New South Wales Thermal Coal Exports Face Permanent Decline

Grim Outlook Prompts the Need for a Planned Transition

Institute for Energy Economics and Financial Analysis
IEEFA.org

November 2018

Tim Buckley, Director of Energy Finance Studies, Australasia (tbuckley@ieefa.org),

Simon Nicholas, Energy Finance Analyst (snicholas@ieefa.org) and

Kashish Shah, Research Associate (kshah@ieefa.org)

Table of Contents

Executive Summary **2**

Introduction **4**

Status of NSW Thermal Coal Export Industry **5**
- **Current Export Volumes** **5**
- **Finance for Coal is Drying Up** **6**

Thermal Coal Trade Forecasts **8**
- **International Energy Agency** **8**
  - IEA: Achieving the Paris Climate Agreement Target 10
- **'Coal Is the Biggest Loser'** **12**
  - NSW Top Thermal Coal Export Markets 12
- **Japan** **14**
  - Japanese Coal-Fired Power Projects Cancelled 16
  - Renewable Energy Momentum 16
- **China** **18**
  - Air Pollution Concerns 20
  - Renewables to Power On 20
- **Taiwan** **21**
  - Offshore Wind 22
- **South Korea** **23**
  - South Korea's Renewables Build-Out is Under Way 25
  - IEA Forecasts Plummeting Korean Coal Imports 26

Other Asian Coal Import Markets **27**
- **India** **28**
  - Indian Thermal Coal Imports: Economically Unviable 29
  - India Domestic Coal: Rising Production and Improving Supply 30
- **Vietnam** **33**
- **Bangladesh** **35**
- **Malaysia** **36**
- **Philippines** **37**
- **Thailand** **38**
- **Pakistan** **38**

Implications of a Declining Market **39**
- **Growing Sulphur Content Concerns** **41**
- **Stranded Asset Risks: Newcastle Coal Port** **42**

Conclusion **43**

Institute for Energy Economics and Financial Analysis **45**

Executive Summary

While the Australian coal industry and its lobbyists continue to maintain that the nation's thermal coal export industry is booming on the back of record export revenues, the reality is very different.

Exports have declined since 2015 and more contraction is expected. High export revenues entirely reflect current high prices which are themselves partially a result of declining investment in thermal coal mining. In short, current high coal prices do not indicate a strong and growing industry, but instead just the opposite: growing concerns over the long-term viability of the industry.

The International Energy Agency (IEA) projects global thermal coal trade volumes to drop 59% by 2040 in its most sustainable outlook. Under this analysis—IEA's Sustainable Development Scenario (SDS), coal trade volumes will plummet to 309 million tonnes coal equivalent (Mtce) in 2040 from 756Mtce in 2016, a compound annual decline of -3.7%.

Compared to this, the New South Wales (NSW) government's long term forecast from its 2016 Intergenerational Report that coal volumes will increase 1.2% per annum for the next 40 years looks hopelessly out-of-date. This figure is aligned with an old, 2014 Office of the Chief Economist forecast that fails to take into account either the progress made by increasingly cheap and efficient renewable energy since then or global Paris Agreement commitments.

The IEA's New Policies Scenario (NPS) is already out-of-date by the time it is published. Forecast coal demand under the NPS is revised downwards each year. It is IEEFA's opinion that the IEA's SDS is a more likely reflection of the world's energy future.

To assume the New Policies Scenario is the more accurate projection of the direction of energy markets going forward is to assume that the world will not take significant action to act on carbon emissions in line with the commitments included in the Paris Agreement, even though most of the world has signed on to do just that.

Since 2014, the outlook for new coal-fired power stations around Asia—the key market for Australian coal exports, most of which come from NSW—has changed dramatically. In total, the project pipeline of coal plants in major Asian markets has dropped from almost 887 GW of capacity to less than 229 GW, a decline of 74%.

In NSW's top four export markets (Japan, China, Taiwan and South Korea), the pipeline has decreased by almost 423 GW since 2015. Meanwhile, the remaining pipeline of projects in South and Southeast Asia (excluding India) represents just 18% of the pipeline reductions seen in NSW's four main markets. Meanwhile, the development pipeline in India, which many Australian coal executives tout as a potential future export market, has shrunk by 234 GW over the same period.

Furthermore, these figures don't take into account coal plant closures. If current pipeline decline and plant closure trends continue, plant retirements will exceed additions by 2022 and the global operating coal fleet will start to shrink.

The reason for this rapid transformation is an unprecedented decline in the cost of renewable energy generation and the significant ramping up of renewable energy deployment since 2014—factors that will continue to drive the market in the years ahead. Bloomberg New Energy Finance (BNEF) sees coal's share of the global electricity market at just 11% by 2050, down from roughly 40% in 2014.

Given these trends, and despite the industry's rosy pronouncements, NSW will not be immune to the long-term decline of the thermal coal export industry. The outlook for thermal coal led the chairman of the Port of Newcastle, the world's leading coal export port, to state that "the long-term outlook for coal is a threat to the port and the Hunter region."

Among the key issues facing the NSW thermal coal industry are:

- **Major investors and financial institutions are turning away from coal at an accelerating rate, a trend that has now spread to Japan–NSW's largest thermal coal export market.**
- **Total coal demand in Japan, NSW's largest market, is expected to drop 71% in the long term under the SDS.**
- **Total demand for coal in China, NSW's second-largest export market, is forecast to fall 57% by 2040 under the SDS.**
- **Taiwan plans to reduce its dependence on coal-fired power from 46% to 30% of generation by as soon as 2025.**
- **Coal imports by South Korea, NSW's fourth-largest market, are forecast by the IEA to decline by nearly 50% to less than 60Mtce in 2040.**
- **India is not a major destination for NSW thermal coal exports and won't be in future. The Indian government has repeatedly committed to reducing thermal coal imports in the long term, the highest cost source of electricity generation in India.**
- **Any growth in coal consumption across Southeast Asia will not be enough to compensate for declining consumption in NSW's four major export markets.**
- **Asia's rapidly developing offshore wind power sector could displace 300-350 million tonnes of thermal coal annually—about 35%-40% of the global seaborne trade.**
- **Australian thermal coal's much touted quality advantage will not be enough to maintain export volumes. According to Wood Mackenzie, less than a quarter of Australia's thermal coal exports meet South Korea's the new sulphur content limit.**
- **Australian exports will not benefit from declining Indonesian exports as much as is often assumed – cuts to the power capacity build-out of Indonesian utility PLN will lead to less domestic coal demand and more thermal coal available for export.**
- **As global coal consumption declines, NSW thermal coal exporters will face increased competition for remaining markets from other exporting nations.**

This report also describes how—even after the recent cancellation of the proposed T4 coal terminal—the Port of Newcastle, the world's largest coal export facility, is currently operating with 24% spare capacity. Far from increasing exports to close this utilisation gap, thermal coal exports are set to decline further in the long term, progressively stranding more capacity.

In other words, the port already has serious problems which will only become more significant in the future. This is exactly what has prompted the chairman of the Port of Newcastle to recognise an "urgent need" for the port to implement a progressive diversification away from its current over-reliance on coal.

Introduction

Australia is the world's second-largest exporter of thermal coal after Indonesia, with more than two-thirds of its thermal coal exported from the state of NSW. A total of 202 million metric tonnes (Mt) of thermal coal was exported from Australia in the fiscal year ending June 30, 2017.[1] Of this total, 144Mt was from NSW.

The great majority of NSW thermal coal exports are shipped out of the Port of Newcastle—the world's largest coal export terminal. As such, it is highly significant that the chairman of the Port of Newcastle has recognised an "urgent need" for the port to diversify away from its reliance on coal, further stating that "the long-term outlook for coal is a threat to the port and the Hunter region."[2]

This noteworthy assertion was followed only a few months later by the announcement that the long-planned Terminal 4 (T4) extension at the Port of Newcastle has been formally cancelled.[3] T4 was planned by coal terminal operator Port Waratah Coal Services (PWCS) on the back of highly optimistic expectations over the future growth in thermal coal exports out of Newcastle. That growth never materialised however, and with spare capacity at the existing terminals, the extension plan was officially dropped.

The NSW coal industry contends that the port's spare capacity is sufficient to cover future growth in thermal coal exports.

In this report, IEEFA explains how, rather than growing, NSW thermal coal export volumes are approaching permanent decline. This is an inevitable part of thermal coal's structural decline now occurring globally, driven by carbon emissions and air pollution concerns as well as ever more efficient renewable energy technology that is now outclassing coal-fired power on all measures. As capital subsidises for new coal-fired power plants from Japan, South Korea and China decline, imported coal fired power plant proposals will increasingly struggle to find private capital support, as has already occurred in Australia.

This report explores the current status and trends of the NSW thermal coal industry and considers key forecasts that highlight the structural decline of thermal coal going forward, a prospect that has major implications for the state's coal export industry. The outlook for the four key export markets for NSW thermal coal are reviewed, as is the future for thermal coal in

[1] Office of the Chief Economist, Resources and Energy Quarterly, June 2018
[2] Sydney Morning Herald, "World's largest coal export port Newcastle has 'urgent need' to diversify", 17 December 2017
[3] Port Waratah Coal Services press release, "Port Waratah Terminal 4 Announcement", 31 May 2018

other Asian markets that the Australian coal industry continues to claim will be drivers of export growth into the future.

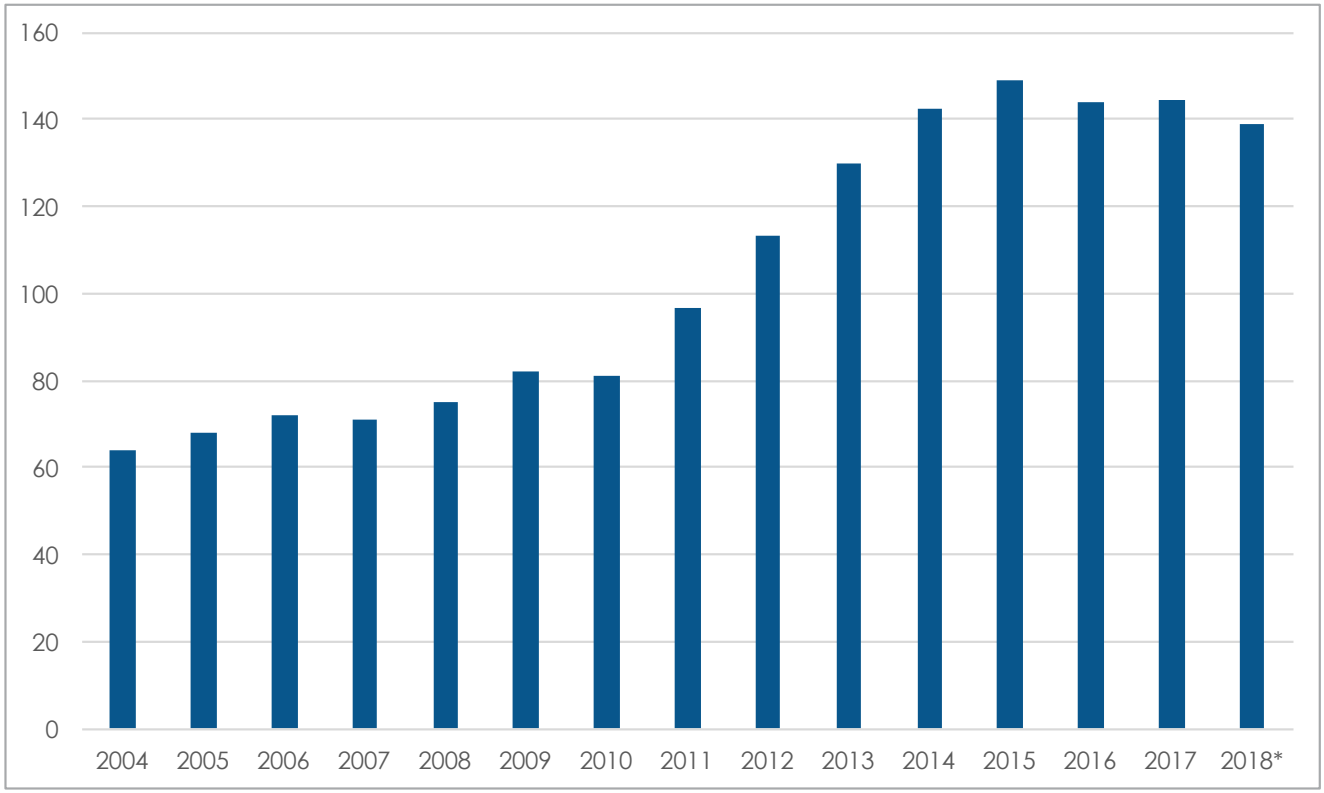
Status of NSW Thermal Coal Export Industry

Recent media coverage of the Australian thermal coal industry has focused on the high revenues, royalties and profits being generated by current high coal prices. This selective narrative fails to acknowledge pivotal and newly emerging trends, such as declining thermal coal export volumes, falling coal mining investment, growing financial headwinds for the coal sector and the fact that coal-fired power is increasingly being outclassed by renewable energy.

Current Export Volumes

It is clear from Figure 1 that exports of thermal coal from NSW have declined since peaking in the fiscal year ended June 2015. Although it is possible that export volumes could rebound in the short term, the longer-term outlook for thermal coal suggests that we are fast approaching a time when thermal coal export volumes enter long-term decline on a permanent basis.

Figure 1: NSW Thermal Coal Exports by Fiscal Year Ended 30 June (Million Tonnes)



Source: Coal Services.
*2018 figure is an annualised projection based on data for the first nine months of fiscal year 2017-18.

Finance for Coal is Drying Up

Faced with rising stranded asset risks, investor and financier support for the coal industry is draining away at an increasing rate. This has major implications for NSW thermal coal exports as overseas sources of potential future off-take of NSW coal are starting to dry up.

In the lead-up to the June 2018 G7 summit, a group of major international investors with a cumulative US$26 trillion of assets under management, called for a phase-out of coal-fired power to address climate change.[4] The 288 investor signatories to the statement included Allianz Global Investors, HSBC Global Asset Management and Nomura Asset Management. In addition to a phase out of global coal-fired power, the group called for the end of subsidies for fossil fuels and a meaningful price on carbon.

This significant step marks the direction that investment in global power capacity is going. Four of the G7 nations are already members of the Powering Past Coal alliance—only Japan the U.S. and Germany are not. Amundi, Europe's largest asset manager with US$1.6 trillion under management, has stated that global investment has reached a clear "tipping point" regarding climate change, with major investors increasingly taking it seriously in their decision-making.[5]

This year has already seen several significant financial institutions distancing themselves from the coal industry and adding their names to the growing list of banks, insurers and investors that have ceased supporting coal.

Europe's largest bank, HSBC, announced in April 2018 that it would stop funding new coal-fired power plants following recent moves by other European banks such as ING, Credit Agricole and BNP Paribas.[6] HSBC did carve out an exception for plants in Bangladesh, Indonesia and Vietnam, but even that is slated to end in five years. RBS followed in May 2018, declaring that it will no longer provide project finance for new coal-fired power stations and coal mines.[7]

In September 2018, Standard Chartered bank announced that it was "stopping our financing of new coal-fired power plants anywhere in the world" after having previously committed to no longer financing new stand-alone thermal coal mines.[8] Standard Chartered had previously been a significant financer of coal-fired power plants.

A significant number of insurers have now also announced a move away from coal. Following AXA's December 2017 decision to divest from companies planning more than 3 GW of new coal plants, Italy's Generali announced in February 2018 its divestment from companies planning new coal facilities. SCOR as well as other French insurers committed to divest or no longer invest in companies listed on the Coal Plant Developers List.

May 2018 saw insurance giant Allianz announce that it will immediately stop insuring

[4] Reuters, "Big investors urge G7 to step up climate action, shift from coal", 4th June 2018
[5] Bloomberg, "Europe's Largest Asset Manager Sees 'Tipping Point' on Climate", 31st May 2018
[6] Reuters, "HSBC to stop financing new coal plants, oil sands, arctic drilling", 20th April 2018
[7] The Guardian, "RBS cuts lending to new coal and Arctic oil projects", 30th May 2018
[8] Standard Chartered, "Here for good means saying no to coal", 25th September 2018

individual coal-fired power stations and coal mines and cease any coal insurance by 2040.[9] It will also ban all companies planning to build more than 500 MW of new coal-fired generation capacity from its investment portfolio.[10] In June 2018, reinsurance major Hannover Re announced it would divest from companies that derive more than 25% of their revenue from coal, meaning that close to half of the world's reinsurers have moved away from coal.[11]

This was followed by an announcement by reinsurance giant Swiss Re the following month that it would stop insuring or reinsuring companies that have more than 30% thermal coal exposure. The announcement further stated that "Swiss Re supports a progressive and structured shift away from fossil fuels."[12] Swiss Re had stopped investing in companies with at least 30% thermal coal exposure in 2016. Then in August 2018, Munich Re—the world's largest reinsurer—announced it would cease investing in companies that derive more than 30% of their revenue from coal-related business, albeit so far only for the developed world markets.

Even as Japan continues to provide significant government-subsidised finance for the development of new coal-fired power plants across Asia, the June 2018 announcement by Dai-ichi Life and then the July 2018 follow-on by Nippon Life to exclude coal investments, shows the financial move away from thermal coal is gaining pace. In August 2018 it was reported Nippon Life and Dai-ichi Life had both decided against providing financial support for Adani's proposed Carmichael thermal coal export mine in Australia's Galilee Basin, following on from China's decision to do likewise in November 2017, heralding a possibly pivotal financial turning point.

The initial effect will be that coal-fired power plants and coal mines will find getting cover from a smaller pool of insurers more expensive. However, with an increasing number of banks also refusing to finance coal, getting coal projects to financial close at all will become increasingly difficult. The progressive exit of major mining companies such as Rio Tinto and South32 from the thermal coal sector adds to the picture of declining investment. These major mining companies were able to fund new coal mining projects off their own balance sheet. Their exit leaves proposed projects in the hands of smaller players that require bank finance to get new mines off the ground. As banks tighten their climate policies, this finance will become increasingly hard and more expensive to obtain.

The global trend of major investors turning away from coal is also reflected in Australia. Around A$1 trillion of Australian superannuation (pension and retirement) funds have committed to the Climate 100+ goals that move investment away from coal and toward cleaner energy.[13]

The impact on thermal coal mining investment is already noticeable. With banks tightening up their environmental policies on climate concerns, investment in new and existing mines is falling. A resultant lack of new supply is holding thermal coal prices high, rather than growth in Asian demand.[14] This tightening is being felt in Australia with the nation's big four banks

[9] Reuters, "Allianz cuts back on coal insurance after environmentalist criticism", 4th May 2018
[10] Insurance Business Magazine, "Allianz succumbs to pressure, reveals it will stop insuring coal firms", 4th May 2018
[11] Reinsurance News, "Hannover Re to step away from coal investment", 20th June 2018
[12] Swiss Re, "Swiss Re establishes thermal coal policy to support transition to low-carbon economy", 2nd July 2018
[13] Australian Financial Review, "Investors worth $1trn say no to coal", 2nd July 2018
[14] Economic Times, "International coal prices to stay firm: Fitch Ratings", 24th May 2018

increasingly unwilling to invest in new thermal coal projects, with the Adani Carmichael mine proposal being a key case in point.[15]

The current high coal prices, and subsequent media coverage of high profits for Australian coal miners, need to be seen in this context. In the case of thermal coal, high prices are not a sign of a strong and growing industry. In fact, they can be seen as an indication of just the opposite, heralding growing concerns over the industry's medium to long term viability.

Thermal Coal Trade Forecasts

Long-term forecasts for the thermal coal trade provide a grim outlook for all export regions including NSW.

International Energy Agency

The International Energy Agency (IEA), which publishes its influential World Energy Outlook (WEO) on a yearly basis, reports a declining long-term global thermal coal market in its latest 2017 projections.

Under the IEA's Sustainable Development Scenario (SDS) which assumes nations take a path toward achieving climate stabilisation, reduced air pollution, and universal access to modern energy,[16] global thermal coal trade volumes drop 28% (to 546Mtce) by 2025 and 59% (to 309Mtce) by 2040. This represents a compound annual growth rate (CAGR) of -3.7% (see Figure 2). Thermal coal demand for power generation drops by 75% in 2040 from 2016 levels under this scenario.

Compared to this, the NSW government's long-term forecast (from its 2016 Intergenerational Report) indicating that coal volumes will increase 1.2% per annum looks hopelessly out-of-date.[17] This figure is aligned with a 2014 Office of the Chief Economist forecast, and it is clear that global electricity markets have changed significantly since then, not least thanks to the rapid decline in the cost of renewables and the significant ramping up of renewable energy deployments.

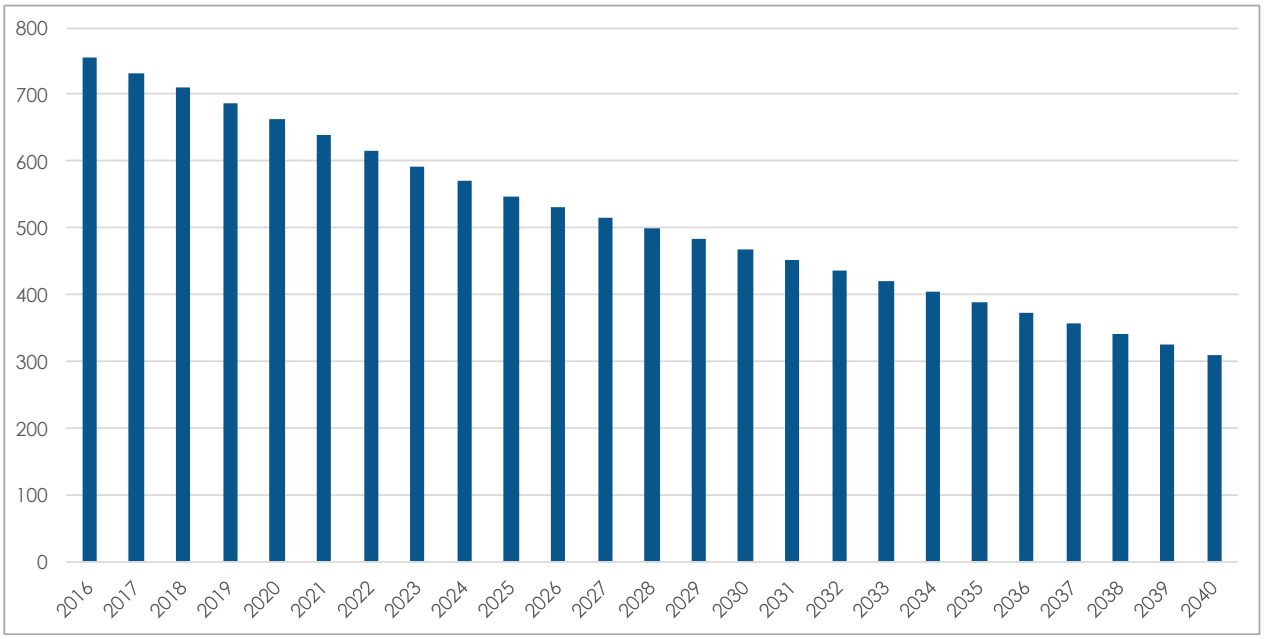
Even under the New Policies Scenario (NPS), which is based on global announced policy settings, and hence is entirely unaligned with the 2 degrees of warming target, the global coal trade declines (5% by 2040). However, the NPS does not take into account future increases in climate policy ambition and further continued technology change that IEEFA sees as virtually certain to happen.

While carbon pricing policies remain controversial in many nations (including Australia), such policies are increasingly common and, in the longer term, will spread to more and more countries, Australia included. (The prospect of a future carbon price in Australia is one of the key risks that has convinced Australian electricity generators not to invest in new coal-fired power). In IEEFA's view, the NPS also fails to take into account continuing gains in efficiency

[15] Reuters, "Asia coal industry sees blue skies, ignores storm clouds: Russell", 10th May 2018
[16] IEA, "Commentary: A new approach to energy and sustainable development - the Sustainable Development Scenario", 13th November 2017
[17] NSW Government, Budget 2016-17: Budget Paper No. 5 – Intergenerational Report

or declining costs of renewable energy and energy storage technology going forward. These trends will drive policy ambition on clean energy worldwide over the coming decades.

Figure 2: IEA World Thermal Coal Trade Under the Sustainable Development Scenario (Million Tonnes)



Source: IEA World Energy Outlook 2017.

To assume the NPS is the more accurate projection of the direction of energy markets going forward is to assume the world will not take significant action to act on climate change in line with limiting warming to below 2 degrees, even though most of the world has signed on to do just that, and reluctance by the U.S. to cooperate is likely to be temporary. International pressure to act on carbon emissions is growing[18] and will continue to do so into the future.

In September 2018, ING became the first bank to commit to using science-based scenarios, including those developed by the IEA, to begin aligning its US$600 billion loan portfolio with the Paris Agreement goal of limiting climate change to well below 2 degrees.[19] Given the IEA's New Policies Scenario is not aligned to the Paris 2 degree goal, only the Sustainable Development Scenario will be useful to ING in re-aligning its portfolio to Paris.

It is also worth noting that even the Minerals Council of Australia (MCA), which represents the country's coal and other mining companies, acknowledges the need for a transition to a low emissions economy that includes "participation in global agreements such as the Paris Agreement with greenhouse gas emission reduction commitments from major emitting nations."[20]

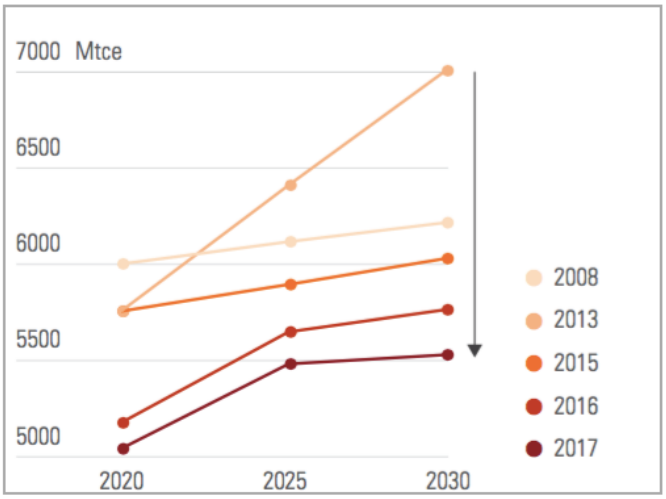
The Minerals Council of Australia's (MCA) new CEO stated in August 2018 that "we have consensus across all of the membership around our energy and climate statement we made

[18] Bloomberg, "Climate Crisis Spurs UN Call for $2.4 Trillion Fossil Fuel Shift", 8 October 2018
[19] ING, "ING will steer portfolio towards two-degree goal to help combat climate change", 14the September 2018
[20] Minerals Council of Australia - Energy and Climate Change Policy

at the beginning of 2018 that talked about making sure we meet the Paris commitment and support for continuous improvement on climate change."[21]

Each iteration of the NPS in the IEA's annual WEO reports is immediately out-of-date upon release as each report is based on prior year data. Figure 3 shows how the NPS has evolved over recent years; each successive iteration of the scenario has shown declining coal demand predictions and IEEFA expects that the 2018 WEO report, to be released in November 2018, will show another reduction in coal demand under the NPS.

Figure 3: IEA New Policies Scenario Global Coal Demand Forecast Evolution (Mtce)



Source: Coal Transitions, IEA.

In IEEFA's view, there is already evidence of building momentum on emissions reduction policies, helped by significant renewable technology advances, making it clear that stated policies will quickly be superseded by further commitments as the world capitalises on the various benefits of deflationary, clean, renewable energy and scales up action to meet Paris commitments. As such, it is IEEFA's opinion that the IEA's SDS is a more likely reflection of the world's energy future.

IEA: Achieving the Paris Climate Agreement Target

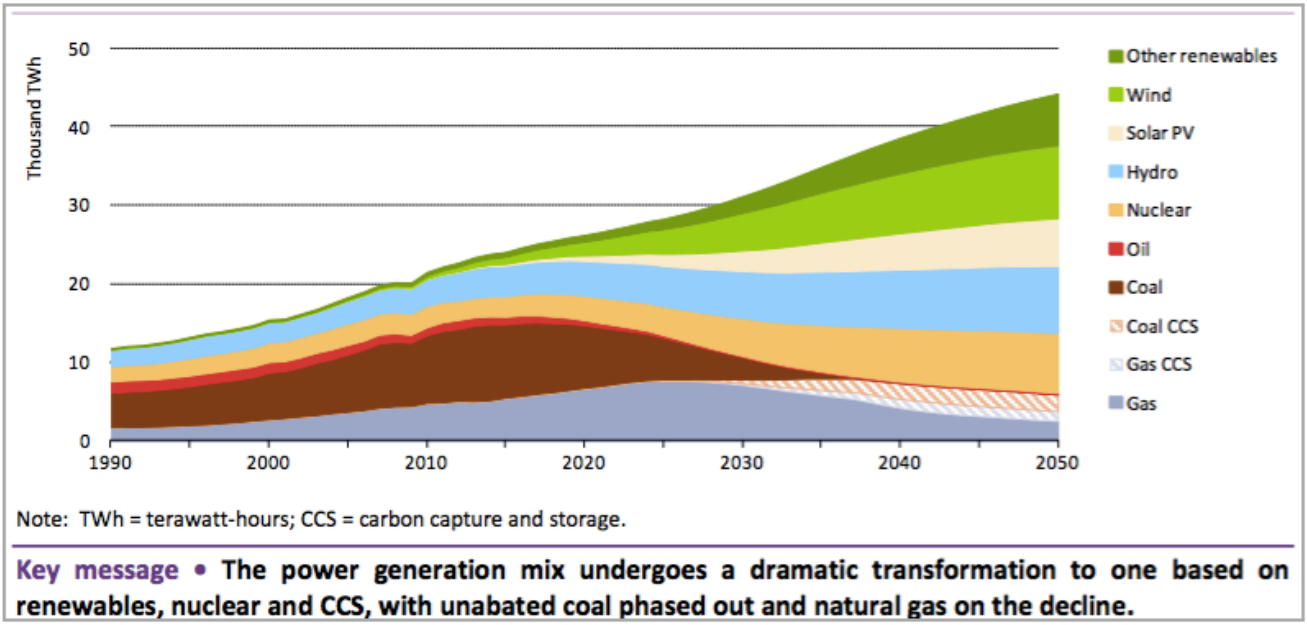
It is worth noting that the IEA's SDS is not a scenario which tracks a path towards meeting the Paris Agreement's target of restricting global warming to well below 2°C with any certainty. For that path, the IEA has developed an alternative scenario that offers a more definite chance of meeting the Paris target. This option is called '66% 2°C'—whereby global policies are set to give a 66% chance that the Paris target "to limit the rise in global average temperature to well below 2°C from pre-industrial levels" is met. This scenario projects an even faster structural decline for the thermal coal industry.

Under the 66% 2°C scenario, coal use in the power generation sector would be 80% below today's level by 2050. By the same date, several G20 countries would have close-to-zero carbon electricity systems. Of the remaining coal-fired power plants in 2050, most would have to be paired with carbon capture and storage (CCS) technology, without which coal

[21] The Australian, "BHP-approved MCA chief Tania Constable backs energy guarantee", 2nd August 2018

use would have to be reduced even further. The IEA concedes that its assumed role for CCS "comes against the background of a limited number of large-scale CCS projects to date."[22]

Figure 4: Global electricity generation by source in the 66% 2°C Scenario



Source: IEA 66% 2°C scenario.

IEEFA would note that commercial deployment of CCS technology absent major government subsidises is unproven and has been left behind by the rapid advance of renewables technology in terms of efficiency and cost. The Kemper plant in the U.S. is a classic example of the current status of CCS technology. Having been slated as the world's most ambitious CCS project, it was converted from coal to gas after falling three years behind schedule and running three times over budget at a cost of US$7.5 billion (bn).[23]

To reach the targets agreed to in the Paris Agreement, the least-efficient coal-fired power plants would need to be phased out by 2030 in most regions, with many of these plants retired before reaching the end of their technical lifetime. Even existing highly efficient coal-fired plants would need to be almost completely eliminated by 2040 in the IEA's 66% 2°C Scenario. Global electricity generation would be dominated by non-carbon emitting sources by 2050 (Figure 4). As a result, coal consumption would drop by more than 65% by 2050 from 2014 levels. More than 80% of current thermal and coking coal reserves would have to be considered "unburnable."[24]

Although IEEFA sees a global step-up in climate ambition in an attempt to meet Paris commitments as highly likely, the SDS is currently a more likely representation of the world's

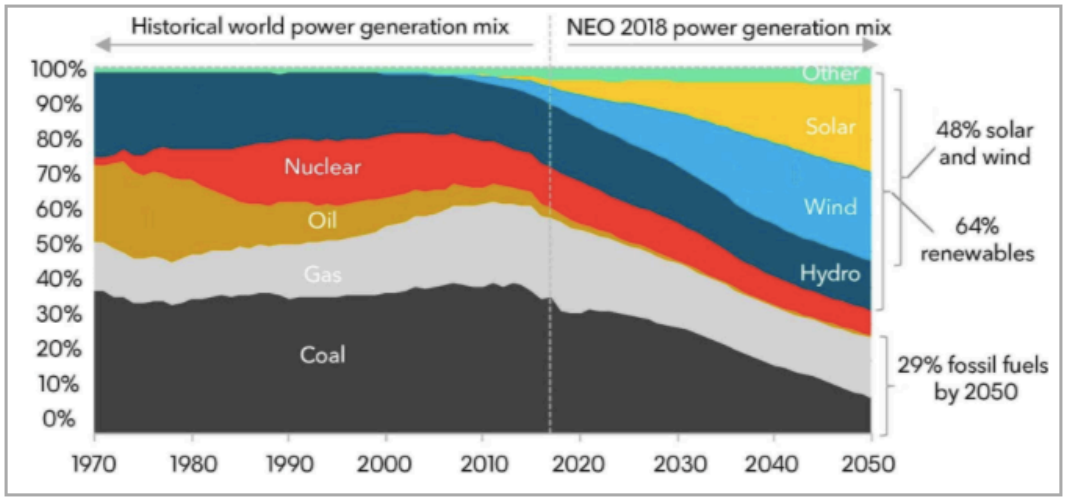
[22] IEA: Chapter 2 of Perspectives for the energy transition – investment needs for a low-carbon energy system ©OECD/IEA 2017, p. 76
[23] Greentech Media, "Carbon Capture Suffers a Huge Setback as Kemper Plant Suspends Work", 29th June 2017
[24] IEA: Chapter 2 of Perspectives for the energy transition – investment needs for a low-carbon energy system ©OECD/IEA 2017, p. 107

energy pathway than the 66% 2°C Scenario. Hence the -3.7% compound annual decline in world thermal coal trade outlined in the SDS is the more likely trend going forward.

'Coal Is the Biggest Loser'

Bloomberg New Energy Finance (BNEF) also releases an annual energy outlook report - the New Energy Outlook (NEO) - which forecasts out to 2050. The most recent report (2018) foresees cheap renewable energy and battery storage technology transforming the world's electricity system from one based two-thirds on fossil fuels in 2017 to one that is two-thirds renewable energy-based by 2050.[25]

Figure 5: Change in Global Power Generation Mix to 2050



Source: Bloomberg New Energy Finance: New Energy Outlook 2018.

Amongst fossil fuel consumption declines, BNEF concludes that "coal is the biggest loser," falling to 11% of global electricity generation by 2050 (Figure 5).

In NSW's key export destinations, BNEF sees a significantly declining role for thermal coal. China will see peak coal use by 2030 and wind and solar will account for 46% of electricity generation by 2050. China will account for 21% of all solar PV installations and one third of all wind capacity in the world by that date.

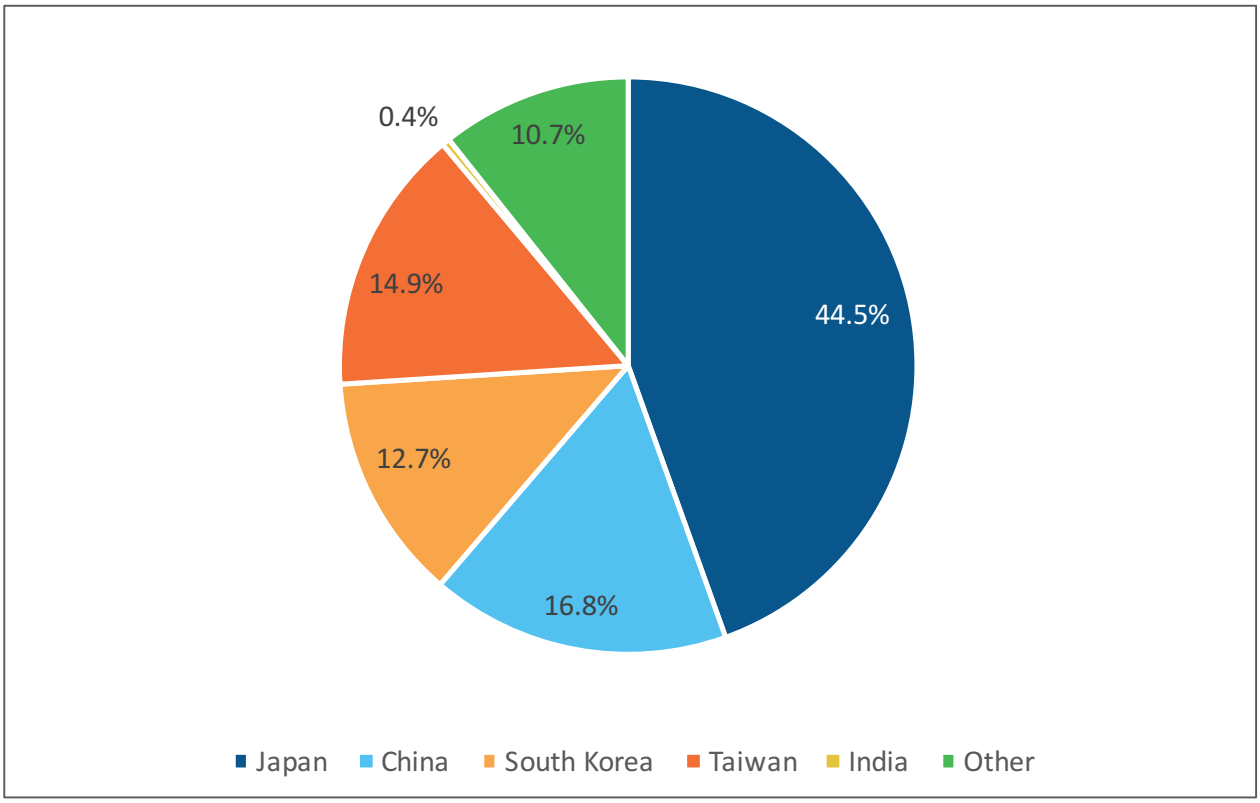
BNEF forecasts that renewables will account for almost three-quarters of electricity generation in Japan by 2050. South Korea will transform from a nation dependent on coal and nuclear for 72% of electricity generation in 2017 to one where gas and renewables will generate 71% of its electricity by 2050.

NSW Top Thermal Coal Export Markets

We consider the future of the global seaborne coal market, and hence the long-term future of the NSW thermal coal export industry, by following the policies and trends being set now in key export destinations.

[25] BNEF, "New Energy Outlook 2018"

Figure 6: NSW Thermal Coal Export Destinations Fiscal Year 2016-17



Source: Coal Services.

The declining outlook for thermal coal exports to Asia in the long term is demonstrated by the collapse in the pipeline of coal-fired projects across the region since 2015. Figure 7 shows the decline in the pipeline of the key coal export markets covered in this report – Australia's big four thermal coal export destinations (Japan, China, Taiwan and South Korea), India and the growing electricity markets across South and Southeast Asia.

From almost 887 GW of plants in the announced, pre-permit or permitted stage of development in January 2015, the project pipeline has collapsed to less than 229 GW as of July 2018.[26] This is a decline of 74% in just three-and-a-half years and is led by the rapidly transitioning electricity markets of China and India.

In NSW's top four markets the project pipeline has decreased by almost 423 GW since 2015 (Japan -4 GW, China -420 GW, Taiwan -1 GW and South Korea +2 GW). Although there has been an increase in some markets (notably the Philippines and Bangladesh), overall the pipeline in potential export markets in South and Southeast Asia (excluding India) has declined by 1.4 GW since 2015.

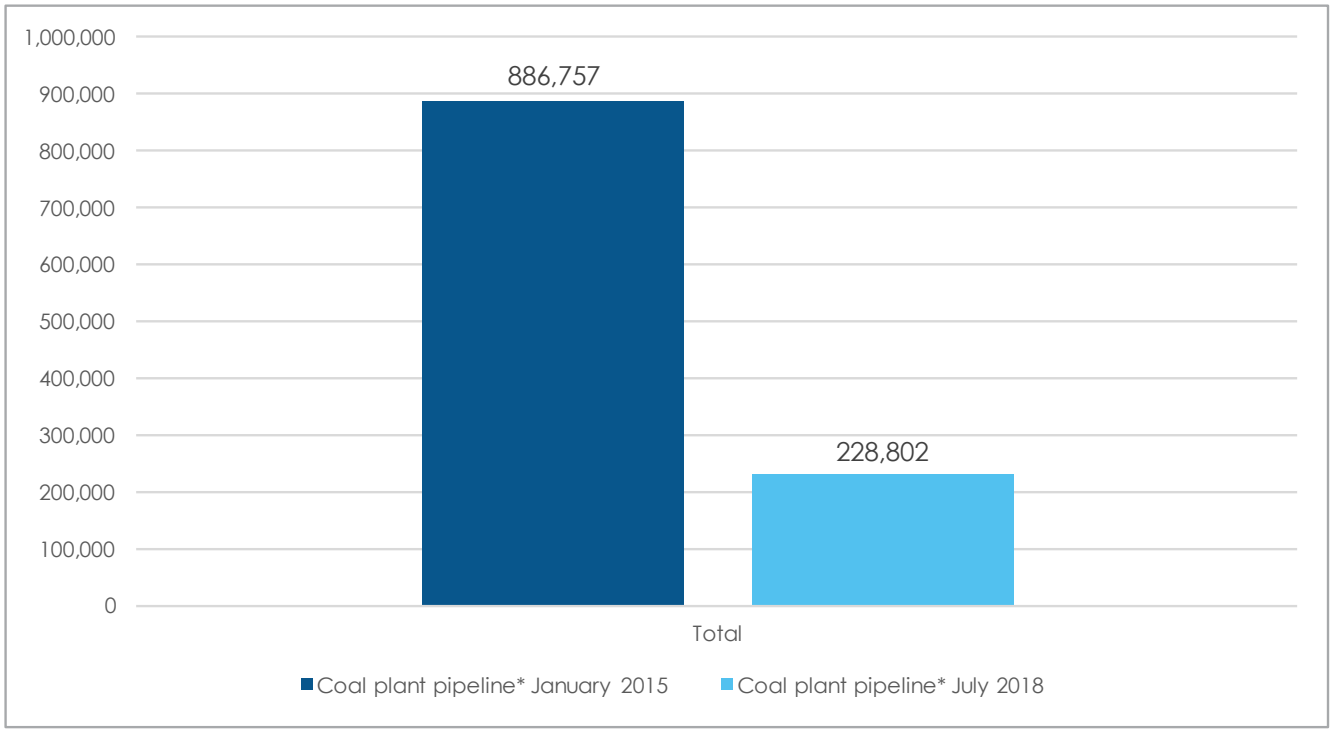
Meanwhile India's coal plant pipeline has shrunk by 234 GW over the same period.

Although almost 229GW of coal-fired power projects remain in the pipeline, this total seems highly likely to decline further given the downward trend and the prospect of renewable energy becoming increasingly competitive. Furthermore, this figure does not take into

[26] Global Coal Plant Tracker - July 2018 data

account coal plant closures. If current pipeline shrinkage and plant closure trends continue, plant retirements will exceed additions by 2022 and the overall global coal fleet will start to shrink.[27]

Figure 7: Coal Plant Pipeline Across Major Asian Electricity Markets (MW)



Source: Global Coal Plant Tracker.
*Projects that are announced or in the pre-permit or permitted stages of development.

Japan

NSW is highly reliant on Japan for its thermal coal exports, with this country accounting for 44.5% of exports in the fiscal year ending 30 June 2017 (Figure 6). Any downturn in the level of Japanese imports will have a significant impact on the NSW thermal coal industry. Japan is completely reliant on imports to meet its coal demand.

In its 2017 World Energy Outlook, the IEA sees Japan's total coal demand dropping 71% to 49Mtce by 2040 under its SDS, down from 168Mtce in 2016. Recent, ongoing developments in Japan, including a number of coal plant development cancellations, make the prospect of declining coal use increasingly probable.

Japan's foreign ministry has voiced criticism of the nation's energy policy with Foreign Minister Tarō Kōno in January 2018 describing current renewable energy targets as "lamentable." He further stated that "For too long Japan has turned a blind eye to global trends, such as the dramatic decrease in the price of renewables and the inevitable shift to decarbonisation in the face of climate change."[28]

[27] Shearer, C., Mathew-Shah, N., Myllyvirta, L., Yu, A. and Nace, T., Boom and Bust 2018: Tracking the Global Coal Plant Pipeline, March 2018.
[28] Japan Times, "How energy neglect holds Japan back", 19th January 2018

Furthermore, an energy task force set up to advise the foreign ministry stated in February 2018 that Japan's current energy policies are damaging the nation's global competitiveness.[29] The task force concluded: "It is obvious that Japan is lagging." Both the foreign and environment ministries have committed to using 100% renewable energy for their own electricity needs.

Significantly, Japanese banks are also now indicating a change in their outlook toward coal. The large Japanese banks are coming under increasing campaign pressure as they are among the largest funders of coal globally.

Sumitomo Mitsui Financial Group has indicated that it may rethink its stance toward coal.[30] This move is almost certain to eventually be followed by major Japanese coal financiers Mizuho Financial Group and Mitsubishi UFJ Financial Group as the financial sector momentum against coal builds both globally and within Japan. In June 2018, Mizuho released a statement that recognized the need for action to tackle climate change and noted global concern about the role coal-fired power plays in carbon emissions. In September 2018, Mitsubishi UFJ stated that it was reviewing its lending policies to the coal-fired power sector.[31]

The week before Sumitomo Mitsui's acknowledgement in May 2018, Japan's second-largest insurer, Dai-ichi Life Insurance announced it would no longer provide financing for overseas coal-fired power projects. This was the first time a Japanese financial institution committed to restricting coal finance. Following this, Nippon Life Insurance—Japan's largest insurer—announced in July 2018 that it will cease financing all coal-fired power stations in Japan and overseas.[32]

Some of Japan's major trading houses have also begun to recognise the climate risks associated with coal. Mitsubishi Corp. has moved to sell its stake in Australian thermal coal mines. Mitsui and Co. stated in 2017 that it has no plans to invest in new thermal coal mines due to environmental concerns. Meanwhile, Sojitz Corp. is also planning to reduce its exposure to thermal coal.[33] Marubeni no longer holds any stakes in operating thermal coal mines.

Perhaps most meaningfully, in September 2018, Marubeni – one of the world's most significant coal-fired power plant developers – announced new policies to wind down its coal power business and increase its focus on renewables. The major Japanese conglomerate is to begin the process of pulling out of coal-fired power by targeting a halving of its holdings in coal plants by 2030. Furthermore, Marubeni will no longer develop any new coal-fired power projects "as a general principle".[34]

[29] Reuters, "Japan task force echoes foreign minister calls to back renewables over coal, nuclear", 20th February 2018
[30] Bloomberg, "Sumitomo Mitsui Signals it May Curb Coal-Fired Power Lending", 16th May 2018
[31] Australian Financial Review, "Major Japanese banks, traders tighten coal policy", 23 September 2018
[32] Reuters, "Japan's Nippon Life to stop financing coal-fired power", 23rd July 2018
[33] Reuters, "Japan's trading houses offload thermal coal assets amid climate concerns", 13th June 2017
[34] Marubeni, "Notification Regarding Business Policies Pertaining to Sustainability", 18th September 2018

Japanese Coal-Fired Power Projects Cancelled

The Australian coal industry touts the new coal-fired power stations in Japan's development pipeline, stating that this will lead to increased thermal coal imports going forward. However, the development pipeline has shrunk in Japan since 2015, dropping from almost 13 GW as at January 2015 to less than 9 GW as of July 2018, according to Global Coal Plant Tracker data.

With electricity demand in Japan declining (Figure 8), renewables continuing to be rolled out, and the government determined to re-start nuclear power plants, that number looks set to decline further. Coal-fired plants that do get built are likely to replace older ones that retire, which could actually decrease coal consumption due to the increased efficiency of new plants.

Sumitomo recently announced that its proposed Sendai-Takamatsu power plant will be switched to run on biomass, not coal, and J-Power scrapped a plan to replace aging power plants with 1,200 MW of new coal-fired power generation.[35] This follows a decision by utility Kansai Electric Power in 2017 to cancel plans to convert its 1,200 MW Akō Power Station from oil to coal.[36] In the same year, the Japanese environment minister urged Chubu Electric Power to reconsider its plans to build a new coal-fired power plant over concerns that Japan will struggle to meet its emissions reduction targets.[37] As coal-fired power falls further out of favour with Japan's environment ministry, Tokyo Gas and Kyushu Electric Power are seeking to build a 1 GW liquified natural gas (LNG) fired plant as an alternative to a planned 2 GW coal-fired power station near Tokyo.[38]

In July 2018, the Japanese Ministry of Economy, Trade and Industry (METI) announced a policy to restrict the construction of low-efficiency coal-fired power plants, recognising the high carbon emissions of such plants. This will virtually prohibit further construction of small plants (those below 112.5 MW).[39]

Japan currently has 6 GW of new coal-fired power under construction while 7 GW has been cancelled or shelved since 2010. With senior Japanese government ministers and major Japanese financial institutions now beginning to move away from coal, IEEFA expects Japan's coal-fired power development pipeline will shrink further over the coming years, particularly as the offshore floating wind sector begins to really take-off in the 2020s.

Renewable Energy Momentum

Japan's financial institutions are increasingly turning to renewable energy projects as they move away from coal. Japan's banks have been making significant renewable energy infrastructure investments abroad, attracted by strong annuity yields backed by long-term power purchase agreements (PPAs) from mostly highly rated utilities. Mitsubishi UFJ Financial Group (MUFJ) and Sumitomo Mitsui Financial Group have been among the largest lead arrangers globally for clean energy asset financing in recent years. These two banks in

[35] Reuters, "Japan's J-Power scraps plans to replace two coal-fired power plants", 27th April 2018
[36] Reuters, "Japan's Kansai Electric cancels plans to switch oil-fired power station to coal", 1st February 2017
[37] Reuters, "Japan environment minister urges Chubu Elec coal-fired power project be reconsidered", 1st August 2017
[38] Nikkei Asian Review, "Tokyo-area coal plant developers consider switch to LNG", 10th August 2018
[39] Nikkei, "Ministry of Economy, Trade and Industry to prohibit the construction of small coal-fired power plants", 25th July 2018

particular have moved into offshore wind in Europe and are now moving into the growing Taiwan market.[40] This experience places these banks in a strong position to support the developing Japanese domestic offshore wind industry.[41] Although offshore wind development in Japan has been slow to date, the government is now working on legislation that should see the sector take off in the near future.[42]

Major international offshore wind energy players are now preparing for expansion into Japan. Ørsted, the world's largest offshore wind generation company, has plans to establish a subsidiary in Japan and Norway's Equinor (previously called Statoil), which built the world's first floating offshore wind installation in Scotland, is preparing to enter the Japanese market as well.[43]

MHI Vestas, a joint venture between Mitsubishi Heavy Industries and Danish wind turbine manufacturer Vestas, was launched in 2014. The joint venture is a leading global provider of offshore wind turbines with units installed across the world's leading offshore wind markets, and it is in an ideal position to benefit from fast-developing Asian markets including Japan.

A number of Japan's major trading houses, including Mitsubishi, Marubeni, Sumitomo and Mitsui have been expanding into Europe's rapidly developing offshore wind power market for years and more recently have moved into the Taiwan offshore arena. This has given them expertise they can utilise in Japan's nascent offshore power sector.

Solar PV installations took off in Japan after the Fukushima disaster, aided by generous tariffs as Japan struggled to address the capacity gap left by the shutdown of all 40 GW of its nuclear power capacity. Over the period 2013-2015, Japan was the second-largest installer of solar PV behind China. Although the rate of new installations has slowed more recently, solar is still being added to Japan's generation capacity driven by cost declines averaging 10% annually. Solar power allowed Japan to meet high electricity demand during its recent summer heatwave and utilities such as TEPCO are increasingly reliant on it.[44]

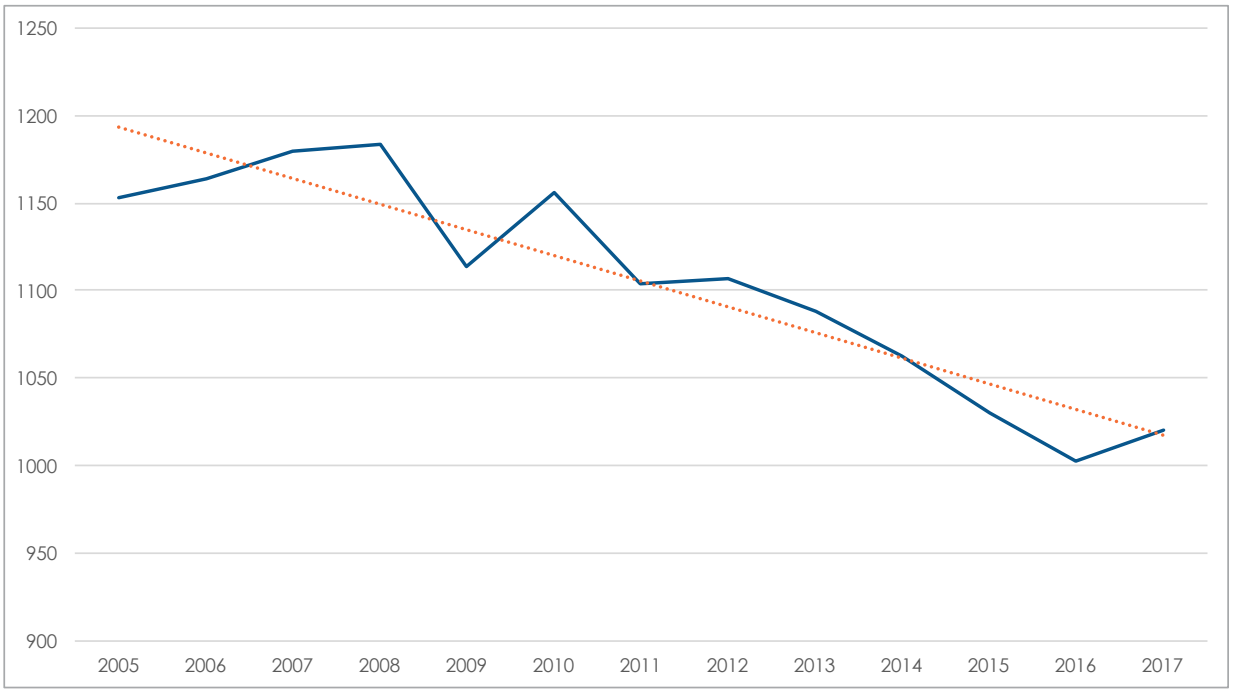
Such is the continuing trend of declining renewables, battery and international, sub-sea cable interconnection costs that BNEF sees renewables accounting for almost three-quarters of Japan's electricity generation by 2050.[45]

Given the doubling of imported thermal coal prices since the start of 2016, the continuing increase in renewable energy generation in Japan will eat into the economic viability of coal-fired power particularly quickly, because electricity demand in the country is in long-term decline. For every extra kilowatt-hour of electricity produced from renewable sources, another source of electricity must lose out. Japan's latest electricity plan calls for a 17% reduction in electricity demand compared to business-as-usual, suggesting the trend of improving energy productivity and declining demand looks set to continue.

---

[40] Clean Technica, "Taiwan's 120 MW Formosa 1 Offshore Wind Farm Reaches Financial Close", 12th June 2018
[41] IEEFA, "Japan is Investing Heavily in Overseas Renewables", 28th March 2017
[42] Bloomberg, "'Dawn' of Asia Offshore Wind Boom Lures Japanese Trading Houses", 29th May 2018
[43] Nikkei Asian Review, "Global wind power companies gear up for business in Japan", 10th July 2018
[44] IEEFA, "Solar helps Japan cope with sweltering summer", 16th August 2018
[45] BNEF, "New Energy Outlook 2018"

Figure 8: Japanese Electricity Generation 2005-2017 (TWh)



Source: BP World Energy Statistics 2018.

In addition, the Japanese government remains committed to restarting as many nuclear power units as possible. In its recently released energy plan, the government aims for nuclear power to contribute between 20% and 22% of the nation's power generation by 2030. Renewables are to contribute 22% to 24% with the remainder coming from coal and LNG. Whether the nuclear power target is achievable is clearly debatable, however, given Japan's declining electricity demand, any increase in nuclear power output eats into the market share held by coal and/or LNG.

Japan recently brought a ninth nuclear power unit back online. There is also the prospect that Kashiwazaki-Kariwa, the world's largest nuclear power plant, could be progressively brought back online, which would further eat away at demand for coal and LNG.[46]

Declining electricity demand combined with increasing renewable energy installations and the return of some nuclear power units means fossil fuels will be progressively squeezed out of the Japanese energy mix with both coal-based and LNG-based generation set to decline. If Japan continues to react to growing pressure on its emissions policies, it will be coal that bears the initial brunt of this decline.

China

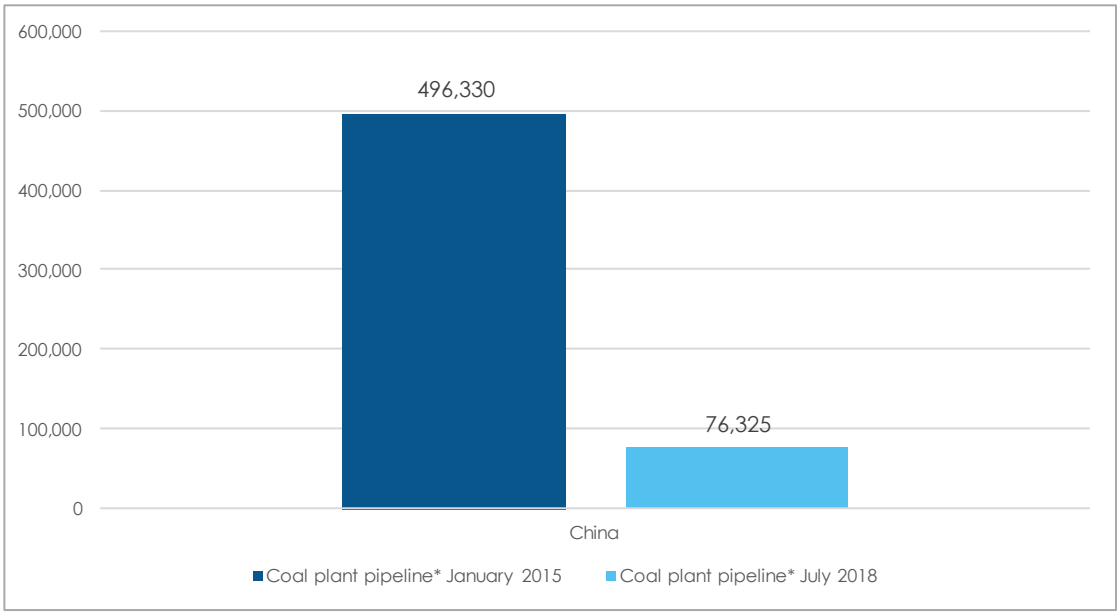
China's thermal coal imports peaked in 2013 at 212Mt. In 2017, total imports into China were 188Mt.

Imports of thermal coal make up only a small proportion of overall Chinese thermal coal consumption, which is dominated by domestic supply. China is in the process of rationalising

[46] Financial Times, "TEPCO shares rally as election result sparks nuclear restart hopes", 10th June 2018

its domestic coal market and improving mining efficiency. A cap on domestic production, including cuts to inefficient mining capacity, has led to a recovery in import volumes since 2015. However, according to the most recent Energy and Resources Quarterly report from the Office of the Chief Economist, the expected addition of new domestic capacity will be a substitute for imports going forward.[47] Domestic coal production reached a nine-month high in September 2018 with total year-to-date production 5.1% higher than the prior year after the opening of new mining capacity, with more capacity expected to come online in the coming months.[48]

Figure 9: Coal Plant Pipeline in China (MW)



Source: Global Coal Plant Tracker.
*Projects that are announced or in the pre-permit or permitted stages of development.

China is currently constructing 76 GW of new coal-fired power plants, but almost 718 GW of planned coal-fired capacity has been cancelled or shelved since 2010.[49] The pipeline of coal plant projects (those that have been announced or are in the pre-permit or permitted stage of development) has collapsed, falling 85% in the last few years (Figure 9). Going forward, an increasing amount of new electricity demand will be met by clean energy sources and IEEFA forecasts that coal's share of the generation mix will steadily decline, continuing a trend that began in 2009.

If China's long-awaited emissions trading scheme, which will initially focus on the power sector, finally comes into force it will place further downward pressure on coal consumption. Meanwhile, S&P Global Ratings expects that a move toward more market-based power trading could also put pressure on coal-fired power.[50]

[47] Office of the Chief Economist, Resources and Energy Quarterly, June 2018
[48] Reuters, "China September coal output hits nine-month high as new capacity starts up", 19th October 2018
[49] Global Coal Plant Tracker - July 2018 data
[50] S&P Global Ratings, "China's Move to Accelerate Market Pricing Of Electricity Will Be Harder On Coal Than Clean Energy", 24th July 2018

Even under the increasingly outdated NPS, the IEA projects that China's total coal imports will decline by 126Mtce, dropping to 70Mtce by 2040. Under the SDS, China's total primary energy demand from coal is projected to fall from 2,796Mtce in 2016 to 1,190Mtce by 2040, a reduction of more than 57%.

Air Pollution Concerns

China's shift away from coal is driven in part by the technological transition that increasingly means renewables are the more economic option (with almost zero short-run marginal production costs), as well as the need to act on carbon emissions. In addition, the Chinese government's plan to increase its reliance on renewables, nuclear and gas is linked to its ongoing commitment to sustainably reduce air pollution.

China is now in its fifth year of its "war on pollution" and in July 2018 released its 2018-20 air pollution action plan. The plan aims to take measures to reduce smog, including cutting coal consumption.[51] The expanded plan now applies to 82 Chinese cities and the major coal producing provinces of Shanxi and Shaanxi.

China became the world's biggest importer of natural gas this year (overtaking Japan) boosted by increased imports of LNG as it continues to progressively wean itself off coal.[52] The IEA projects a significant increase in China's gas imports going forward under its "Blue Skies" anti-pollution policy. By 2023, China is expected to be importing 171 billion cubic metres (bcm) of natural gas, up 82% from 94bcm in 2017. This will include 93bcm of LNG in 2023, up from 51bcm in 2017. China's overall gas demand is expected to increase 59% to 376bcm by 2023.[53]

Renewables to Power On

China has been rolling out renewable energy at a rapid pace, with 2017 a landmark year for clean energy including a world-leading 53 GW of solar power installed. Although a repeat of that total isn't expected in 2018, China continues to add to its enormous renewable energy capacity. By the end of the first half of 2018, China's wind power capacity had reached 170 GW with solar just behind at 150 GW. China's combined clean energy capacity, which includes 340 GW of hydropower, has reached 680 GW, up 13% year-on-year.[54]

Despite these impressive numbers, China is nowhere near its renewable energy potential. The government is aiming for 210 GW of wind power by 2020, according to its five-year plan for wind power, and is on track to beat this target according to a report from Make Consultancy – now Wood Mackenzie Power & Renewables. Cumulative Chinese wind capacity will exceed 400 GW by 2027, including a significant uptake of offshore wind, according to the report.[55]

China has recently increased its renewable energy consumption targets from 20% of consumption to 35% by 2030.[56]

---

[51] Reuters, "China to cut coal use, curb steel in 2018-2020 pollution plan", 4th July 2018
[52] Bloomberg News, "China Takes Gas Crown as Clean-Air Push Powers it Past Japan", 24th June 2018
[53] IEA, Gas Market Report 2018
[54] China Daily, "Natural gas demand rises in first half", 31st July 2018
[55] Asian Power, "China's wind power capacity could reach 400GW after 2027: report", 3rd August 2018
[56] Bloomberg, "China Steps Up Its Push Into Clean Energy", 26th September 2018

Batteries will add to the penetration of renewable energy at coal's expense, according to BNEF's 2018 New Energy Outlook. The report predicts that the continuing reduction in battery costs will allow wind or solar paired with batteries to provide power cheaper than existing Chinese coal-fired power plants, by 2028. As a result, BNEF predicts wind and solar will provide 46% of China's total power generation by 2050. Chinese wind and solar capacities are forecast to reach 1,000 GW and 1,100 GW respectively by that date.[57]

The rapidly falling cost of renewable energy and batteries, combined with serious government efforts to combat air pollution, is set to reduce China's reliance on coal. As the nation's domestic coal industry rationalisation takes effect, it will be thermal coal imports that will be squeezed out first.

China imports the majority of its coal from Indonesia and Australia. Imports of Australian coal are of the lower, high-ash 5,500 net as received (NAR) specification, rather than Australia's high-grade 6,000 NAR benchmark product. Significant knock-on effects will ripple through the Asian market as China's import demand decreases permanently. India currently imports 5,500 NAR thermal coal from South Africa, and Australian producers may seek to compete in that market. However, the opportunity for this may be limited given the economic problems currently facing imported coal-fired power plants in India (see India section below).

Taiwan

Taiwan was the third-largest export destination for NSW thermal coal for the year to 30 June 2017 at 21.5Mt. As with the markets in Japan and China, it is clear that demand for thermal coal imports will decline in Taiwan too. Similarly with other Asian countries, air pollution is a major public concern in Taiwan.[58]

Taiwan does have 2.4 GW of coal-fired capacity under construction but the project pipeline has now virtually disappeared after a series of cancellations. The 1,600 MW Changgong plant was rejected by Taiwan's EPA and two units at the Taichung Power Station will now be run on gas rather than coal. The large Taipei Port and Hsinta Power Station proposals have been cancelled. Most recently, the 1,200 MW Shenao power proposal was cancelled in October 2018.[59] This was the last major coal-fired power plant in Taiwan's pipeline and it leaves only one, small 49 MW plant in the planning phase. Including the recent Shenao cancellation, 14 GW of planned coal-fired power stations have been cancelled or shelved in Taiwan since 2010.[60]

Taiwan's electricity generation from coal peaked in 2007 according to BP data.[61] With little or no demand growth in the longer term, coal's share of the generation market is expected to drop from 46% to 30% by 2025, which will result in an absolute reduction in coal consumption.

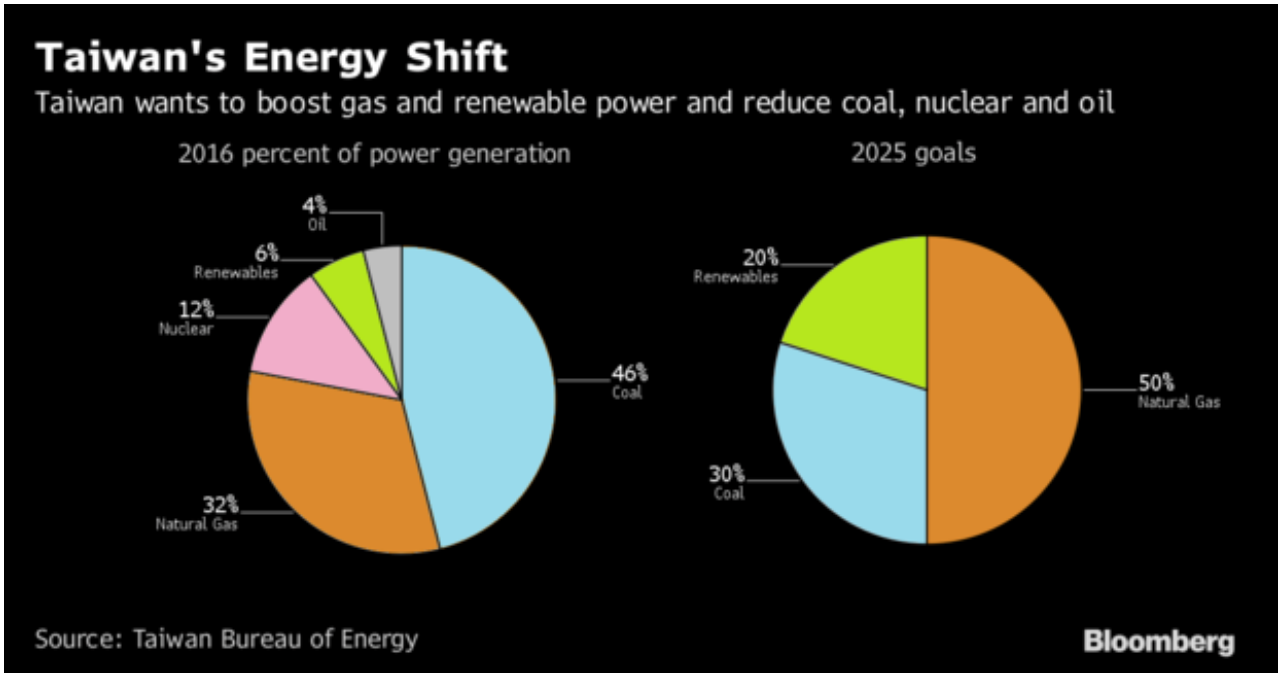
As well as decreasing reliance on coal-fired power and ending nuclear power generation, Taiwan aims to rapidly increase generation from renewable energy, with a target of 20% by

[57] BNEF, "New Energy Outlook 2018"
[58] Taipei Times, "KMT delivers signatures for petitions", 28th August 2018
[59] Taiwan News, "Government to scrap Shenao power plant project: Taiwan premier", 12th October 2018
[60] Global Coal Plant Tracker - July 2018 data
[61] BP - Statistical Review of World Energy 2018

2025. An increase in renewable energy generation will boost energy security in a nation that is currently dependent on imports to fuel its electricity generation system.

Taiwan's renewable energy target requires a roll-out of 25 GW of renewables by 2025 and solar will be a major contributor. A solar development zone was declared in Changhua in July 2018—fast becoming a renewables hub within Taiwan—for the development of Taiwan's largest solar farm (320 MW).[62] The nation's solar ambition is now attracting major investors, with BlackRock, the world's largest investor, acquiring Taiwanese solar interests in August 2018.[63]

Figure 10: Taiwan's Energy Transition Has Begun



Source: Bloomberg, Taiwan Bureau of Energy.

Offshore Wind

Much of Taiwan's renewables development will be driven by offshore wind. This sector has been spearheaded by northern Europe, but now other countries around the world are set to benefit from the experience and cost reductions discovered, including China, Japan, India, Vietnam and South Korea. The Taiwanese government is accelerating plans for offshore wind deployment, aiming to build 14 wind farms with a total capacity of 5.5 GW within the next seven years. Two demonstration plants are set to come online in 2019.[64]

Danish offshore wind leader Ørsted won 920 MW of projects off the Changhua coast in Taiwan's first offshore wind auction in June 2018. This lifted Ørsted's Taiwan offshore wind portfolio above 1.8 GW.[65] Meanwhile, MHI Vestas—the world's second biggest offshore wind turbine maker—is planning to use Taiwan as a hub to service the fast-growing Asian offshore

[62] Taipei Times, "Special zone for solar power set up in Changhua", 18th July 2018
[63] The Asset, "BlackRock Real Assets makes first solar investment in Taiwan" 2nd August 2018.
[64] Taiwan News, "Cabinet accelerates offshore wind farm development in Taiwan", 7th July 2018
[65] Ørsted, "Ørsted wins 920MW offshore wind projects in Taiwan", 22nd June 2018

market.[66] Offshore wind turbine leader Siemens Gamesa signed ten memoranda of understanding (MoU) with Taiwanese companies in August 2018 as it prepares to take part in the burgeoning offshore power market there.[67]

Offshore wind across Asia has the potential to displace a significant proportion of global seaborne thermal coal volumes. The IEA expects global offshore wind installations to more than triple to over 60 GW by 2025[68] and Asian nations have the potential to build a combined 100 GW of offshore wind by 2030. China has a target of 10 GW by 2020 and Wood Mackenzie Power & Renewables suggests China could reach 30 GW by 2030. India has an initial target of 5 GW by 2022 and then 30 GW by 2030. South Korea has an 18 GW target by 2030 while Japan and Taiwan have targets of 10 GW and 5.5 GW, respectively.

Figure 11: Asia's Offshore Wind Opportunity by 2030

Country	GW
China	30
India	30
South Korea	18
Japan	10
Taiwan	5.5
Indonesia, Philippines and Vietnam	6.5
Total	**100**

Source: Media reports, government documents, IEEFA estimates.

These targets are ambitious given that Asia is in the early stages of its offshore build-out. However, with utilisation rates of offshore wind having the potential to reach 55%, if only 70% of this 100 GW target is installed, this still could displace 300m-350m tonnes of thermal coal annually—about 35%-40% of the global seaborne thermal coal trade.[69]

South Korea

There has been a significant change in the long-term coal demand outlook for NSW's fourth-largest thermal coal export destination since President Moon Jae-in was elected in 2017.

The new government's long-term plan for the South Korean electricity system calls for dramatically reduced reliance on coal and nuclear and a boost to renewable energy and LNG-fired power generation, which the Australian government's Export Finance and Insurance Corporation (EFIC) noted was good for the Australian LNG industry but bad for Australian thermal coal.[70]

Under the plan, renewables will provide 20% of the nation's electricity by 2030 (up from 6.7%) and renewable energy capacity is to be expanded from 11.3 GW to 58.5 GW by that date.[71]

[66] Bloomberg New, "MHI Vestas to Use Taiwan as Export Hub for Asia Offshore Wind", 2nd July 2018
[67] Offshorewindbiz, "Siemens Gamesa Signs 10 Offshore Wind MoUs in Taiwan", 8th August 2018
[68] IEEFA, "IEA: Offshore wind capacity could top 200GW by 2040", 26th September 2018
[69] IEEFA, "Offshore wind power: the underexplored opportunity to replace coal in Asia", 30th August 2018
[70] EFIC, "South Korea – New energy policy good for Australian LNG but not coal", July 2017
[71] Reuters, "South Korea finalizes energy plan to boost renewable power generation", 29th December 2017

Over the same period, coal's share of the power mix is to fall from 45.3% in 2017 to 36.1%. Forecast electricity demand has also fallen to 100.5 GW in 2030 from 113.4 GW in the previous electricity demand forecast, due to significant focus on energy productivity initiatives. Electricity generation growth averaged less than 3% per annum since 2012. In the government's latest electricity plan, the forecast for electricity demand growth has been reduced to 1% per annum through to 2030, due to lower expected GDP growth and energy efficiency measures.[72]

The government aims to encourage a switch from coal to LNG and renewables with increased taxes on coal. Coal consumption taxes were increased 20% to KRW36/kg (US$32/t) in April 2018.[73] The government now plans to raise the coal tax by another 28% to KRW46/kg (US$41/t), while cutting the tax on LNG imports by 75% beginning in April 2019.[74] The coal tax is in addition to South Korea's carbon price, which was introduced in 2015 via a cap-and-trade system that currently prices carbon at around US$20/t.

Plans to build new coal-fired power plants are now under review and it is expected that at least two of the proposed new plants will instead proceed as LNG-fired plants.[75] Two others may also proceed as LNG plants.

According to the government's 2030 energy plan, LNG's share of the generation mix will increase from 16.9% to 18.8% as reliance on coal and nuclear declines.[76] The nation is taking steps to diversify its sources of LNG imports and increase storage capacity as demand for the fuel increases. Additional gas infrastructure investment is planned to reach US$5.5bn by 2031.[77] In a reversal of previous forecasts, which had anticipated declining LNG demand, the new plan to reduce reliance on coal means that LNG demand has now been re-forecast upward. By 2031, total LNG demand across domestic, industrial and electricity generation is forecast to reach 40.5Mt, up 11% from the 2018 forecast demand of 36.5Mt.[78]

In addition to the national government, provincial governments in South Korea are also taking measures to reduce reliance on coal. South Chungcheong province, also known as Chungnam, is home to the majority of South Korea's coal-fired power plants, yet the province has declared a vision to cut reliance on coal to zero by 2050 while rapidly scaling up renewable energy capacity. The province joined the global Powering Past Coal Alliance in October 2018.[79]

As well as concerns about carbon emissions, South Korea's increasing efforts to reduce coal consumption are driven by air pollution concerns. In April 2018, the Organisation for Economic Cooperation and Development (OECD) reported that South Korea has the worst air quality of any economically advanced nation.[80] Air pollution was a hot topic in the 2017

[72] EIA, South Korea: Overview, 16th July 2018
[73] Platts, "S Korea unveils power mix plan for 2030 focused on renewables, LNG", 14th December 2017
[74] Reuters, "S.Korea to raise coal tax; lower LNG tax for power generation", 30th July 2018
[75] Reuters, "South Korea plans shift to renewables, but coal, nuclear to remain strong", 14th December 2017
[76] Platts, "S Korea unveils power mix plan for 2030 focused on renewables, LNG", 14th December 2017
[77] Reuters, "S.Korea sees natural gas demand growing to over 40 mln T by 2031", 5th April 2018
[78] Platts, "S Korea unveils power mix plan for 2030 focused on renewables, LNG", 14th December 2017
[79] Powering Past Coal Alliance, "Ten new Powering Past Coal Alliance members announced at Global Climate Action Summit", 13th September 2018
[80] The Korea Times, "Korea has the worst air of advanced economies, report shows", 19th September 2017

presidential election, with both leading candidates presenting policies designed to lower coal consumption in order to address air quality concerns.[81]

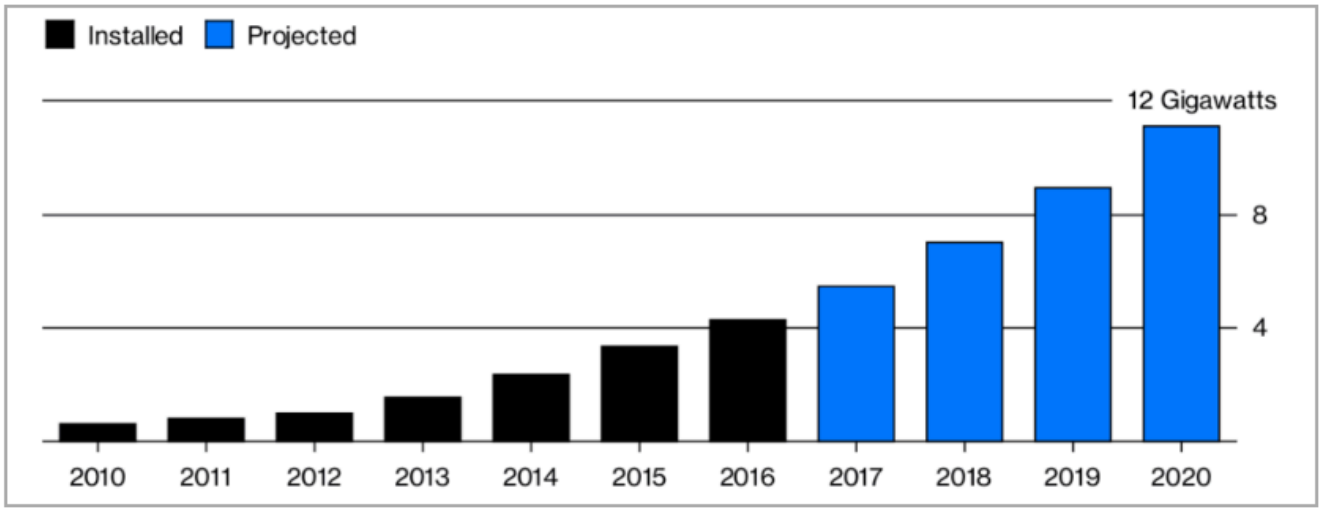
One of President Moon's first actions after his election was to temporarily close older coal-fired power plants to make good on his election promise to improve air quality. A similar measure has been taken in 2018 with five older plants suspended from March until June.[82]

South Korea's Renewables Build-Out is Under Way

South Korea's build-out of renewable energy capacity sufficient to generate 20% of the nation's electricity by 2030 is well under way. The year 2017 saw annual solar PV capacity additions in South Korea increase to 1.1 GW.[83] This was driven by strengthening government support and the introduction of reverse auctions. By 2020, the rate of installation is expected to reach 2 GW per year.[84]

South Korea's capital city will install 1 GW of solar by 2022. The "Solar City Seoul" project will involve the investment of US$1.6bn.[85] Meanwhile in March 2018, the Korea Energy Agency signed a memorandum of understanding with Masdar—an Abu Dhabi-based energy company. The aim is to develop a strategic partnership to support solar, wind, waste-to-energy and energy storage projects.[86]

Figure 12: Actual and Projected South Korean Solar PV Installations to 2020



Source: Bloomberg Businessweek, Bloomberg New Energy Finance, Korea Energy Agency.

With its long coastline, offshore wind will also play an important role in South Korea's energy future. As offshore wind costs continue to drop, South Korea recently inaugurated its first

[81] Bloomberg, "Front-Runners Target Smog as Koreans Don Masks for Election Day", 9th May 2017
[82] Hellenic Shipping News, "South Korean Kogas' Apr LNG sales mark biggest increase in 17 months", 10th April 2018
[83] IRENA, Renewable Capacity Statistics 2018, March 2018
[84] Bloomberg, "South Korea Makes Renewable Energy Push", 8th December 2017
[85] PV-Tech, "Seoul-ar City: South Korean capital investing US$1.5bn for 1GW of PV", 22nd November 2017
[86] PV-Tech, "Masdar and Korea Energy Agency to collaborate on solar, floating PV and energy storage", 27th May 2018

offshore wind farm off the coast of Jeju Island.[87] In June 2018, the Energy Ministry announced plans to build 12 GW of offshore wind by 2030.[88] South Korea already has 4 GW of offshore wind in the pipeline.[89]

Korea Electric Power Corp (KEPCO), the state-owned power utility, has historically based its power generation on nuclear and fossil fuel technology. However, it is now ramping up investment in renewables both in Korea and overseas.[90] The size of its renewable infrastructure investment supports our view of a step-change in ambition and strategic shift.

The previous government announced in late 2016 that KEPCO would invest US$3bn in domestic renewable energy across 2017 and 2018 as part of a plan to boost renewable energy generation, a plan that has since been replaced with an even more ambitious one by the new government.[91]

KEPCO is already investing in the rapidly growing energy storage sector, and South Korea is set to be a key growth market in this segment, with policies mandating that certain commercial and industrial companies install energy storage capacity. This move suits South Korea, given it is a major manufacturer of batteries for energy storage from companies such as LG Chem and Samsung SDI.[92] Macquarie has recently invested in the largest energy storage system in South Korea.[93]

This year (2018) has already seen KEPCO take steps to prepare South Korea for increasing reliance on renewable energy. In February it was announced that KEPCO had commissioned GE to build a new 4 GW high-voltage transmission link between Seoul and the east of the country.[94] Enhanced transmission links are required to connect renewable generation hotspots with load centres in major cities.

IEA Forecasts Plummeting Korean Coal Imports

The IEA does not separately disclose projections for South Korea under the Sustainable Development Scenario. However, even under the New Policies Scenario the IEA made the highly significant statement that:

> "We see Korean coal imports dropping by nearly 50% to less than 60 Mtce in 2040."[95]

In its New Energy Outlook 2018 report, Bloomberg New Energy Finance sees the South Korean electricity generation mix moving from 72% coal and nuclear in 2017 to 71% gas and renewables by 2050.[96] As the nation's coal and nuclear plants retire, BNEF foresees the

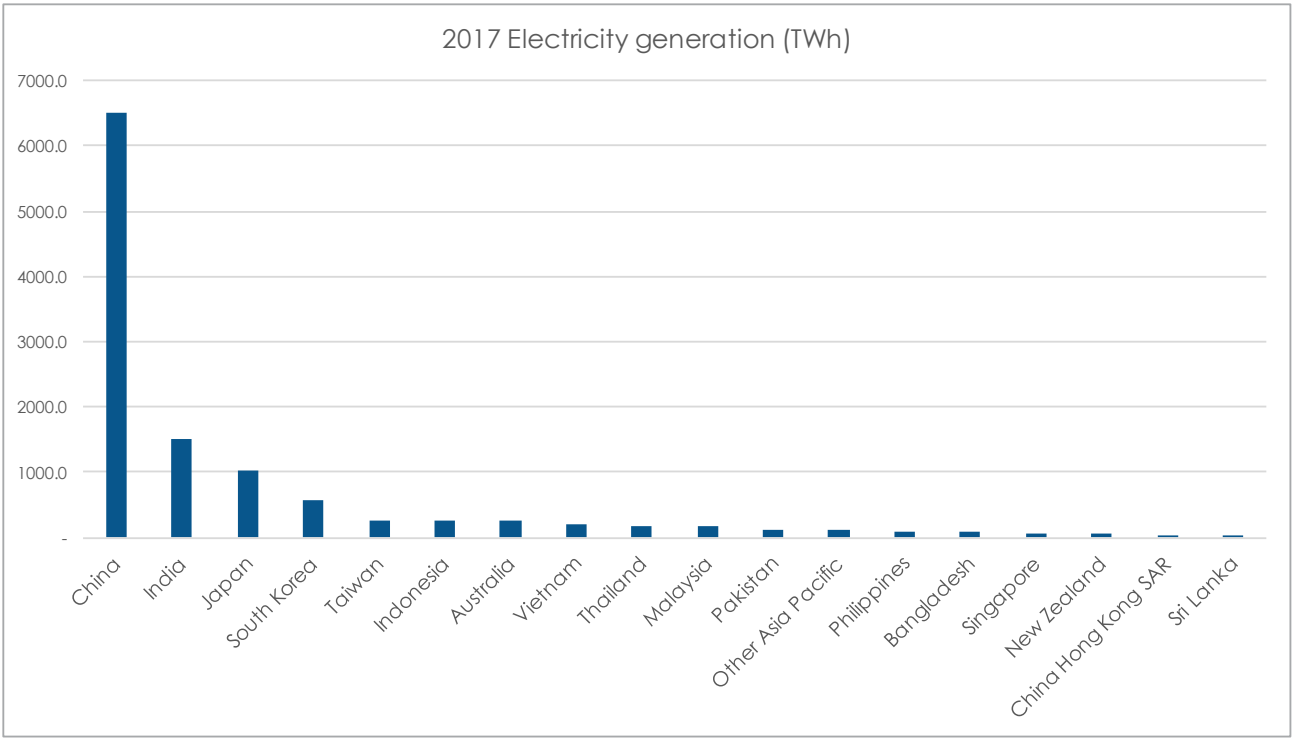
[87] Offshorewindbiz, "South Korea's First Commercial Offshore Wind Farm Goes Live", 17th November 2017
[88] Yonhap News, "S. Korea to add 12 GW of wind capacity by 2030", 26th June 2018
[89] IEEFA, "South Korea moving forward with offshore wind projects", 20th June 2018
[90] Yonhap News, "KEPCO buys interests in 3 solar projects in U.S.", 30th March 2018
[91] Pulse News, "Korea's 6 power firms under KEPCO to invest total $3bn in renewable energy over next 2 yrs", 27th December 2016
[92] Energy Storage News, "IHS Markit: 40% of energy storage pipeline is co-located with solar PV", 18th April 2018
[93] PV-Tech, "Macquarie to finance solar hybrid and 'largest' energy storage project in South Korea", 6th September 2018
[94] Greentech Media, "South Korea Stengthens Grid to Take On More Renewables", 20th February 2018
[95] IEA: World Energy Outlook 2017, p. 226
[96] BNEF, "New Energy Outlook 2018"

electricity system becoming increasingly based on renewables, supported by Korea's battery storage manufacturing capacity as well as gas peaking plants.

Other Asian Coal Import Markets

NSW thermal coal exports are dominated by the four export destinations outlined above. It is clear that in each of these countries, coal imports are heading towards a permanent, structural decline. As such, Australia's thermal coal mining industry often promotes the idea that other Asian nations will pick up the coming shortfall, allowing coal exports to continue to grow.

Figure 13: Size of Asian Electricity Markets – 2017 (TWh Generated)



Source: BP World Energy Statistics 2018.

Figure 13 puts this idea into perspective. Countries that the mining industry sees picking up the slack such as Vietnam, Thailand, Bangladesh and the Philippines, are tiny electricity markets compared to China, Japan and South Korea. With the major markets expected to significantly reduce coal imports in the long term, these smaller nations will not be able to fill the gap, even though some are dependent on imports for their coal. This is especially true given they will inevitably install increasing amounts of cheaper and cleaner renewable energy going forward, which will undermine the viability of new coal plants. Furthermore, public opposition to coal plant proposals across Southeast Asia is mounting.

The exception in Figure 13 is India, the second-largest electricity market in Asia. Currently NSW exports very little thermal coal to India but the industry continues to maintain that this is a key future destination for exports. However, this assertion is not aligned with stated Indian government policy or developments taking place on the ground in India.

India

India is not a major destination for Australian thermal coal exports. Just 0.4% of NSW thermal coal exports went to India in the fiscal year ended 30 June 2017 (Figure 6). Most Indian thermal coal imports are sourced from Indonesia and South Africa. However, the coal industry often cites India as a potentially important export destination for Australian thermal coal in the future.

The latest Resources and Energy Quarterly report from the Australian government's Office of the Chief Economist acknowledged the Indian government's repeated statements that it intends to end the import of thermal coal in the long term—"government policy remains focused on self-sufficiency."[97] NTPC, India's largest operator of coal-fired power plants, has already virtually eliminated coal imports according to Central Electricity Authority data.

The 2017 IEA World Energy Outlook report sees no significant increase in India's overall coal demand under the SDS. By 2040, demand reaches 584Mtce compared to 574Mtce in 2016. The 2017 WEO report was based on 2016 data; the following year was a highly significant one for the rapid expansion of renewable energy in India which added further support to the SDS projection.

There were large reductions in the cost of Indian solar PV and wind power in 2017, to the extent that Indian renewables are now cheaper than existing domestic coal-fired power. The Indian fiscal year that ended in March 2017 was the first year that combined renewable installations outpaced coal-fired power construction (with net thermal installs falling 65% year-on-year to a decade low of 7.7GW (Figure 14).

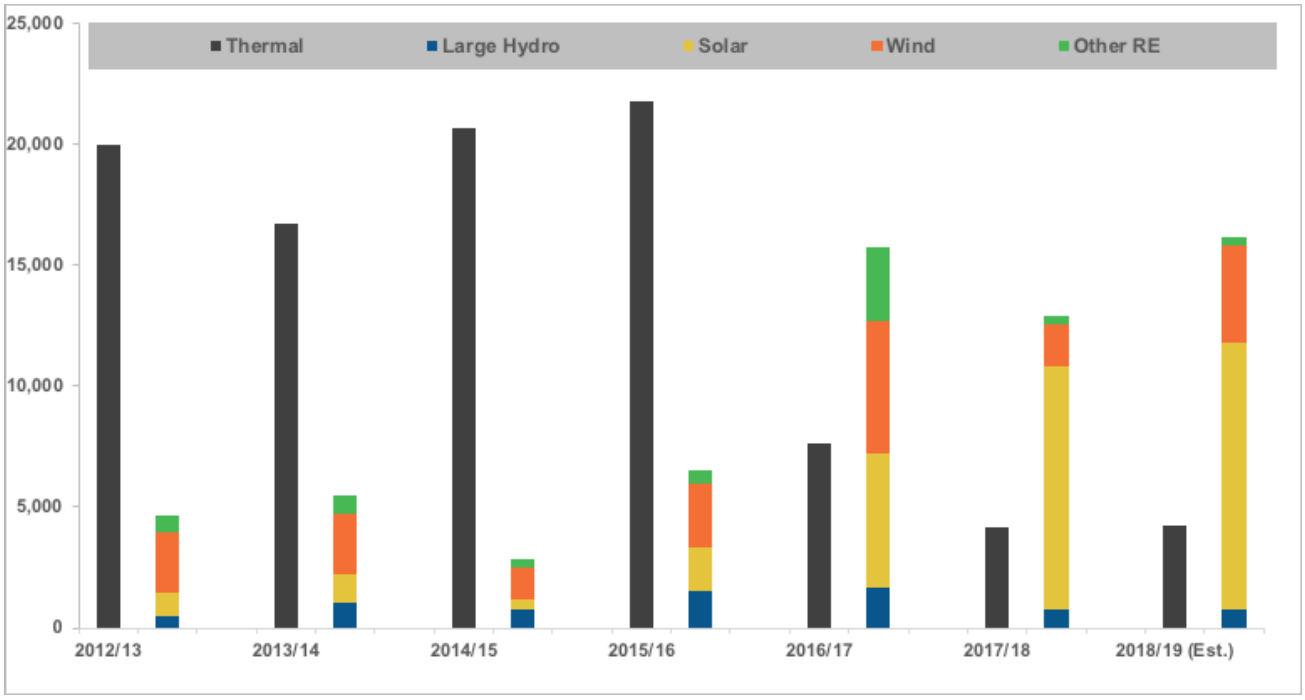
The following fiscal year, from April 2017 to March 2018, saw India install just a net 4.2 GW of coal-fired power (down another 46% year on year) and more solar PV capacity than all other technologies combined, with a total of 10.4 GW.

The current fiscal year (to March 2019) has, if anything, seen India's renewables ambition increase even further. The government is already looking beyond its initial target of installing 175 GW of renewable energy by 2022, a target many thought highly ambitious at the time it was set, and which was followed by a further target of 275 GW by 2027. The Ministry of New and Renewable Energy is targeting 40 GW of renewable energy auctions each year until 2028, comprising of 30 GW of solar and 10 GW of wind power.[98]

More than 10 GW of solar PV projects were tendered in May 2018 alone. Following this, in June 2018, Power Minister R. K. Singh announced the possibility of a 100 GW solar tender program.[99] Although no details as to how this huge initiative will be implemented have been released, the ambition is clear, and it follows the announcement by Japan's SoftBank that it intends to invest US$60-100bn in Indian solar.[100] India has also recently announced a move into offshore wind with a target of 30 GW by 2030.[101]

[97] Office of the Chief Economist, Resources and Energy Quarterly, June 2018
[98] Economic Times Energyworld, "India to auction 40 GW renewables every year till 2028", 1st July 2018
[99] Mercom India, "Over 10 GW of Solar PV Projects Tendered in May 2018 in India", 6th June 2018
[100] CNBC, "Japan's Softbank will reportedly invest up to $100 billion in Indian solar power project", 14th June 2018
[101] Clean Technica, "India Plans 5 Gigawatts Offshore Wind by 2022, 30 Gigawatts by 2030", 26th June 2018

Figure 14: India Renewable and Thermal Power Capacity Additions (MW)



Source: Central Electricity Authority of India (CEA), MNRE India, IEEFA estimates.

India's huge renewables ambition will be dependent on the necessary grid enhancements that will allow the nation's electricity system to take on additional variable generation capacity. In addition, renewable energy storage will play a major role going forward, something that is yet to make much impact in India, but which will ultimately allow renewables to further undercut the business model of coal-fired power.

Many analysts will be of the opinion that there is little chance of India meeting its highly ambitious renewable energy targets. IEEFA would suggest that this matters little—if India comes even remotely close to its targets, it will have successfully and sustainably transformed its electricity system, adding a powerful deflationary trend that reinforces the economic viability of this energy security-enhancing strategy. Meanwhile, rather than stepping back from its early ambitious targets, India has announced even more aggressive plans. India has clearly identified renewables as the more affordable, least cost and clean way to meet its growing electricity demand. Renewables will also bring power to the many rural inhabitants that cannot be served via coal-fired power plants fuelled by expensive imported coal.

Indian Thermal Coal Imports: Economically Unviable

The IEA's over-optimistic view on Indian coal imports is also partly based on its 2017 view that: "For the moment, imports appear to be the cheapest supply option along most of India's western coastline."[102] Since then, things have turned increasingly sour for Indian west-coast power plants that run on imported coal.

The two largest coal-fired power plants in India, the Mundra power stations owned by Tata Power (4.0 GW) and Adani Power (4.6 GW), have proven to be economically unviable due

[102] IEA: World Energy Outlook 2017, p. 221

to the doubling of imported coal prices since 2016. Tata Power has since stated that it will aim to run its plant, designed for imported coal, on 50% domestic coal in a move that we estimate would reduce its fuel costs by more than US$150m annually relative to current spot prices.[103]

Meanwhile, for months at a time during 2018, Adani Power has turned off most units of its Mundra plant as it is cheaper to pay the penalty for breaching its Power Purchase Agreements (PPA) than lose money on every kWh generated. This hardly seems to support the IEA's assertion that India's west coast may become "a new arbitrage point and price marker for global trade."

The Indian government has taken a number of other actions to reduce the country's reliance on imported coal, including improving the financial health of the nation's power distribution companies, driving increasing efficiency in domestic coal production and making significant capital investments to expand rail delivery capacity (see below). The latter efforts will result in even less need for thermal coal imports; India's electricity generation future will be based on cheap renewables and domestic coal, with the Central Electricity Authority continuing to target a cessation of thermal coal imports.[104] While acknowledging the role of coal-fired power in the short and medium term, BNEF forecasts that the Indian power market will be dominated by wind and solar by 2050, supported by batteries and flexible gas.[105]

India Domestic Coal: Rising Production and Improving Supply

In its latest Resources and Energy Quarterly report, the Office of the Chief Economist noted that in India: "Higher than expected production from the domestic coal industry and the possibility of further measures to encourage higher domestic production could weigh on import demand."[106]

The Australian thermal coal industry downplays rising Indian domestic coal production, often highlighting that the world's largest coal miner, state-owned Coal India Ltd., consistently misses its production targets. This allows the Australian industry to make highly optimistic assumptions about India's future coal import requirements.

While Coal India does tend to miss its ambitious production target increases, the company is significantly increasing production. In the current fiscal year, Coal India missed its targeted production growth for the first three months by 9%. Even so, the company's production was more than 15% higher than over the same period in the prior year,[107] at the same time that further coal-fired power capacity build-out is slowing.

India is now taking steps to further boost production and improve transport logistics for domestic coal. The Office of the Chief Economist has noted the reforms that will allow private companies to commercially mine coal, (currently about 94% of coal in India is mined by state-owned companies, mainly Coal India, Singareni Collieries and NLC India).

---

[103] Financial Express, "Tata Power expects nod for spot sale of excess power from Mundra in 2 months", 20th June 2018
[104] Economic Time Energyworld, "There is no need to import coal: Power ministry tells High Court", 10th December 2018
[105] BNEF, "New Energy Outlook 2018"
[106] Office of the Chief Economist, Resources and Energy Quarterly, June 2018
[107] Business Standard, "Coal India's production up 15.2% off-take grows 11.7% in Apr-June", 1st June 2018

This may be the biggest reform to the Indian coal sector since nationalisation in 1973. The game-changing move will increase competition and drive efficiency in the domestic coal sector and is expected to lead to a reduced need to import thermal coal.[108] The first steps in this reform were evident in 2017/18 with NTPC and Adani Enterprises each producing 7Mtpa of thermal coal in-house, with plans to more than double that production in the next two years. Indian credit rating agency CRISIL, owned by Standard and Poor's, expects this reform alone will cut India's current account deficit by US$4.4bn annually due to reduced coal imports.[109]

As well as increasing production, India needs to increase the efficiency of coal transportation. New dedicated railways are being built to transport coal while Coal India is investing in its own coal rakes to get around the shortages that hold up delivery. A recently approved new railway in Chhattisgarh could increase coal production by 100 million tonnes per annum in that state alone.[110] The Adani Group, India's largest coal importer, has stated that it expects coal imports to stagnate from the Indian fiscal year 2022 as the logistical issues with domestic coal are resolved.[111] With increasing self-sufficiency in mind, the coal minister has also noted that state-run enterprises NTPC and Bharat Heavy Electricals will convert coal-fired power stations designed for imported coal so that they can use domestic supply.[112] Coal supply reform has also reduced the average rail trip and hence rail costs for coal deliveries by 25% since 2012.

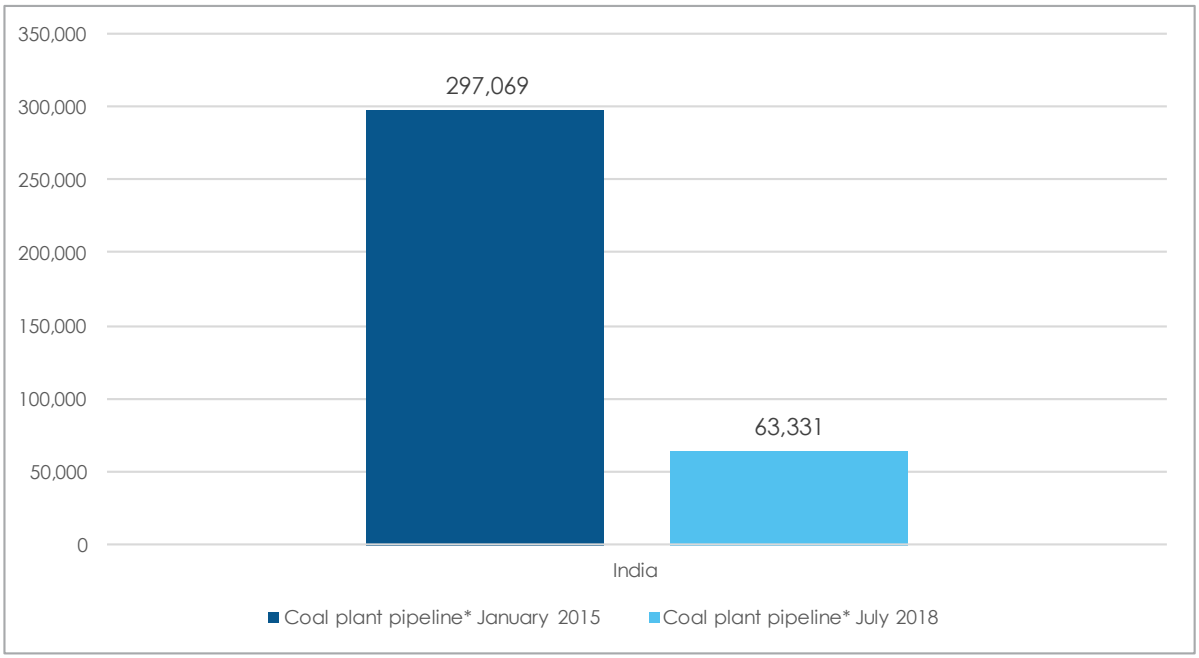
India's efforts to cease thermal coal imports and rely on domestic coal will be greatly helped by the slowing of its coal-fired power build out (Figure 14). This has been driven by lower than expected electricity demand growth, the rise of cheap renewables and continuing financial stress at many coal-fired plants.

Bank of America Merrill Lynch believes Indian banks face US$38bn in losses on bad loans to the coal-fired power sector – the most significant bad loan risk in India.[113] With the banks unwilling to take loss ratios of up to 75% on their power sector lending, there is currently no resolution to the situation in sight. Under these circumstances, it is not surprising that India's planned coal power pipeline has shrunk dramatically with 573 GW of proposed plants cancelled or shelved since 2010.[114] India's current coal plant pipeline is significantly smaller than it was even two years ago, shrinking from almost 300 GW in 2015 down to just 63 GW in 2018, a decline of 79%. With renewables outcompeting domestic coal on cost, this pipeline looks set to continue its decline.

---

[108] Economic Times Energyworld, "Approval for auction methodology for commercial coal mining a game changer: Experts", 20th February 2018
[109] CRISIL, "Commercial coal mining can cut import bill by Rs 30,000 cr", 6th March 2018
[110] Economic Times Energyworld, "Cabinet approves new broad-gauge rail line in Chhattisgarh", 26th September 2018
[111] Reuters, "India's Adani sees six-fold rise in coal mining volume despite challenges in Australia", 24th July 2018
[112] Economic Times Energyworld, "BHEL-NTPC recalibrating turbines to reduce dependence on imported coal: Piyush Goyal", 4th April 2018
[113] Bloomberg, "Abandoned Power Plant a $38 Billion Warning Sign for India Banks", 25th June 2018
[114] Global Coal Plant Tracker - July 2018 data

Figure 15: Coal Plant Pipeline in India (MW)



Source: Global Coal Plant Tracker.
*Projects that are announced or in the pre-permit or permitted stages of development.

India's newest electricity sector blueprint - National Electricity Plan (NEP) 2018 - released in January of this year, retained the core target of 275 GW renewables by 2027 from its draft in 2016. The plan also includes a timeline for dealing with the most polluting coal-fired power plants, which should ease concerns about the lack of visible progress to date by the Ministry of Power in terms of tighter air pollution regulations, especially with an apparent five-year deferral of the 2017 deadline for installation of emission controls.

The NEP 2018 includes a new target for closing 48.3 GW of end-of-life coal plants. Specifically, the plan forecasts 22.7 GW of coal power plant closures over the five years from FY2017-FY2022. This would include 5.9 GW of normal end-of-life retirements and 16.8 GW of closures due to inadequate space for flue gas desulfurization (FGD) equipment. An additional 25.6 GW of coal capacity is slated for retirement in the five years to FY2027.[115]

Taking the retirements and planned new construction totalling 94.3 GW into account, the NEP 2018 sees India's coal power capacity reaching 238 GW in 2027, 11 GW lower than the 2016 draft forecast, with the great majority of future capacity based on wind and solar energy.

In IEEFA's view, the significant slowing in coal-fired capacity construction combined with increasing production of domestic coal and increasing reliance on renewables will inevitably squeeze out imports once domestic coal transport logistical issues have been addressed.

[115] India's National Electricity plan Annexure 5.4, 5.5, 5.6

Vietnam

Vietnam represents 1.7% of Asia-Pacific electricity generation.[116]

The Australian coal industry often uses Vietnam as an example of a nation whose future coal consumption growth will make up for coal import declines in its major markets.

Like other emerging Asian nations, any plans to build expensive coal-fired power stations in Vietnam are reliant on heavily concessional government finance from the export credit agencies (ECAs) of Japan, China and South Korea. But with increasing international pressure on these ECAs to cease international coal financing on climate grounds, and the agencies instead starting to finance renewable energy projects, there is a serious likelihood that this concessional coal finance will dry up in the future. Absent financial subsidises, the high cost of new imported coal-fired power plants will then mean that the expected build-out of such plants in places like Vietnam, Bangladesh and the Philippines will never happen to the extent predicted by the Australian coal industry.

The latest Global Coal Plant Tracker data shows that Vietnam's coal plant development pipeline has shrunk 19% since 2015.[117] In addition, 34 GW of coal-fired power projects have been cancelled or shelved since 2010, and that number looks set to increase, especially now that renewable energy is starting to make an impact in Vietnam. Current high thermal coal prices are making renewable energy seem even more attractive relative to coal-fired power.

At a recent Korean National Assembly hearing, the CEO of Korean Western Power, a subsidiary of Korean electricity utility KEPCO, disclosed that it was considering turning its Quang Tri 3 coal-fired power project in Vietnam into a renewable energy project.[118]

Coal-fired power in Vietnam is highly controversial and public campaigns against its expansion are becoming increasingly recognised globally.[119] The coal industry in Vietnam is now openly recognising the challenge of public opposition to new coal plants. Responding to pollution and emissions concerns, the Vietnamese finance ministry has recently revealed plans to increase environmental taxes on coal by 50%.[120]

In June 2018, Vietnam announced a significantly increased ambition for renewable energy, aiming to triple electricity output from renewable sources and for 26% of households to use solar by 2030.[121] In addition, Vietnam has plans to build LNG-fired capacity; increasing international pressure on coal-fired power may see LNG-based plans gain prominence over coal.[122]

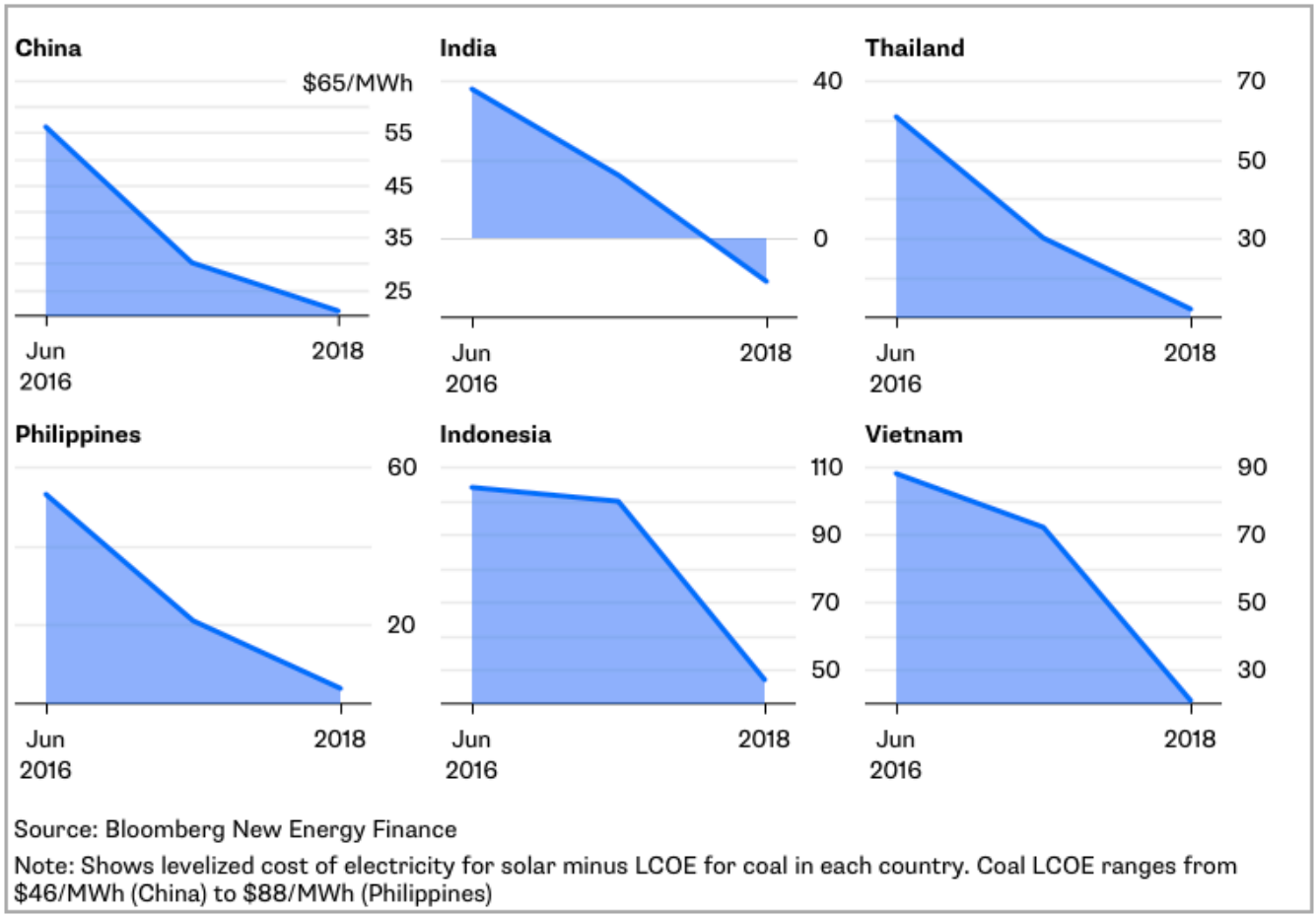
A growing number of renewable projects have been announced recently in Vietnam, which suggest that such technology can play an increasingly major role in the nation's power

---

116 BP - Statistical Review of World Energy 2018
117 Global Coal Plant Tracker - July 2018 data
118 SFOC, 중부발전 사장, 국감에서 찌레본 3호기 중단하였다고 밝혀 - 중부발전/서부발전 국정감사 질의 응답, 19 October 2018
119 Vietnam Investment Review, "Long An power centre hits delays", 18th January 2018
120 VN Express, "Proposed environmental tax on coal would inflate electricity price: expert", 19th May 2018
121 Reuters, "Vietnam sets out green ambitions with bold targets for solar, rare earth", 4th June 2018
122 VN Express, "PM talks up Mekong Delta potential for gas-fired power plants", 27th July 2018

capacity expansion. The recent boom in solar projects in Vietnam has been helped partly by the government's decision to cancel two nuclear power proposals, with solar being earmarked to fill the resulting energy gap.[123]

Figure 16: The Premium for Solar Generation Over Coal in Asia Has Slumped, Turning Negative in India



Source: Bloomberg New Energy Finance

Note: Shows levelized cost of electricity for solar minus LCOE for coal in each country. Coal LCOE ranges from $46/MWh (China) to $88/MWh (Philippines)

Recent projects include a 168 MW solar plant in Ninh Thuận province, which was approved in April 2018 and has begun construction.[124] A consortium including Japanese company Europe Clean Energies Japan is to develop a 44 MW project in Cu Jut district.[125] Meanwhile, Thailand's largest solar energy company Superblock has a US$1.8bn plan to install 700 MW of wind power in Vietnam, with construction on the first phase already started and expected to be operational by 2020.[126]

In June 2018, a Thai/Vietnamese consortium announced plans to build the largest solar PV plant in Southeast Asia—a 420 MW project at Tây Ninh.[127] In the same month, Quang Bình

[123] VN Express, "Solar power construction takes off in Vietnam after nuclear plans scrapped", 6th February 2018
[124] PV Magazine, "Construction begins on 168 MW project in Vietnam", 8th June 2018
[125] PV-Tech, "Univergy to develop 44.4MW solar project in Vietnam", 18th April 2018
[126] Reuters, "Thailand's biggest solar firm plans $1.76 billion in Vietnam wind projects", 9th February 2018
[127] PV-Tech, "B. Grimm and Xuan Cau to develop Southeast Asia's largest solar project", 19th June 2018

province signed a memorandum of understanding with Ayala Group of the Philippines to build a 352 MW wind project.[128] A further 340 MW of wind is to be built across several sites in Cà Mau, Bạc Liêu, and Sóc Trăng provinces.[129]

Other recent renewable projects include a 48 MW solar plant to be built for Vietnamese conglomerate TTC by Japanese company Sharp Corporation. This project is part of TTC's plan to build 1 GW of solar across the country. Further projects this year include the start of construction on a 30 MW solar project in Ninh Thuận province[130], announcement of a plan by Sterling and Wilson to build 300 MW of solar in Vietnam by mid-2019,[131], a proposal for a 50 MW solar plant by Scatec Solar[132], and California-based Vasari Energy's plans for up to 200 MW of fixed and floating solar.[133]

The impact of cheap renewable energy together with increased demand for action on climate change will have a significant impact on coal demand in Southeast Asia – a region seen by the Australian coal industry as a key driver of thermal coal demand going forward. According to the IEA's Southeast Asia Energy Outlook, "The use of coal in the Sustainable Development Scenario is vastly diminished, falling by around 30% in the period to 2040, as renewables eat into coal's share of the power mix."[134]

Bangladesh

Bangladesh's represents less than 1% of Asia-Pacific electricity generation.[135]

Bangladesh's electricity generation is currently dependent on domestic gas and expensive oil and diesel. With domestic gas reserves drying up, the nation has a plan to transform its electricity mix to one which is largely dependent on imported coal and LNG, with additional generation from nuclear and renewable sources.

Plans to build a fleet of imported coal-fired power stations have been in existence for years but the reality is that these have been severely delayed with little evidence of progress in most cases. Reportedly, 18 of the 19 large coal-fired power plants planned for Bangladesh are facing significant delays due to funding issues or poor planning.[136] According to the most recent annual report from the Bangladesh Power Development Board (BPDB), half of the six import coal-fired power projects currently in the development pipeline have pushed back their expected completion dates. This includes the controversial Rampal project, which has been delayed another eight months after having been pushed back seven months in the prior year's annual report. Furthermore, five of the import coal-fired power projects that were

[128] Manila Standard, "Ayala to build big Vietnam wind project", 28th June 2018
[129] Pöyry, "Pöyry awarded owner's engineering services assignment for a large wind farm project in Vietnam", 2nd August 2018
[130] PV-Tech, "Two large-scale Vietnam solar projects underway from PEN-VN and Conergy", 23rd January 2018
[131] Business Wire, "Sterling and Wilson Plans 300 MW Solar PV Projects in Vietnam", 9th April 2018
[132] Economic Times Energyworld, "Norway's Scatec Solar plans new power plants in Southeast Asia", 27th January 2018
[133] PV-Tech, "Vasari plans 180MW of ground-mount and floating solar in Vietnam", 22nd June 2018
[134] IEA: Southeast Asia Energy Outlook 2017
[135] BP - Statistical Review of World Energy 2018
[136] Dhaka Tribune, "Little progress in large coal-fired power plant projects", 21st January 2018

on the BPDB's development list in the previous year have disappeared from the most recent annual report.

As coal-fired projects languish, LNG-fuelled power plants have been gaining momentum in Bangladesh. In July 2018, agreements valued at US$7.4bn to build 6GW of LNG-based power generation and related infrastructure were announced.[137] In June 2018, the Asian Development Bank approved a US$500m loan for an 800 MW gas-fired plant in Khulna[138] and in September 2018 an agreement was signed with Siemens to develop a 3.6 GW LNG-fired plant.[139] Much of the LNG build-out will be ECA financed, but with coal financing facing most of the campaigning resistance, there is a significant likelihood that LNG capacity plans will be easier and quicker to advance.

As renewables get ever cheaper and more efficient, they are bound to play a larger role in Bangladesh's power system. The nation's first large solar power plant was commissioned in October 2018.[140] With solar power in India now cheaper than existing coal-fired power, Bangladesh recently announced a proposal to import 2,000 MW of solar power from India.[141] The power ministry has also confirmed it is looking at further opportunities to import renewable power from its larger neighbour.[142] Hydropower imports from Nepal and Bhutan are also likely to play an important role as Bangladesh seeks to import 9 GW from those two countries.[143]

Meanwhile, a new study that collected detailed wind speed data in Bangladesh has found that the nation has far more wind power potential than previously thought.[144] Improved assessment techniques have led to the conclusion that Bangladesh could install more than 10,000 MW of wind power, a potentially important turning point for renewable energy in the country.

With the delay in coal-fired power plants, Bangladesh's electricity mix may well end up being based more on imported LNG, with some domestic renewables and nuclear, supplemented by imported renewable and hydro generation. With the nation in need of a fast build-out of new capacity to match rapidly rising electricity demand, new plans are moving quickly and coal is being left behind.

Malaysia

Malaysia represents just 1.4% of Asia-Pacific electricity generation.[145]

Malaysia currently has just 2.6 GW of coal-fired power projects under construction and has no further projects in the pipeline.[146]

---

137 Daily Star, "$7.4b deals inked to produce 6,000MW", 12th July 2018
138 Daily Star, "ADB gives $500m for 800MW plant", 27th June 2018
139 Dhaka Tribune, "Bangladesh seals deal for another 3,600 MW power plant", 8th September 2018
140 Reuters, "With solar farms and roof panels, Bangladesh inches towards green power goal", 16th October 2018
141 Livemint, "Bangladesh wants buy solar power from India", 16th April 2018
142 The Hindu, "Bangladesh is keen on buying renewable power from India", 1st July 2018
143 Dhaka Tribune, "Bangladesh plans to import 9,000MW from neighbours", 9th April 2018
144 New Age, "'Bangladesh has huge potentiality in wind power'", 13th June 2018
145 BP - Statistical Review of World Energy 2018
146 Global Coal Plant Tracker - July 2018 data

In 2018 a new government was formed in Malaysia with major reforms on the agenda. Within the power sector, one of the first moves by the new government was to cancel four independent power producer (IPP) contracts that would have gone to coal-fired projects and place four others under review. These projects were awarded directly without tender. The energy ministry has now committed to open tender processes, which may undermine the position of incumbent proponents and power technologies in favour of new, cost-effective options.[147] The new energy minister stated in a recent speech that renewables are the key to Malaysian energy security and affordability. She specifically called out the nation's reliance on imported coal as an energy security risk, and stated that more renewables will help address this issue.[148] The new government has committed to raise Malaysia's renewable energy capacity (excluding large hydro) from 2% to 20% by 2025.[149]

It seems likely that the opportunity for a major build-out of new coal-fired power capacity is now in the past and that newer, renewable energy technology will dominate capacity additions in the coming decades.

Philippines

The Philippines represents less than 1% of Asia-Pacific electricity generation.[150]

There are currently 3 GW of coal-fired power plants under construction and another 3 GW of proposals have been permitted. Since 2010, more than 5 GW of coal-fired power plant plans have been cancelled or shelved and IEEFA would expect this figure to grow as renewable technology improvements going forward continue to undercut coal.

High electricity prices, partly driven by expensive coal, diesel and oil imports, means that renewable energy alternatives can already outcompete fossil-fuel based generation across many islands of the Philippines archipelago.[151] Meanwhile, an over-commitment to coal-fired power has led to declining utilisation rates and the prospect of stranded assets.

Coal-fired power plant owners in the Philippines are already acting to avoid this stranded asset risk. In May 2018, Ayala Group, one of the Philippines largest listed companies, announced that its AC Energy power generation arm will seek to sell 50% of its coal-fired power assets.[152] Coal-fired power currently accounts for about 80% of Ayala's power portfolio with the rest coming from wind, solar and geothermal sources. The company is now seeking to change directions by moving away from coal and its clouded outlook, while raising capital to invest in more sustainable power projects.

Ayala is investing in renewable energy projects in Australia and Vietnam and, along with other companies, will increasingly invest in renewables in the Philippines as the technological advantages of clean energy become ever more apparent. In August 2018, Philippine utility

[147] IEEFA, "Southeast Asian fossil fuel risk is underpriced", 8th August 2018
[148] The Star, "Ministry to review IPP contracts, four cancelled", 12th July 2018
[149] IHS Markit, "Impact of Malaysia's new government on the electricity market", 31 May 2018
[150] BP - Statistical Review of World Energy 2018
[151] Eco Business, "Electricity in the Philippines does not to be so expensive – or dirty", 16th May 2018
[152] Manila Standard, "Ayala selling $1-billion coal plants", 20th May 2018

Meralco received bids in a solar power tender as low as US$44/MWh – the lowest bid for large scale solar in Southeast Asia to date.[153]

The reduction in renewable energy costs are far from over; in addition, these costs reductions will shortly be followed by significantly reduced battery storage costs – a technology development that will permanently change electricity markets globally in the long term.[154]

Thailand

Thailand represents 1.5% of Asia-Pacific electricity generation.[155]

Coal Plant Tracker data shows that there is only 600 MW of coal-fired power under construction and the 3.5 GW of planned capacity in the pipeline is not even at the pre-permit stage yet. This pipeline has declined by 37% since 2015, falling from 5.5 GW. Since 2010, 9 GW of planned coal-fired capacity in Thailand has been cancelled or shelved.

Bituminous coal imports for power generation are currently on a downward trend having fallen 26% year-on-year for the first eight months of 2018.[156] Overall coal imports are up 11% due to a large increase in lignite imports to cover decreased domestic production from the Mae Moh lignite mine. Increased lignite imports will not be sourced from NSW—in Australia, lignite is mined in Victoria and none is exported.

In Thailand, the construction of coal-fired power plants has become increasingly controversial in line with similar concerns worldwide.[157] Meanwhile, Thailand's renewable energy ambitions are being raised. The nation's target of 30% of final energy consumption from renewables by 2036 is driven in part by its need for energy security as its domestic gas reserves become depleted.

The International Renewable Energy Agency (IRENA), which Thailand joined in 2015, states that this ambition could reach 37% by the same date.[158] With the Mae Moh mine expected to be depleted in the mid-2030s, renewable energy will become even more important if Thailand is to address its carbon emissions while avoiding the cost and energy security concerns that come with relying on imported coal and LNG.

Pakistan

Pakistan represents 1.1% of Asia-Pacific electricity generation.[159]

Pakistan is a key part of China's Belt and Road Initiative and is home to a number of Chinese power projects including a significant pipeline of coal-fired power projects. Many of these power plants will be fuelled by domestic lignite from the Thar coal fields.

---

153 PV Magazine, "Philippine utility Meralco receives Southeast Asia's lowest solar bid", 13th August 2018
154 Bloomberg, "NextEra CEO: Cheap, 'Disruptive' Batteries Coming to Kill Coal", 20th June 2018
155 BP - Statistical Review of World Energy 2018
156 Platts, "Thailand's August coal imports rise 5% on year to 2.46 mil mt", 25th September 2018
157 Bangkok Post, "No such thing as 'clean' coal power", 20th May 2018
158 IRENA, Renewable Energy Outlook: Thailand, November 2017
159 BP - Statistical Review of World Energy 2018

Some plants are being built on the coast to run on imported coal although there are indications that the new Pakistan government may seek to avoid further reliance on expensive fossil fuel imports[160], especially as imports have become even more expensive as the Pakistan rupee has weakened significantly in 2018. Reducing fossil fuel imports will be key to restoring Pakistan's current account balance going forward.

NSW is likely to find that any growth in Pakistan thermal coal imports will be eyed as an opportunity for South African coal exporters who will provide significant competition due to their geographic advantage. South Africa is currently heavily reliant on India as a destination for its coal exports. As India moves increasingly toward self-reliance for its coal needs, South Africa will need alternatives, and its export coal industry views Pakistan as a key growth area. Declining Indian thermal coal imports will also mean Indonesia will look for alternatives with Pakistan also likely to be in its sights.

Although behind neighbouring India, renewable energy projects are now being developed in Pakistan. Further cost reductions in renewable technology will see renewables compare favourably to the cost of imported coal-fired power plants.[161]

Implications of a Declining Market

As global seaborne thermal coal market volume continues to decline, NSW will face increasing competition in its existing coal markets from other exporters.

The decline of European coal imports is already leading producers in the U.S., South Africa, Columbia and Russia to seek alternative markets in Asia, directly competing with Australian exports. Glencore, Australia's biggest thermal coal exporter, stated in August 2018 that it is witnessing growth in U.S. and Columbian coal volumes in the Asian market and added that South African and Russian coal was also being diverted to Asia. Glencore also noted the "decline in energy content of Indonesian and Australian export thermal coals," a trend that could see Australia's high-quality advantage over rival nation's exports start to erode.[162]

U.S. coal is competing with South African and Indonesian coal in India, and with Australian coal in Japan and South Korea,[163] and 2018 is looking like it will be a record year for U.S. thermal coal exports as U.S. domestic coal consumption continues to decline.[164]
There will also be a significant knock-on effect as Coal India ramps up its production and reduces supply constraints around the country. South African and Indonesian exporters, the main suppliers to India, will be looking for new export destinations around Asia to replace lost Indian imports. Meanwhile, declining Chinese imports will leave a significant amount of Australian and Indonesian coal seeking new markets.

NSW could even face the prospect of increased competition from within Australia if planned Queensland Galilee Basin mine projects were to go ahead. Global energy consultancy

[160] Express Tribune, "CPEC rail project: Govt seeks to avoid financial risks in $9bn deal", 14th September 2018
[161] PV-Tech, "Pakistan solar just a PPA away from beating grid parity", 15th February 2018
[162] Glencore, 2018 Half-Year Report, August 2018
[163] Energy Information Administration, "U.S. coal exports increased by 61% in 2017 as exports to Asia more than doubled", 19th April 2018
[164] Bloomberg, "Trump's Making U.S. Coal Exports the Greatest They've Ever Been", 2nd August 2018

Wood Mackenzie has estimated that NSW Hunter Valley coal production could decline by 86Mt/year by 2035 if the Galilee Basin projects were to proceed.[165]

The Australian coal industry maintains that it will be able to increase its share of the market due to the high quality of Australian thermal coal suggesting nations seeking to reduce emissions and pollution will be seeking a higher quality fuel (energy content 6,000kcal/kg net as received). This omits the fact that a significant amount of Australian coal exports is comprised of a lower quality coal (high ash, 5,500 kcal/kg net as received), much of which is exported to China.[166] A drop in Chinese demand for this Australian coal grade will mean exporters will need to find alternative destinations, such as India where it would need to compete with South African exports in a declining import market there.

The idea of Australia increasing market share also fails to address the likelihood that nations wishing to reduce carbon emissions and air pollution will simply move away from coal altogether. This is a prospect that becomes ever more likely as clean energy alternatives become continuously cheaper.

The coal industry also sees Australian coal replacing Indonesian coal in some markets as Indonesia starts to use more of its coal domestically to fuel new power plants. However, the scale of Indonesia's coal-fired power build-out is not as certain as it once was. State-owned utility PLN recently cut its planned electricity build-out by as much as 22GW over the next 10 years due to lower-than-expected demand growth, and then put the development of over 13 GW of planned new capacity on hold.[167]

Excessive coal-fired power generation construction has led to over-capacity in Indonesia, which will lead to significant capacity-based payments to independent power producers (IPPs) for power plants that stand idle. PLN, and ultimately Indonesian consumers, will bear the cost. While PLN continues to constantly over-estimate demand increases, IPP payments are becoming dependent on increasingly unstable subsidies and tariffs.

Coal-fired power producers in Indonesia face increasing political and regulatory risk in the face of over-capacity, the declining cost of renewable technology, and pollution concerns. Since 2010, 31 GW of planned coal-fired power plants have been cancelled or shelved.[168] Investors will not be able to ignore these risks going forward as Indonesia's forecast generation mix looks increasingly out-of-step with global market trends. Indonesia is already feeling the impact of financiers moving away from coal. At a recent coal industry conference, the deputy CEO of Indonesian independent power producer PT Adaro Power acknowledged that obtaining finance for coal-fired power plants was getting increasingly problematic.[169]

As a result of the headwinds faced by coal-fired power in Indonesia, and the advance of renewables, there is likely to be more Indonesian coal available for export than the Australian coal industry expects.

---

[165] Sydney Morning Herald, "Digging up a lot more coal won't bring more jobs", 16th July 2018
[166] Platts – FOB Newcastle 5,500 NAR Coal
[167] IEEFA, "Indonesia hits the reset button on PLN's expansion plans", 18th September 2018
[168] Global Coal Plant Tracker - July 2018 data
[169] IEEFA, "Losses make Indonesian electric company a high-risk bet", 5th June 2018

Furthermore, key off-takers of Indonesian coal including China, India and South Korea are highly likely to reduce their imports over the coming decades, which will mean excess Indonesian thermal coal export capacity seeking to compete with Australian, South African, U.S., Columbian and Russian coal in a declining market.

Growing Sulphur Content Concerns

The outlook for NSW coal in a declining market is further clouded by increasing concerns about air pollution around Asia and the potential for further attempts to address the issue by favouring low-sulphur coal.

Australia's export benchmark coal is a high-energy, low-ash product. However, it also tends to have a higher sulphur content than thermal coal from South Africa, Indonesia and Russia. In an effort to address air pollution, South Korean power generators have been restricted to burning coal with an average sulphur content of 0.4% or lower since July 2018. This restriction has the potential to have a significant impact on Australian thermal coal. According to Wood Mackenzie, less than a quarter of Australia's thermal coal exports meet South Korea's the new sulphur content limit.[170] Industry journal Australian Coal Report has reported that Australian exporters will lose out to Indonesian suppliers under Korea's new policy.[171]

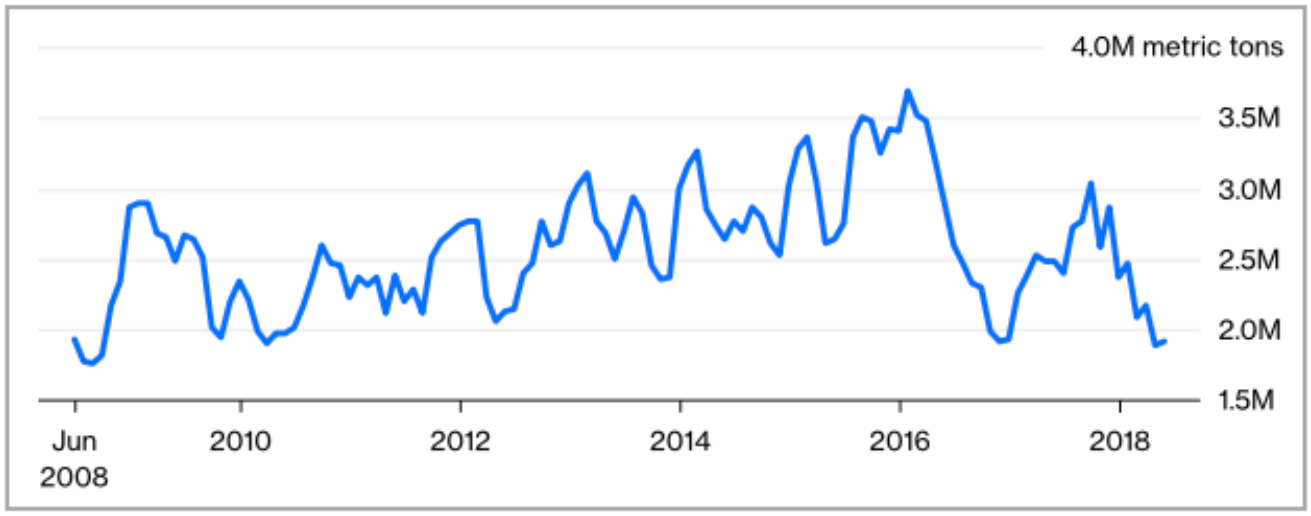
Historically, South Korea has imported most of its coal from Indonesia (low-energy, low-sulphur coal) and Australia (high-energy, high-sulphur coal). The new ruling is likely to mean that some Australian imports will be replaced with coal from sources that produce coal with a lower sulphur content, such as South Africa and Russia. South Korea had started to diversify its coal import sources even before the sulphur cap. In 2017, South Korea imported more thermal coal from South Africa, Canada and Columbia. With the imposition of the sulphur cap this source diversification may continue, to the disadvantage of Australian exporters.

Although it is too early to attribute entirely to the new sulphur regulations, South Korean imports of Australian coal have dropped significantly since the new regulation was announced in May.[172] That month the trailing three-month average of Australian imports reached a 10-year low (Figure 17). Over the first five months of 2018, South Korean thermal coal imports from Australia were down 7.4% compared to the same period in 2017. In June, South Korean imports of Australian thermal coal were down 27% on the same month in the prior year.[173]

As Australian coal exports to South Korea have declined in 2018, those from South Africa have gone up. Over the first half of 2018, South African exports to South Korea are up 22%.[174] South Africa is restricted in the extent to which it can increase its exports, but it is seeing a continuation of a long-term decline in exports to Europe, enabling it to boost exports into Asian markets where it often competes with Australian thermal coal.[175]

[170] Reuters, "South Korea's sulphur cap alters Asian coal market dynamics: Russell", 31st May 2018
[171] Newcastle Herald, "Korean restrictions on coal sulphur impacting Hunter exports", 23rd August 2018
[172] Reuters, "South Korea's sulphur cap alters Asian coal market dynamics: Russell", 31st May 2018
[173] Platts, "South Korean June thermal coal imports at eight month low: customs", 19th July 2018
[174] Platts, "South African June thermal coal exports up 2.5% on the month, H1 flat", 6th August 2018
[175] Montel News, "South African coal exports to Europe slump 50% in H1", 1st August, 2018

Figure 17: Trailing Three-Month Average Australian Coal Exports to South Korea Touched a Ten-Year Low in May 2018



Source: Australian Bureau of Statistics, Bloomberg Opinion calculations.

If South Korea takes further action on air pollution, or other nations start to address the issue by limiting sulphur content, there could be major implications for Australian thermal coal exports going forward. India and China have recently brought in new sulphur emissions regulations that are more stringent than existing rules in Europe, Japan and the U.S.,[176] and with global concern about air pollution on the rise, further tightening of regulations looks set to follow.

The Australian thermal coal industry often highlights its high energy content as a key reason why Australian exports will increase, even as the seaborne thermal coal market declines. However, Australian thermal coal's high sulphur content may be a handicap that impedes this.

Stranded Asset Risks: Newcastle Coal Port

After the announcement that the T4 coal terminal project was being cancelled, the coal industry was quick to put a positive spin on the event by highlighting that there was still spare coal export capacity at the Port of Newcastle for future growth in coal exports out of NSW. Figure 18 shows that the coal terminals at the port are operating at just over three-quarters of capacity with 24% unused.

Given the likely decline in NSW thermal coal export volumes over the next decades, this existing spare capacity seems more of a problem than a solution. Thermal coal exports from NSW peaked in 2015 and there is no guarantee that volumes will rise above the 2015 figure in the short or medium term. In the long term exports will certainly fall, as any rise in the thermal coal imports by the smaller Asian electricity markets will be more than offset by declining imports by current major destinations.

[176] Bloomberg Opinion, "Burning Brimstone Promises Fresh Hell For Coal", 20th July 2018

Figure 18: Port of Newcastle Coal Capacity and Utilisation

	Capacity Mtpa	Capacity Mtpa	Cancelled
Carrington Coal Terminal	25		
Kooragang Coal Terminal	120		
Port Waratah Coal Services Limited (PWCS)		145	
Newcastle Coal Infrastructure Group (NCIG)		66	
T4 Proposal			70
Total Newcastle Coal Port Capacity		211	
Total Coal Throughput (Thermal and Coking Coal, YTD July 2018 - Annualised)		160.2	
Unused capacity		24%	

Source: Port of Newcastle, Port Waratah Coal Services, Newcastle Coal Infrastructure Group.

As a result, the unused capacity at the Port of Newcastle is set to grow over the next few decades—the coal terminals will become progressively stranded.

Port of Newcastle coal terminal operator Newcastle Coal Infrastructure Group (NCIG) launched a US$200m loan in August 2018 with Japanese bank Sumitomo Mitsui Banking Corp as lead arranger. Despite the launch, it was reported that "some bankers are concerned about the long-term sustainability of the coal sector."[177]

It is this concern over coal's long-term sustainability that has led the chairman of the Port of Newcastle to recognise an "urgent need" for the port to diversify away from a reliance on coal.[178]

Conclusion

If the Port of Newcastle now has concerns about the long-term sustainability of the thermal coal export industry, it is time for the NSW government and the wider business community to show similar concern.

Thanks to the unstoppable spread of ever-cheaper and more efficient renewable energy, global electricity markets are undergoing a technology-led transition away from fossil fuels.

All of NSW's top thermal coal export markets are showing indications that they will significantly reduce their imports in the long term. This trend is increasingly accepted by the International Energy Agency, an organisation that has its roots in the fossil fuel industry. An externally imposed downturn will hit NSW government revenues at the very time that demands for funding to support disrupted communities will grow. This energy transformation will only pick up speed from here and will be driven even faster as governments around the world step up action on carbon emissions.

With thermal coal prices high but export volumes stagnating, now is the time to rationalise the NSW thermal coal industry in order to protect return on investment while reorganising in

[177] IFRAsia, "Australia's NCIG taps Ninja loan market", 15th August 2018
[178] Sydney Morning Herald, "World's largest coal export port Newcastle has 'urgent need' to diversify", 17 December 2017

preparation for the major downturn in export volumes that will occur in the longer term. The opening up of further thermal coal mining capacity will introduce more supply into a market that will shortly go into permanent decline. This needs to be avoided if in order to maximise the value of remaining thermal coal production.

The global energy transition is happening whether governments, corporations and communities like it or not. The only question now is what form they want it to take—planned or chaotic?

Institute for Energy Economics and Financial Analysis

The Institute for Energy Economics and Financial Analysis (IEEFA) conducts research and analyses on financial and economic issues related to energy and the environment. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. More can be found at www.ieefa.org.

About the Authors

Tim Buckley

Tim Buckley, IEEFA's director of energy finance research, Australasia, has 25 years of financial market experience covering the Australian, Asian and global equity markets from both a buy and sell side perspective. Tim was a top-rated Equity Research Analyst and has covered most sectors of the Australian economy. Tim was a Managing Director, Head of Equity Research at Citigroup for many years, as well as co-Managing Director of Arkx Investment Management P/L, a global listed clean energy investment company that was jointly owned by management and Westpac Banking Group.

Simon Nicholas

Simon Nicholas is a research analyst with IEEFA in Australia. Simon holds an honours degree from Imperial College, London and is a Fellow of the Institute of Chartered Accountants of England and Wales and has 16 years' experience working within the finance sector in both London and Sydney at ABN Amro, Macquarie Bank and Commonwealth Bank of Australia.

Kashish Shah

Kashish Shah, a Research Associate at IEEFA, has a master's degree in economics from the University of Sydney and an engineering degree from NMIMS University in Mumbai. Kashish has worked in the Global Analytics Division of the Royal Bank of Scotland with a focus on regulatory policies. Kashish has research experiences in India's public sector in his work for a member of Indian Parliament and a University of Sydney-based research group.

Important Information

This report is for information and educational purposes only. The Institute for Energy Economics and Financial Analysis ("IEEFA") does not provide tax, legal, investment or accounting advice. This report is not intended to provide, and should not be relied on for, tax, legal, investment or accounting advice. Nothing in this report is intended as investment advice, as an offer or solicitation of an offer to buy or sell, or as a recommendation, endorsement, or sponsorship of any security, company, or fund. IEEFA is not responsible for any investment decision made by you. You are responsible for your own investment research and investment decisions. This report is not meant as a general guide to investing, nor as a source of any specific investment recommendation. Unless attributed to others, any opinions expressed are our current opinions only. Certain information presented may have been provided by third parties. IEEFA believes that such third-party information is reliable, and has checked public records to verify it wherever possible, but does not guarantee its accuracy, timeliness or completeness; and it is subject to change without notice.