Tackling Coal-Driven Air Pollution in China and India

Lessons learned for Indonesia

REPORT

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Photos: Ed Wray for IISD

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1.0 Introduction

As the three most populous countries in Asia, China, India and Indonesia share a lot in common when it comes to projected significant economic growth, and along with it, an increase in the power capacity driven by a booming demand. In order to meet the power demands and renewable power targets set out in the Nationally Determined Contributions (NDCs), it is estimated that an investment of at least USD 321 billion per year is required for the power sector in 32 developing member countries. According to the Asian Development Bank, the People's Republic of China will see the largest investment in the power sector, accounting for 54 per cent of the total investment required under the NDCs. The People's Republic of China is also the top emitter in the region (and globally), with projected emissions of 10.1 $GtCO_2$ by 2030. This compares to 4 $GtCO_2$ in India and 0.8 $GtCO_2$ in Indonesia (Zhai, Mo, & Rawlins, 2018)

Although the implementation of NDCs is expected to drive down the share of fossil fuels overall, coal is still expected to play quite a significant role in the power mix of Asian countries. The share of coal in the generation mix for India is expected to drop from 75 per cent in 2014 to 58 per cent in 2030 (see Figure 1). The share of coal in China is also predicted to drop from 73 per cent in 2014 to 51 per cent in 2030 (see Figure 2) (Zhai et al., 2018).

Indonesia's share of coal in the fuel mix for power generation has been increasing steadily throughout the years and is expected to reach its peak in 2021 with 68.2 per cent, before gradually reducing to 54.6 per cent by 2025—although it will still remain as the dominant fuel mix (PLN, 2019). There is a plan to add 56.39 GW of power generation capacity by 2028, of which 27.1 GW will come from coal. As of 2018, installed capacity of coal power plants in Indonesia was 27.7 GW (PLN, 2019).

Figures 1–3 show the projected energy share under the NDC scenario for all three countries. The figures show that coal plays a dominant role in the current energy mix for all three countries and that all three countries are aiming to reduce their dependence on coal in the coming years.

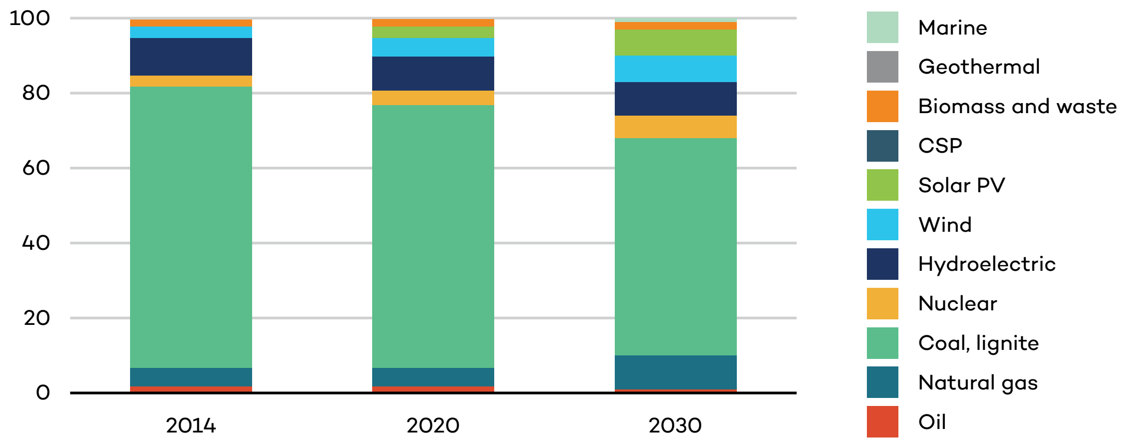

Figure 1. India: Power generation share by source under NDC scenario (%)

Source: Enerdata, 2016.

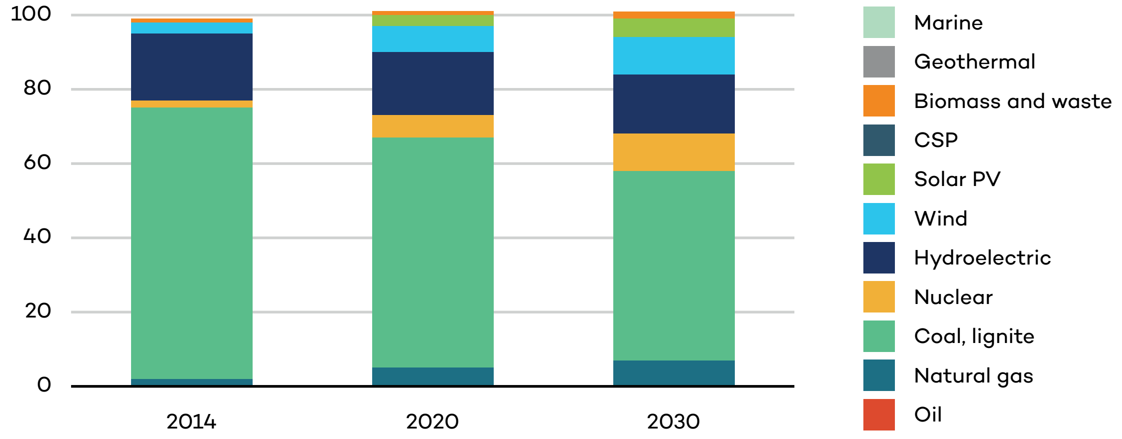

Figure 2. People's Republic of China: Power generation share by source under NDC scenario (%)
Source: Zhai et al., 2018.

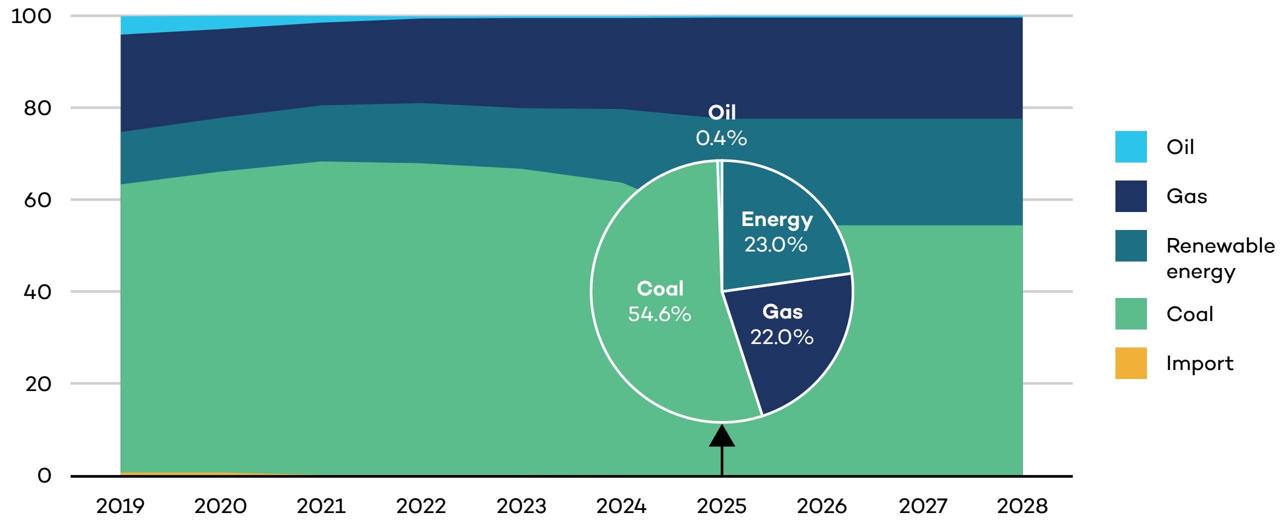

Figure 3. Indonesia: Projected power generation mix 2019–2028
Source: PLN, 2019.

Coal is proven to have very noxious effects on human health. Burning coal to produce electricity or heat releases small particles ($PM_{2.5}$ and smaller) and different toxic elements that are related to non-communicable diseases (NCDs) such as cardiovascular and respiratory diseases and cancer. Air pollution-related NCDs include ischemic heart disease, chronic obstructive pulmonary disease, lower respiratory infection, cardiovascular diseases, acute low respiratory infections, asthma and lung cancer. Failing to recognize and address these externalities can have very negative impacts on human health.

Large coal consumers such as China and India are taking measures to reduce their reliance on coal, limiting air pollution and its noxious effects on their populations. Coal-driven air pollution was estimated to cause over 241,000 premature deaths in China in 2013 (Health Effects Institute, 2016) and 169,000 in India in 2015 (Health Effects Institute, 2018; Institute for Health Metrics and Evaluation, n.d.). One study in Indonesia estimated 7,500 premature deaths due to coal in 2011 and expected this number to increase to 25,000 by 2030 if no measures are taken (Koplitz et al., 2017). NCDs caused by air pollution in Indonesia are among the main causes of premature death in the country (Institute for Health Metrics and Evaluation, n.d.; Sanchez & Luan, 2018).

Although air pollution in China and India is currently heavier compared to Indonesia (see Figure 4), these two countries have been giving more attention to tackling it. Given Indonesia's very large coal growth projections and current level of air pollution, lessons can be learned from both China and India when it comes to addressing air pollution.

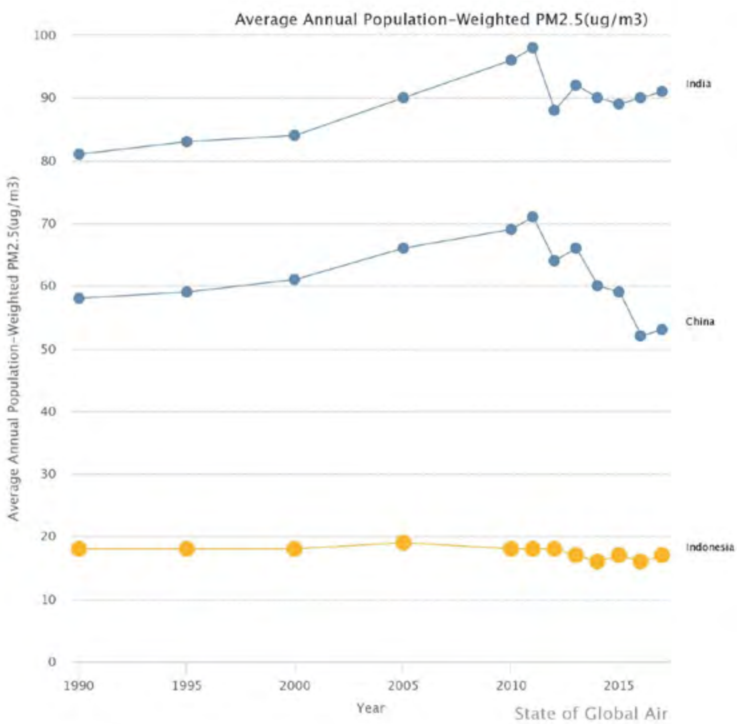

Figure 4. Comparison of ambient particulate matter pollution

Source: State of Global Air, 2019.

2.0 Tackling Air Pollution in China

In the past few years, tackling air pollution in China has become a priority, especially in large cities like Beijing (Zhai, 2017). China has undertaken a series of efforts to reduce coal power plants and promote renewables. This section summarizes main policies that China has implemented in both areas and the predicted health impacts of these policies.

2.1 Coal Phase-Out and Subsidies

A forthcoming report by the International Institute for Sustainable Development (IISD) discusses the health benefits from NDC implementation in China. In recent years, the Chinese government has undertaken significant efforts to reduce greenhouse gas emissions and the use of coal. China has published several laws and regulations that demonstrate a strong commitment to addressing climate change. Fossil fuels, particularly coal and coal-fired power plants, have received major attention. The government has set targets to control coal consumption and increase efficiency of coal use. It has addressed the excess capacity of coal-fired power plants and has set more stringent standards for civil and industrial use of coal. Some policies, such as the Work Program to Strengthen Air Pollution Prevention in the Energy Industry and the Coal-Fired Electricity Energy Saving, Emission Reduction, and Upgrade and Transformation Action Plan (2014–2020), explicitly address the topics of air quality and emission reductions.

China also introduced some of the toughest standards for emissions from coal power plants back in 2011, which are presented in more detail in Table 2. Some of the standards are even stricter than the European Union's, with an emphasis on the more highly polluted regions in China. The new national standards have been successfully enforced, with levels of particulate matter, nitrogen oxide and sulphur dioxide emissions from the coal-based power sector in the country decreasing significantly compared to 1990 levels, despite huge growth in the power generation sector (Singh & Issar, 2017).

However, China also devotes part of its public budget to financing polluting fossil fuels, including coal, the primary cause of air pollution-related diseases as well as the principal contributor to climate change. In 2016, China released its peer review for fossil fuel subsidies, estimating a total of USD 15.42 billion (CNY 96.8 billion) in government support to fossil fuels (Organisation for Economic Co-operation and Development, 2016). The International Monetary Fund (IMF), which estimates the cost of the externalities associated with the use of fossil fuels, puts the total value of subsidies in China in 2018 at USD 1.42 trillion (post-tax). Of this total number, USD 1.04 billion is subsidies for coal (IMF, 2019).

To put all the numbers in perspective, it is interesting to compare them to the health budget. In 2017, China spent USD 214 billion on public health (Sanchez & Wang, forthcoming). This amount has increased over the past few years, although it is still well below the cost of health externalities from the use of fossil fuels estimated by the IMF. Figure 5 compares the different public expenditures in China, showing that subsidies to the consumption of fossil fuels are around 17 per cent of the budget allocation to public health. When externalities are considered, the total cost is over 10 times higher than the public health budget (Sanchez & Wang, forthcoming).

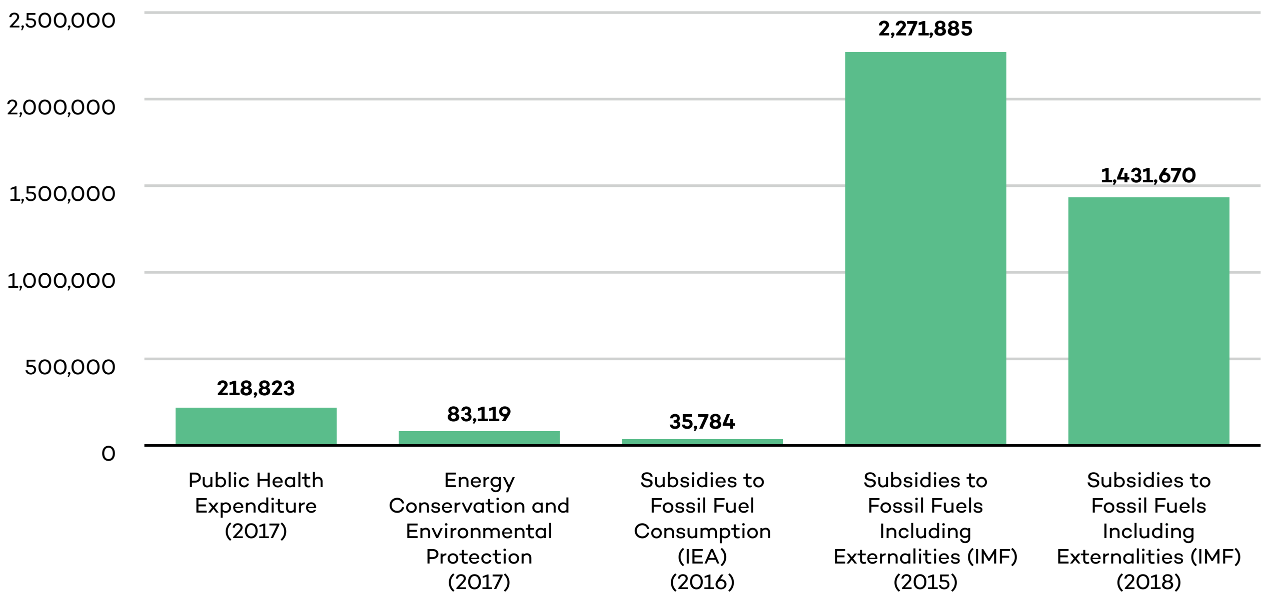

Figure 5. Comparison of Chinese spending on health, energy conservation and environment protection, subsidies to fossil fuel consumption, and value of fossil fuel externalities, in USD million

Source: Sanchez & Wang, forthcoming; IMF, 2019.

2.2 Renewable Energy Uptake

One of the targets listed in the National Total Emission Control Program during the 13th Five-Year Plan is that, by 2020, non-fossil fuel energy will account for 15 per cent of primary energy consumption. Also under the 13th Five-Year Plan, the target for renewable energy development is that all renewable energy power generation capacity will be 680 million kW, and power generation will be 1.9 trillion kWh, accounting for 27 per cent of total power generation by 2020 (Sanchez & Wang, forthcoming).

The booming investment in renewable energy reached USD 127 billion in 2017, around 45 per cent of the global investment in renewables that year (Hodges, 2018). Furthermore, China introduced a green electricity certificate trading scheme in 2017 and has been pushing forward broader reforms, such as fossil fuel taxation, to address environmental externalities[1] (Qi, 2018).

These moves, together with the strong price reductions that renewable technologies are seeing, are expected to accelerate the uptake of clean renewable technologies by 2030. China aims to bring renewable power costs down through economies of scale and technological advances. A recent draft plan from the National Development and Reform Commission (NDRC) indicated that China is revising the definition of its target for renewable energy to supply at least 35 per cent of total electricity consumption by 2030 (Bloomberg News, 2018), which is around 10 per cent more of the share in 2016 (IEA, 2017).

In May 2018, China's NDRC, Ministry of Finance and National Energy Board issued a statement halting all subsidies for utility-scale solar projects in favour of competitive bidding and greatly reducing feed-in tariffs. This move came in response to the surge of solar installations, from 2.5 GW in 2011 to 130 GW in 2018, due

[1] China has established a National Emission Trading Scheme and the Environmental Protection Tax Law, which are breakthroughs in China's environmental protection and climate change mitigation. The Environmental Protection Tax replaces the pre-existing mechanism of pollution discharge fees and has broader coverage of air pollutants, water pollutants, solid waste and noise. It aims to enforce the "polluter pays" principle. The National Emission Trading Scheme covers only the power generation sector in its first phase, but it is expected to expand to cover eight energy-intensive sectors across the Chinese economy.

to generous government incentives in the form of feed-in tariffs. However, over 70 per cent of China's large-scale wind and solar projects have been installed in resource-rich regions, leading to China having the worst renewable curtailment rates in the world (Baker, 2018).

According to a Citigroup note (Xu & Stanway, 2019), China is likely to allocate about CNY 3 billion (USD 443 million) of fixed subsidies for solar in 2019. The bank estimates capacity additions of 42 GW this year under its base case, with potential for 50 GW. Of that, CNY 750 million will be allocated to distributed rooftop power projects with a combined capacity of 3.5 GW, with the rest going to solar stations. China added 20.59 GW of wind capacity in 2018, bringing the country's total to 184 GW, according to National Energy Agency data (Xu & Stanway, 2019).

Under a new policy that was launched in January 2019, the Government of China announced its plan to turbocharge the development of subsidy-free wind and solar projects in the world's biggest solar market. This will leverage a rapid drop in construction costs since 2012 and tackle a gaping payment backlog. The central authorities outlined a range of requirements to enable the extensive deployment of grid parity projects. The government promised to provide direct policy support to help renewable energy developers achieve "grid price parity" with traditional electricity sources. Grid companies will be encouraged to guarantee electricity purchases from pilot projects, lower transmission fees and support cross-regional delivery of subsidy-free power. The NDRC said it would further boost the revenues of solar projects by cutting land costs and promoting new market mechanisms like green certificate trading (Xu & Stanway, 2019).

Furthermore, policy-makers have insisted local authorities minimize non-technical development costs including land fees, taxes and other charges, and ensure that there are no "binding conditions" that could hinder projects. The government said it will establish a market in green power certificates that will be made available to grid-parity projects as an additional source of income for developers (Shaw, 2019).

2.3 Health Impacts

Although China has come up with comprehensive policy packages to mitigate climate change and reduce air pollution, it is still too early to directly observe the effects. Models that estimated the health co-benefits all concluded that the benefits will outweigh the cost of implementing those policies, especially in the long term (2050). Table 1 summarizes the results of these models.

Table 1. Summary of main modelling results of direct health benefits and co-benefits of implementing air pollution reduction and climate-friendly policies

Study	Scenario	Direct health benefits	Health co-benefits[2]
The Lancet Countdown on $PM_{2.5}$ Pollution-Related Health Impacts of China's Projected Carbon Dioxide Mitigation in the Electric Power Generation Sector Under the Paris Agreement: A Modelling Study (Cai et al., 2018)	Implementation of China's NDC targets	368,568 premature deaths avoided by 2050	Between USD 17.38 billion and USD 55.55 billion in 2050 in terms of life value savings[3]
Health Co-Benefits From Air Pollution and Mitigation Costs of the Paris Agreement: A Modelling Study (Markandya et al., 2018)	Implementation of China's NDC targets[4]	200,000 premature deaths avoided between 2020 and 2050 (cumulative)	USD 6.5 trillion saved between 2020 and 2050 (cumulative)
Co-benefits of Climate Mitigation on Air Quality and Human Health in Asian Countries (Xie et al., 2018)	Achievement of the 2°C climate mitigation goal, and consequent reduction of particulate matter ($PM_{2.5}$) and ozone concentration	225,000 premature deaths avoided by 2050	USD 720 billion by 2050 in terms of life value savings
Climate, Air Quality and Human Health Benefits of Various Solar Photovoltaic Deployment Scenarios in China in 2030 (Yang, Li, Peng, Wagner, & Mauzerall, 2018)	Deployment of distributed photovoltaic in the east together with interprovincial transmission[5]	10,000 premature deaths avoided by 2030	N/A
Potential Co-Benefits of Electrification for Air Quality, Health, and CO_2 Mitigation in 2030 China (Peng, Yang, Lu, & Mauzerall, 2018)	Switch to a half-decarbonized power supply for electrification of the transport and/or residential sectors[6]	69,000 premature deaths avoided by 2030	N/A

Source: Sanchez & Wang, forthcoming

[2] Note that these figures cannot be compared directly with the IMF estimate of externalities, since these figures assume cumulated gains under the evolution of the scenario to include more clean energy sources and other underlaying assumptions.

[3] These values result from considering the median value of other value of statistical life estimates for China.

[4] This study evaluates multiple climate scenarios. This table collects only the results of the NDC-related modelling.

[5] This study is based on China's government goal of 400 GW installed capacity by 2030. The results displayed in the table are the ones for the optimal scenario, indicated in the table.

[6] The study evaluates different scenarios to control air pollution from the electricity sector. The results displayed in the table indicate the optimal scenario.

The benefits listed by the evaluated models are mostly the result of a strong reduction in the use of fossil fuels, mostly for power generation (coal), which would lead to a significant improvement of carbon dioxide emissions and $PM_{2.5}$ levels, consequently improving air quality in the country. The reduced air pollution is expected to significantly improve health, notably reducing the number of stroke cases, followed by ischemic heart disease, chronic obstructive pulmonary disease and lung cancer. If all NDC policies are implemented, 370,000 premature deaths could be avoided by 2050 (see Figure 6) (Cai et al., 2018).

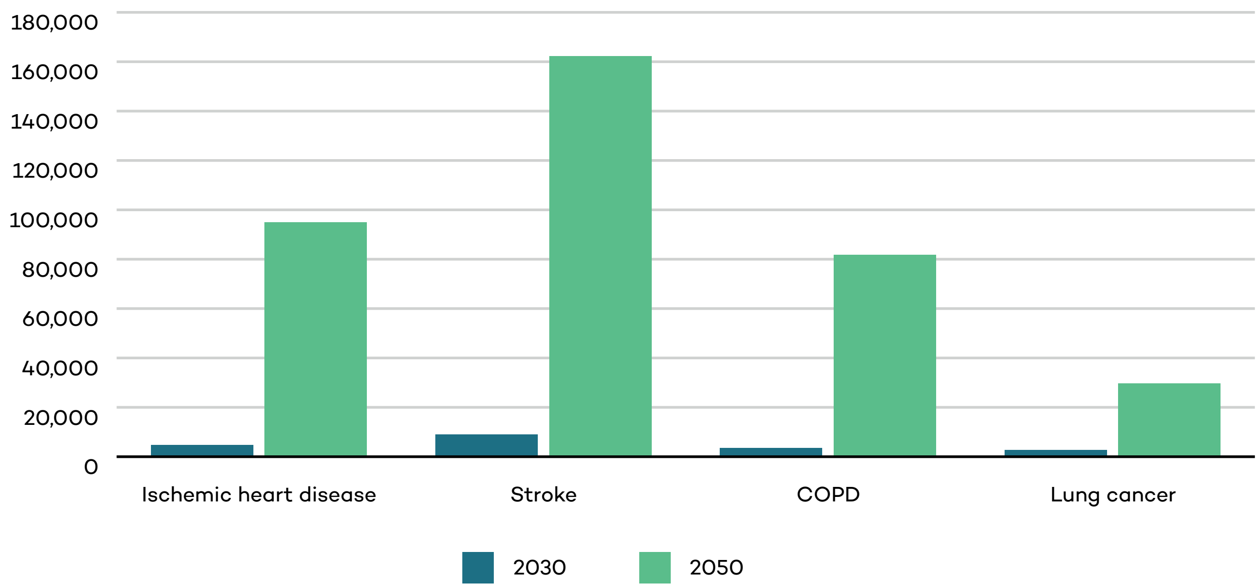

Figure 6. Avoided premature deaths from main respiratory and cardiovascular diseases in China by 2030 and 2050, due to the implementation of measures to achieve NDC targets

Source: Sanchez & Wang, forthcoming.

3.0 Tackling Air Pollution in India

In India, fossil fuel- and biomass-based energy are major causes of air pollution, particularly emissions from transport, coal-fired power plants and traditional cookstoves. The associated health costs are estimated at 3 per cent of India's GDP (Garg et al., 2017). One estimate has India accounting for half of all global deaths due to ambient air pollution (1.8 million deaths in India in 2015) (Landrigan et al., 2018).

WHO air pollution standards are consistently exceeded in India, especially in large cities. Civil society has started to take a more active role and is mobilizing to pressure the government to act. As a consequence, the Government of India is undertaking actions to improve air quality and dedicating energy subsidies to cleaning the energy mix (Soman et al., 2018).

3.1 Coal

In India, coal has remained the dominant source of energy at the national level, followed by oil, natural gas, renewables and others. The share of coal, oil and natural gas in total primary energy mix was 56.3 per cent, 29.5 per cent and 6.2 per cent, respectively, in 2017, while the share of renewable and hydro energy is 2.9 and 4.1 per cent, respectively (British Petroleum, 2018).

Coal and oil are projected to dominate India's current energy mix until 2040. India's draft National Energy Policy, however, envisages that replacing them with natural gas and renewables will mitigate concerns about climate change and local air pollution. A shift to domestic sustainable energy resources (wind and solar) will also improve energy security (NITI Aayog, 2017).

India uses several levers to shape its energy mix, including subsidies in the form of fiscal incentives, regulated energy prices and other forms of government support. Coal subsidies benefit coal through the entire value chain, from mining to the construction and operation of coal power plants. IISD estimates that the level of quantified subsidies to coal in India has remained relatively stable, at USD 2.6 billion in fiscal year (FY) 2014 and USD 2.4 billion in FY 2017 (Soman et al., 2018). The IMF (2019) estimated that the total value of subsidies in India, including externalities, in 2018 (latest available figure) was USD 209,490 million. USD 159,270 million of the total value are subsidies and externalities for coal.

Coal-fired power plants produce a range of external costs, including local air pollution. The current price of coal does not fully reflect these costs, although India has begun to internalize some of them through its clean environment cess: a tax of USD 5.7 per tonne of coal produced, with a fund earmarked for supporting clean energy technology research and projects. With the introduction of the Goods and Services Tax (GST) in 2017, the clean environment cess has been replaced with the GST compensation cess, which is no longer directed into the National Clean Energy and Environment Fund.

Stricter coal power plant emission standards are another step toward internalizing the environmental cost of coal and improving air quality. The Ministry of Environment, Forest and Climate Change announced stringent norms for emissions control from coal power plants in 2015. The standards varied by the age of the plant (CPCB, 2018) and targeted the largest sources of air pollution in India—nitrogen oxide, sulphur dioxide, mercury and particulate matter. Existing plants were given two years to comply, ending in December 2017, and new plants were required to comply at the point of commissioning, starting in January 2017. When the December 2017 deadline was not met by the plants that were to install flue gas desulfurization, it was extended to December 2022.

3.2 Renewables Uptake

The Government of India is making strides to adopt clean energy. As a part of its international commitment, India put forward its NDCs under the Paris Agreement. It has set quantifiable targets to be met by 2030: reduce the emission intensity of its GDP by 33–35 per cent from 2005 levels; install 175 GW of renewables by 2022; install 40 per cent of cumulative electric power capacity from non-fossil fuel sources by 2030; and create an additional carbon sink of 2.5 billion to 3 billion tonnes of carbon dioxide equivalent (Thambi, Bhatacharya, & Fricko, 2018).

India has already installed 78 GW of renewable capacity as of April 2019 (CEA, 2019), a 70 per cent increase in less than three years. Dramatic reductions in solar and wind power costs and resulting competitive prices in auctions have resulted in tremendous progress in the installation of renewables in the country. In the future, electric vehicles (EVs) could be another major disruptor in India's energy system. While no formal target has been established, government officials have suggested that 30 per cent of vehicle sales will be EVs by 2030 (Avora, 2018).

In the past three years, government support to renewables has increased almost six-fold: from USD 431 million in FY 2014 to USD 2.2 billion in FY 2017 (see Figure 7). This is a positive trend, showing public finances flowing in line with major sustainability objectives and goals to improve India's energy security via increased use of domestic resources. However, at 10 per cent of total quantified energy subsidies (USD 23.0 billion in FY 2017), it remains a minor share of overall energy subsidies.

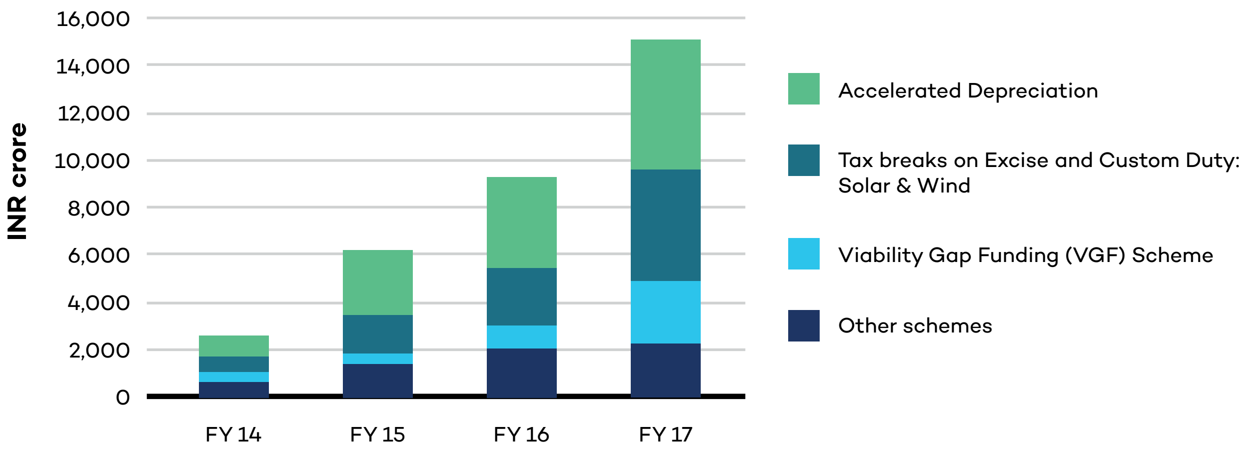

Figure 7. Total subsidies for renewables in India

Source: Soman et al., 2018.

3.3 Health Impacts

Coal-fired power plants produce a range of external costs, including local air pollution. The Health Effects Institute (2018) finds that coal is one of the largest sources of fine particulate matter ($PM_{2.5}$) in India today, and it will be the single largest source by 2050, responsible for 1.3 million deaths per year. Coal is also the largest single source of greenhouse gas emissions that drive climate change (Health Effects Institute, 2018).

The delays are effectively a benefit to plant operators, at the cost of public health: complying with the emissions norms would avoid an estimated 300,000–320,000 premature deaths between 2019 and 2030. The monetized value of these health benefits by 2030 is INR 9,62,222 crore (USD 149.3 billion) (Center for Study of Science, 2018).

In January 2019, India launched the National Clean Air Programme to combat air pollution. Under the plan, government is set to achieve up to a 30 per cent reduction of $PM_{2.5}$ and PM_{10} concentration by 2024 with 2017 as the base year. City-specific action plans are being formulated for 102 non-attainment cities identified for implementing mitigation actions (Press Information Bureau, 2019). A study by the Energy Policy Institute at the University of Chicago estimates that an average Indian could live 1.3 years longer if India reduces particulate pollution by 25 per cent under the National Clean Air Programme goal (ET Energy World, 2019).

4.0 Lessons Learned for Indonesia

4.1 Indonesia's Energy Prospects

As part of the Paris Agreement, Indonesia committed to reducing greenhouse gas emissions by 29 per cent below its baseline emissions by 2030 (and by 41 per cent conditional on international support [COMMIT, 2018]). Since more than a third of Indonesia's greenhouse gas emissions come from the energy sector, one of the key efforts to achieving this target was by setting a national target of 23 per cent of renewable energy in the energy mix by 2025. However, there is a good chance that Indonesia will miss this target. In the electricity sector, the share of renewable energy to date is around 13 per cent. The Government of Indonesia estimated an increase to 16–17 per cent in the next 2–3 years, with several large-scale hydroelectric power plants and geothermal power plants coming online (Kurniawan, 2019).

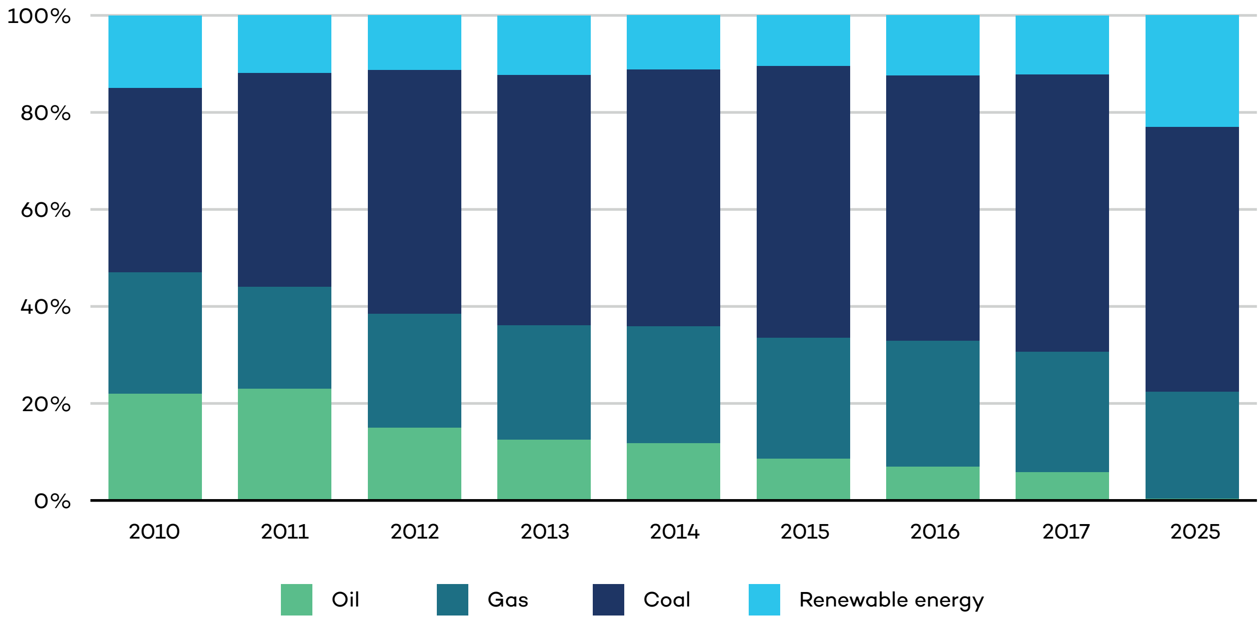

Figure 8. Development of the fuel mix for power generation.
Source: PricewaterhouseCoopers, 2018; PLN, 2019.

Figure 8 shows the development of the fuel mix for power generation from 2010–2017, as well as the projected fuel mix in 2025. It shows that the share of coal has been growing significantly in the past few years, while the growth of renewable energy seems to be stagnant. Installed capacity additions of renewable energy power plants have been slow over the past three years, with only 320 MW of additional capacity being installed. The total renewable installed capacity stood at 9.4 GW as of the end of 2018, well under the Ministry of Energy and Mineral Resources (MEMR)'s target of 15.5 GW by the second quarter of 2018 (IESR, 2019). Research from the Institute for Essential Services Reform (2018) concludes that the current slow growth of renewable capacity will continue in 2019. Even if the 23 per cent renewable energy target is achieved by 2025, coal is still expected to be the main fuel source in the mix.

One of the reasons for coal's continued use is the 35,000 MW program that was launched in 2015. This program, which aims to accelerate electricity generation in Indonesia, will see 57 per cent of the power under this program come from coal, leading to a huge expansion in the share of coal in the energy mix. As of November 2018, 2.9 GW of these projects is operational; 18.2 GW is being constructed; 11.5 GW has been awarded power purchase agreements but have not yet entered the construction phase; 1.7 GW is in the procurement process; and the remaining 1 GW is still in the planning process (PLN, 2019).

4.2 Current Status of Air Pollution Control Policies

The WHO estimated that air pollution-related NCDs caused around 62,000 deaths in Indonesia in 2012. Stroke, ischemic heart disease and lung cancer were the most observed diseases (WHO, 2016). The health burden of coal-driven air pollution in Indonesia is expected to increase significantly as new coal power plants are built in the country. In 2011, Indonesia registered the highest mortality from coal emissions compared to its neighbours, mostly due to coal combustion (Koplitz et al., 2017). The report estimated that 7,480 excess deaths occurred per year in Indonesia due to coal combustion. This is almost twice the estimates in Vietnam (4,250 excess deaths per year) and almost six times more than in Thailand (1,330 excess deaths per year).

There seems to be increased awareness within the society regarding the impact of air pollution, especially in the big cities. In December 2018, a citizen lawsuit against the governors of Jakarta, West Java, Banten, and President Joko Widodo and his ministers (Minister of Forestry and Environment, Minister of Health, and Minister of Internal Affairs) cited their failure in handling the issue of air pollution. The head of the Environmental Laboratory for DKI Jakarta said that the local government has only recently (early 2019) installed a monitoring device for $PM_{2.5}$. Until then, the government had only measured air quality based on PM_{10} (CNN Indonesia, 2018).

Since 2017, the Clean Air Action Coalition, consisting of Greenpeace, Wahana Lingkungan Hidup Indonesia (WALHI), the Indonesian Center for Environmental Law and the Indonesian Consumer Protection Agency, has been pressuring the ministries of Forestry and Environment to revise the standard for ambient air quality in Presidential Decree (Peraturan Presiden) Number 41/1999. As of now, the standard for daily average of $PM_{2.5}$ is 60 $\mu g/m^3$, way more lenient than WHO's standard of 25 $\mu g/m^3$. Additionally, the yearly average of 15 $\mu g/m^3$ is also more lenient than WHO's standard of 10 $\mu g/m^3$. The plan to revise this standard has been on the agenda since 2009, with no real progress so far (Sawung, 2017).

4.3 What Can Indonesia Learn from China and India?

4.3.1 Coal Power Plant Standards

Currently, the standard of emission for coal power plants in Indonesia is regulated under PerMen LH Number 21/2008. This regulation is long overdue for an update, and the current standard is seen by various environmental organizations to be far too lenient in comparison to countries such as China and India. This regulation is currently being reviewed for revision; however, after receiving input from MEMR, the new standards seem to be weaker than previously intended. According to the draft, there are three categories for thermal power plants:

- Category 1: Power plants operating before December 1, 2008.
- Category 2: Power plants that are in the planning phase or operating between January 1, 2009 and December 31, 2020.
- Category 3: Power plants operating after January 1, 2021.

According to WALHI, this categorization implies that no power plants will be included in Category 3, since everything is already in the planning phase. Greenpeace added to the criticism, citing that approximately 75 per cent of existing coal power plants currently comply with these standards; hence, they are not required to lower their emissions (Syahni & Zamzami, 2018).

When MEMR submitted its input to draft, the standards became even lower. The reason for this is most likely that there are already a number of large-scale coal power plants currently under construction/in the planning stage that will be affected by the previous standards. These plants need some design modifications in order to meet the standards, which risks delaying their development. Therefore, MEMR suggested a simplified categorization of before and after the decree came into effect. This new categorization implies that all nine new coal power plants in Java and Bali that are currently under various stages of development will be covered by the old standards instead of this new standard. It also does not help that, to date, no punishment has been imposed for violations of emissions standards. Given the high dependence of PLN on coal-based power plants, shutting down plants due to violations would be problematic (Syahni & Zamzami, 2018).

As a comparison, China introduced some of the tightest emission standards for coal power plants back in 2011 (see Table 2). India also revised its standards for particulate matter, sulphur dioxide and nitrogen oxide in 2015 to be in line with the global standards. The Center for Science and Environment in India expects that the implementation of the new standards will result in 65–85 per cent lower emissions by 2026/27 compared to the business-as-usual scenario (Singh & Issar, 2017). It is pretty clear from Table 2 that, even after revision, the emission standards in Indonesia are more lenient than what is already being applied in India and China. Although there was a delay in implementing the new standards and some resistance from the coal industry in India, they managed to overcome it by setting up manageable installation and upgrade requirements, a manageable electricity tariff increase and an achievable timeline.

Table 2. Comparison of coal power plant standards.

		Unit	mg/Nm^3	mg/Nm^3	mg/Nm^3	mg/Nm^3
		Parameter	**SO_2**	**NO_2**	**PM**	**Hg**
Indonesia	Permen LH Draft Revision Suggestion	Cat 1	550	550	75	0.03
		Cat 2	400	300	50	0.03
		Cat 3	100	100	30	0.03
	MEMR Suggestion	Planned and/or operating before decree takes place	550	550	100	0.03
		Planned and/or operating after decree takes place	200	200	75	0.03
India		Units installed till 2003	600 (for units < 500 MW); 200 (for units ≥ 500 MW)	600	100	0.03 (for units ≥ 500 MW)
		Units installed between 2004 and 2016	600 (for units < 500 MW); 200 (for units ≥ 500 MW)	300	50	0.03
		Units installed after 1 January 2017	100	100	30	0.03
China		New plants	100	100		
		Existing plants	200 (for 28 provinces) 400 (for provinces with high sulphur coal)	100 (built during April 2004-December 2011) 200 (built before April 2004)		
		All plants			30	0.03

Source: Singh & Issar, 2017; Indonesian Center for Environmental Law, 2018.

4.3.2 Support to Renewable Energy Versus Coal Subsidies

As discussed in Section 4.1, Indonesia is finding renewable energy uptake difficult. In comparison, both India and China have undertaken important steps to support renewables and increase their share in the national electricity mix, as described in previous sections.

India considered that fossil fuel subsidies often fail to meet intended objectives efficiently and has committed to reforming inefficient and wasteful fossil fuel subsidies as part of its commitments to the G20 and the Sustainable Development Goals (Gerasimchuk et al., 2018). Indeed, subsidies to fossil fuels in India have decreased over the past three years while subsidies to renewables have increased significantly (see Figure 9), showing a political will to reduce India's dependency on fossil fuel and shift to renewables.

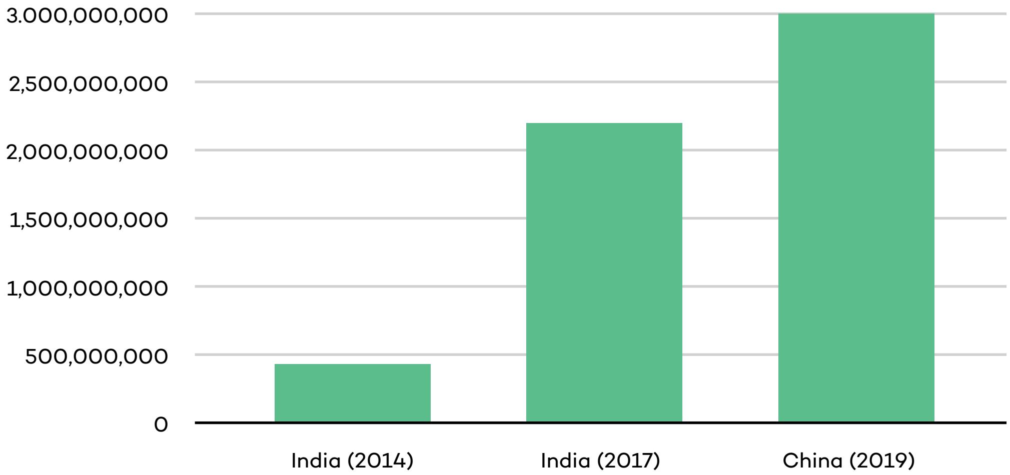

Figure 9. Support for renewables in India

Source: Soman et al., 2018; Shen, 2019.

According to Citigroup Inc (Shen, 2019), China is likely to allocate about CNY 3 billion (USD 443 million) in fixed subsidies for solar in 2019. The bank estimates capacity additions of 42 GW this year under its base case, with a potential gain of 50 GW (Shen, 2019). In May 2018, the government announced that all subsidies for utility-scale solar projects were to be halted in favour of competitive bidding in order to force provinces to utilize unused capacity and reduce subsidy bills. However, the government appears to have backtracked on this drastic move after demand and solar material prices fell globally. The government started approving subsidized solar projects again at the beginning of 2019 (Shen, 2019).

While China and India subsidize renewable energy, there is currently no subsidy scheme for renewable energy in Indonesia. The feed-in tariff was replaced by the local average generation cost scheme (BPP). Under this scheme, the tariff of renewable energy electricity is capped at 85 per cent of the BPP. This system of pricing does not recognize the environmental benefits of renewable energy and favours fossil fuels (IISD, 2018).

4.3.3 Missing Air Pollution Measures and Data

The level of pollution in ambient air is assessed through air quality monitoring systems, which can help governments achieve targeted standards for pollution reduction and improve air quality. Air quality data can also help inform citizens of the air pollution level throughout each day. However, Indonesia has scarce data about air pollutants from coal combustion, or from any source at all. $PM_{2.5}$ measurements are available for Central Jakarta and South Jakarta (Jakarta South [US Consulate], n.d.), but even these are not from the Government of Indonesia. So far, the Government of Indonesia measures PM_{10} in several big cities, but it is missing data from many other regions. Considering that Java and Bali are highly populated regions with a large number of coal power plants, addressing this lack of data is the first step to increasing air quality awareness in the country.

According to Greenpeace, the average concentration of $PM_{2.5}$ in Jakarta shows a worsening trend each year. Based on an air quality monitoring device located in the U.S. Embassy, the yearly average of $PM_{2.5}$ in South Jakarta in 2018 was 42.2 μg/m³, a steep increase compared to 26.9 μg/m³ in 2017 (Saragih, 2019). Referring to the national standard in Presidential Decree Number 41/1999 regarding control of air pollution, the yearly average of $PM_{2.5}$ should not exceed 15 μg/m³, which implies that $PM_{2.5}$ pollution for the past two years in Jakarta has far exceeded this standard. Furthermore, WHO (2018) has a stricter standard of an annual average of $PM_{2.5}$ with 10 μg/m³, which means that the air quality is far worse when compared against the WHO standard. This also implies that the government-imposed standards are far less strict and should be reviewed.

In contrast to the lack of measurement and data in Indonesia, Chinese citizens are able to access real-time air quality data from more than 200 air quality stations through various websites (e.g., https://aqicn.org) and mobile applications. For example, in 2015, the China's Institute of Public and Environmental Affairs launched the Blue Map app, which allows users to access local sources of air pollution, air and water quality, and inspect emissions from 9,000 polluting companies (Qi, 2018). This easy access to information informs the public of polluting factories in their surroundings and, as a consequence, creates public pressure when they do not comply with emission standards (McMahon, 2019).

In India, ambient air quality monitoring is executed by the Central Pollution Control Board (CPCB). The nation-wide program is known as the National Air Quality Monitoring Programme. The network covers 731 operating stations covering 312 cities/towns in 29 states and six Union Territories. However, unlike in China, the air quality data is not yet available in real time. The monitoring is carried out for 24 hours twice a week, resulting in 104 observations in a year. The air pollutants being measured are sulphur dioxide, nitrogen oxide, PM_{10} and $PM_{2.5}$. The CPCB engaged with various other agencies, such as pollution control committees and the National Environmental Engineering Research Institute in Nagpur, to ensure the uniformity and consistency in air quality data (CPCB, 2018).

Box 1. EV policies in India and China

India is counting on EVs as a future opportunity to address local air pollution in cities as well as to reduce oil use. While no formal target has been established, government officials have suggested that 30 per cent of vehicle sales in India will be EVs by 2030, depending on the development of domestic battery technology and EV infrastructure across the country. Subsidies for EVs are gaining momentum, although they are still relatively small in value: they rose from INR 1.7 crore (USD 0.3 million) in FY 2014 to INR 148 crore (USD 22.1 million) in FY 2017.

China announced its New Energy Vehicle (NEV) mandate back in 2017, with a plan to sell 4.6 million EVs by 2020 and ban cars with traditional internal combustion engines in the longer term. The mandate took effect in April 2018, and the government has since been aggressively pursuing NEVs to both to cut air pollution and develop a strong industry. The policy establishes NEV credit targets of 10 per cent of the conventional passenger car market next year and 12 per cent in 2020. The program also incents automakers to exceed their NEV quotas, allowing them to sell credits to companies that do not meet their quotas (Steer, 2018). However, earlier this year, China announced that it is scaling back subsidies on EVs as the industry matures and costs fall. The government plans to eventually phase them out completely after 2020, due to concerns that automakers are becoming too reliant on them instead of developing new technologies and better vehicles (Niu, Zhang, & Tian, 2019).

The Government of Indonesia first planned to release a decree regarding EVs in 2017. In March 2019, the Coordinating Minister for Maritime Affairs, Luhut Binsar Panjaitan, said that the draft was complete and ready to be signed by the president; however, at the time of writing, no official announcement had been made regarding the status of the decree (CNN Indonesia, 2019).

The government's two main targets for this decree are lowering the air pollution level and improving national energy security. EVs rely on electricity supply, which could be met using local fuel sources. Since Indonesia relies heavily on coal for electricity generation, the increasing demand for electricity from the growing EV industry might also mean more coal power. Hence, MEMR's B20 program, where PLN is directed to utilize biodiesel for their diesel power plants, is expected to continue once the EV industry is up and running. This program is expected to resolve the issue of air pollution from both electricity generation and the growing number of vehicles (Wulandhari, 2019).

The ministries of Industry and Finance have started assessing new tax and incentive concepts to support the EV industry. The manufacturer of vehicles with the lowest emission levels will receive the highest tax incentive. Included in the incentive package are a tax holiday, tax allowance, free import fee and super deductible tax (Hermawan, 2019).

5.0 Key Messages and Conclusions

Both India and China have undertaken important steps to support renewables and increase their share in the national electricity mix. Subsidies to fossil fuels in India have decreased over the past three years as subsidies to renewables increased significantly, showing a political will to reduce India's dependency on fossil fuel and shift to renewables. In the past three years, the Indian government support to renewables has increased almost six-fold: from INR 2,608 crore (USD 431 million) in FY 2014 to INR 15,040 crore (USD 2.2 billion) in FY 2017.

In China, under a new policy launched in 2018, the government promised to provide direct policy support to help renewable energy developers achieve "grid price parity" with traditional electricity sources. The grid companies will be encouraged to guarantee electricity purchases from pilot projects and lower transmission fees, as well as support cross-regional deliveries of subsidy-free power. The NDRC said it would further boost the revenues of solar projects by cutting land costs and promoting new market mechanisms like green certificate trading (Xu & Stanway, 2019).

Indonesia can learn from the measures taken in India and China. Phasing out fossil fuel subsidies and dedicating savings to energy efficiency and renewable energy sources would result in significant greenhouse gas emission reductions, health gains and a faster implementation of the NDC targets.

When it comes to tackling air pollution, the biggest contrast when Indonesia is compared to China and India is measurement and availability of air pollution data in Indonesia. While Indonesia has measurements of PM_{10} in several spots, air quality monitoring in China and India measures various air pollutants, including $PM_{2.5}$, with nation-wide measuring points. In India, the ambient air quality monitoring is executed by the CPCB. The National Air Quality Monitoring Programme covers 731 operating stations in 312 cities/towns in 29 states and six Union Territories. However, unlike in China, the air quality data in India is not yet available in real time. The monitoring is carried out for 24 hours twice a week, resulting in 104 observations in a year. China's real-time air quality data can be accessed by citizens through various websites and mobile apps such as Blue Map. This easy access to information helps the public to become aware of polluting factories in their surroundings and, as a consequence, creates public pressure to enforce the standards.

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