Energy&Climate
INTELLIGENCE UNIT

Asia's Tigers:

Reconciling Coal, Climate and Energy Demand

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Executive Summary

The Issue

According to a number of reports, Asia is on the verge of a huge expansion in coal burning, with two countries, China and India, accounting for the majority of an estimated 2,457 new coal-fired power stations either planned or in construction worldwide.

Coal is the highest carbon-emitting source of energy. Coal consumption today is responsible for nearly half of all global energy-related carbon emissions, and coal-fired power plants account for nearly a third of energy-related emissions.[1] Coal power plants are also long-lived assets that last for many decades, and so can lock in high-carbon development for nearly half a century.

A rapid, sustained build-out of Asian coal power capacity could therefore make it impossible to achieve the target, agreed at December's United Nations climate summit in Paris, to limit global average warming since pre-industrial times to "well below" 2 degrees Celsius (2C).[2] With continued coal expansion, meeting that target would probably require unrealistic levels of carbon cuts elsewhere, and indeed negative emissions. The International Energy Agency (IEA) has previously estimated that to limit global average warming to no more than 2C, almost all new energy infrastructure must be low-carbon from 2017, or else replace equivalent existing high-carbon capacity, to avoid locking in unsustainably high levels of emissions for decades to come.[3] Some Western commentators have argued that continued growth in Asia's fleets of coal power plant would therefore make climate action in developed countries meaningless.[4]

The focus of this report is China, India, Indonesia and Vietnam. Collectively, these four countries have pipelines of 1,824 coal power plants either planned or under construction, accounting for 74% of the estimated global pipeline of 2,457 units.[5] The IEA estimates that India alone will account for half of global coal demand growth through 2020, and Southeast Asia for another quarter.[6]

This report examines whether coal-fired generation is likely to grow on anything like the scale suggested. It asks, instead, whether China is nearing the end of its unparalleled expansion in coal-fired capacity.[7] It investigates whether India, Vietnam and Indonesia are poised to take over from China, or whether they are re-thinking such an expansion. And it asks how many plants might actually be built.[8]

Findings

A number of factors suggest that these four countries will eventually build far fewer than the 1,824 new coal-fired power plants in the pipeline:

1. Worldwide, from 2010-2015, shelved or cancelled coal power proposals out-numbered completed power plants by two to one.[9] For the four Asian countries we focus on, the relevant rate is 1.5 to one, with 635GW cancelled or shelved, compared

with 411GW completed. For India, the ratio is four to one, with 390GW cancelled since 2010 compared with 98GW completed.

2. In both India and China, coal plants are being used for less and less of the time. In China, the average "utilisation rate" (the proportion of time that power plants run) has fallen, for coal, from 60% in 2011 to below 50% last year. For India, the similarly defined "load factor" (the proportion of nameplate capacity used) has fallen from a peak in 2008 of above 78%, to below 65% last year. Depending on trends in power prices, this may make new plants progressively less profitable, and less attractive to investors. Chinese utilities have been left with "over-built" capacity for various reasons, including: a credit-fuelled industrial investment binge; slowing economic growth; over-optimistic expectations for electricity demand; lagging grid and other supporting infrastructure; and a failure to foresee expansion in and falling costs of renewable generation. In India, the problem has more to do with a failure of infrastructure investment, coal shortages, and cash-strapped grid operators.

3. This trend in falling utilisation rates is likely to continue. In China, the biggest brake comes from rapidly slowing economic growth combined with ambitious targets for energy efficiency and clean generation. Clean energy may be sufficient to meet all of the country's projected electricity demand growth, thus consigning any new coal power plants to an increasingly idle surplus. Meanwhile, both China and India are massively expanding renewable and nuclear generation, both of which have near-zero operating costs once built. Given that real-time electricity despatch is usually on the basis of least marginal cost, these will displace fossil fuel power when available. The result may be falling and unpredictable utilisation rates, and thus greater investment risks in fossil fuel-fired power, as seen in Germany. China is now investing heavily in technologies that will enable its electricity system increasingly to use variable renewables as "baseload", including storage, electric vehicles and regional interconnection.

4. These four Asian nations, especially China and India, are experiencing severe air pollution, and coal is one of the main culprits. Air pollution has added to other social and environmental concerns, including public opposition to new mines, especially in India. These are prompting governments to enact curbs, including India's carbon tax on coal. Such regulations would be expected increasingly to impact investment decisions for new coal power plants.

5. The successful conclusion of the Paris climate summit last December will accelerate existing investments in energy efficiency and low-carbon generation. The IEA has estimated that national pledges agreed under the Paris Agreement would require around $14 trillion investment over the next decade and a half. And some countries appear to be going further and faster than those pledges. China appears on course comfortably to over-achieve its target to halt carbon emissions growth by 2030. India is leading an international coalition of nations to accelerate solar investment. And one month after the Paris Agreement, Vietnam said that as a result of its international emissions commitments it would review its plans for new coal-fired power.[10] The Paris Agreement also virtually guarantees that at least $100bn per year will flow from the developed world into developing countries from 2020, unlocking conditional

elements in their national climate pledges (INDCs). A large proportion of this funding will be used for clean energy investments.

Taken together, these factors indicate that the four Asian nations considered in this report are likely to complete far less than half of their collective, current coal power plant pipeline. How much each country builds will depend on trends in construction and operating costs, delivery and investment, as well as the rate of economic growth. In our estimation, the global figure for new build will fall far short of 1,000 power plants in the next five years, and is likely to lie in the region of around 500. For context, some 1,082 coal power plants were completed worldwide from 2010-2015.[11]

Beyond the next five years, we note ambitious targets in China, in particular, to drive growth in non-fossil fuel energy which is incompatible with further aggressive growth in coal-fired power generation. For example, China's domestic targets unveiled in the run-up to the Paris summit imply the building of an additional 800-1,000GW of nuclear, wind, solar and other zero-emission generation capacity by 2030.

When considering the climate impact of proposed Asian coal power plants, and the argument that these undermine the case for emission cuts in the West, four further factors need to be considered:

- Small, old, inefficient coal-fired stations are closed even as new ones are built, thus reducing the overall net increase in coal capacity
- New plants are more efficient than old ones, so emissions rise more slowly than net capacity
- Historical data show that larger plants are more likely to be shelved or cancelled, meaning that cancellations have a disproportionate impact in constraining added capacity
- As a result of falling utilisation rates, emissions are rising more slowly than capacity, and may even fall as capacity rises. Indeed, coal-fired power generation has fallen in China over the past two years, while the country added about 120GW of new thermal capacity.

The Four Tigers

China, India, Indonesia and Vietnam have the world's four biggest coal power project pipelines. Together, they represent 82% of the 718 units globally under construction.

Table 1. Coal power plant projects, number of generating units

Country	Proposed	In construction	TOTAL
India	297	149	446
China	795	384	1,179
Indonesia	87	32	119
Vietnam	56	24	80
WORLD	1,739	718	2,457
All four countries			
Number of units	1,235	589	1,824
Share of world, %	71.02%	82.03%	74.24%

Source: Global Coal Plant Tracker, December 2015

These pipelines must be viewed in the historical context of project cancellations, as described above; the net effect of coal plant closures; and new plans to expand renewable and nuclear power.

Worldwide, from 2010-2015, some 2,300 coal power plant units were completed, shelved or cancelled, according to the Global Coal Plant Tracker. Cancelled or shelved projects accounted for 53% of the total. Regarding capacity, some 1,350GW was completed, shelved or cancelled worldwide. Cancelled or shelved projects accounted for 66% of the total, or double the completed capacity. In the four Asian economies studied in this report, the proportion was 61% of capacity shelved or cancelled, varying from 43% in China to 80% in India.

These cancellation rates provide one guide for how much of the present capacity pipeline may actually get built, but may prove conservative if the Paris Agreement on climate change is effective and global coal financing becomes progressively less available.
In addition, there is evidence that domestic policy positions in China, India and Vietnam are turning away from coal, led by China. This report finds that China's annual new build of coal-fired power plants may have peaked in 2015, as a result of chronic over-capacity and a shift to renewables and nuclear. Meanwhile, India's government has staked its "Power for All" initiative on an aggressive expansion of virtually all generation options concurrently, including domestic coal, solar, wind and nuclear power, plus grid upgrades and energy efficiency improvements. And Vietnam in January 2016 surprised markets by announcing a review of proposed new coal-fired power plants, with a view to substituting some of these with gas and renewable power.

There are four trends which, with support, could further boost the outlook for low-carbon energy in coal-based Asian economies.

1. Learning low-cost delivery lessons: India has developed a successful model for cost-effective delivery of solar power, achieving tariffs as low as 4.34 rupees per kilowatt hour

(kWh), or around $0.06 (fixed flat for 25 years in nominal terms), in line with the estimated levelised cost of new imported coal-fired power, at $0.05-0.06/kWh:

- "Plug and play" utility scale solar parks, providing land and grid connections
- A state-owned, financially secure, utility off-taker
- Reverse auctions, pitting developers against each other, successfully delivering the lowest cost to the state/consumer.

2. Thinking big in off-grid solar: Off-grid solar could be an alternative to grid infrastructure, rather than a stopgap. India has ambitious targets for 40GW of distributed roof-top solar by 2021/22, from less than 1GW now:
    - The cost of coal power in remote off-grid areas includes the significant capital cost of extending the transmission network
    - Cheaper off-grid solar could be seen as "big infrastructure", substituting for rather than complementing grids, to boost rural lifestyles and consumption.

3. Use of climate finance under the Paris Agreement: All countries made climate action pledges under the Paris Agreement reached at the end of 2015. Developing countries will receive help from financial instruments under the Agreement, such as the Green Climate Fund (GCF), and the Asia Infrastructure and Investment Bank (AIIB):
    - The energy choices by these four coal-based economies will largely set the path of global CO2 emissions this century
    - Vietnam recently proposed to review new coal plant projects, in view of its Paris commitments
    - The GCF has committed to invest $2.5 billion in 2016. Coal-based Asian economies are an obvious mitigation priority.

4. Tackling air pollution: Fine particulate matter is emitted from burning coal, waste and biomass in power plants, industrial stoves and urban heating systems, and from less efficient diesel cars:
    - Eliminating coal-fired power in urban and populated areas is one important way to reduce deaths from air pollution
    - China is rapidly transitioning from coal burning in urban areas. India may follow its lead, for example in and around Delhi; while in Indonesia, civil society has opposed new coal plants in densely populated Java.

1. CHINA

Summary

China is the world's biggest consumer of coal and the leading developer of coal-fired power plants, with 203GW under construction and a further 509GW proposed, according to Global Coal Plant Tracker.[12] But China is also leading a rapid national policy agenda to drive its low-carbon transition.[13] The country targets a peak in overall coal consumption by 2020. Its coal-fired power generation has fallen since 2013. It is closing old coal-fired plants, especially those near major cities. And China continues to ramp up renewable and nuclear power. Falling utilisation rates of thermal power plants indicate over-capacity.

A slowing, re-balancing economy: China is shifting from investment in energy-intensive heavy industry to consumption-led growth. That is leading to rapidly slowing electricity consumption growth. In 2015, China's total electricity use grew by 0.5%, its slowest rate in at least four decades.

Over-capacity: Slowing consumption growth has coupled with continuing new coal plant construction to create over-capacity: there are far more coal power plants in China than are needed. The country added around 72GW of thermal power in 2015, and 51GW the previous year, even while thermal power generation fell in both years. Some 123GW of new thermal capacity therefore appear to have made net zero contribution to electricity consumption, illustrating the chronic over-capacity.*

OUTLOOK TO 2020 AND BEYOND: China has announced a cap on coal consumption in 2020.[14] The latest IEA forecasts now accept that consumption will peak this decade, with demand in 2020 at or below 2013 levels.[15] It sees consumption falling significantly in industries that use coal directly, notably steel and cement; but it believes that coal consumption for power generation will continue to rise, albeit slowly, for several decades more.[16] But a decline in coal-fired generation steepened last year.

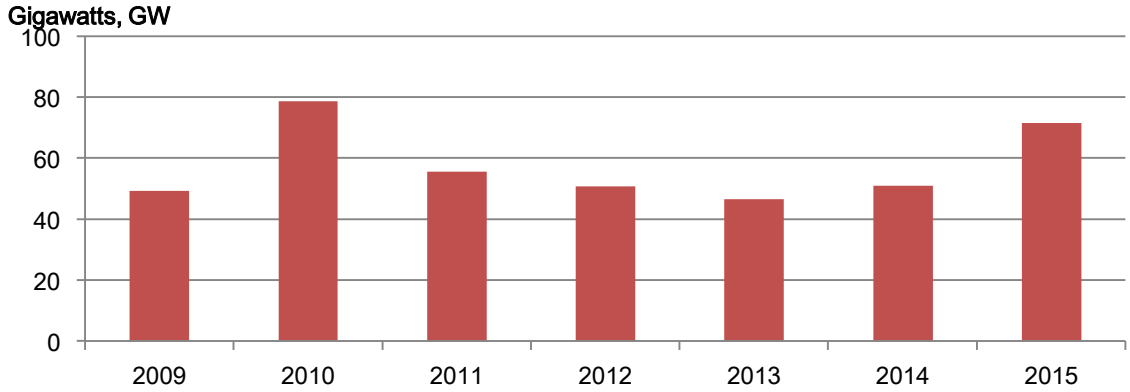
Power plant capacity

Thermal power, largely coal, dominates China's installed electricity generating capacity, with 990GW out of a total 1,507GW, according to the National Energy Administration (NEA). And even as absolute coal consumption falls, the country is adding new power plants. Thermal capacity surged 8% in 2015, by 72GW, according to the NEA.[17] (That annual growth is equivalent to almost the entire installed electricity generating capacity of Britain, the world's

* China's statistics agencies categorise generation technologies according to thermal, nuclear, hydropower and other renewable. "Thermal power" refers to using heat to drive a steam turbine. The heat may come from burning fossil fuels or waste, or by nuclear fission. Given that China has much less gas than coal and that nuclear power is treated separately, this report treats "thermal power" as a rough proxy for coal.

fifth largest economy).[18] Global Coal Plant Tracker data imply that the average new coal plant unit in China has 600 megawatts (MW) capacity. Building around 70GW of new coal was therefore equivalent to 120 power plants per year. This was not, of course, a net build rate, as old plants also closed; neither does it imply an increase in coal-fired power generation.

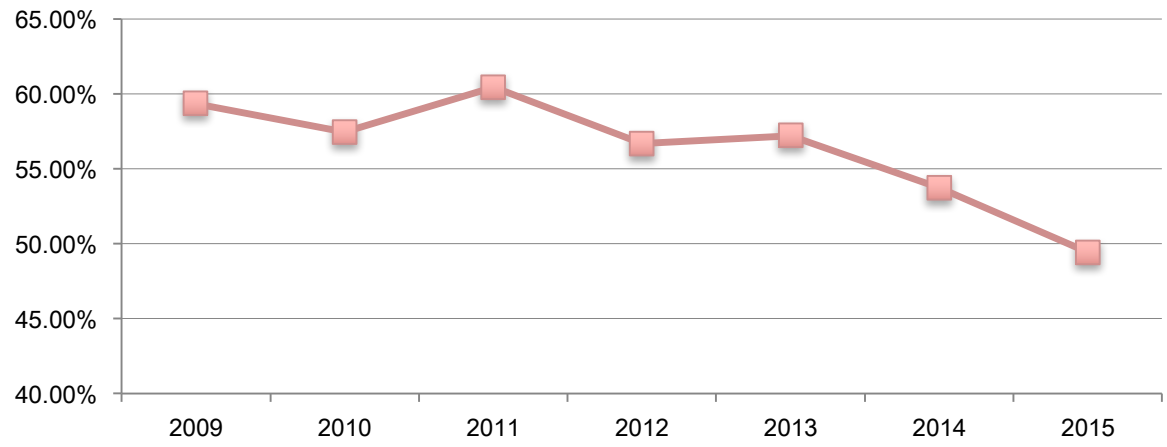
Fig. 1 Annual added thermal power capacity (GW), 2009-2015



Source: NEA

OUTLOOK TO 2020: The actual average operating hours of China's thermal power plants – called the utilisation rate – has fallen every year since 2011 (see Figure 2). That is a result of over-capacity, as the country ramps up wind and solar power and power demand growth slows. Falling utilisation rates imply growing pressure to shut excess capacity and to slow capacity additions. The China Electricity Council estimates that the country will add about 48GW of "fossil fuel" capacity in 2016, below last year's 72GW "thermal power".[19] Both these statistics are essentially referring to coal, given the country's far more limited gas power. Coal capacity additions may therefore have peaked.

Fig 2. Utilisation rates of thermal power, %, 2009-2015



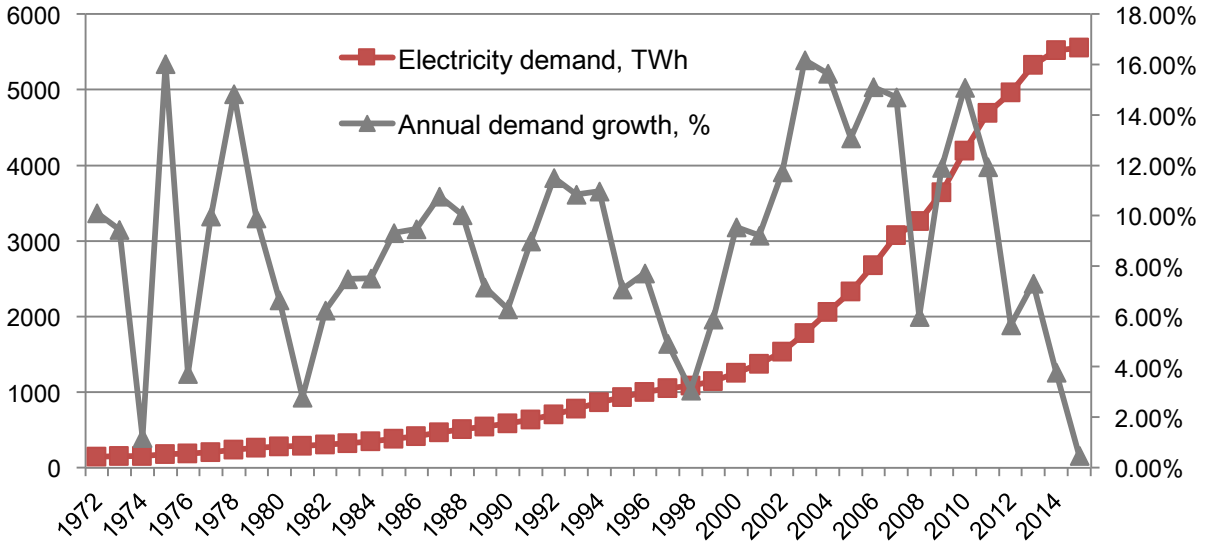
Source: NEA

Power demand

A major reason for falling utilisation rates is slowing demand growth for electricity. China's overall power demand grew last year by just 0.5%, according to the NEA,[20] the slowest growth rate for more than four decades.[21] That reflects changes in key energy-intensive

sectors such as steel, where China last year registered its first drop in output in three decades.[22]

Figure 3. China's annual electricity demand (TWh) and year on year growth (%), 1972-2015

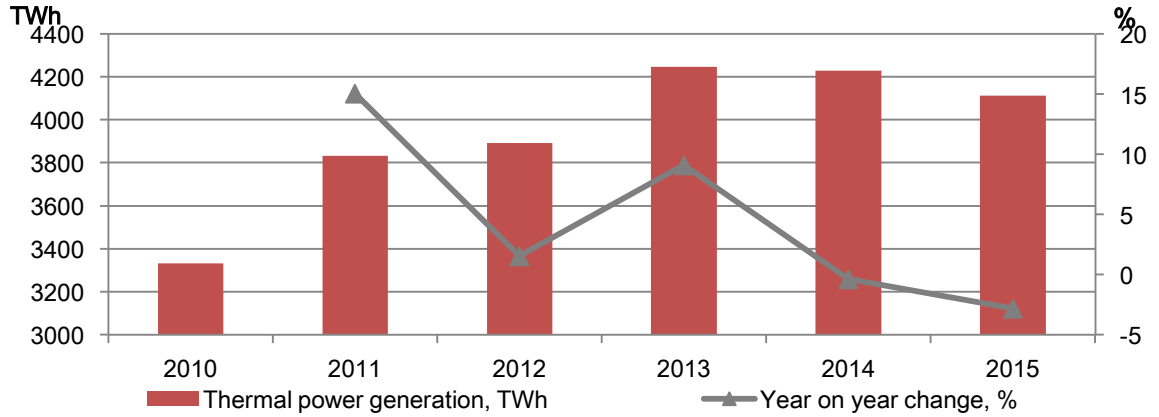


Sources: World Bank (1971-2008), NEA (2009-2015)

Thermal power generation

Total power generation fell 0.2% in 2015, NBSC data show.[23] Thermal power fell by a faster 2.8%, for its second successive year.

Figure 4. China thermal power generation, 2010-2015



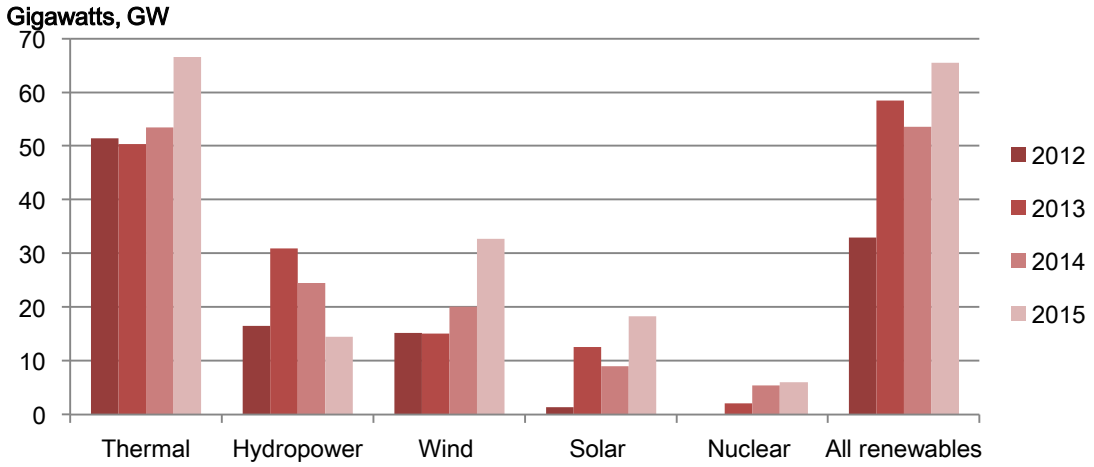
Source: NBSC (2010-2013 data from annual Statistical Yearbook,[24] 2014-2015 from monthly "Industrial Production Operation" data [25])

OUTLOOK TO 2020 AND BEYOND: Future demand for coal-fired electricity will depend on the demand outlook, including economic growth, the rate of new energy efficiency gains, and the pace of capacity additions in non-thermal power including renewables and nuclear.[26]

A low-carbon transition

Growth in low-carbon renewable and nuclear power may further cool the prospects for coal, by driving a wedge between energy demand and coal use.[27] Renewable power capacity growth exceeded thermal power growth in 2013 and 2014, and the two were neck and neck last year. That is a problem for coal: in an era of spare capacity, coal generation will fall first because it has the highest marginal cost, hitting profitability disproportionately.[28] The latest official data show that China's renewable power capacity has continued to soar, in particular solar PV, which grew by 15GW to a cumulative 43GW last year.[29] The NEA now expects China's cumulative solar PV capacity to reach 150GW in 2020, exceeding the official target of 100GW. China's fight against air pollution may also dim coal prospects around certain cities. For example, the 2013 Air Pollution Control Action Plan bans construction of new coal-fired power plants in various coastal provinces.[30]

Figure 5. Annual growth in capacity of power generating technologies, 2012-15



Source: NBSC

OUTLOOK TO 2020 AND 2030: China has adopted targets to improve the environment, tackle climate change and boost air quality, which will impact the growth and consumption of coal directly:

- By 2020, coal consumption will be capped at 4.2 billion tonnes, and 62% of all energy use;[31] the country plans to install some 200GW of wind (from 96GW at the end of 2014) and 100-150GW of solar power (from 28GW)[32]
- By 2030, China plans to halt national growth in carbon emissions, and increase the share of non-fossil energy sources to at least 20%, from 11% in 2014.[33] The targets imply an additional 800-1,000GW of nuclear, wind, solar and other zero-emission generation capacity.[34]

Conclusions

FACTORS SUPPORTING CURBS ON COAL AND CARBON EMISSIONS	
The momentum is with low-carbon energy	○ Annual added renewable power capacity exceeded thermal power in 2013 and 2014 ○ China has announced plans to cap coal consumption in 2020, and carbon emissions by 2030.
Too much coal power	○ The country has more than 100GW of effectively idle capacity in thermal power ○ Adding more coal capacity would conflict with a planned economic rebalancing, and with environmental targets ○ China has started to cut surpluses in related sectors, including a ban on new coalmines and big capacity cuts in steel.[35]
Falling electricity demand growth	○ In 2015, electricity demand slumped to its slowest growth in more than four decades, with slow growth expected to continue.
CHALLENGES	
A transition from coal will be slow	○ A comparison of coal power generation in 2015 (4,210 TWh) and 2000 (1,114 TWh) suggests that the vast majority of the coal fleet is less than 15 years old, with several decades of life left [36] ○ Recent programmes for premature retirement have closed less than 20GW of older capacity annually.[37] This has significant economic cost relating to writing off stranded assets well before their end of original economic life.
Surplus power plants may still be used	○ If the economy picks up again, or if alternatives – such as hydropower – fall short.

2. INDIA

Summary

India has set ambitious targets under its "Power for All" initiative – to increase power generation by 50% and bring reliable electricity to everyone by 2019.[38] The big question is what balance of energy technologies India uses to meet this growth, between fossil fuels, renewables and nuclear. It will undoubtedly need all of these; how they balance will depend on whether India can meet ambitious targets for wind and solar power, the rate of economic growth, the rate at which energy use becomes more efficient, and whether new infrastructure investment can boost the economics of coal. Nuclear suffers from high capital costs, technology barriers and long lead-times.

The momentum is still with coal power. India is adding 15-20GW of coal capacity annually, well ahead of a combined 6GW of nuclear and renewables in 2014/15. However the government has just doubled a tax on coal, the latest indication of a desire to reduce its share in the mix.

India has a very high coal power cancellation rate. India shelved or cancelled some 390GW of coal projects from 2010-2015, compared with 98GW installed, according to Global Coal Plant Tracker. Only a fraction of the country's present estimated pipeline of around 290GW of coal-fired power may therefore be built.

Like China, India's coal plants are under-used. "Load factor" refers to the proportion of a power plant's capacity that is actually used. In data going back to 1986, coal plant load factors peaked in 2008, falling rapidly since as a result of under-investment in the grid and coal production shortfalls. India has successfully overcome some of those problems, to the extent that there are now record high coal surpluses at pitheads.[39]

India has extraordinarily ambitious targets for wind and solar power. If India meets targets for an additional 140GW wind and solar capacity by 2022, then renewables growth would be comparable with expected coal power capacity growth. India has a further target to increase the installed capacity of nuclear by nearly 60GW by 2032. A significant hydro-electricity investment programme is also starting after a decade of delays. Rising renewable and nuclear power capacity would put further pressure on coal plant load factors. Meanwhile, the country has ambitious energy efficiency targets, for example to achieve energy savings equivalent to one tenth of total consumption today, and by 2019 to replace all incandescent light bulbs with LEDs.

Political and economic background

India has a population of some 1.3 billion people, including around 240 million without access to electricity.[40] One important driver therefore for electricity system expansion is to meet Prime Minister Narendra Modi's target to provide reliable electricity for all Indian citizens by 2019, under his "Power for All", or "round the clock" (24-7) initiative.[41] Total electricity demand has more than doubled in the past 10 years. The government wants power generation to increase by half again by 2020.[42] India is on course to be the world's

fastest growing major economy through the next several decades, in line with expected economic and population growth, urbanisation and a very significant rise in the share of population entering the work force.[43]

Coal consumption

India's total coal use rose some 12.8% in 2014, to 907 million tonnes, accounting for 11.4% of global demand, and moving the country into second place in the global coal consumption ranking, according to the IEA's Medium-Term Coal Market report.[44] The power generation sector accounts for more than four-fifths of India's lignite** consumption, and three quarters of coal consumption.[45] That is a far greater share than in China, at around half, reflecting smaller cement and steel sectors.

OUTLOOK TO 2020 AND BEYOND: India's coal consumption raced ahead of the rest of the world in 2014, growing more than eight times faster in absolute terms than second-placed Turkey.[46] The IEA expects India to lead global growth through 2040.[47] India wants to double domestic coal output to 1.5 billion tonnes annually by 2020 and to cut imports.[48] Infrastructure targets include opening 60 new mines; construction of several, 4GW-each "ultra mega power projects"; and the completion by 2017 of three major coal rail links from northeastern coal-producing regions to demand centres.[49] All such infrastructure projects could lock in coal use for decades to come.[50]

Power plant capacity

India had a cumulative installed coal-fired power capacity of 175GW as of January 31 2016, according to the Central Electricity Authority, representing some 61% of total generating capacity.[51] That compares with 61GW in 2000, according to the IEA, representing a compound annual growth rate of about 7%.[52] Official data suggest that new installed coal-fired capacity has averaged 18GW annually over the past three years, up to March 31 2015.[53] The Global Coal Plant Tracker estimates that about 19GW of new coal-fired capacity were added in the year to January 2016.[54]

Table 2. Cumulative and annual added coal-fired capacity (GW)

Financial year	Cumulative GW	New installed GW
2011/12	112.0	n/a
2012/13	130.2	18.2
2013/14	145.3	15.1
2014/15	164.6	19.3

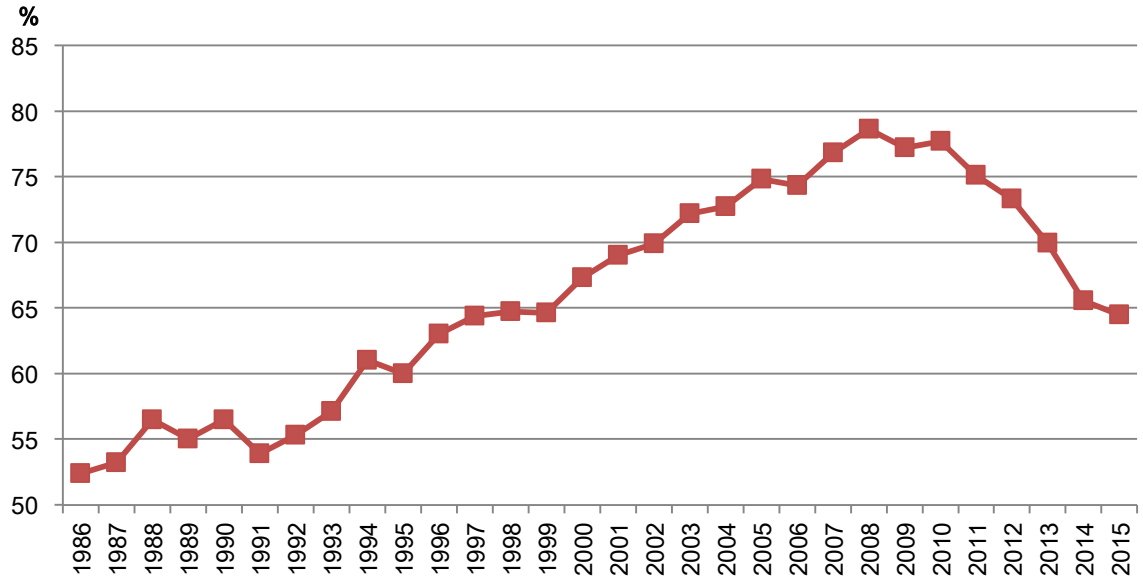
Source: Ministry of Power

** Coal includes lignite, unless stated otherwise

OUTLOOK TO 2020 AND BEYOND:
India has ambitious energy and economic growth targets. Per-capita energy use is still only one third of the global average. The IEA says India may need to build an additional 800GW of power generating capacity by 2040 to meet demand.[55] The big question is what balance of coal, gas, nuclear and renewables will provide that added capacity. The Indian government says that coal "will continue to dominate power generation in future".[56] Coal will account for the majority of cumulative installed capacity, but renewable energy technologies could dominate new capacity additions.

On the bullish side for coal, Prime Minister Narendra Modi's government is addressing some of the infrastructure problems that have plagued the sector.[57] The IEA expects India to add another 50GW of coal-fired power plants by 2020, which would be a sharp slowdown on the last five years, and an extra 265GW by 2040.[58] On the cautionary side, the Global Coal Plant Tracker finds that shelved and cancelled coal projects have outnumbered completions by four to one since 2010. Meanwhile, the average load factor of existing coal power plants (the percentage of their nameplate capacity actually used) is falling, as a result of poor grid investment and unreliable off-take (see Figure 6).[59] In an era of over-capacity, renewable power wins because it has the lowest marginal cost, and so is dispatched first.

Figure 6. Load factors of coal and lignite power plants, %, 1986-2015

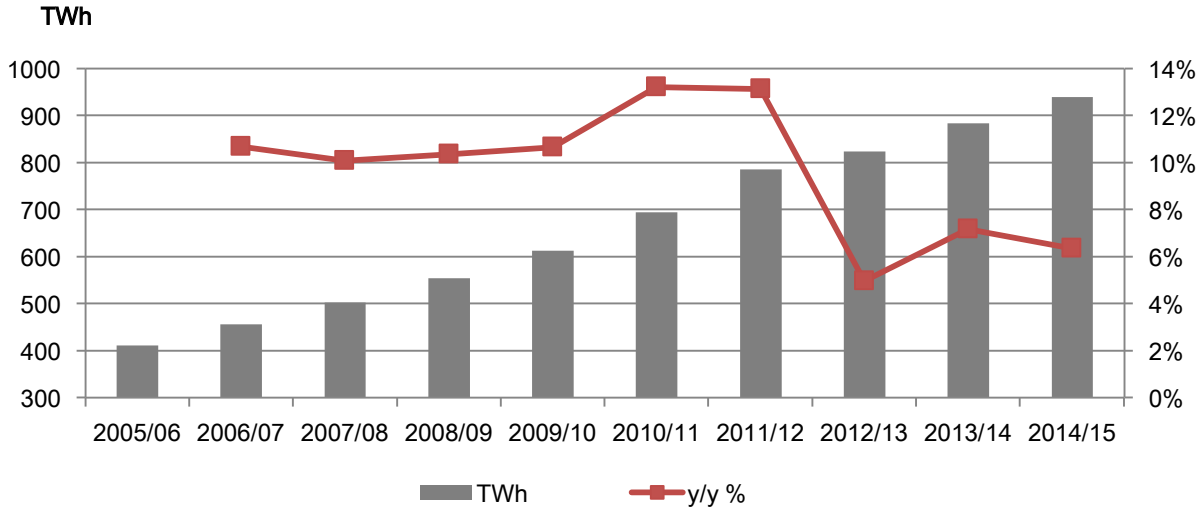


Source: Ministry of Power [60]

Power demand

From 2010-2015, total electricity demand rose at a slower rate than during any other decade since Indian independence in 1947, at an annualised 6.3%.[61] A further slowdown is noticeable in the past 10 years (see Figure 7).

Figure 7. Annual electricity demand and growth rate, 2005-2015

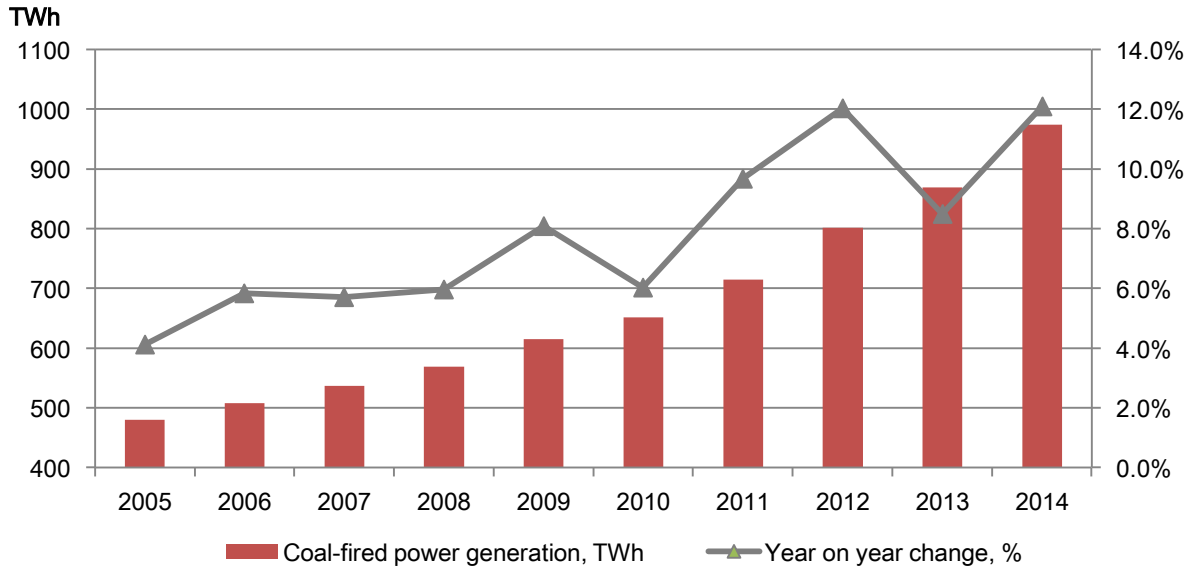


Source: Ministry of Statistics and Programme Implementation (2005-2014);[62] Ministry of Power (2014/15)[63]

Power generation

India has seen a recent trend of accelerating growth in coal-fired power generation. Within that trend, there have been bumps, such as a surge in 2014/15.[64] That was a result of a weak monsoon, when hydropower slumped by a tenth. Coal accounted for more than three quarters of gross electricity generation at the end of the financial year 2014/15.[65]

Figure 8. India's coal-fired generation, TWh, 2005-2014



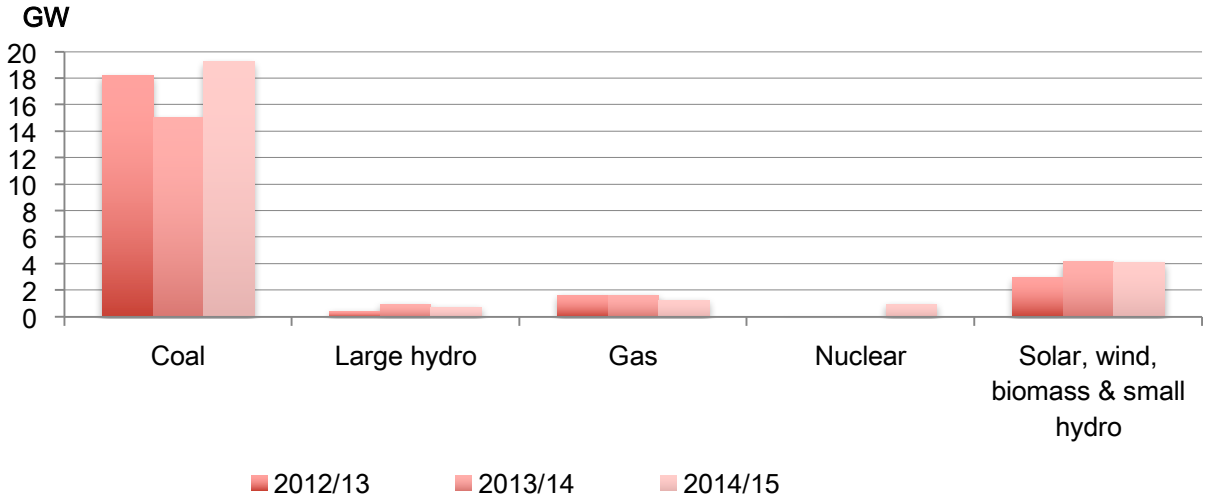
Sources: IEA WEO (various years); IEA Medium-Term Coal Market Report 2015

OUTLOOK TO 2020 AND BEYOND: India's energy ambitions will be impossible to achieve without coal. But the country has exceptionally ambitious targets to deploy renewable power through 2022, and plans a significant nuclear expansion. Renewables have an awful lot of catching up to do, but meeting the country's wind and solar targets would imply comparable capacity growth to coal.[66]

A low-carbon transition

Growth in India's renewable power capacity has been rapid, but still lags far behind coal (see Figure 9).[67] But recent, aggressive cost reductions may boost solar, in particular. The state-owned utility, NTPC, has conducted several reverse auctions within solar parks, where land and transmission facilities are provided. These achieved a record low tariff in January 2016 of 4.34 rupees/ kWh ($0.06). Such bids are close to estimated costs for new imported coal-fired capacity in India of $0.05-0.06/ kWh.[68] And rooftop solar has clear cost advantages over coal in remote, off-grid areas where centralised generation must include the extra cost of network expansion. India presently has an installed capacity of roof-top solar below 1GW, which it plans to increase to 40GW by 2022. Meanwhile, the country has steadily increased a tax on coal production, most recently to 400 rupees per tonne ($6), whose proceeds go to the National Clean Environment Fund.[69] And the country is starting to take action to curb air pollution in cities. India has 13 of the world's 20 most polluted cities, as a result of coal and biomass burning and traffic fumes.[70]

Figure 9. Annual growth in generating capacity, various technologies, 2012-15



Source: Ministry of Power

OUTLOOK TO 2020 AND BEYOND: On the downside for low-carbon energy, further expansion of renewables faces some of the same infrastructural difficulties as coal, including land clearances required to boost transmission through "green energy corridors". In addition, India has higher cost local manufacturing of solar and wind power equipment than China. India has sought to enforce "local content" rules in solar power projects, which the World Trade Organisation recently rejected.[71] On the up side, India faces environmental and energy security pressures which both motivate a diversification away from coal. India is ramping up targets to boost efficiency, for example under its market-based industrial efficiency scheme and LED lighting programme. And it has set ambitious targets for renewable energy, under the Paris Agreement on climate change, including:[72]

- By 2022, to increase fivefold combined wind, solar and biomass power capacity, to 175GW in 2022 from 32GW in 2015, with sub-targets of 100GW solar, 60GW wind and 10GW biomass
- By 2030, to increase the share of non-fossil fuels in its power mix to 40%, from 30% today
- By 2032, to increase nuclear capacity to 63GW from 6GW today.

Conclusions

FACTORS SUPPORTING CURBS ON COAL AND CARBON EMISSIONS	
Differences from China's economic growth	○ India has a different type of economy, with less energy-intensive industry, and so may avoid a ramp-up in electricity demand as China experienced from 2000 ○ India's coal power is on a smaller scale: its coal use today is less than a quarter of China's, and will remain a third less in 2020.[73]
Parallels with China's coal decline	○ China's shift to structural decline in coal consumption was unanticipated by experts and analysts ○ China's coal decline is a result of slowing economic growth; investment in renewable power; and efforts to combat air pollution. India also faces severe air pollution, and is investing strongly in renewables.
Pressures on coal	○ Environment: India is ramping up economic growth just as concerns mount regarding the environmental impacts of coal, including climate change, water use and air quality ○ Market and infrastructure: coal faces multiple legacy infrastructure and market difficulties, including production, freight and the viability of distribution companies.
CHALLENGES	
The momentum is with coal	○ India is adding about 20GW of new coal capacity annually, or five times that of non-hydro renewables ○ India is in the process of investing in coal-related infrastructure which may lock in future demand.
More than half of India's coal power plants are below 10 years old.[74]	○ There is therefore less opportunity to replace them with cleaner renewable, nuclear or gas-fired capacity. However, many coal-fired power plants in India were built under a planned 25-year asset life as opposed to 40-50 year effective life in China and the US.

Renewables face their own infrastructure constraints	○ India's renewable power targets are exceptionally challenging, but we note the acceleration in cumulative solar deployments (from 1GW in 2014/15 to 5GW presently, with a target of 12GW in 2016/17) ○ The Indian grid features load shedding, record high transmission losses and struggling distribution companies which complicate integration of variable renewables.

3. VIETNAM AND INDONESIA

Summary

Indonesia and Vietnam installed about 8GW of coal-fired power between them in 2015. **Vietnam has announced it will review its plans for new coal-fired power**, to implement "international commitments to cut emissions".

Indonesia still has big plans for coal. It intends to install an additional 35GW of electricity generation capacity by 2020, of which 20GW is coal.

Neither Indonesia nor Vietnam ranks in the top 10 countries by cumulative installed coal power capacity, but both rank in the top four for development pipelines (see Table 3 below).[75]

Table 3. Country ranking by pipeline (proposed or under construction), January 2016

Country	Pipeline, GW	Installed capacity since 2010
China	711.8	292,575
India	290.1	98,410
Vietnam	53.0	8,448
Indonesia	45.4	11,795
Japan	23.4	1,850

Source: Global Coal Plant Tracker

Vietnam

Vietnam plans to build out its coal-fired capacity to improve security of electricity supply and reduce power shortages in the wake of recent rapid economic growth and industrialisation. At present, generation is dominated by hydropower, gas and coal.

According to Global Coal Plant Tracker, Vietnam installed about 5GW in the 12 months to January 2016.[76] The IEA notes that Vietnam intends to install a further 19GW of coal capacity by 2020.[77] The country has a pipeline of 12GW under construction and a further pipeline of 41GW in pre-development. However, Vietnam has shelved or cancelled nearly twice as many power plants as it has built since 2010.

There are however signs that Vietnam plans a radical strategic shift in direction for its power generation mix, announcing in January that it would review all new coal plant projects and aim to substitute these with gas and renewables, to implement "international commitments to cut emissions".[78]

Indonesia

Indonesia has signalled that it wants to build some 35GW of new generating capacity by 2020, including some 20GW of coal.[79] Progress through this coal pipeline has been well behind schedule to date, partly attributable to social resistance in heavily populated Java based on concern about potential air pollution impacts.[80]

According to Global Coal Plant Tracker, Indonesia installed nearly 3GW in the year to January 2016.[81] Indonesia has a total pipeline of 45GW of new coal projects, including 40GW announced and awaiting construction, and 5GW currently under construction. Indonesia has a better track record of project completions than Vietnam, installing twice as many as were shelved or cancelled since 2010.

Indonesia also aims to raise renewable energy to 23% of the energy supply, excluding traditional biomass, by 2025, from 6% presently. The target is anchored in the country's National Energy Policy in 2014 and is supported by a feed-in tariff.[82]

Conclusion

In recent years, the headline figure of “power plants either planned or under construction” has proven to be a poor guide to the number of units actually completed. A variety of factors from the global to the local mean that a majority of plants planned or under construction are abandoned. This already makes the oft-quoted 2,400 figure probably a big over-estimate.

However, new factors are progressively undermining the social and economic case for new coal. The cost of building renewables is falling, and technological advances are likely to ease their grid integration. Meanwhile, coal economics are suffering from over-capacity in many countries, and in China in particular, slowing electricity demand growth. Coal utilisation rates are falling in India and China, reducing the investment case for new capacity. Citizens are increasingly restive about air pollution, not least in China, India and Indonesia, and governments and businesses are increasingly concerned about climate impacts. The Paris Agreement has increased confidence that a global low-carbon transition is inevitable.

The net impact of these pressures will almost certainly be a further significant reduction in the extent and pace of new build. The four countries considered in our report will build new coal-fired power stations, and in the case of India, coal is likely to play a significant role in expanding overall generation capacity. But old coal power plants are closing, and those in operation are likely to run less of the time. As a result, an increase in emissions will not automatically follow an increase in capacity: in China, they have recently decoupled.

Over half of the world’s population lives in Asia, and Asia is the fastest-growing continent economically. Therefore, increasingly what happens in Asia determines the course for the rest of the world. But the pressures on coal expansion noted in this report are not unique to Asia. For example, coal new build in the United States is at a standstill,[83] while in Europe the economics of coal generation make progressively less sense.

It is far too soon to signal the end of coal in Asia, particularly in poorer countries. But the case for building new coal-fired stations is quickly dwindling, and in China may soon be non-existent. In our estimation, the number of new coal-fired power plants built across Asia is likely to be in the hundreds, probably the low hundreds. As such, the argument that there is no point in Western nations decarbonising because their emission cuts will be dwarfed by emission gains from Asia is based on shaky ground.

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