEC

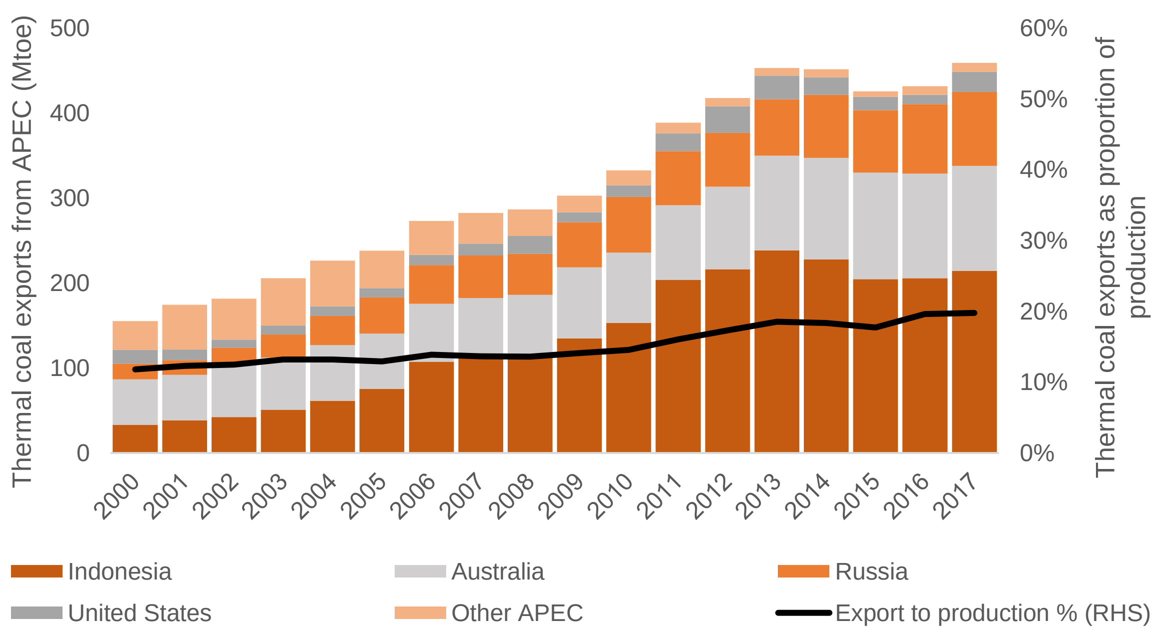
In 2017, APEC member economies imported 364 Mtoe of thermal coal and 112 Mtoe of metallurgical coal to satiate their demand. The APEC coal producing economies simultaneously exported 459 Mtoe of thermal coal and 190 Mtoe of metallurgical coal.

The top three global exporters of coal in 2017 were all APEC economies: Indonesia, Australia and Russia. APEC economies were also major coal importers in 2017. China, Japan, Korea and Chinese Taipei were joined by India, the second-largest importer and only non-APEC economy in the top five coal importing economies (IEA, 2019a).

Thermal coal

Figure 1.19 shows that thermal coal exports have grown considerably since 2000 in APEC, though they fell in 2014 and 2015, before recovering in 2016 and 2017. The proportion of APEC thermal coal exports to APEC thermal coal production has increased from 12% in 2000 to 20% in 2017. Indonesia's thermal coal exports have increased from 33 Mtoe in 2000 to 214 Mtoe in 2017, a 547% increase. Indonesian thermal coal exports peaked at 239 Mtoe in 2013. Indonesia, Australia and Russia accounted for 93% of APEC thermal coal exports.

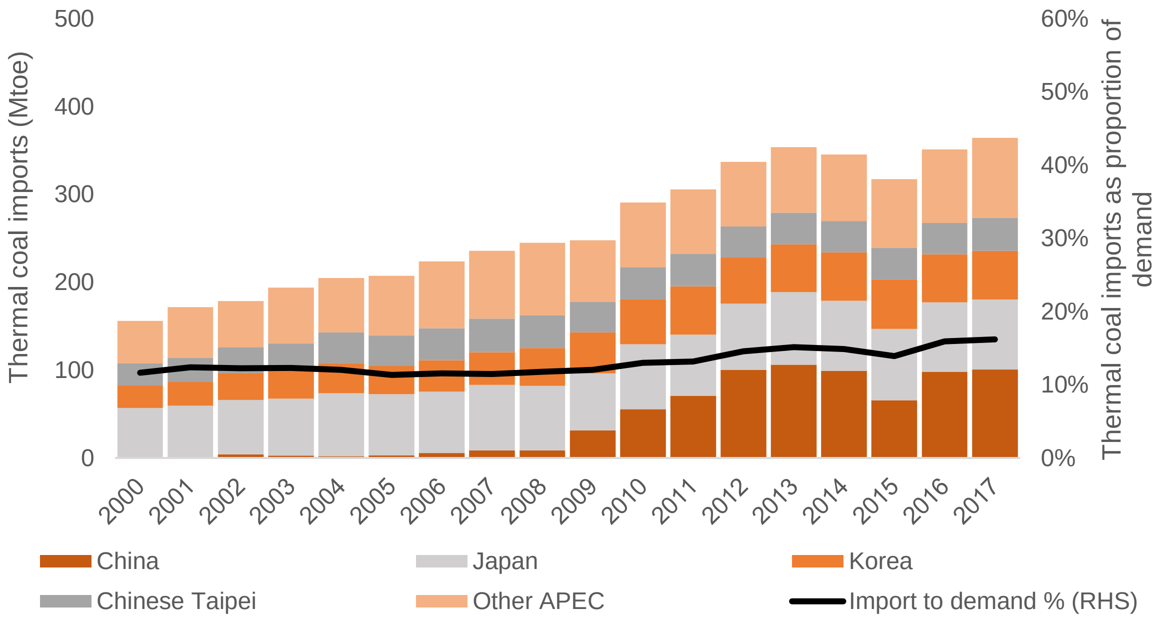
Figure 1.19: Thermal coal exports and proportion of thermal coal exports to APEC thermal coal production, APEC economies, 2000–2017



Source: (IEA, 2019a) APERC calculations.

APEC thermal coal imports were 21% lower than APEC thermal coal exports in 2017. China was the largest thermal coal importer in 2017, importing 101 Mtoe (Figure 1.20). In 2008, China's thermal coal imports were much smaller at only 8 Mtoe. This rapid ramp-up in thermal coal imports accords with Figure 1.4, which shows China's coal production unable to keep pace with its demand for the most recent decade of available data.

Figure 1.20: Thermal coal imports and proportion of thermal coal imports to thermal coal demand, APEC economies, 2000–2017



Source: (IEA, 2019a) APERC calculations.

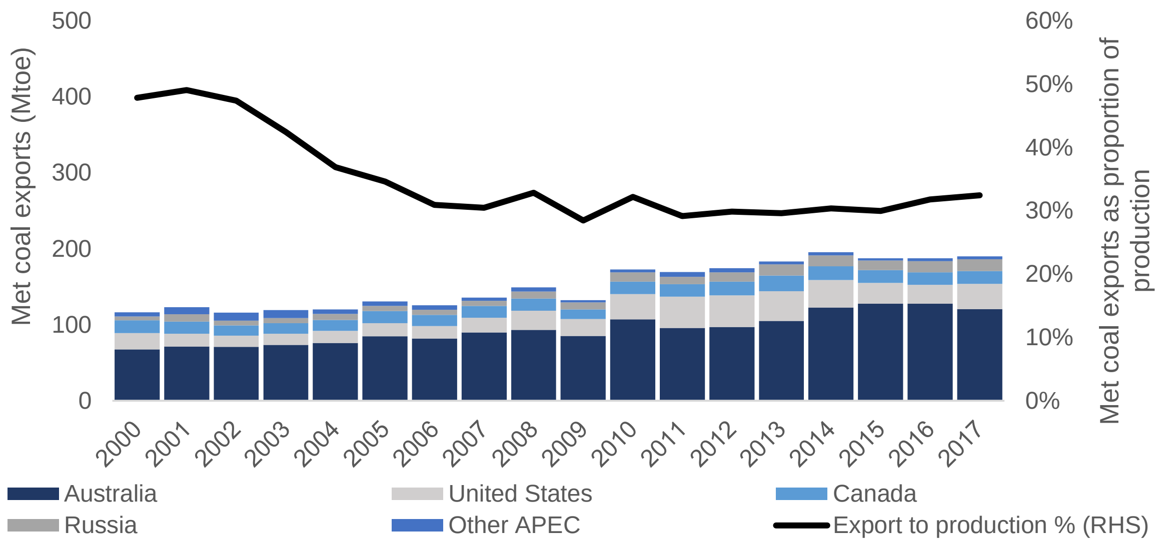
In 2017, Japan, Korea and Chinese Taipei were the next-largest thermal coal importers, importing 80 Mtoe, 55 Mtoe, and 37 Mtoe, respectively. APEC thermal coal imports as a proportion of APEC thermal coal demand (TPES) have only recently begun to grow. In 2000, the proportion was 12% and in 2017, 16%. For southeast Asian economies Malaysia, Thailand and the Philippines, thermal coal imports were 128%, 71% and 187% higher in 2017 relative to 2007. Growth in thermal coal imports is expected to continue in the southeast Asian economies to fuel their expanding fleet of coal-fired power plants.

Metallurgical coal

The APEC trade in metallurgical coal was smaller in absolute energy terms than APEC thermal coal trade. But as a proportion of production (for exports) and demand (for imports), metallurgical coal is traded more than thermal coal. Figure 1.21 shows that metallurgical coal exports have steadily increased from 123 Mtoe in 2000 to 190 Mtoe in 2017. Australia accounted for 61% (121 Mtoe) of all APEC metallurgical coal exports in 2017, followed by the US (33 Mtoe), Canada (17 Mtoe) and Russia (15 Mtoe).

APEC metallurgical coal exports as a proportion of APEC metallurgical coal production were as high as 49% in 2001, though they fell to 32% in 2017. Close to 3 out of every 10 tonnes of metallurgical coal produced in APEC has been exported since 2007.

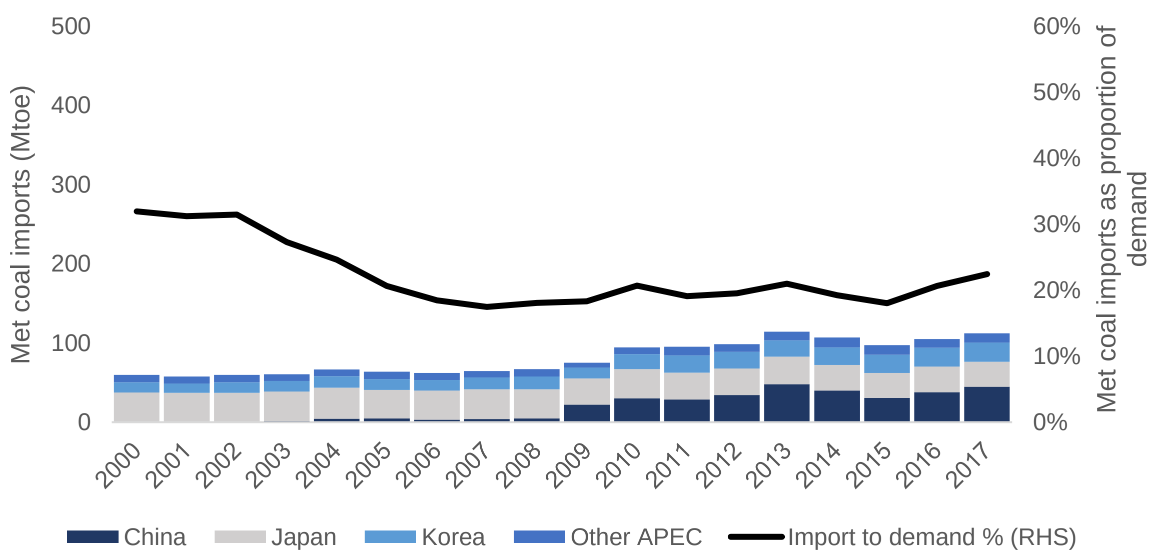
Figure 1.21: Metallurgical coal exports and proportion of metallurgical coal exports to APEC metallurgical coal production, APEC economies, 2000–2017



Source: (IEA, 2019a) APERC calculations.

In a similar story to thermal coal, China was the largest importer of metallurgical coal in APEC (45 Mtoe) in 2017 (Figure 1.22). As recently as a decade before, China's metallurgical coal imports were close to zero. Again, this rapid ramp up was because China's coal production was unable to meet their rapidly growing coal demand. Japan and Korea were the next-largest metallurgical coal importers, importing 32 Mtoe and 24 Mtoe, respectively. China, Japan and Korea accounted for 89% of APEC metallurgical coal imports.

Figure 1.22: Metallurgical coal imports and proportion of metallurgical coal imports to metallurgical coal demand, APEC economies, 2000–2017



Source: (IEA, 2019a) APERC calculations.

APEC metallurgical coal imports were 32% of APEC metallurgical coal demand (TPES) in 2000. This proportion declined over the subsequent decade to 21% in 2010 and was 22% in 2017.

Chapter 2: Coal Demand and Supply Outlook

Thermal coal and metallurgical coal supply and demand trends discussed in Chapter 1 show that coal is a foundational input for most APEC economies. For thermal coal, a competitive relative price in recent decades (relative to alternative power generation and heat providing technologies) has meant that thermal coal is the most prominent fuel in the APEC energy mix. Metallurgical coal is a similarly important fuel, though its importance is less to do with relative prices and more to do with meeting the demand for steel, a difficult to substitute product.

At the time of writing, widespread economic shutdowns are still in effect due to the COVID-19 pandemic. It's possible that there will be a V-shaped recovery, and that the world returns to a similar economic trajectory that was in place beforehand. But it's also possible that the recovery is drawn out, with a significant, and long-lasting slowdown for all sectors and industries. The uncertainty of this pandemic (from a health and economic perspective) is plain and reflected by volatility in almost all markets.

The short-term outlook for both thermal and metallurgical coal is contingent on how the global economy recovers from the current pandemic. The IEA expects that global coal demand fell 8% in the first quarter of 2020. The APEC region will record similar sized falls in coal demand. These are large impacts, but over the medium- to long-term, other factors will become more influential. This chapter discusses these other factors.

Coal markets

Coal demand and coal supply meet at a dynamic equilibrium through prices. But price formation is subject to market characteristics of varying degrees across APEC economies, and the world broadly. Some of the more prominent factors to influence the market equilibrium for coal are discussed in this section.

Subsidies

There are varying forms of subsidies for different aspects of the coal product chain. Such assistance can involve:

- getting coal to market; transportation subsidies
- providing generous leasing terms for mining operations
- shouldering disproportionate project risks through low-cost financing
- guaranteeing revenue for coal-fired power plants.

The prevalence of these implicit and explicit subsidies means that either the demand for, or supply/production of, thermal coal is higher than otherwise. For difficult to substitute metallurgical coal, subsidies are less influential due to less responsive (inelastic) demand.

These types of support are not unique to coal. Other fossil fuels and renewable energy sources receive varying levels of support, depending on the economy. The demand and supply outlook for coal is shaped by these economy policies that provide varying levels of support.

In China, guaranteed operation hours and administered wholesale electricity prices have encouraged coal-fired power since the 1980s (Ren *et al.*, 2019). In the US, coal is indirectly supported via electricity subsidies, given that most coal consumption in the US is for electricity generation (EIA, 2018). For Russia, publicly subsidised railways are supporting coal exports (IEEFA, 2015).

The IEA estimates that global consumption subsidies to coal in 2018 amounted to USD 3 billion (IEA, 2019c). This level of support will impact supply and demand at the margin. But against the larger trends of a movement away from polluting, high GHG-emitting technologies, and increasing cost competitiveness of alternative power generation technologies, subsidies have a lower impact.

The distortions from subsidies are not necessarily suboptimal either. In many cases, subsidies are important to smooth the transition away from fossil fuels, such as for communities that derive a large proportion of income from coal mining (Columbia SIPA, 2019).

Financing

There is increasing difficulty in obtaining financing for thermal coal projects in many APEC economies. A growing list of financial institutions including insurers, banks, and assets managers have made public statements indicating that they will no longer support new coal-fired power plants or new thermal coal mines.

Globally, 200 GW of new coal-fired power plant capacity are under construction (Global Energy Monitor, 2020). An additional 300 GW of capacity are in earlier stages of the development pipeline. In a declining market for thermal coal financing, many of these projects are unlikely to be built.

APEC southeast Asian economies are home to a significant proportion of thermal coal plant construction and development activity. At the beginning of 2020, there were 12 GW of capacity under construction in Indonesia, 8.7 GW in Viet Nam, and 1.6 GW in the Philippines (Global Energy Monitor, 2020). An additional 52 GW of coal-fired power plants are in the development pipeline for APEC southeast Asian economies.

In China, almost 100 GW of coal-fired power plants are currently under construction, with an additional 106 GW in the development pipeline. There is also 9.3 GW of coal-fired power capacity under construction in Japan and 7.3 GW in Korea. Financial institutions in China are the largest source of financing for thermal coal projects throughout the world. Fellow APEC economies Japan and Korea are home to the other major institutions that provide thermal coal financing.

Part of the reason for a shrinking thermal coal financing market is that some institutions are taking concerted efforts to reduce pollution and reduce GHGs. But an equally prominent reason is that thermal coal-fired plants are becoming less economically viable. Carbon prices are absent in many jurisdictions and markets. But there is an expectation that explicit or implicit mechanisms will be instituted. Financing a thermal coal project that is likely to be subject to increased operating costs, via a carbon price, becomes less attractive relative to alternative investments.

To speak to the diminishing investment environment for coal, a recent survey of institutional investors identified an average hurdle rate for new coal mines of 40% (West, Poudineh and Fattouh, 2019). Some of the responding investors were unwilling to finance new coal mines, no matter the rate of return. The unwillingness to invest in coal has implications for the supply outlook. Constrained supply brought on by lower levels of investment could lead to supply and demand mismatches, and price spikes. This has negative implications for an orderly transition away from fossil fuels. On the other hand, thermal coal price spikes will make alternative generation sources more competitive and potentially spur the transition away from thermal coal more quickly than anticipated.

Carbon pricing

The size of the global coal market is supported by the presence of subsidies. Carbon pricing typically has the opposite effect. APEC economies currently have multiple forms of economy-wide and sub-economy carbon pricing policies. These carbon pricing policies affect demand for, and supply of, coal by imposing a price on carbon dioxide or equivalent emissions associated with coal at the point of use.

Chile, Mexico, Canada and Japan each have an economy-wide carbon tax in place (World Bank, 2020). In the case of Canada, the economy fuel charge (carbon tax) acts as a backstop if provincial carbon tax policies do not meet a minimum baseline. Australia, New Zealand, Korea, Mexico and Canada have economy-wide emissions trading systems (ETSs). These are either cap-and-trade or baseline-and-credit arrangements.

China is set to institute an economy wide ETS in 2021. Japan, Indonesia, Viet Nam, Chinese Taipei, and Chile are also deliberating on economy wide ETSs. In addition to Canada's provincial carbon taxes, China, Japan, and the US each have multiple sub-economy ETSs in place, such as the California and Tokyo Cap-and-Trade programs.

There is a trend for economies to account for the cost of emissions and facilitate a sufficiently paced transition to a net-zero global economy.[6] But these policies are politically fraught. Communities that derive income from fossil fuels are susceptible to policies that do not appropriately manage the imposition of climate change costs (Columbia SIPA, 2019). Regional and global coordination is also important when instituting such policies. Carbon pricing policies that do not have adequate border accounting mechanisms will typically shift production and consumption from one jurisdiction to another, without achieving a net improvement in global emissions.

APERC and other institutions release periodic forecasts that model alternative future energy demand and supply scenarios. In scenarios with binding carbon prices, thermal coal demand falls at a pace that is commensurate with the magnitude of the carbon price. In the most recent APERC energy demand and supply outlook, the climate change scenario enacts a global cap-and-trade constraint

[6] Net zero refers to net zero carbon dioxide (or equivalent) emissions.

which sees coal demand displaced by alternative technologies. Details of this forecast are provided in the APEC Energy Demand and Supply Outlook section.

Carbon capture, utilisation and storage

CCUS technologies are an important element in the portfolio of solutions designed to address the risks of climate change (National Petroleum Council, 2019). But deployment of these technologies is currently limited. For power generation, there are only three operational coal-fired power plants with these technologies in the world (all are in APEC). The first is the Boundary Dam coal-fired power station in Saskatchewan, Canada. The second is the Petra Nova coal-fired power plant in Texas (EIA, 2017). The last is the Haifeng carbon capture test platform of China Resources. China has also had multiple other operational coal-fired CCS facilities, though most are no longer operational.

The limited deployment of CCUS technologies is mostly due to cost.[7] For a thermal or industrial power plant, CCUS requires additional capital expenditure and increased operating costs, relative to a similar plant without CCUS. Part of the additional operating costs involves a loss of efficiency (parasitic energy losses), or the need for additional energy from an external source. In jurisdictions that institute a carbon price or similar policy, CCUS deployment will become increasingly cost competitive.

Retrofitting CCUS technologies is one of the least-cost options for continuing to meet rising energy demand, and meeting emissions reduction targets (Coal Industry Advisory Board, 2019). This is especially true for many emerging economies in APEC, that are home to newly built coal-fired power plants. At the end of 2018, China had retrofit 810 GW of coal-fired plants with ultra-low-emissions technology. High efficiency pulverized industrial coal boilers, used by China, have bulk coal combustion thermal efficiency of over 90%.

For future energy scenarios with high renewables penetration, high efficiency, low-emitting coal plants equipped with CCS have the potential to provide the lowest abatement costs over the medium to long term (Gamma Energy Technology and RedVector, 2018).

Retirement of mature coal-fired power plants often makes economic sense. These plants have already been depreciated and are often at the end of their useful operating life. But for newer coal plants, such as many built in southeast Asia and China, premature retirement is economically costly. CCUS is one of the best prospects for avoiding the costs of early retirement and meeting emissions reduction goals.

Economy support for CCUS research, development and deployment, will continue to drive cost reductions, and improve the economic viability for coal, and other fossil fuels. The US recently spurred improvements in the economics for CCUS via the 45Q tax credit, enacted in February 2018. The tax credit provides a market-based incentive for enterprises to actively develop CCUS technologies. Industrial manufacturers that capture carbon from their operations can earn USD 50 per tonne of CO_2 stored permanently. Alternatively, they can earn USD 35 if the CO_2 is used for additional applications

[7] There are also risks to economic viability when captured CO_2 falls short of projections. The Boundary Dam project was required to pay a penalty for not delivering an agreed amount of CO_2 (MIT, 2016). This has disincentivised additional projects.

such as EOR.

The learnings from the initial CCUS power plants in Saskatchewan, Texas, and multiple units in China are leading to cost savings strategies for a new suite of projects, throughout the world. Even so, the development pipeline for new CCUS facilities is currently lagging the required deployment needed to meet emissions reductions ambitions set out in the Paris Accord. Expansion of CCUS in APEC is reliant on policy support. The speed of development, support and uptake of CCUS will influence ongoing demand and supply for coal in APEC.

The current development of CCUS is tied mostly to power generation. For sectors that are the most difficult to decarbonise, such as steel manufacturing, CCUS is crucial for achieving net-zero emissions goals. Successful research, development and deployment of CCUS technologies for these industrial applications will support future coal demand and supply.

Box 1 – Coal divestment policies: The end of the coal age in APEC economies is coming, but divesting coal could be slower than you think

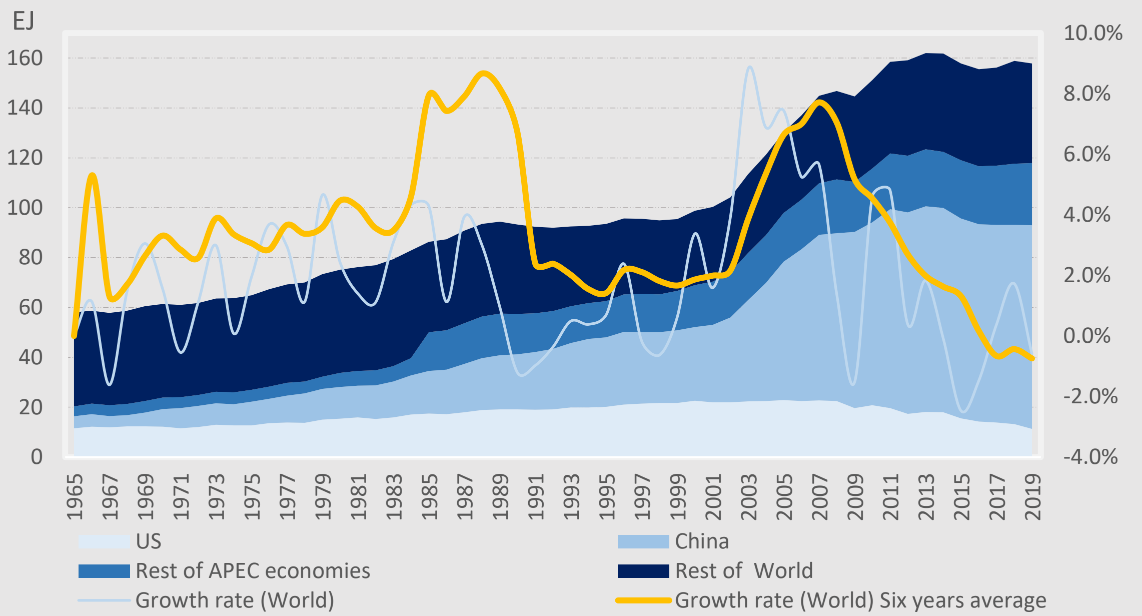
The energy sector is undergoing one of the most significant transformations since industrialisation began. During this time, coal has been one of the keys to creating the current technological society, which brings affordable energy access, economic growth and development to many economies. But in the last decade, technical, economic, social and political forces have tempered global coal demand and led to a reduction in coal demand in many economies.

A growing number of international organisations, governments, and non-governmental organisations have a new vision of a carbon-free future. New technologies and fuels, with better economic efficiencies, that are environmentally sustainable, are becoming prominent. Many questions have arisen, especially those related to how fast the energy transition can be and how quickly fossil fuels can be divested. But divesting coal and fossil fuels could be slower than expected.

In 2019, global coal consumption declined by 0.6%, its fourth decline in six years (see Figure B1.1), displaced by natural gas and renewables, particularly in the power sector. Coal's share of the primary energy supply fell to 27%, its lowest level in 16 years, and coal trade decreased for the first time since 2015 by 1.3% (BP, 2020).

According to the IEA, coal consumption is expected to remain broadly steady over the next five years, with an isolated decrease in coal demand of about 8% in 2020 as a result of the COVID outbreak (IEA, 2019b, 2020).

Figure B1.1: Historical coal consumption by region, 1965–2019



Source: (BP, 2020), APERC calculations

During most of the past two centuries the coal industry has been a driving force in the energy world. But everything comes with a price. Air pollution and GHG emissions have been the most substantial externalities of the industrialisation age. As a result, voices have risen calling for action, including a significant reduction of coal consumption in the energy sector. The UNFCCC Paris Agreement in 2016[8] was a landmark moment in the fight against climate change. Since then, aspirational long-term energy policies have been endorsed by the public and private sectors, including strategies to divest from coal-related business.

How fast will the divestment and phasing out of coal occur?

The new policy path reveals varying degrees to which divesting is occurring. Many an industry, firm or financial conglomerate aspires to completely exit from coal-related business (Trencher *et al.*, 2020). Even the most significant fossil fuel industries have a plan to become carbon neutral by 2050. But these plans will take place over a period of decades; industries, governments and financial institutions are yet to exit from coal-related investments. The "transition" is the key word to this process and the prolonged process means stranded assets are one of the biggest risks.

In 2020, BlackRock announced that sustainability was at the heart of its investment decisions. "Awareness is rapidly changing, and we believe we are on the edge of a fundamental reshaping of

[8] The overarching aim of the Paris Agreement is to reduce GHG and ensure that global temperatures don't rise more than 2C above pre-industrial levels this century, and ultimately pursue a scenario where the temperature rise remains below 1.5C.

finance". BlackRock held companies in its portfolios that accounted for a staggering 9.5 Gt of CO_2 emissions, or 30% of total energy-related carbon emissions in 2017, and it has the highest ratio of coal investments compared to overall size among the ten largest fund managers (BlackRock, 2020).

BlackRock's sustainability policy is an important signal of an intended move away from fossil fuels. The current level of BlackRock's coal investments is near USD 18.6 billion. BlackRock is currently removing companies generating more than 25% of their revenues from thermal coal production from its discretionary active investment portfolios.

In 2020, the Australian General insurer QBE (which manages USD 23.5 billion worth of assets) also announced that they have completed their divestment from thermal coal related business (mining, transport and power). They have no interest in owning assets that they expect to lose value. QBE expects that there will be a significant negative financial impact on thermal coal assets from environmental and social demands. Suncorp has also announced that it will phase out its investments and insurance exposure to thermal coal by 2025. All Australian based insurance companies have now effectively committed to removing coal from their investment portfolios.

Outside APEC, it is common to find examples of coal divestment policies. For instance, Norway's sovereign wealth fund (with more than USD 1,000 billion in assets), decided in 2019 to cut off investments to companies mining 20 million tonnes of thermal coal or more per year. Inside APEC, coal divestment in the US is being driven by economic rationality. The long-term structural transformation is inescapable, and "Companies, investors, and governments must prepare for a significant reallocation of capital" (Mooney, 2020).

The United States case: A rational and cost-effective divestment policy on coal-fired power plants

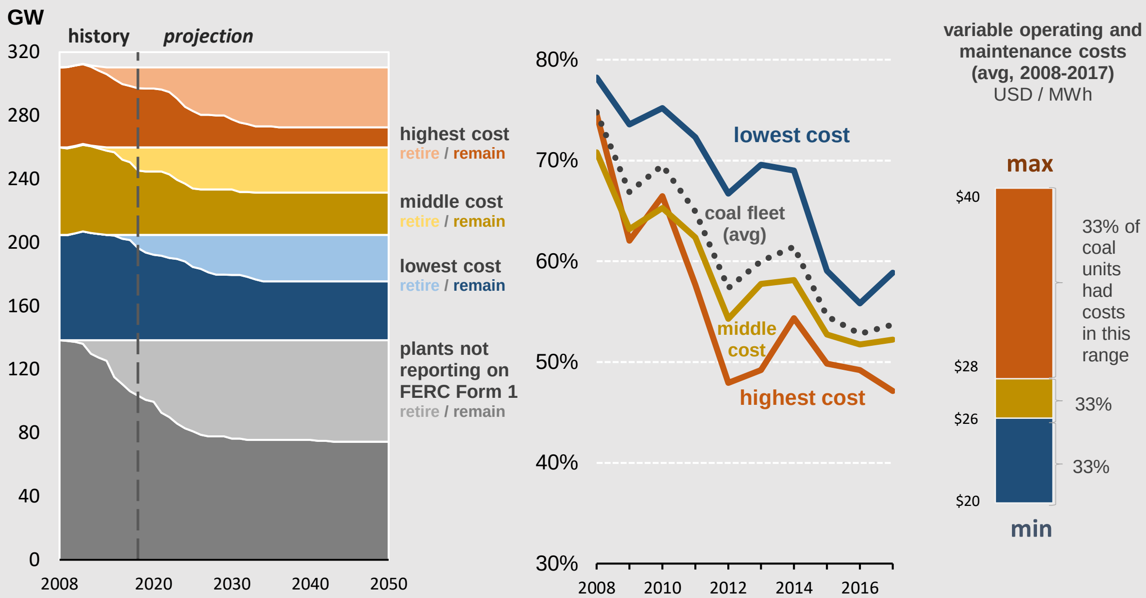
Divestment policies can be based on more than climate change. Investors are considering higher efficiencies from alternative technologies, as well as externalities and co-benefits. These include lower levels of air pollution and a substantial decrease in social challenges.

Over the last decade, the arrival of new energy technologies at competitive prices, and a rapid transition from coal to natural gas, has seen coal consumption in the US decrease significantly. However, divestment is also influenced by government. Current federal government pledges are at odds with coal divestment.[9]

The US power sector has been driven by consistently low natural gas prices, which have made natural gas generating units more competitive, and led to a general decline in the utilisation of coal-fired power plants. A reduction in use leads to a decrease in revenues, which translates into lower operating margins and less ability to cover costs. The final effect is for the plant to be decommissioned. Figure B1.2 shows the different levels of decommissioning based on levelised prices and on the relation between capacity factors and total variable costs (fuels + operating and maintenance [O&M]) in US coal-fired generation units.

[9] The UK is one of the best examples of a faster change driven by government policies. It took only 10 years for the UK to move from 60% coal dependence to almost zero without any side-effect on energy security.

Figure B1.2: Projected capacity changes for US coal-fired power plants, 2008–2050, and coal steam capacity factors by O&M cost level, 2008–2017



Source: (EIA and Sargent & Lundy, 2019), *APERC calculations*

The reduction in the efficiency of coal units explains why, since peaking at nearly 318 GW in 2011, US coal power capacity declined to 248 GW in 2019. Recent studies conducted by the EIA (US) show a high correlation between plant retirements and O&M costs. According to the studies (EIA and Sargent & Lundy, 2019), a larger share of generation units with higher O&M costs retired by the end of 2018 than those with relatively low variable costs.

In 2019, the US power sector accounted for more than 90% of domestic coal consumption, and the rest was consumed mostly by the industrial and commercial sectors. Coal consumption in the industrial and services sectors has declined from 56 Mtoe in 2000 to 27 Mtoe in 2019. US coal consumption has fallen by more than half since its peak in 2005, mostly driven by reduced coal use to produce electricity. US coal consumption fell to 336 Mtoe (532 million tonnes) in 2019, an annual decrease of 15%, and the lowest level since the 1970s (EIA, 2020d).

Despite divestment policies in the power sector, US coal consumption in food manufacturing has remained relatively stable since 2000. The rest of the manufacturing industries have seen significant declines in coal consumption. The largest declines have been in the industry sector (paper, chemical, and primary metal industries) (EIA, 2020e). Between 2000 and 2019, coal consumption in the services sector declined from 2.4 Mtoe to 0.5 Mtoe. Many of the facilities in the services sector have switched from consuming coal to natural gas for space heating.

In 2016, the US government banned new coal leases on federal lands, though the ban was quickly lifted by the Trump administration in 2017. The ban was the primary reason why there were no new coal leases granted on federal lands between 2016 and 2018 (Blondeel and Van de Graaf, 2018). At the same time as these federal government actions, JP Morgan Chase, PNC Financial, Goldman Sachs and Morgan Stanley announced commitments to back away from financing the coal industry (Goldman Sachs, 2016; Marino, 2016).

While influential, the federal moratorium did not apply to non-federal lands, with this territory accounting for at least 60% of total US coal production (The Secretary of Interior, 2016). Moreover, the policy did not apply to production activities already occurring, metallurgical coal mining, small lease modifications, or emergency modifications (Blondeel and Van de Graaf, 2018).

Divestment of coal in the power system driven only by cost-efficiency is likely to reach its limit by 2025. From this time, coal divestment may occur more slowly than expected unless the US government promotes a more significant and faster reduction, and reduces coal subsidies (which in 2018 amounted to USD 3 billion (IEA, 2019c)).

The current level of support affects supply and demand at the margin. The creation of *just transition* policies will be critical for communities that derive a large proportion of income from coal mining. Job creation, community support, and a smooth transition away from coal are essential in such communities (Columbia SIPA, 2019).

Japan, still on the path of coal investments but something has started to change

Japanese firms engaged in the overseas coal market have started to slow down their activities. Since 2018, partial divestment policies were observed in both the upstream and downstream markets in Japan. Four of the five largest trading companies and several financial institutions have unveiled plans prohibiting new thermal coal investments (Trencher *et al.*, 2020). Nevertheless, evidence indicates that industries, governments and financial institutions are yet to entirely exit from coal-related businesses.

Today it is more likely to observe massive diversification, including renewables and green hydrogen, than faster phasing out of coal. The largest Japanese utilities, J-Power, Kansai Electric Power Company (KEPCO) and Tokyo Electric Power (TEPCO), have decided to pursue carbon neutrality through low carbon emissions technologies: coal (ultra-supercritical), coal gasification, combined heat and power, CCS, plus an increase in generation from nuclear and renewables technologies.

Some studies have also emphasised the role of mining communities and the lack of a *just transition* policy in terms of new jobs that is prolonging a transition away from coal. The lack of knowledge and professional expertise in renewables technologies may also increase delays.

There are multiple Japanese companies with partial coal divestment commitments in Japan. Some of the more notable commitments from financial institutions and trading companies are:

Institution	Divestment Policy	Slow Policy / Coal Support
Mitsubishi UFJ (MUFG)	- Refrain from financing new coal power generation projects. - Refrain from financing mining projects using mountaintop removal techniques.	- Support for high-efficiency coal power generation and carbon capture - Support for ultra-supercritical projects - Support coal mining projects, considering environmental, social and health impacts

Mizuho	- Support for lower-emission technologies which include ultra-supercritical coal-fired power plants. - Support on investment projects that includes CO2 emitting policies	- Support for ultra-supercritical projects
Mitsui Bussan	- Refrain from acquiring new thermal coal mine projects - Started the sale of existing coal-related assets	- Focus only on coking coal (upstream)
Sumitomo Mitsui Financial Group (SMFG)	- Support carbon capture projects	- Limit finance to ultra-supercritical projects or higher regardless of country or region. - Finance other CPFF projects less efficient than ultra-supercritical if the Japanese government had approved them or if located in countries suffering severe lack of access to electricity.
Marubeni	- Refrain from new CFPP development.	- Increase the share of renewables to 20% by 2023. - Support for ultra-supercritical projects - Focus on coking coal (upstream)

Finally, economic and structural factors are influencing divestment trends in each industry differently. As an example, current long-term PPAs and capacity payments are some of the most significant barriers to divestment of coal in the Japanese power sector. There are still considerable incentives to export coal-fired power plants built using ultra-supercritical technology. The current full support from the Japanese government and many Japanese financial institutions means that a firm coal divestment policy in the short- and mid-term is unrealistic.

APEC Energy Demand and Supply Outlook

The nature of global energy systems means that coal demand and coal supply do not change drastically from year to year. Capital expenditure is limited in how quickly it can alter the energy landscape in the short term. But across longer time frames, multiple factors can compound to result in very large shifts in energy systems. APERC and other institutions undertake scenario modelling to understand how energy systems might look under certain assumptions. The following provides a summary of recent work undertaken by APERC.

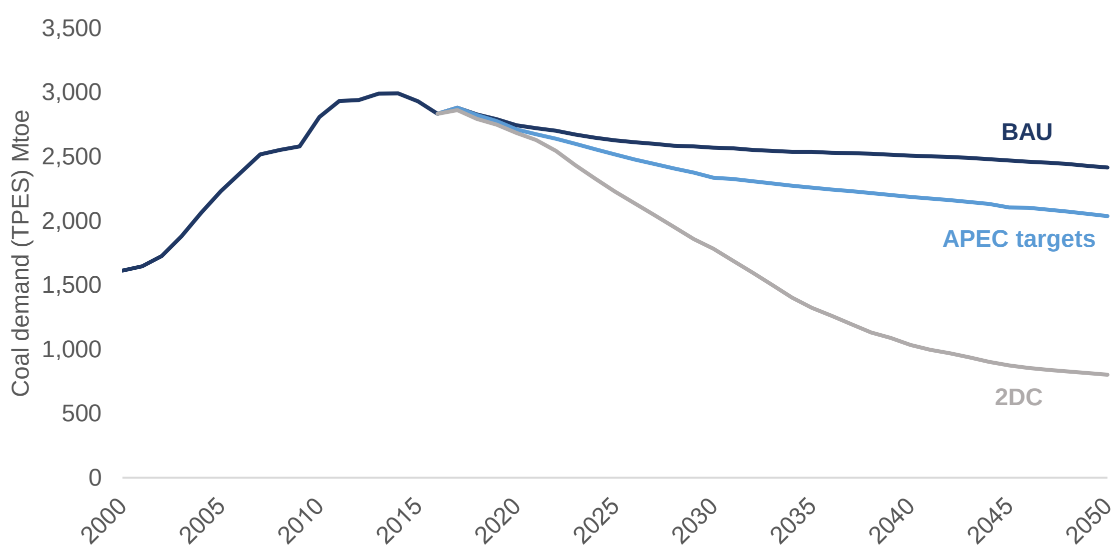
The Seventh edition of the APEC Energy Demand and Supply Outlook (the Outlook) was released in May 2019. The report examines energy demand and energy supply scenarios for APEC economies through to 2050. The business-as-usual (BAU) case assumes current trends continue to 2050. Two alternative scenarios model energy demand and energy supply trajectories required to meet APEC energy intensity and renewable energy commitments (the APEC Target scenario) and emissions goals as laid out by the Paris Accord (2-degrees Celsius scenario).

The APEC coal demand outlook

In a world that continues as is (BAU scenario), the Outlook projects that APEC energy demand increases by 22% through to 2050. Despite this overall energy demand growth, coal demand (TPES) declines by 15% (Figure 2.1). This absolute decline in coal is consistent with the slowing demand for coal discussed in Chapter 1. But the declining trend is not consistent across all economies. In 9 of the 21 APEC economies, coal consumption increases from 2016 to 2050. Coal demand (TPES) grows almost threefold in southeast Asia from 124 Mtoe in 2016 to 344 Mtoe in 2050. For China, the largest coal consuming economy, domestic policies see coal demand peak and then fall to 25% lower in 2050 than 2016.

The BAU scenario traces a trajectory for coal demand to 2050 should the world continue to develop with limited additional policy interventions. Two alternative scenarios outline what's required to meet the challenge of a lower emitting, lower pollution, energy system. The APEC Target scenario assumes that APEC economies increase their efforts to reduce energy intensity by 45% between 2005 and 2035 and double the share of renewables in the energy mix from 2010 to 2030. In this scenario, APEC energy demand increases by 7% out to 2050, as opposed to 22% in the BAU. This lower overall energy demand and an increased share of renewables means that coal is displaced, particularly in the power sector, declining by 28% in 2050, relative to 2016 (Figure 2.1).

Figure 2.1: APEC coal demand (TPES) under BAU, APEC target, and 2DC modelled scenarios, 2000–2050



Source: (APERC, 2019).

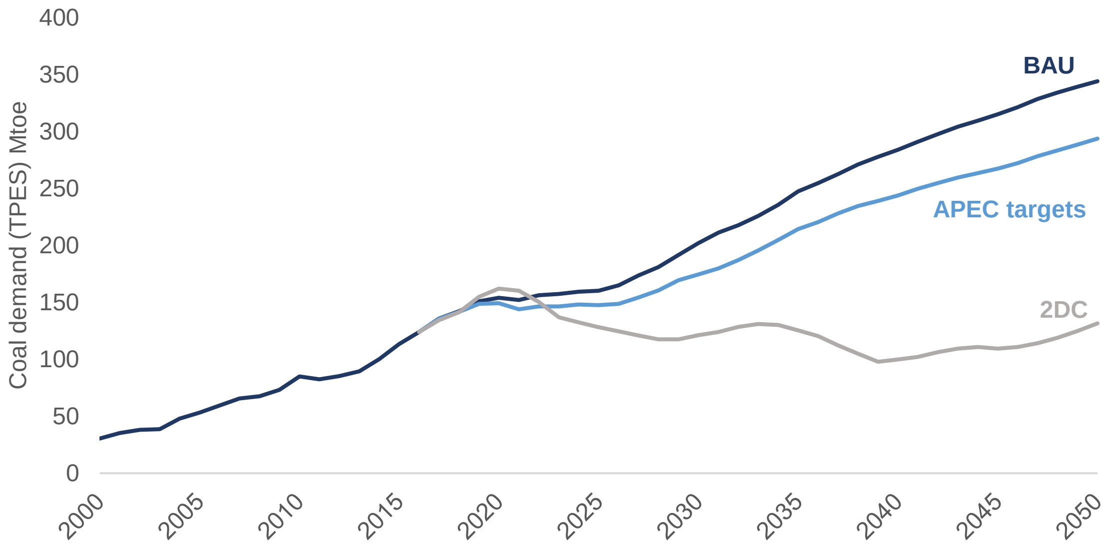
The Outlook also builds a scenario with assumptions that would see a 50% chance of limiting average global temperature rise to 2 degrees Celsius above pre-industrial times (2DC scenario).[10] In this scenario, energy demand is 11% lower in 2050 relative to 2016, and coal demand falls by 72%. The

[10] This scenario assumes APEC economies contribute a proportional global share required to meet the 2DC target.

share of renewables and nuclear combine to account for almost 40% of APEC energy demand. CCS technologies are also deployed widely, though natural gas with CCS becomes the most competitive flexible source of power generation, and almost entirely displaces coal by 2050.

For the APEC southeast Asian economies, there is still considerable growth in coal demand in the APEC Target scenario as shown in Figure 2.2. But under the 2DC Scenario, southeast Asian coal demand is only 6% higher in 2050 relative to 2016. Southeast Asian demand for energy still grows considerably under the 2DC scenario, but much of the demand is met by alternative generation, and heat providing, technologies. For China, coal demand is 1,925 Mtoe in 2016. This falls to 1,441 Mtoe in 2050 under the BAU Scenario (25% fall) and to only 545 Mtoe under the 2DC scenario (72% fall).

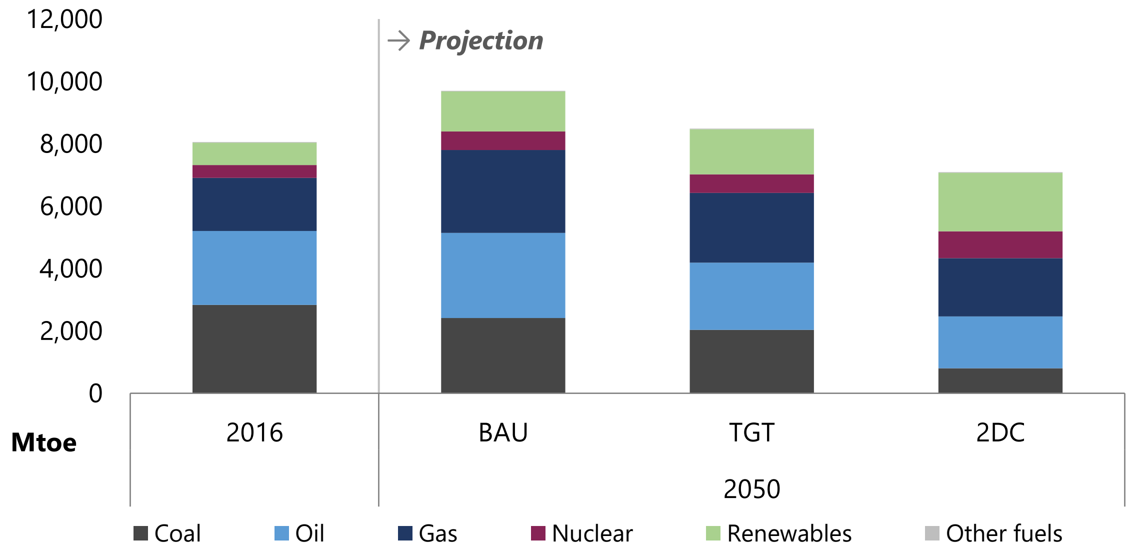
Figure 2.2: APEC southeast Asian economies coal demand (TPES) under BAU, APEC Target, and 2DC scenarios, 2000–2050



Source: (APERC, 2019).

A summation of how the APEC energy system looks under the different scenarios is provided in Figure 2.3. The absolute (and relative) declines in APEC coal demand are prominent. But even in the 2DC scenario, coal remains an important input in the energy mix, particularly for use cases such as steel manufacturing. The consumption of coal is made compatible with aggressive efforts to mitigate climate change through CCUS technologies, as discussed earlier in this chapter.

Figure 2.3: APEC energy demand (TPES) under BAU, APEC target, and 2DC scenarios in 2050 compared with 2016

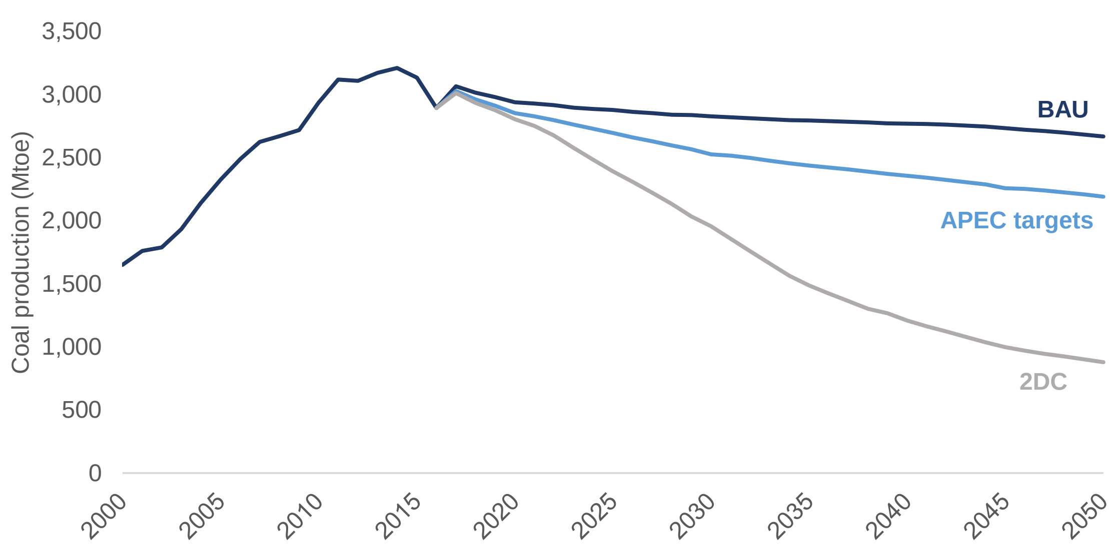


Source: (APERC, 2019).

The APEC coal production outlook

Coal production is responsive to projected coal demand in the BAU, APEC Target, and 2DC scenarios. But the decline in coal production is not quite as large as the decline in coal demand. In the BAU, APEC coal production falls 8% by 2050, which is smaller than the 15% decline for coal demand. For the APEC Target scenario, APEC coal production falls 24%. For the 2DC scenario, APEC coal production falls by 70%.

Figure 2.4: APEC coal production under BAU, APEC Target, and 2DC Scenarios, 2000–2050



Source: (APERC, 2019).

The modelled declines in APEC coal production are lower than the declines in APEC coal demand due to the non-APEC world's continuing demand for coal from the APEC coal producing economies.

The APEC coal trade outlook

In terms of projected trade, coal exports grow by 14% under the BAU, from 638 Mtoe in 2016 to 726 Mtoe in 2050. Australia remains the largest coal exporter in APEC, with increased thermal coal exports (121 Mtoe in 2016 to 190 Mtoe in 2050), offsetting a gradual decrease in metallurgical coal production (127 Mtoe to 93 Mtoe). The fall in metallurgical coal exports from Australia is due to falling demand from China and flat demand from Japan, Korea and Chinese Taipei (IEA, 2017). Indonesia's coal exports peak in 2025 and then decline as domestic demand more than triples by 2050, outpacing coal production growth.

APEC coal exports to non-APEC members grow by 39% in the BAU Scenario. This trend highlights the continued opportunities to grow coal exports from APEC, particularly with burgeoning demand growth in India, complementing rapid growth in coal demand in southeast Asia under the BAU scenario.

The trade story for coal is curtailed under the APEC Target scenario, with coal exports from APEC economies falling to 542 Mtoe in 2050. Under the 2DC scenario, coal exports from APEC economies fall to 210 Mtoe. These declines align with the lower global demand for coal in these scenarios.

Economy developments impacting the outlook for coal in APEC

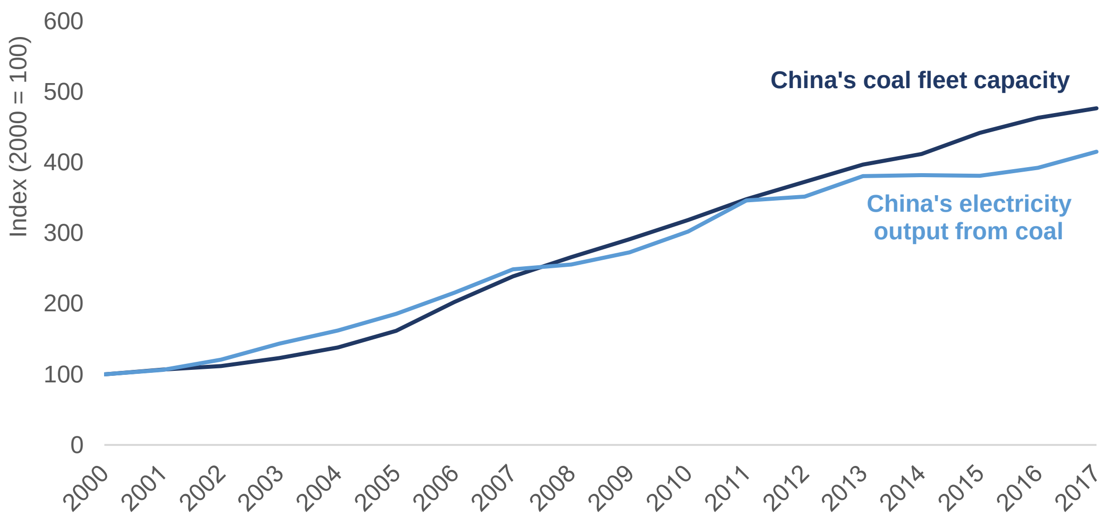
The executive summary table provides a summary of policies that will impact the demand for, and supply of, coal in APEC economies. Additional notable developments for APEC economies are discussed here.

China

As shown in Chapter 1, China has relied on thermal coal to fuel its rapid economic growth of recent decades. Investment in coal-fired power plants occurred on the back of favourable economics and policies that ensured a competitive rate of return (through administered wholesale electricity prices and guaranteed operational hours) that have been in place since the 1980s (Ren *et al.*, 2019). These market conditions are currently under review in China.

Historically, the growth in electricity output from coal-fired power plants mostly kept pace with the growth in the size of China's coal-fired power fleet, as shown in Figure 2.5. But there has been surplus investment in coal-fired power plants in recent years. Structural changes to the regulatory approval process are main drivers of this divergence. In 2014, China decentralised the coal power plant approval process from the central government to provincial governments (Sandalow, 2019). What may have made economic sense from a local perspective did not necessarily make sense from a economy-wide perspective of the energy system.

Figure 2.5: China electricity output from coal-fired power plants alongside growth in coal fired power plant capacity, 2000–2017



Source: (APERC, 2019).

The large increase in capacity has exacerbated the fall in fleet-wide operating hours, with the average capacity utilisation falling below 50% in 2016 (Zheng, 2017). Profitability has been squeezed, particularly with the increase in thermal coal prices in China in 2017. This problem of overcapacity is also an issue in the cement industry, that also relies on thermal coal for heating applications.

Measures to contain coal overcapacity were enacted in the 13th Five Year Plan (FYP) (2016 to 2020). The most notable imposition is that coal-fired power capacity was capped at 1,100 GW, which led to the cancelation or postponement of multiple new coal-fired power plants. As mentioned in the financing section, there is currently 100 GW of new coal-fired power plants in development in China. The forthcoming 14th FYP (2021 to 2025) will determine how many of these power plants are built, and whether additional coal-fired power plants are built as well. The extent of new builds will be influential in the short- to medium-term outlook for thermal coal demand.

A notable development in 2019 is that planning restrictions have been eased for new coal power plants in multiple provinces from 2022 onwards. This was likely because constraints were no longer necessary to curtail new builds, but the COVID-19 pandemic has meant that provincial governments are approving new coal plants as a form of stimulus (Gardiner, 2020).

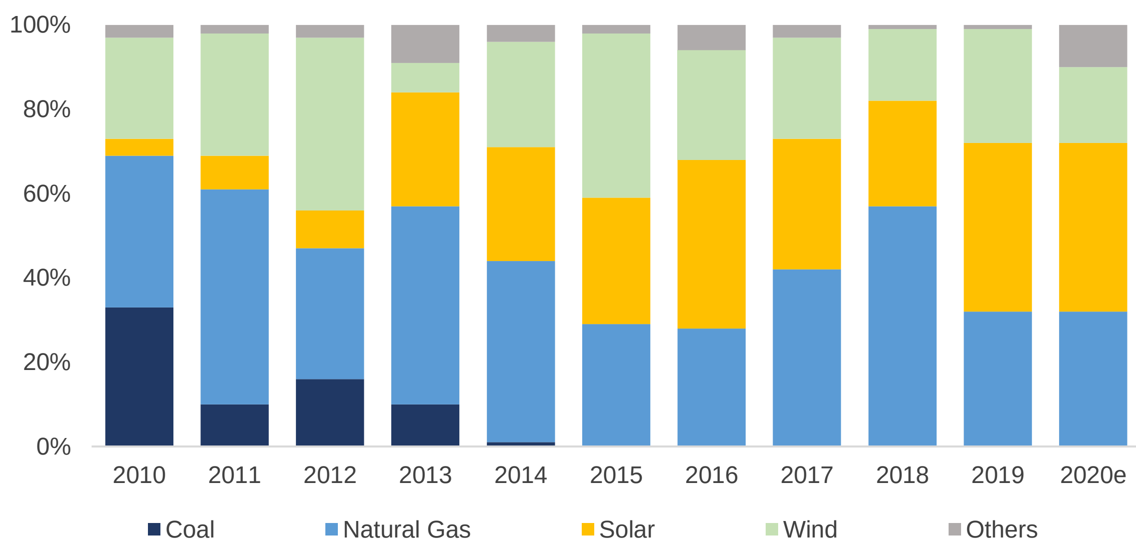
At the same time as a large increase in coal-fired power capacity in the mid-2010s, China incentivised coal-to-gas switching in the buildings and industry sectors to combat air pollution (BP, 2019). Such policies have tempered overall demand for thermal coal. China has a wide-ranging set of policies that address climate change while also promoting economic growth and cutting local air pollution (Sandalow, 2019). In aggregate, China's policies and market developments are likely to see demand for thermal coal moderate and decline over the coming decade.

Metallurgical coal demand is likely to be subdued as well. China remains the world's largest producer of steel, but the recent announcement of COVID-19 stimulus is relatively modest, and will not halt the decline in demand that was occurring before the pandemic (Saleheen, 2020).

United States

In the last decade, US power companies have decommissioned more than 546 coal-fired power units, totalling 102 GW of generating capacity. Plant owners intend to retire another 17 GW of coal-fired capacity by 2025. The US coal units retired in 2018 had an average capacity of 350 MW and an average age of 46 years, compared with an average capacity of 129 MW and average age of 56 years for the coal units that retired in 2015 (EIA, 2019b). There has been no meaningful coal fired capacity additions in the US for five years, as shown in Figure 2.6. After peaking at nearly 318 GW in 2011, installed coal capacity declined to 248 GW in 2019 in the US (EIA, 2020a).

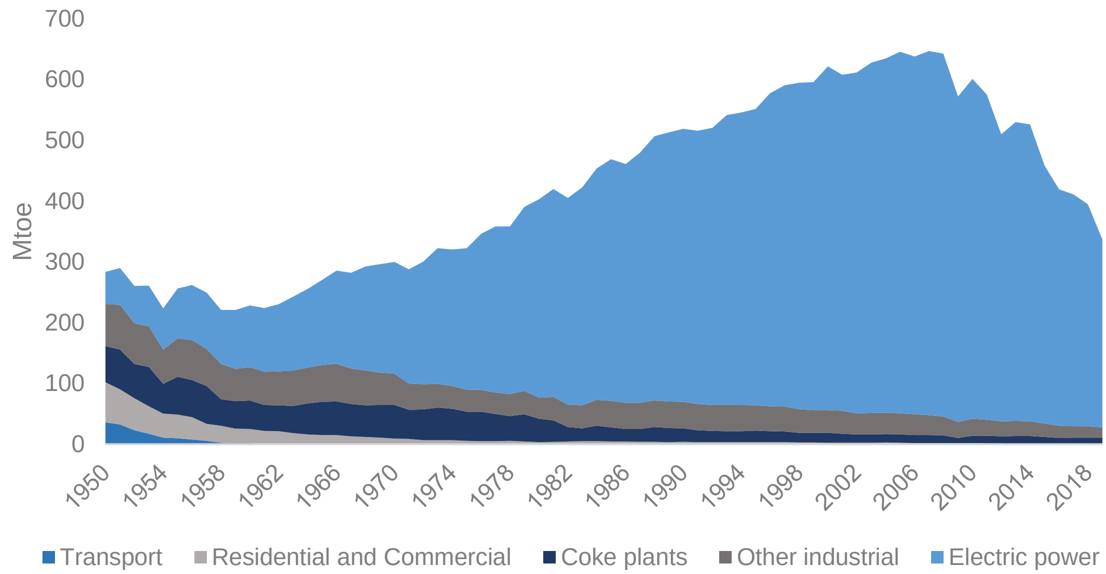
Figure 2.6: New US electricity generation capacity additions, 2010–2020e



Source: FERC, 2020, Wood Mackenzie/SEIA U.S. Solar Market Insight®, APERC adaptation

As shown in Figure 2.7, US coal consumption is primarily used to generate electricity in the US. Consumption peaked in 2007 and has since declined markedly since then. In 2019, the US consumed 336 Mtoe of coal, with 92% for electricity production. According to the US Annual Energy Outlook, coal-fired generating capacity could decrease by 109 GW (or 46%) between 2019 and 2025 to comply with the Affordable Clean Energy (ACE) rule before levelling off near 127 GW by 2050 (EIA, 2020b).

Figure 2.7: US coal consumption by sector, 1950–2019



Source: US Energy Information Administration, 2020, APERC calculations.
Note: Coal consumption in Mtoe was calculated by converting million tonnes of coal production the average calorific value of US coal.

Multiple US states, and the District of Columbia (DC), have also legislated zero (or near-zero) emissions electricity generation, for as early as 2032 in the case of DC (EIA, 2020c). This places additional constraints on the outlook for domestic thermal coal in the US.

US thermal coal exports were affected by the downturn in global coal demand, dropping 30% in 2019 relative to 2018 (EIA, 2019a). Metallurgical coal exports also declined by 12%. US coal exports were equivalent to 53 Mtoe in 2019 using average energy content values for US coal (EIA, 2019a). The slowing trends for global thermal coal and metallurgical coal consumption, discussed in Chapter 1, limit growth potential for US coal exports.

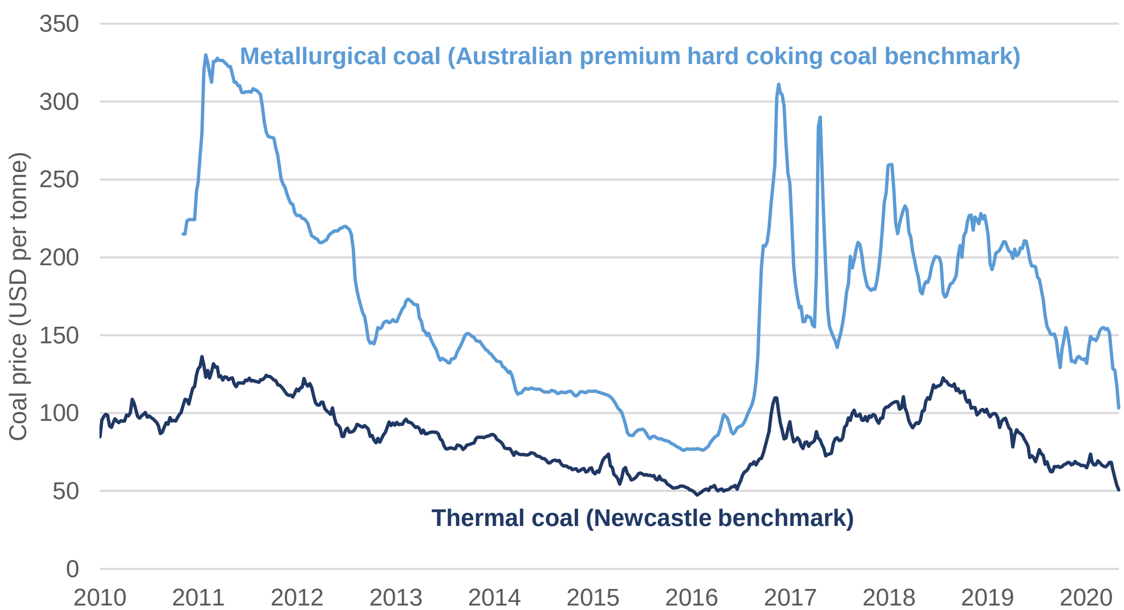
The US has submitted formal notification of its withdrawal from the Paris Climate Agreement on Climate Change to the United Nations. Part of the rationale for the withdrawal is to revive the US coal mining industry. However, the underlying economics are likely to mean that thermal coal production and consumption will continue to decline in the US. The COVID-19 pandemic has brought forward these trends. At the peak of the lockdown in April 2020, coal generation in the US was down more than 30% year-on-year, with a higher share of the electricity mix met by renewables and natural gas (Rhodium Group, 2020).

Chapter 3: Coal prices

Thermal coal and metallurgical coal serve two fundamentally different markets. The price for these two commodities is influenced by both common and unique factors. Benchmark metallurgical coal prices have historically traded at a premium, and often significantly so. Certain market conditions have meant that metallurgical coal has traded at a price that is more than three times the price of thermal coal, as shown in Figure 3.1.

Metallurgical coal is more susceptible to price volatility due to a smaller contingent of metallurgical coal producing economies. Weather events or geopolitical circumstances that threaten the logistics of supply chains can lead to shortfalls and price spikes that are larger than for thermal coal.

Figure 3.1: Coal spot prices, January 2010 to April 2020



Source: globalCOAL, IHS
Notes: Newcastle benchmark is the price for seaborne thermal coal in the Asia-Pacific region

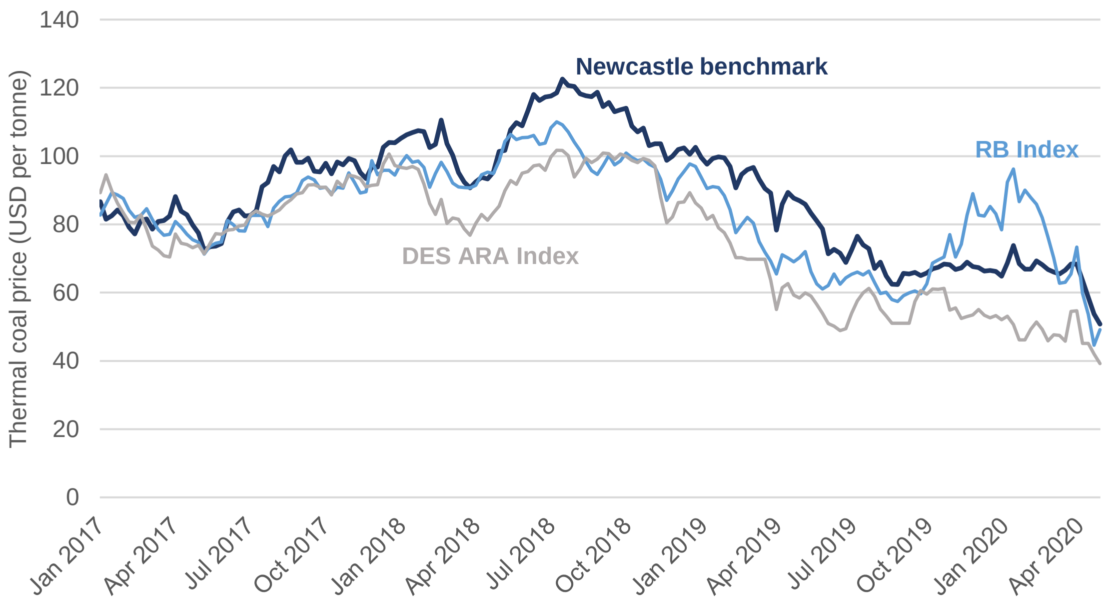
Thermal coal price movements

The price for thermal coal spiked in April 2017 due to a cyclone that impacted supply coming out of Queensland, Australia. By June 2017, the effects of the cyclone had subsided. However, a large and sustained increase in demand from China and South Korea meant that thermal coal prices proceeded to increase to USD 100 per tonne. Import demand remained strong, particularly from China, with thermal coal spot prices remaining above USD 90 per tonne.

Thermal coal prices then moved beyond USD 100 per tonne in December 2017 due to strong winter season demand. After falling back below USD 100 in the spring, summer demand drove prices to USD 120 per tonne in July 2018. This large increase was again due to strong demand from China, but also strong demand from India. A year-on-year increase in imports by South Korea was also a factor in the price rise.

Since the peak of USD 120 per tonne in late July 2018, a month-on-month decrease in imports from China has led to a sustained decline in thermal coal prices. The decline continued to mid-2019, with thermal coal prices eventually finding a low of USD 62 per tonne in August 2019.

Figure 3.2: Thermal coal spot prices, January 2017 to May 2020



Source: globalCOAL
Notes: DES ARA is a coal price benchmark for thermal coal delivered at the ports of Amsterdam / Rotterdam / Antwerp; RB Index is coal price benchmark for thermal coal delivered FOB at Richards Bay Coal Terminal in South Africa; Newcastle benchmark is the price for seaborne thermal coal in the Asia-Pacific region.

The price decline was influenced by a year-on-year drop in thermal coal imports by China in early 2019 (related to imported coal regulations), and a year-on-year decline in imports by Japan and South Korea. At the same time as this fall in demand, export capacity out of Indonesia, Australia, and Russia increased, contributing to the fall in price.

There was also a fall in thermal coal demand in European markets (and commensurate drop in the delivered price at the ports of Amsterdam, Rotterdam, and Antwerp) that was brought on by a sharp fall in European natural gas prices. This fall in demand and prices in Europe contributed to downward pressure on thermal coal spot prices in Asia.

Thermal coal prices found support near the end of August 2019, with prices remaining in a range of USD 65 to 70 per tonne through to the end of March 2020. Prices have again started to fall in April 2020 due to the demand destruction caused by the COVID-19 pandemic. Thermal coal prices were near USD 50 per tonne at the end of April 2020.

Metallurgical coal price movements

The spot price for metallurgical coal fell to below USD 160 per tonne at the beginning of 2017, from over USD 300 per tonne in November 2016. The fall in price was short lived, with a cyclone damaging railways in Queensland causing the spot price to increase to USD 290 per tonne.

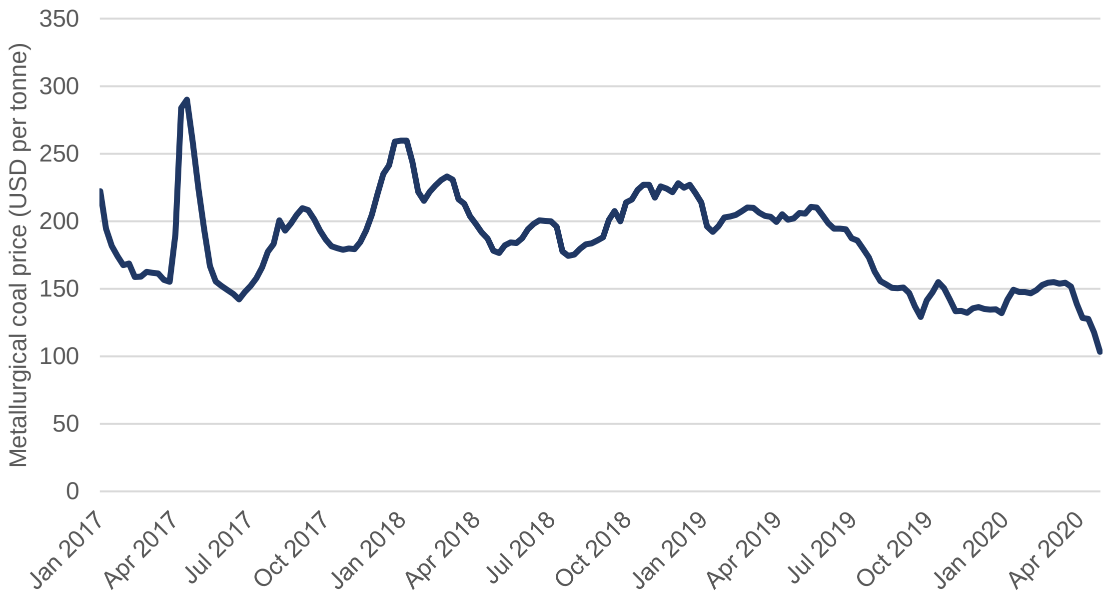
In June, rail transport returned to normal, and the metallurgical spot price fell back to USD 140 per tonne. China and India metallurgical coal procurement trends were then influential in driving a sustained rise in metallurgical coal prices through mid-2017. November 2017 saw a significant backlog of queued seaborne metallurgical coal vessels at Dalrymple Bay in Queensland. Russia and Canada also curtailed their supply, leading to the metallurgical spot price increasing to USD 260 per tonne at the beginning of 2018.

Easing supply constraints and moderating demand saw the price fall back to USD 170 per tonne in late April 2018. However, increased import demand, from China and India in particular, saw metallurgical coal again trade at prices near, and above, USD 200 per tonne. A coal mine accident in Australia and vessel bottlenecks at Dalrymple Bay were influential in keeping spot prices near USD 220 per tonne at the end of 2018.

Metallurgical coal traded near USD 200 per tonne for the first six months of 2019. However, China was the only economy to record year-on-year pig iron production growth out of the leading steel producing economies in 2019. This meant that demand for metallurgical coal was subdued. An increase in production due to the resumption of operations at a suspended coal mine in Australia, and increased production at existing coal mines, meant that metallurgical coal began to be oversupplied. From June through to October 2019, the metallurgical spot price fell from USD 200 to USD 130 per tonne.

In early 2020, metallurgical coal continued to trade in a range between USD 130 and USD 150 per tonne. From mid-March, the compounding impact of the COVID-19 pandemic eventually led to a fall in demand for metallurgical coal. The spot price dropped sharply lower from near USD 150 per tonne at the end of March to USD 100 per tonne at the beginning of May.

Figure 3.3: Australian premium hard coking coal spot price, January 2017 to May 2020



Source: IHS

Projection to 2022

The COVID-19 pandemic is currently the largest influencing factor on short-term demand for thermal and metallurgical coal. The fall in demand and resultant fall in price has been large, but as of May 2020, prices for both these commodities have found support. Thermal coal prices are close to USD 50 per tonne, while metallurgical coal is trading near USD 110 per tonne.

The first wave of COVID-19 outbreaks have begun to taper in many economies, with economic activity beginning to ramp again. As the economy recovers, demand for thermal coal and metallurgical coal will gradually return to pre-COVID-19 levels. However, because the ongoing impact of the virus is not known, there is significant uncertainty about the extent to which economic activity will be able to return to pre-pandemic levels.

The latter half of 2019 already saw a fall in production due to weakening demand for thermal and metallurgical coal. With the onset of COVID-19, some coal exporting economies, such as South Africa and Colombia, have seen coal production fall to very low levels. If demand recovers quickly, there is a concern that thermal coal and metallurgical coal will be in short supply, which could lead to large price spikes.

From the low prices in mid-2020, the spot price of thermal coal has risen in June and July with the onset of the summer demand period. Assuming a post-pandemic recovery, prices are likely to continue to rise, subject to seasonal fluctuations. According to IEEJ, the spot price for thermal coal is likely to reach a price in the high USD 60s per tonne in 2021 and rise moderately to the low USD 70s per tonne in 2022. Increasing demand in Asia from ASEAN economies and India will be influential in a sustained price rise. IEEJs average annual forecast prices for thermal coal are shown in the Table 3.1.

For metallurgical coal, the spot price is likely to remain in the USD 110s per tonne for the remainder of 2020, before increasing to prices in USD 140s per tonne in 2021. Demand for metallurgical coal from India will be influential in determining whether prices continue to rise through 2022. The average annual price for metallurgical coal is also shown in Table 3.1.

Table 3.1: Spot prices for thermal and metallurgical coal (annual average), 2018 to 2022

USD per tonne	**Actual**		**Projection**		
	2018	2019	2020	2021	2022
Thermal coal	106	77	60	65	70
Metallurgical coal	207	176	120	140	155

Source: IEEJ

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