GATHERING DUST

Coal Imports to Thailand

GREENPEACE

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Cover photo: *mechanical diggers transfer coal from barges to trucks at a coal distribution centre in Nakhon Luang District, Ayutthaya Province (© Roengchai Kongmuang / Greenpeace)*

TABLE OF CONTENTS

THE STORY OF COAL IMPORTS TO THAILAND: 10 KEY FACTS AND 5 KEY ACTIONS

10 KEY FACTS

1 Rising Imports: Coal imports started rising in the mid 1990s, outstripping domestic coal consumption since 2014. In 2019, 21.7 million tons of coal were imported to Thailand, which is 60.8% of the total 35 million tons of coal consumed that year. (Chapter 2, pp. 22-25)

2 Increasing Industrial Use of Coal: The industrial share of coal consumption against electricity increased from 23% in 1990 to 39% in 2019. Industrial usage is for cement production (61% share in 2019), food, textiles and other factory outputs. (Chapter 2, pp. 20-21)

3 Private Sector Use of Imports: Practically all coal imports are used by the private sector, accounting for all industrial consumption (in 2019 a 62.7% share of import usage) and private sector power producers. (Chapter 2, p. 24)

4 Imports Untaxed: The process of importing coal creates greenhouse gas emissions from shipping, air pollution from coal dust, water pollution in sea and rivers, and river bank erosion. However, there is 0% import tax and no excise tax placed on coal imports to account for these externalities. As a result, the private sector has switched to coal from other energy sources because it is cheaper. (Chapter 2, p. 24; chapter 6, p. 66)

5 Major Exporters: Nearly all coal imports are transported to Thailand by sea. In 2019 the three highest exporters to Thailand were Indonesia, Australia and Russia. Some coal is imported overland from Laos. (Chapter 3)

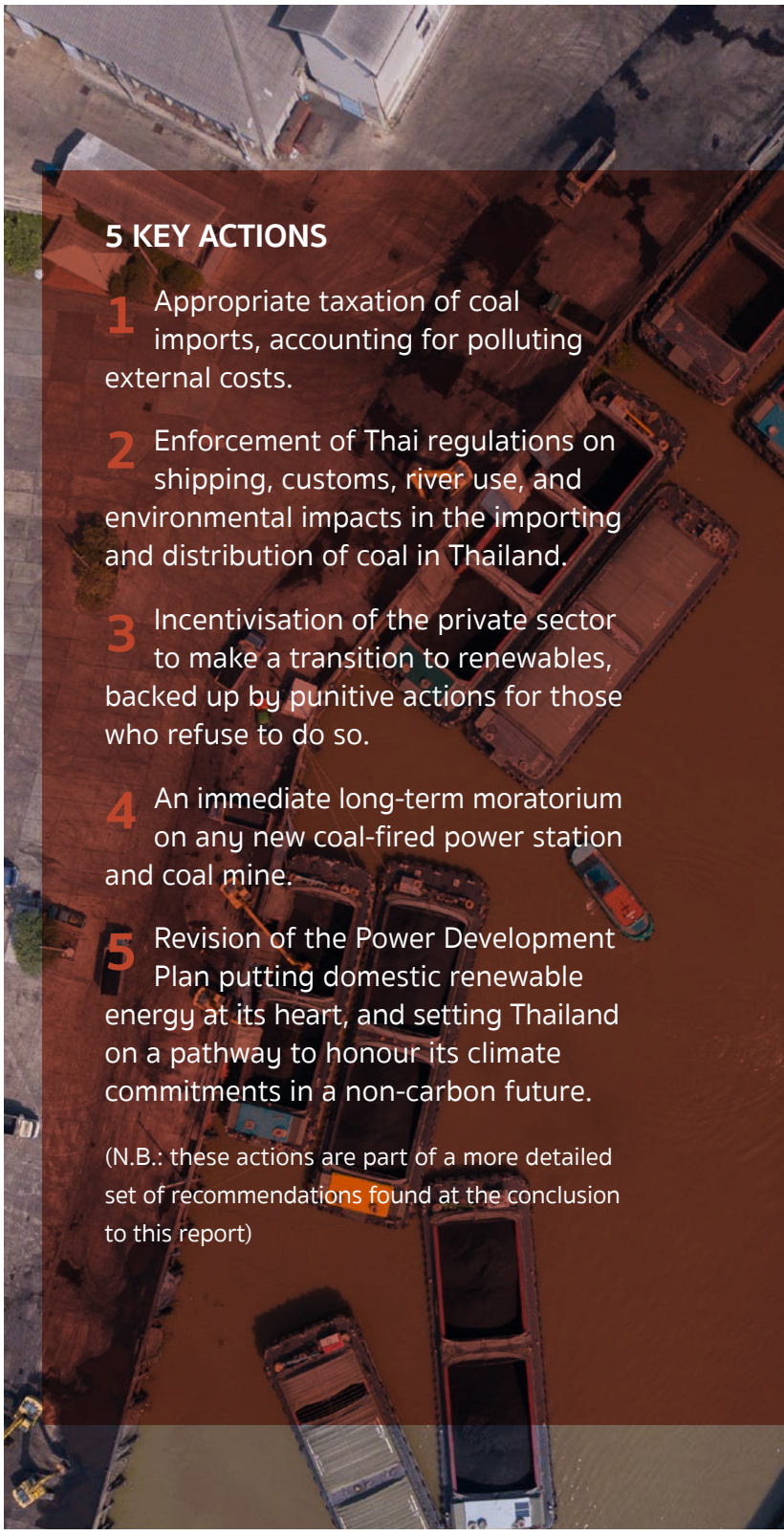
6 Major Corporate Players: Thai companies are integrated throughout the coal import value chain, owning mines in exporting countries such as Indonesia and Australia, shipping companies, distribution firms in Thailand, and end of line consumption points. Major players here include Banpu, Lanna Resources (which is owned by Siam Cement Group), Energy Earth, and Asian Green Energy (AGE). These companies trade coal to multiple countries other than Thailand. (Chapters 2, 3, 4).

7 Arrival Points of Coal Imports: Most imported coal arrives at Ko Si Chang Anchorage Area (14.4 million tons in 2019 which is 66.7% of all imports), from where it is transported by barge along the rivers Chao Phraya and Pa Sak to distribution centres in Nakhon Luang District, Ayutthaya Province. Most other imported coal arrives at Map Ta Phut Industrial Port, serving a number of power plants at the onsite industrial estate. (Chapter 4, pp. 38-39)

8 Distribution Centres in Nakhon Luang: At least 19 companies operate port, storage and distribution facilities in Nakhon Luang, from where coal is transported onwards by truck. Distribution centres expanded here after 2011, following the murder of a local anti-coal activist and the shutdown of similar operations in Samut Sakhon Province. (Chapter 4, pp. 42-45)

9 Unenforced Regulation: Following a court case brought by local residents, in 2019 the Thai Administrative Court stated that ports in Nakhon Luang must downsize to support a maximum boat capacity of 500 tons, and provincial and sub-district authorities must enforce regulations on noise, dust, odour, river bank erosion, and the parking of barges. There is no sign that these conditions are being met, and local authorities are failing to impose any consequences on non-compliant companies. (Chapter 4, pp. 47-49)

10 An Energy Transition to Renewables: The rise in coal imports counters Thailand's commitments to reduce its greenhouse gas emissions, even while it is one of the countries most at risk from climate change. However, a number of studies demonstrate the potential for renewables (such as 100% renewable power in the Mekong Region by 2050) that are less costly than coal and can generate a significant number of domestic jobs. (Chapter 6)



5 KEY ACTIONS

1 Appropriate taxation of coal imports, accounting for polluting external costs.

2 Enforcement of Thai regulations on shipping, customs, river use, and environmental impacts in the importing and distribution of coal in Thailand.

3 Incentivisation of the private sector to make a transition to renewables, backed up by punitive actions for those who refuse to do so.

4 An immediate long-term moratorium on any new coal-fired power station and coal mine.

5 Revision of the Power Development Plan putting domestic renewable energy at its heart, and setting Thailand on a pathway to honour its climate commitments in a non-carbon future.

(N.B.: these actions are part of a more detailed set of recommendations found at the conclusion to this report)

INTRODUCTION

In February 2018, 33 activists set up a hunger strike outside the United Nations headquarters in Bangkok. They were protesting against the planned construction of two new coal-fired power plants in Krabi and Songkhla Provinces. Meanwhile, several residents of Nakhon Luang, Ayutthaya Province have been campaigning for over a decade about the polluting activities of coal distribution companies in the district. They have opened legal proceedings against industrial, river, and administrative authorities at provincial, district, and sub-district levels, who have failed to protect them against the impacts of dust and water pollution emerging from coal distribution. These cases highlight the passionate response of civil society against the horrid consequences of coal production and use, both for electricity generation and industry. Despite being a signatory of multiple global climate agreements, Thailand retains a thirst for fossil fuels in its power generation system.

The 2018 Power Development Plan revised against earlier plans to build new coal-fired power stations, but various actors continue to lobby for their future inclusion. Just as significant is the rise of coal as a cheap fuel to supply independent power producers and factories. With domestic reserves dwindling, this private sector use of coal looks to imports for its supply.

The aim of this report is to look at the coal import industry. It does so by tracing:

- the rise of imports against domestic production and consumption
- where imports come from
- distribution in Thailand with a focus on a centre at Nakhon Luang District, Ayutthaya Province
- the social and environmental impacts of coal transportation and distribution

The report is bookended by cases against the use of coal, and the need for an energy transition to renewable power

sources, fulfilling Thailand's climate commitments. It concludes with a set of recommendations towards such a transition, and to counter localised air and water pollution. Quite simply, there is no place for coal as a source of energy in Thailand, the only profit being for corporate figures in the coal industry. Instead, these actors must be incentivised to shift to renewables, where economic modelling is extremely promising. Despite the economic devastation of the COVID-19 pandemic, there is an opportunity to stand back, take a look at Thai energy policy, plan for and act on a carbon-free future that promotes Thai domestic energy security.

This study on coal imports took place over a year. It involved the scouring of various company reports and trade data, in order to trace the journey of coal from mine to consumption point, and the corporate role in the value chain. Greenpeace teams from other countries were consulted to learn more about the coal industry and Thai connections in these lands. Visits were made to key sites in Thailand, including Ko Si Chang Anchorage Area, Nakhon - Luang distribution centre, Mae Moh and Omkoi in northern Thailand, and Yusob port in Trang Province. During these visits, conversations were held with numerous actors, including community activists campaigning against the impacts of coal transportation and use, authorities administering the importing of coal, academics looking into the topic, and officials involved in the drawing out of energy policy. Interviews were unstructured to allow respondents to frame their work and experiences of coal in their own terms.

Throughout the report, trade data is provided from international and domestic sources. In general, these datasets correlate well, so that they represent a good marker of the coal trade. Where anomalies are found, they are signalled in the text.

1. THE CASE AGAINST COAL

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Although the polluting outcomes of coal mining are well known, it is useful to restate these impacts, so we can then assess coal imports to Thailand. The coal industry commonly sells an image that the fuel is both cheap and clean. But both assertions can be questioned, once external impacts on human health, the environmental landscape, and the climate are factored in. A 2011 study calculated that all externalities over the life cycle of coal would cost the US public over 0.5 trillion USD per year (Epstein et al., 2011). Incorporating these costs would double to triple the price of coal per kWh, making renewables far more competitive. A 2016 study by the International Renewable Energy Agency (IRENA) calculated that doubling the share of renewable energy sources by 2030 (and therefore limiting fossil fuel growth), could save 1.2 trillion USD globally per year in external costs (principally in pollution and extreme weather events through climate change), rising to 4.2 trillion USD per year by 2030 (Markandya et al., 2016). As an additional incentive, doubling the share of renewables by 2030 could lead to direct and indirect employment for 24.4 million people (IRENA, 2016, p. 10).

Setting up a coal mine involves land clearances which can include large tracts of forest, degrading the habitats of local flora and fauna (EndCoal, 2014b; Prurapark & Asavaritikrai, 2020). Excavating the earth releases dust as air pollution, and heavy metals and minerals into water sources. The combustion of coal causes acid rain, greenhouse gas emissions and the release of sulphurous and photochemical smog (Prurapark & Asavaritikrai, 2020, p. 17). Coal is highest emitter of greenhouse gases from all fuel use, in 2018 releasing 14,766 Mt CO_2, or 44.1% of total global fuel emissions at 33,513.3 Mt CO_2 (IEA, 2020a; Figure 1). The highest sector of fuel emissions was electricity and heating with a 41% share (13,977.8 Mt CO_2), and coal plants emit more in this sector than any other power source. Furthermore, the combustion of coal involves intensive water use to drive its turbines when heated and then act as a coolant. One typical 1,000 MW plant uses the same water in a year that could supply 7,000 hectares of farmland or 670,000 urban residents (EndCoal, 2014a).

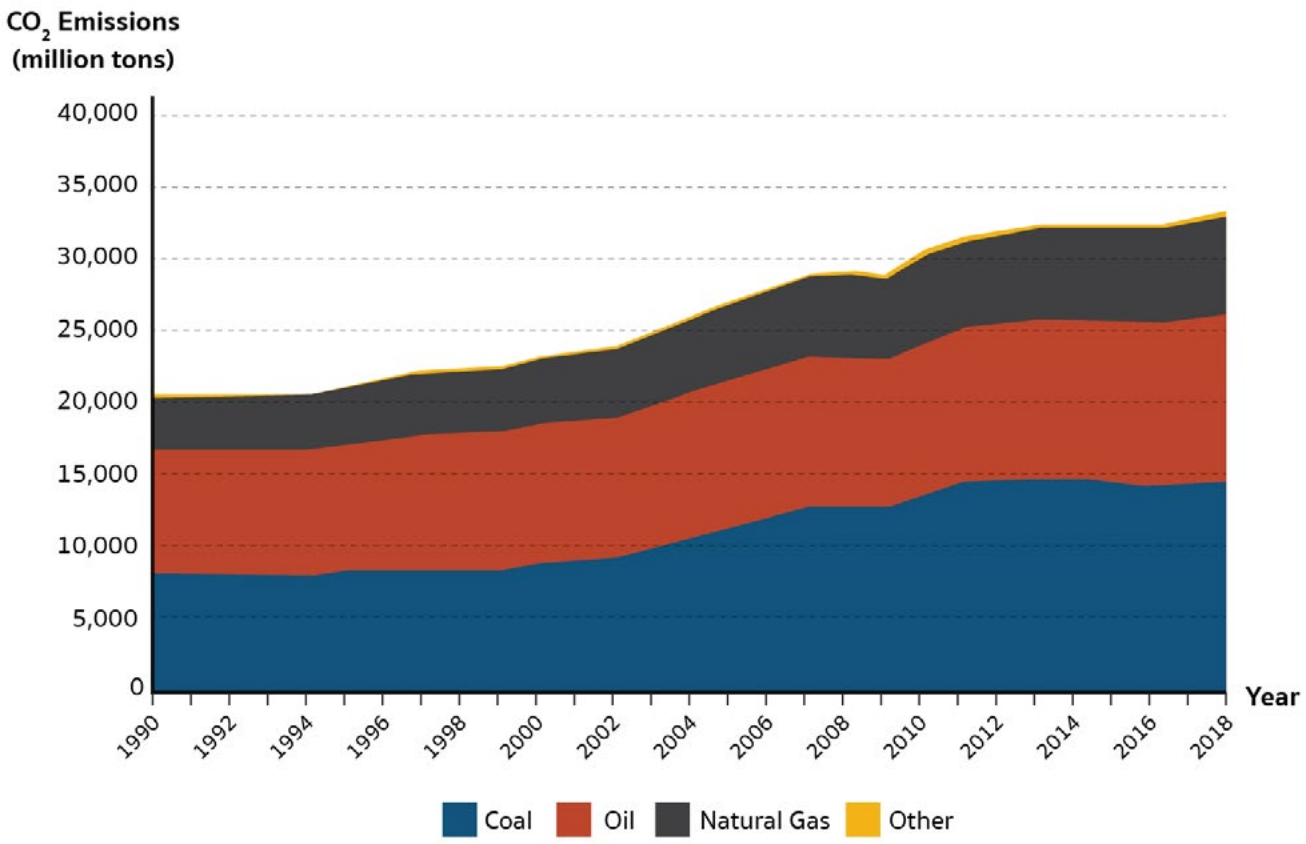

Figure 1: CO_2 emissions by energy source 1990-2018
(Source of data: International Energy Agency)

Coal mining and combustion can have profound effects on the quality of life for local communities, with potential impacts upon respiratory, cardiovascular, reproductive and neurological human systems, as well as carcinogenic risks (Burt et al., 2013; EndCoal, 2015). The impacts are particularly bad for children, the elderly, pregnant women, and sufferers of asthma. 350,000 people die prematurely per year from coal air pollution, with millions suffering from serious illness (EndCoal, 2014b).

The coal industry has done much to promote improvements to its practices. The technology to reduce the release of pollutants during pre-combustion, combustion, and post-combustion has certainly improved, although it is costly and does not limit greenhouse gas emissions. But the projection of 'clean coal' is a pinnacle of oxymoronic green-washing. Coal has never been and never will be clean. The good news is that corporate and political actors are increasingly recognising the need to transition away from fossil fuels in general and coal specifically. On 24th August 2020, Storebrand, a Norwegian asset manager worth more than 90 billion USD, divested from Rio Tinto, ExxonMobil, and Chevron as part of a new climate policy (Ambrose, 2020a). Other large investors are following suit. One month earlier, UN General Secretary António Guterres warned India to turn away from coal to battle against climate change, arguing further that it

makes no commercial sense. During a lecture at Tsinghua University on 23rd July, he said that:

> ***"Investing in fossil fuels means more deaths and illness and rising healthcare costs. It is, simply put, a human disaster and bad economics. There is no such thing as clean coal, and coal should have no place in any rational recovery plan [to COVID]."***
>
> ***(António Guterres, Quoted in Harvey, 2020)***

What does this all mean for Thailand? Firstly, Thailand is not a super-emitter like the USA or China. However, it is one of the countries most vulnerable to the risks of climate change. The NGO Germanwatch releases an annual Global Climate Risk Index looking at extreme-weather events linked to climate change. In their 2020 assessment, they rank Thailand 8th in terms of countries most affected between 1999 and 2018 (Eckstein et al., 2020). In particular, the country is susceptible to both flooding (the 2011 great flood cost up to 40 billion USD) and drought, which has a potential cost of 0.52% GDP particularly impacting upon the agricultural sector (ONEP, 2015). Bangkok is sinking by 2cm per year, and 10% of the national population live in areas likely to be underwater by 2050 (L. Ocharoenchai & Davy, 2020). Along with city traffic, coal-fired power stations and other industrial complexes have contributed to serious air pollution in the capital (Rujivanarom, 2018).

In terms of power production, Thailand has its own crude oil, natural gas, and coal reserves, but following present production rates, oil and gas are expected to deplete within 10 years (IRENA, 2017). Despite the promotion of renewable energy over the last ten years, Thailand retains a heavy reliance on fossil fuels to meet growing demand, and a dependency on imports of these fuels. In particular, this caters to a rise in power generation for private-sector industry, with a strong lobby to increase coal consumption. The 2015 Power Development Plan called for the construction of three new plants in Krabi and Thepa, Surat Thani Province. Even though a revised plan in 2018 cancelled these orders, there is no guarantee they will not be brought back at a later date. A report by the Energy Regulating Commission repeats the mantra of clean coal technology, promoting it as a cheap and stable fuel, from which the public should not fear pollution (OERC, 2019). However, this ignores the facts that renewables are price-competitive in Thailand, demand does not warrant an increase in fossil fuel power plants, and civil society opposition is high. A study by Greenpeace estimated 360 premature deaths per year from BLCP and GHECO-One coal-fired power plants at Map Ta Phut Industrial Estate in Rayong (Greenpeace, 2015, pp. 21–22). Coal is symbolic for private sector resistance to change in Thailand.

2. FROM DOMESTIC PRODUCTION TO GLOBAL COMMODITY CHAINS

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A NORTHERN RESERVE

Although natural gas is the principal fuel for electricity generation in Thailand, coal retains significant usage. The first coal explorations took place in 1897 in Krabi basin (Prurapark & Asavaritikrai, 2020, p. 25). However, production did not accelerate until its incorporation into a power generation system with the formation in 1967 of EGAT (Electricity Generating Authority of Thailand). A total of 2,008 million tons have been found within the country (Prurapark & Asavaritikrai, 2020, p. 25). However, by the end of 2019, proven coal reserves in Thailand amounted to 1,063 million tons (BP, 2020). 99% of the reserve is low-quality lignite (see Box 1 on different types of coal). In the present day, Mae Moh mine in Lampang Province is by far the largest active mine, serving an onsite power plant (Box 2). In 2019 it contributed 98.3% of domestic output. A second significant source for EGAT was located in Krabi Province, but the mine was discontinued in 2008. Otherwise there is a small contribution to domestic production from privately-owned coal mines, listed under their operating permits in Table 2.

BOX 1: TYPES OF COAL

Table 1 highlights the qualities of different types of coal. Coal with a higher carbon content is harder and with a higher generation of heat. Coal types with a low to mid-range carbon content are used for power generation. Mid-range types are also used for various industrial process such as cement production. Anthracite is low in sulphur and ash, and with a high release of heat, is suitable for home use and industries such as metal works.

Type of coal	Also known as	Carbon content	Moisture content	Ash content	Sulfur content	Use
Anthracite	Hard coal	86-98%	Low	Low	Low	Household, chemical, metal and glass industries
Bituminous	Soft coal	45-86%	2-7%	Low	Low	Power generation, metal and cement industries
Subbituminous	Brown coal	35-45%	10-20%	Moderate	Moderate	Power generation, metal and cement industries
Lignite		25-35%	30-70%	High	Low-high	Power generation

Table 1: Different Types of Coal, Their Properties and Uses

BOX 2: MAE MOH, THE LARGEST COAL PLANT IN SOUTHEAST ASIA

Mae Moh Coal Power Plant, in Lampang Province, generates electricity using lignite coal from an onsite mine. After the discovery of coal in 1953, mining started a year later, and the first units of the power plant commenced operation in 1978. The site covers an area of 135 km^2, representing the largest coal-fired station in Southeast Asia (NGO Forum on ADB, 2008). The plant is run by EGAT, with several components receiving support from the Asian Development Bank (ADB). Despite a perceived success of the project in terms of power generation, there are major environmental and social impacts. As well as the millions of tons of carbon emissions, the release of sulphur has led to the death of hundreds of local residents, with 1992 and 1998 deemed particularly severe years (Prurapark and Asavaritikrai, 2020, p. 42). Up to 30,000 people have beenwere displaced during the construction of the plant (Greenpeace Southeast Asia, 2015). The plant can supply 50% of electricity needed to the north, 30% to the central region, and 20% to the northeast. However, the plant has potential for 30 years more usage, using onsite reserves.

Location	Owner	Patent Permit No.
Li District, Lamphun Province	Banpu PCL	25982/16074 and 25983/16075
Ngao District, Lampang Province	Santitranon company	30458/15853 and 304571/15854
Mae Tha District, Lampang Province	Siam Cement Group	30438/15792
Baan Haeng Sub-District, Ngao District, Lampang Province	GREENS YELLOW CO., LTD	30485/16138 (unknown status)

Table 2: Privately-owned coal mines in Thailand
(Source of data: Office of Natural Resources and Environmental Policy and Planning)

There are plans to establish coal mines in Omkoi District, Chiang Mai Province (using 284.3 rai or 45.3 ha), and Mae Tha District, Lampang Province (using around 900 rai or 144 ha). Both would serve an SCG cement plant in Lampang. The Omkoi mine will directly affect 1,541 households, principally local Karen communities (N. Ocharoenchai, 2019). There are major concerns about the loss of forestland and associated biodiversity, as well as air pollution and greenhouse gas emissions, which could seriously affect the quality of life for local residents. The Thai National Human Rights Committee has criticised the Environmental Impact Assessment for the mine as containing potential violations, calling for a revision (Post Reporters, 2020). Meanwhile, a strong network of activists are looking to stop the project altogether.

EXPANDING THE POWER NETWORK

The rise in demand for electricity in Thailand outstrips population increase. From 1999 to 2019, electricity per capita increased by 220% from 1,310.7 to 2,885.9 kWh per person per annum (EPPO, 2019). During this time, the majority of electricity production in Thailand used natural gas, contributing 57-72% of power annually over the last twenty years (Figure 2). Nevertheless, the majority of coal use in Thailand is for electricity production, in 2019 involving 61% of all coal consumption (21.8 million tons). This makes it the second highest fuel type used. In 2019, coal contributed 16.9% of electricity in terms of Gigawatt (Figure 3).

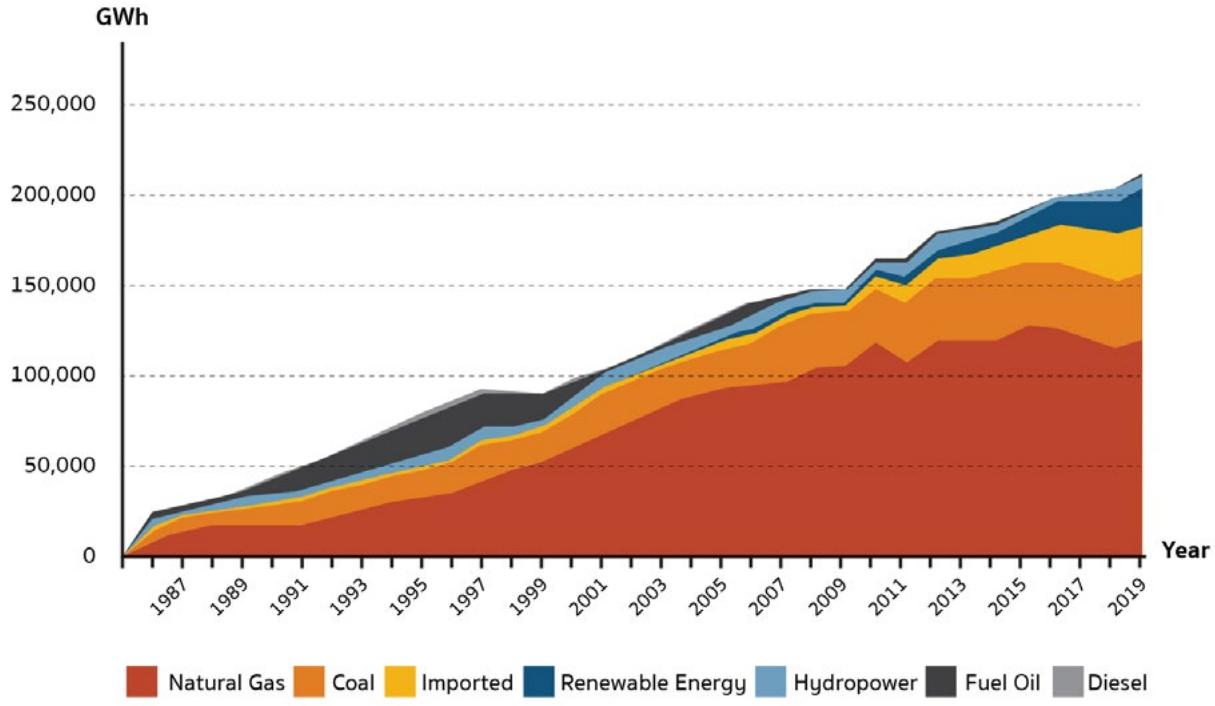

Figure 2: Power generation in Thailand in Gigawatt hours (GWh) by fuel type, 1986-2019
(Source of data: Energy Policy and Planning Office)

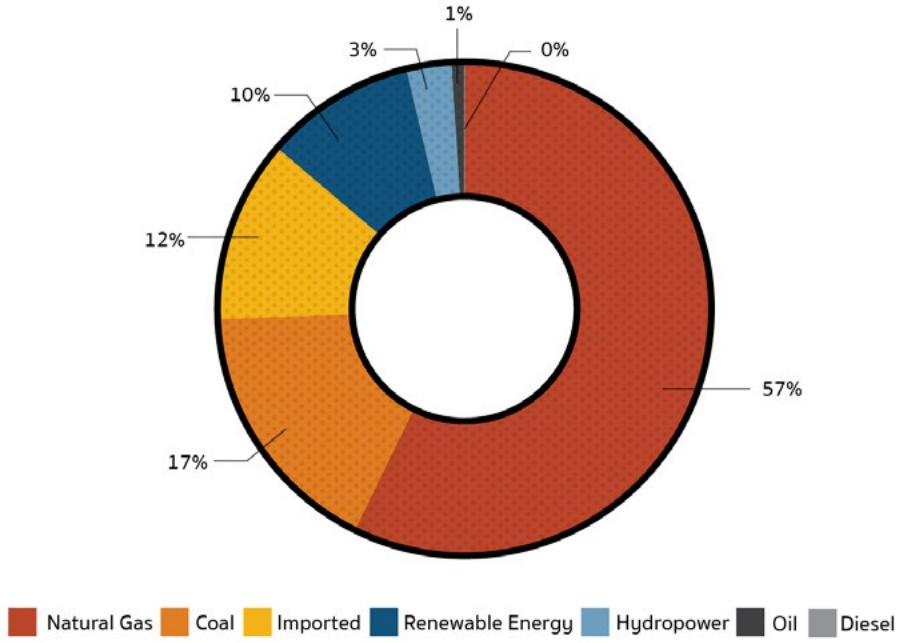

Figure 3: The share of power generation in Thailand by fuel type in Gigawatt hours (GWh), 2019 (Source of data: Energy Policy and Planning Office)

Until the 2000s, nearly all electricity production using coal involved EGAT-run power stations. However, privately-owned coal-fired plants take an increasing share of consumption use, so that in 2019, Mae Moh contributed 62.8% of coal use for electricity. Private producers fit into three categories:

- Independent Power Producers (IPPs): Capacity of over 90 megawatts (MW), using natural gas or coal as a fuel type, and with a long-term power purchase agreement with EGAT.
- Small Power Producers (SPPs): Out of total capacity, 10-90 MW is sold to EGAT, the rest to industrial customers located nearby the plant. Contracts with EGAT are up to 25 years long. Power plants here use a variety of fuel types, including natural gas, coal and oil.
- Very Small Power Producers (VSPPs): Out of total capacity, up to 10 MW is sold to the Metropolitan Electricity Authority (MEA) or Provincial Electricity Authority (PEA). In principle, VSPPs produce electricity through renewables. This powers a local grid system or factory, and the scheme allows excess to be sold to EGAT under a non-firm contract. In this way, such projects overlap the function of industrial production and power generation. Regulations allow for the supplementary use of other fuel types (such as coal) up to 25% of consumption, due to the seasonal availability of biomass. It is possible that power producers are manipulating this loophole to maximise fossil fuel usage, potentially beyond its regulatory quota.

Nearly all coal used in IPPs, SPPs and VSPPs is imported. In 2018, there were a total of 937 SPPs and VSPP projects (Tunpalboon, 2019). A list of the coal-fired plants under firm (defined provision) contracts to EGAT is provided in Table 3, with a longer list of 22 plants included as Appendix 1. Some plants are part of a collection of projects, which are included

in a single power purchase contract. For example, the SPPs owned by Glow Energy are part of a collection of eight projects, with an agreed provision of 630 MW. Table 3 does not include VSPPs since these are registered under renewable energy production (solar, wind, biomass, biogas, and waste), even though in actuality they may be using fossil fuel types including coal. Many plants are found in industrial estates within Rayong Province. For example, Banpu PCL owns a 50% stake in BLCP power plant, and has a long-term purchase agreement with EGAT until 2032. The power plant contains two units with a total capacity of 1,434 MW, and it's dispatch rate to EGAT in 2019 was 98.4% (Banpu, 2019, p. 61).

Name	Date of operation	Location	Owner	Capacity (MW)
State-owned				
Mae Moh	1972	Lampang	EGAT	2,400
Electricity imported from foreign coal mine				
Hongsa	1972	Xayaboury Province, Laos	Hongsa PCL	1,473
Independent Power Producer (IPP)				
BLCP	2006	Map Ta Phut Industrial Estate, Rayong	Banpu PCL; EGCO Group (50:50 share)	1,434
GHECO-One	2012	Map Ta Phut Industrial Estate, Rayong	Glow Energy PCL; WHA Energy 2 Co., Ltd	660
Small Power Producer (SPP) – Contracts with EGAT with defined provision of electricity				
Glow SPP 2/ Glow SPP 3[1]	2000	Map Ta Phut Industrial Estate, Rayong	Glow Energy PCL	513
Glow Energy CFB 3	2010	Map Ta Phut Industrial Estate, Rayong	Glow Energy PCL	85
National Power Supply (2 projects)[2]	1999	304 Industrial Park, Prachinburi	National Power Supply PCL (Double A Power)	328
IRPC	2015	IRPC Industrial Zone, Rayong	IRPC PCL	240
TPT	1995	Map Ta Phut Industrial Estate, Rayong	TPT Petrochemicals PCL	55

1 Co-generational natural gas and coal-fired facility
2 Bituminous coal mixed with biomass

Table 3: Coal-fired power plants in Thailand and Laos (State-owned, IPPs and SPPs) with contracts to sell electricity to EGAT

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MIXED MESSAGES FOR FUTURE GENERATION

There have been mixed messages on the future of coal for power generation in Thailand. The main strategy is laid out in Power Development Plans (PDPs). The 2015 PDP called for an increase in the share of coal from around 20% of a predicted 197,891 GWh in 2016 to 23% of 326,119 GWh in 2036 (Energy Policy and Planning Office, 2015). The increase in coal use was intended to offset a reduction in dependence upon natural gas, from 64% to 37% in 2036. To accomplish this rise, the plan proposed the construction of three new public coal-fired plants in the south of Thailand.

- Krabi coal-fired power plant, with a capacity of 800 MW and planned completion in 2019
- Thepa coal-fired power plant (Songkhla Province), with two units (both with a capacity of 1,000 MW) and planned completion in 2021 (unit 1) and 2024 (unit 2)

Activists and communities from around the country complained that the plan overestimated projections in demand, under-prioritised renewable energy, and so unnecessarily promoted new fossil-fuel power stations that would have negative impacts upon local residents (Wangkiat, 2015). In February 2018, 33 activists staged a hunger strike outside the United Nations headquarters in Bangkok in order to protest against the construction of all three power plants (Post Reporters, 2018). With a change in the Minister of Energy, and in the face of new production

and consumption data, a revised PDP in 2018 reversed many of the earlier decisions. Rather than coal having a 23% share of 326,119 GWh in 2036, it is now planned for a 12% share of 367,458 GWh in 2037. Energy capacity through renewables are revised for an increased contribution, due to a higher than expected increase in solar power from 2014-2017 (Beckstead, 2018). However, there are three points of note:

- The principal area of expansion lies back in the hands of natural gas, thereby retaining a dependence on fossil fuel sources.
- Further growth in renewable energy is only placed in the final ten years of the 2018 PDP, by which time a new plan is likely anyway (see below).
- Despite the reduction in its share and decrease from the 2015 PDP, the absolute contribution of coal still rises due to the overall rise of power generation.

There is an acceptance that the 2015 PDP unnecessarily promoted new power plants. As a result, the new coal-fired power plants at Krabi and Thepa have been put on hold, although a new gas-fired plant has been proposed for Surat Thani Province. However, there remain issues around plants run by independent power producers such as National Power Supply Company, which use coal (Box 3). With a cabinet reshuffle in August 2020, which resulted in a new Minister of Energy, there is a likelihood that the power plan will be revised once more, and no guarantee that the expansion of coal stays off the table, with EGAT still pushing for Thepa to be built.

BOX 3: DOUBLE A PCL

Double A operates a pulp and paper business, along with power production using coal and biomass (Double A, 2017). Its main paper factory is located in Bang Pakong District, Chachoengsao Province, and two operational power plants for biomass waste from the paper production process (through affiliate National Power Supply Company) are situated in neighbouring Prachinburi. One of these uses bituminous coal. The electricity from this station supplies EGAT and also facilities within the industrial estate in which it is located. In 2019, government policymakers ordered a new planned power plant in Prachinburi to switch from running on coal to natural gas (Praiwan, 2019a). The plant, to be run under an EGAT power purchase agreement by National Power Supply Company was intended to be operational by 2014, but has been delayed. In the meantime, EGAT pushes forward plans for a further coal-fired plant in Chachoengsao to be operated by National Power Supply Company (Praiwan, 2019b). There are similar discussions for a switch to gas.

Two transportation subsidiaries supplying the coal-fired power plants are NPS Ocean Star Company Limited (shipping) and NPS Orana Company Limited (inland river transportation). A subsidiary PT. Utami Jaya Mulia is connected to coal mines in Kalimantan, Indonesia.

INDUSTRIAL USES

Over the last thirty years, the industrial sector has taken a growing share of coal usage, from 23% in 1990 to 39% in 2019 (Figure 4). The overwhelming majority of coal used for industrial consumption is imported to Thailand. Factory outputs include cement, paper, food, and textiles (EPPO, 2019, p. 108). Some companies are also involved as IPPs, showing how industrial and power generating functions overlap (Box 3). There are a variety of industrial processes that use coal as a fuel for their factories. For example, the Thai company Chememan PCL is a leading lime producer in Asia. It owns six coal-fired quicklime kilns at Kaeng Khoi Plant, Saraburi Province, using 70,000 tons of coal in 2019 (Chememan, 2019). However, the most significant sub-sector is the cement industry.

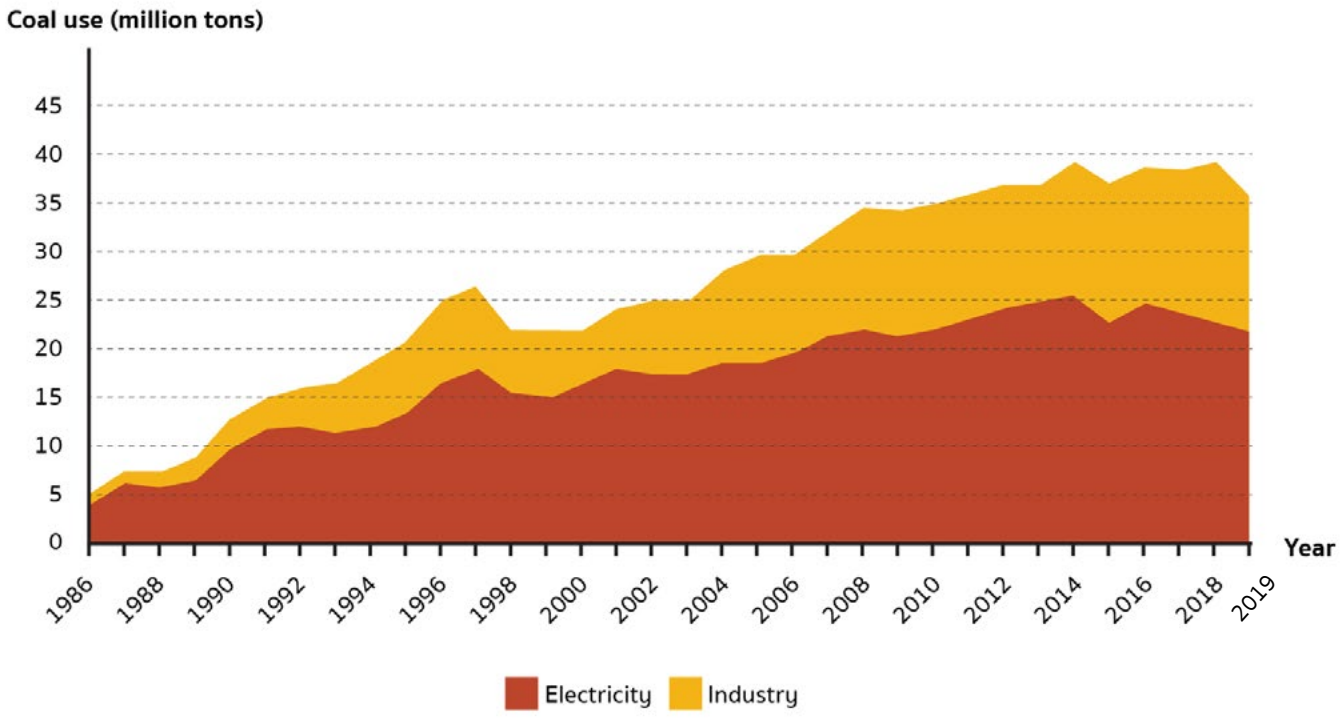

Figure 4: The shift in coal use for electricity and industry in Thailand, 1986-2019
(Source of data: Energy Policy and Planning Office)

BOX 4: SIAM CEMENT GROUP

Established in 2013 by King Rama VI (to this day, the Crown Property Bureau owns a 30% share), SCG PCL is focused in three core businesses, namely cement-building materials, chemicals and packaging (SCG, 2019). The company employs over 54,000 people, and in 2019 the annual revenue was 438 billion baht (with 184,690 million baht from the cement-building sector). SCG invests in cement production around the region, including Cambodia, Lao PDR, Myanmar, and Vietnam. In 2016, it was reported that the company uses approximately 2-3 million tons of coal per year in Thailand for its cement and paper business (ERC, 2019, p. 74). In 2017, the director of SCG Trading Co., Ltd. stated that they were importing around 6 million tons per year (Voice TV, 2017). This demonstrates a wider role in coal distribution that may be feeding SCG regional projects, and also being sold for other purposes within Thailand.

The company has six cement plants, with four in Saraburi Province, one in Lampang, and one in Nakhon Si Thammarat. One of the factories in Saraburi is for white cement, with all other plants in Thailand producing grey cement. The national capacity in 2019 was 23 million tons. The output is available to the private construction sector within Thailand, and through a series of retail stores, as well as exports to neighbouring ASEAN countries.

SCG is also the major shareholder in Lanna Resources PCL (45.09% share), which controls mining and shipping companies importing coal from Indonesia, for industrial usage and by IPPs and SPPs (Lanna, 2019). Once arriving in Thailand, much coal is taken to Nakhon Luang District of Ayutthaya province, where there are two SCG-owned two distribution centres and one owned by Lanna Resources.

Thailand produced an average of 38 million tons of cement per year between 2015 and 2019 (Lunkam, 2020), catering to domestic purposes and export to ASEAN partners. Coal is used within the cement-making process to heat a number of ingredients in a kiln, which includes limestone, clay, sand, and iron ore. The 2019 Banpu annual report claims that the cement industry is the highest private sector industrial use of coal. For the first ten months of 2019, the reports accounts for 7.6 million tons of coal used in cement production, which is 61% of industrial use (Banpu, 2019, p. 46). There are sixteen integrated cement plants in Thailand, of which ten are found in Saraburi Province, close to the main coal distribution centre in Nakhon Luang District, Ayutthaya (CemNet, 2020).

Many Saraburi factories have been established for over thirty years already. In the past, they used oil and natural gas as a power source, and only recently converted to coal consumption, concurrent with the expansion of coal distribution in Nakhon Luang. Other factories are found in Phetchaburi, Nakhon Sawan, Lampang and Nakhon Si Thammarat provinces. The owner of most plants is Siam Cement Group (SCG – see Box 4). Following a contraction in cement production and trade during 2020 due to the coronavirus pandemic, it is expected that the construction sector will soon pick up, facilitated by large-scale infrastructure projects (such as in the Eastern Economic Corridor) and a recovery in the real estate market, particularly in Bangkok Metropolitan Region (Lunkam, 2020).

THE RISE OF IMPORTS

In 2019, the total consumption of coal in Thailand was 35.7 million tons, down from 39.3 million tons in 2018 (Figure 5). This counters an otherwise upward trend. Domestic coal contributes only 39.2% to the amount consumed, so that the majority of coal being used in Thailand is imported from abroad. Indeed, since 2014 imports of coal have outstripped domestic consumption. Representing the gap between total and domestic coal consumption seen in Figure 5, Figure 6 shows that imports started to rise in the mid 1990s, delayed by the Asian Financial Crisis in 1997, and then expanding significantly from the 2000s onwards. Using data from UN Comtrade (Figure 7), Thailand ranks as the 14th highest coal importer, even if it brings in less than a tenth of the highest importers (China and India).

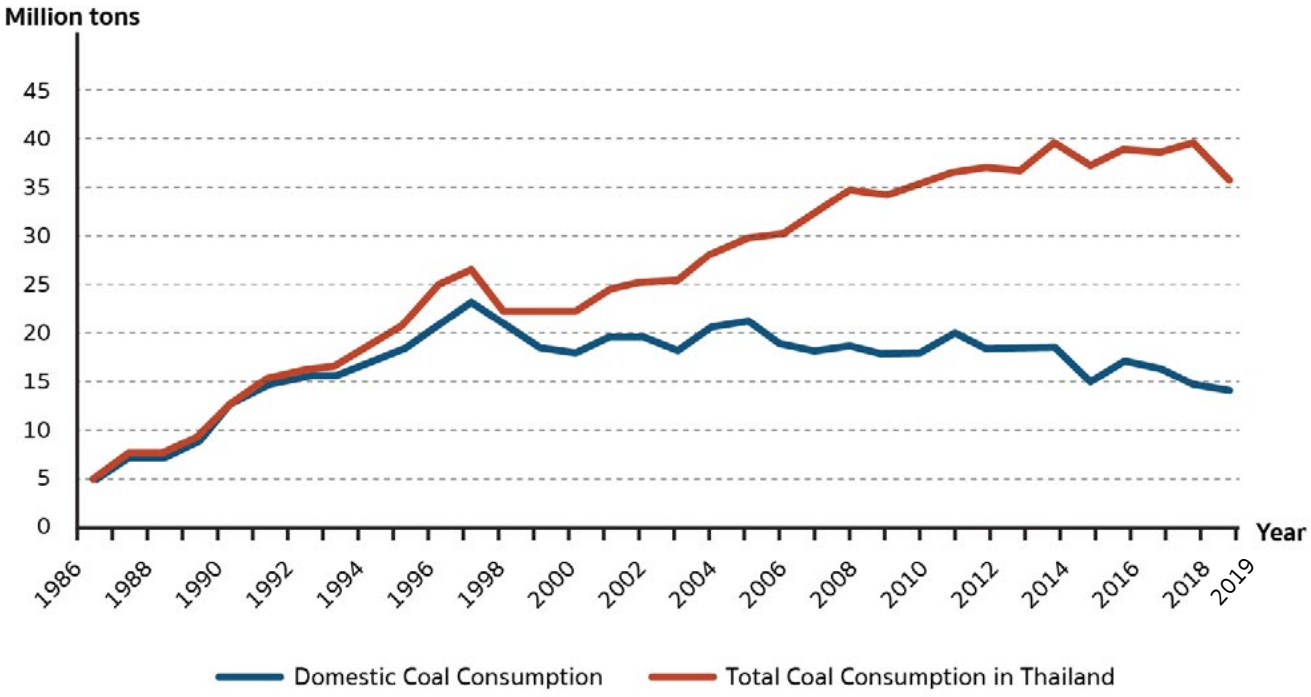

Figure 5: A comparison of total coal consumption and domestic coal consumption in Thailand, 1986-2019 (Source of data: Energy Policy and Planning Office)

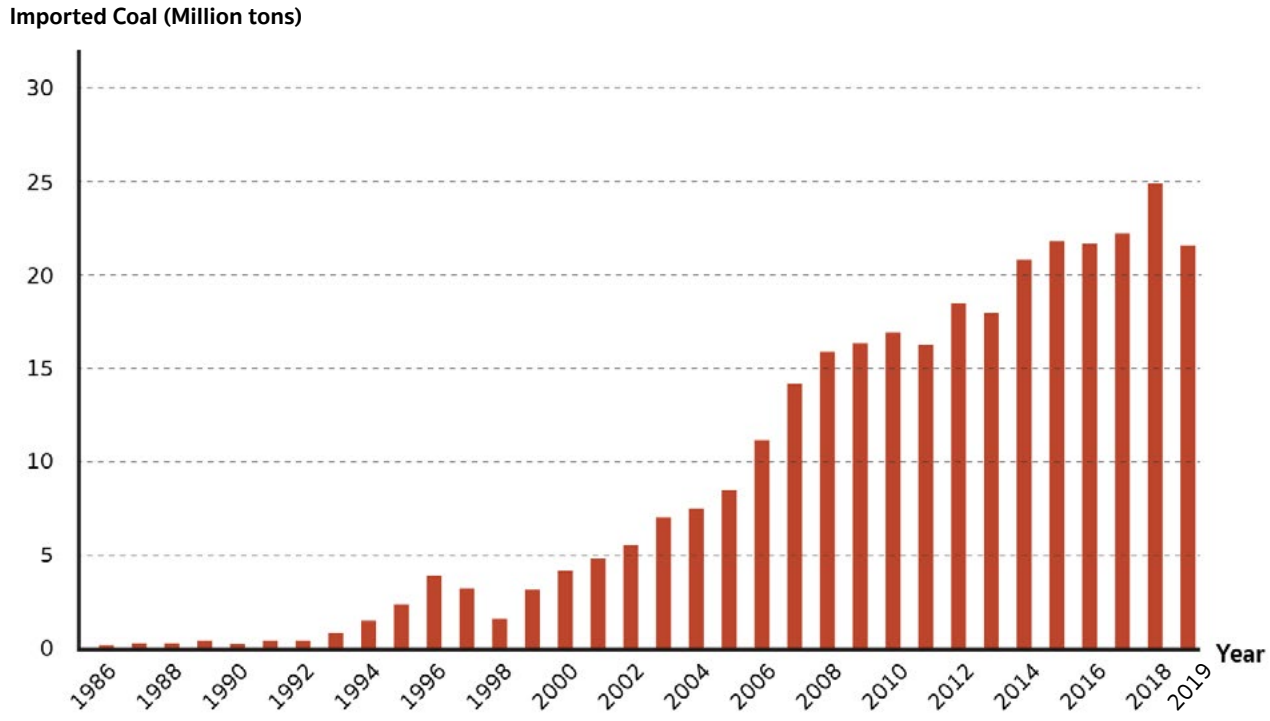

Figure 6: Coal imports to Thailand
(Dataset: The Thai Customs Department, compiled by EPPO)

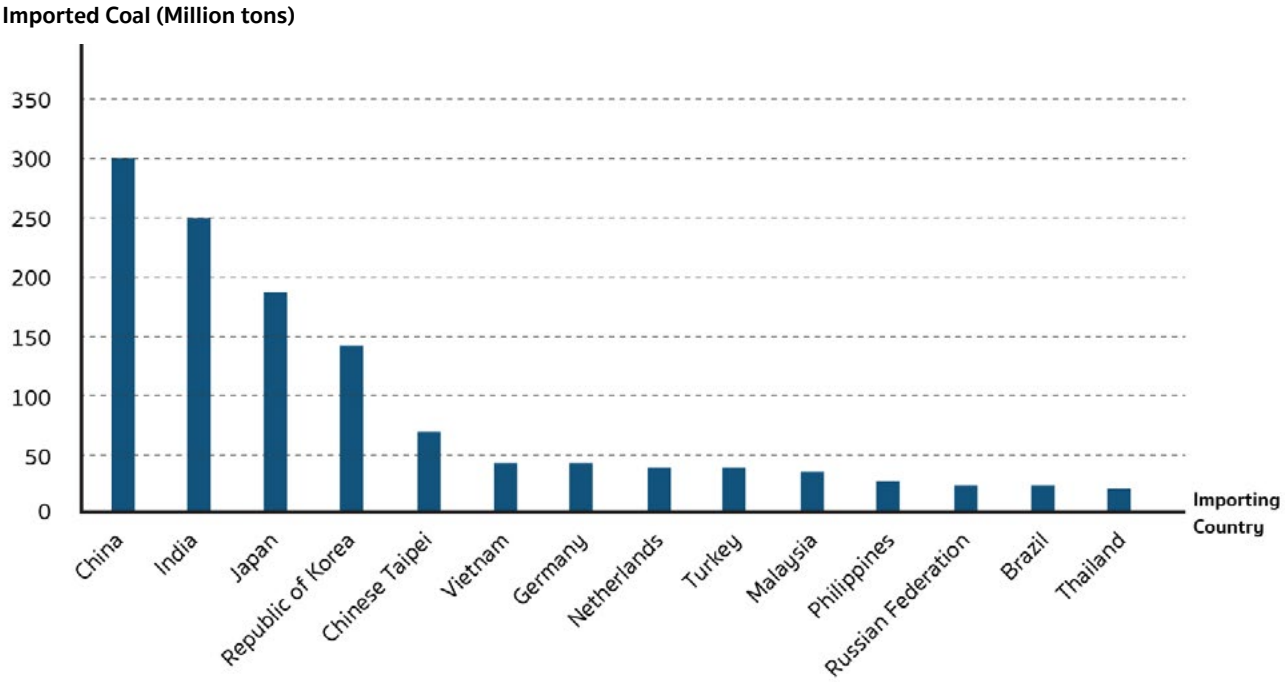

Figure 7: The world's highest importers of coal
(Source of data: UN Comtrade)

Looking at the evidence from the previous sections, coal imports predominantly satisfy demands from the private sector (Banpu 2019 p. 46). To acquire coal, some companies and entrepreneurs engage in short-term bidding contracts or from the spot market (Banpu, 2019, p. 46). Other are more deeply positioned in the value chain, whether owning shares in mines abroad (for example, Banpu in Indonesia and Australia, see also Box 4 on SCG), companies shipping coal to Thailand, or local distribution firms. Figure 8 shows the split of import use between industry, IPPs and SPPs. Since imports started rising 30 years ago, industrial uses have consistent taken over a 50% share, in 2019 standing at 62.7%.

There are various factors influencing the rise of coal imports. Firstly, with domestic production decreasing since the mid-2000s, itself of low-quality lignite, it is unsurprising that Thai consumers have looked to the international coal market. In particular, the proximity of Indonesia, and the richness of its reserves, is a clear attraction for supply to Thailand. The economics of coal imports also counts in their favour. Compared to other fuel types, coal is cheap. Transportation costs are relatively low per unit, even if a large amount of coal is needed to generate electricity (Prurapark & Asavaritikrai, 2020, p. 88).
The tax regime around coal is extremely favourable. From 1987-2014, a tax ceiling of 25% was placed on coal imported to Thailand, but in practice, only 1% was charged, and 7% VAT placed on top. Since 2014, the tax has been fully exempted so that only the 7% VAT remains. Furthermore, excise tax is placed on diesel, petroleum, and natural gas to raise revenue and temper usage as harmful products, but there is no such tax on coal.
Up to the mid-2000s, oil was still the preferred power source for factories in Thailand. However, once prices increased, and with import tax at a higher rate, many factories shifted to the now relatively cheaper coal, and larger companies took an active role in mining, shipping and distribution.

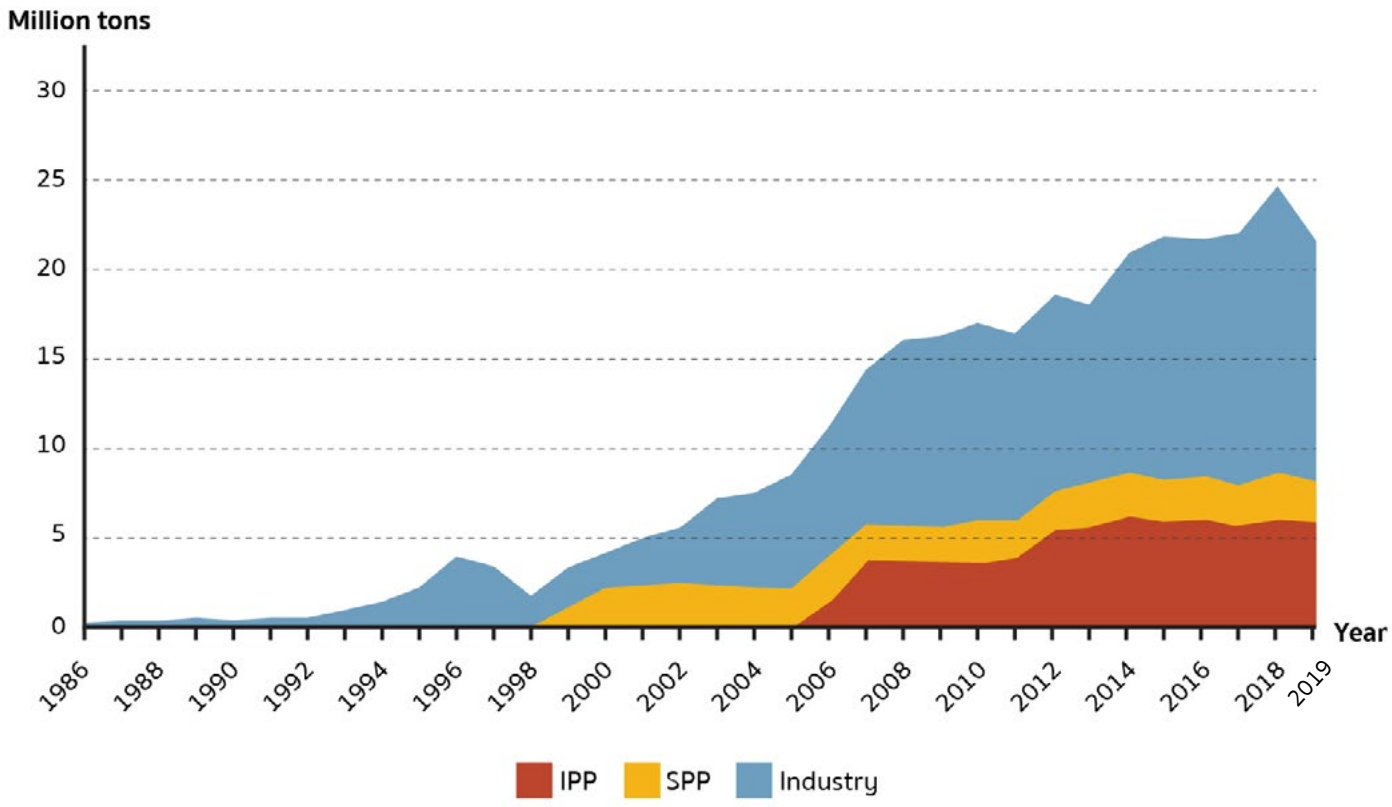

Figure 8: Coal imports to Thailand by user
(Source of data: The Thai Customs Department, compiled by EPPO)

3. KEY EXPORTERS

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2019 IN DETAIL

Table 4 gives a detailed breakdown of 2019 coal imports to Thailand. The figures correlate between international statistics and those used by the Thai Energy Policy and Planning Office. 20 countries exported coal to Thailand in this year. The top four exporting countries are named as Indonesia, Australia, Russia, and Laos. Further exporters include the Philippines, Colombia, USA and Vietnam. Indonesia, Australia, and Russia are among the top producers of coal, and are well-established as the top three global exporters, with Indonesia exporting around 460 million tons in 2019, Australia 390 million tons, and Russia 220 million tons. This represents around 70% of total global coal exports.

The vast majority of coal is transported to Thailand by sea (Figure 9). Different types of bulk carriers are used to transport the commodity, ranging from mini-vessels carrying less than 10,000 tons, up to Capesize ships with a capacity between 100,000 and 200,000 tons. Only imports from Laos are arriving overland. However, since the mid-2000s, a Thai-Burmese joint venture has been trying to exploit coal reserves in Mai Khot, Shan State, Myanmar, for both onsite power generation to export, and coal transfer by truck to Thailand (EJAtlas, 2018). A cross-border network of civil-society and NGOs have successfully lobbied against operationalisation. Even so, a new joint venture between the Thai company Sahakol Equipment PLC, and

Exporter	Coal import quantity to Thailand (tons)					Total		
	Anthracite	Bituminous	Subbituminous	Lignite	Coking Coal	Quantity (tons)	Value (thousand USD)	Value (thousand THB)
Indonesia		3,162,847	12,121,830			15,284,677	945,222	29,333,282
Australia	36	4,090,017				4,090,053	330,526	10,257,286
Russia	32,053	652,856	459,031			1,143,940	94,800	2,941,949
Laos				382,568		382,568	11,062	343,289
Other	93,633	231,352	440,777	278	19,210	785,250	78,701	2,442,345
Total	**125,722**	**8,137,071**	**13,021,639**	**382,846**	**19,209**	**21,686,488**	**1,460,314**	**45,318,246**

Table 4: Imports of coal to Thailand in 2019, by country of origin and type of coal (Source of data: UN Comtrade)

Golden Lake Co., Ltd. from Myanmar, have since 2019been trying to re-establish the project (Nation, 2019).

Tracing coal imports to Thailand involves tracking shipment details and lines of company ownership across national borders, moving through multiple parts of a commodity chain. With transparency often lacking, the picture provided here is not complete. However, there are many lines of trade which are available to trace in the public domain, and provide useful markers to the wider import system. Where information could be uncovered, an overview for the three main countries exporting to Thailand is now given, namely for Australia, Indonesia, and Russia. Some consideration is also given to imports overland from Laos.

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Figure 9: Self-discharging bulk carrier at Ko Si Chang anchorage area

INDONESIA

Despite being the world's largest exporter of coal at over 450 million tons in 2019, Indonesia has only the sixth highest reserve at just under 40 billion tons (BP, 2020, p. 44). Since Thailand started importing coal in the 1990s, Indonesia established itself as the key trader of subbituminous and bituminous coal, in 2019 exporting over 15 million tons. A number of Thai companies have close ties to Indonesia. For example, GP Group ships coal to Thailand through its subsidiary Premthai Logistics Limited, feeding its distribution centre in Ayutthaya Province under Premthai Energy Limited. There are a number of companies who own mines in Indonesia, and the main ones are featured below.

● Banpu PCL

Banpu has a legacy of domestic coal-mining in Thailand, linking to limestone extraction and cement production. However, after exhausting local reserves it has focused on offshore coal production. The company is one of the largest coal producers in Indonesia with a reserve of 300 million tons (as of December 2019), as well as owning mines in Australia, China, and a pilot project in Mongolia (Banpu, 2019, p. 71). Banpu also has a 37.5% stake in Phu Fai Mining Company Ltd., which mines for lignite in Xayabouri Province, Northwest Laos, subsequently used at Hongsa Power Plant

Figure 10: Coal operation of Banpu in East Kalimantan, Indonesia (Source of data : Banpu, 2020)

(40% ownership share for Banpu), with the electricity exported to Thailand. Coal operations in Indonesia are conducted through PT Indo Tambangraya Megah Tbk (ITM), in which Banpu has a 68% share. ITM is believed to own 68 pits in East Kalimantan through five subsidiaries PT Indominco Mandiri, Trubaindo, Bharinto Ekatama, Kitadin Embalut and Jorong Barutama Greston (Apriando, 2017; Banpu, 2019; Figure 10). For exports, the coal mines are served by Banpu-owned port terminals at Bontang and Jorong. Exports are sent to a number of countries other than Thailand, namely China, India, Bangladesh, Japan, South Korea and Taiwan. This shows how the company now operates as a multinational integrated into numerous components of the commodity chain. In May 2018, PT Indominco Mandiri was fined 145,000 USD for depositing 4,000 tons of hazardous coal waste on an open dump, an illegal act causing both water and air pollution (Ompusunggu, 2018).

- **Lanna Resources PCL**

The core business of Lanna Resources is coal, followed by biomass (Lanna Resources, 2019, p. 3). It has various subsidiaries that cater to mining in Indonesia, where it has operated for 18 years, and shipping to Thailand, for distribution via a centre in Nakhon Luang. The main subsidiaries are:

- **Lanna Harita Indonesia (LHI)** – mining operation in Kutai Regency and East Kalimantan. Lanna has a 55% share, with a concession agreement running from 2001 to 2031. The remaining reserves are 25 million tons and at present production capacity reaches 3.5 million tons per year.

- **Singlurus Pratama (SGP)** – mining operation in Kutai Regency and East Kalimantan. Lanna has a 65% share, with a concession agreement running from 2009 to 2039. The remaining reserves are 50 million tons, and at present production capacity is at 3 million tons per year.

- **United Bulk Shipping Pte. Ltd.** – registered in Singapore, the subsidiary was set up to operate and manage ocean freight transport and coal trading. Lanna has a 49% share.

As well as Thailand, Lanna also exports to India, Japan, South Korea, Taiwan and Hong Kong. The major shareholder in Lanna Resources is Siam Cement Group (see Box 4 on p. 21).

- **Energy Earth PCL**

The main subsidiary of Energy Earth, PT Tri Tunggal Pitriati (TTP), was registered in 2007. Between 2010 and 2015, the company acquired shares and mining rights for open-pit mines in Kutai Regency, East Kalimantan (Energy Earth, 2016). By 2016, three mines carried licenses with a total reserve of 83 million tons, under further subsidiaries:

- **PT. Tri Tunggal Pitriati (TTP)** – mining operation in Tanah Bumbu Regency, South Kalimantan. License acquired until reserves are depleted.

- **PT. Jhoswa Mahakam Mineral (JMM)** – mining operation in Kutai Regency, East Kalimantan. License acquired until reserves are depleted.

- **PT. Belayan Abadi Prima Coal (PT. BAPC)** – mining operation in Kutai Regency, East Kalimantan. License acquired until end of May 2033.

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The output feeds domestic use and is also sold to China, India, South Korea, Taiwan, and Bangladesh. There are subsidiaries based in Hong Kong and Guang Dong to develop coal trading in China. Clients in South Korea and China are state-owned power plants. Energy Earth is also looking to acquire other mines, and expand into Cambodia, Vietnam and Sri Lanka. Back in Thailand, a distribution centre is situated in Nakhon Luang. In 2016, 33% of its imported coal was consumed in cement production, with 67% for other industries, such as paper, food and textiles.

As seen in the examples given above, a core of Thai-owned mines are found in East Kalimantan. There have been some exports from Sumatra, as the island located closest to Thailand and with the largest coal reserve in Indonesia. Rapier-Behr Company Ltd. has been involved in coal trade between Southern Sumatra and Thailand (RBC, 2013), and in its early dealings with Indonesia, Banpu secured a mine on the island. However, Kalimantan is now the core provider of coal.

AUSTRALIA

Australia has the third largest global reserve of coal at nearly 150 billion tons in 2019 (BP, 2020, p. 44). Although deposits are found throughout the country, the largest share of resources are found in Queensland (including the Bowen basin) and New South Wales (including the Sydney basin). The country is the world's second highest exporter of coal approaching 400 million tons in 2019. Its primary customers are Asian, the largest importer being Japan, but also with small volumes exported to South America. Thailand has been importing bituminous coal from Australia since 2006, rising to a high of over 4 million tons in 2019.

There are few corporate linkages on view between Australian coal mines and Thai firms. However, in 2010 Banpu bought Centennial Coal Company Limited. Established in 1989, Centennial operates five mines in New South Wales with a reserve of just under 300 million tons (Banpu, 2019, p. 71), for domestic use and export. Shipping points are Newcastle and Port Kembla (Figure 11), and Banpu owns a 16.66% stake in the Port Kembla Coal Terminal Ltd (Banpu, 2019, p. 175).

Figure 11: Centennial Coal Company operations in New South Wales, Australia (Source of data: Centennial, 2020)

RUSSIA

Russia has the second highest global coal reserve at over 160 billion tons in 2019 (BP, 2020, p. 44). It is now the third highest global exporter, with a significant expansion over the past five years as it expands its coal terminals. With a focus on bituminous and subbituminous coal, imports to Thailand started in 2013, quickly accelerating to over 1 million tons in 2017, at a value of nearly 100 million USD (ITC, 2020). In a short space of time, Russia has established itself as the third largest coal supplier to Thailand.

Following export data, Table 5 shows known coal mines exporting to Thailand, with the locations shown in Figure 12, along with the main ports. There are no Thai owners of coal mines in Russia, which remain under the control of domestic companies. The largest Russian coal company is Siberian Coal Energy Company (SUEK), owned by

Region	Locality	Company	Reserve (million tons)
Republic of Khakassia	Chernogorsky	Siberian Coal Energy Company (SUEK)	142
	Abakansky		39
	Izykhsky		38
	Vostochno-Beisky		123
Khabarovsk	Urgalugol		-
Buryatia	Tugnuisky		-
Zabaykalsky Krai	Apsatsky		70
Kemerovo Oblast	Kirov		592
	Ruben		144
	Yalevsky		437
	Vinogradovsky	Kuzbasskaya Toplivnaya Company (KTK)	119
	Taldinsky	Kuzbassrazrezugol coal company	-
	Prokopyevsky municipality	LLC Resource	-
Sakhalin Island	Solntsevsky	East Mining Company (EMCO)	300
Sakha Republic	Elga Coal Complex	A-Property	2,000

Table 5: Known coal mines and ports in Russia exporting to Thailand

Figure 12: Known regions in the Russian Federation with coal mines exporting to Thailand and principal ports

the oligarch Andrey Melnichenko, and with the highest number of mines exporting to Thailand. The Elga Coal Complex, located in the southeast part of Sakha Republic, has proven reserves of over 2 billion tons of coal, one of the world's largest single deposits. In 2019, Russian-Armenian businessman Albert Avdolyan acquired control of the complex from international mining and steel group Mechel. There are also reports that a small amount of anthracite, mined by the Siberian Anthracite company, is shipped to Thailand, although with mines in Kemerovo, Amur, and Novosibirsk regions, it is unclear where this coal originates.

Coal from inland Russia is transported by train to the east coast of the country. For example, from the Republic of Khakassia, this involves a journey of 5,000 km. The two main ports from which coal is shipped to Thailand are located at Vanino (of which Mechel has a controlling stake) and Nakhodka (owned by EVRAZ). From Solntsevsky mine on Salakhin Island, coal is transported to the Shakhtyorsk port for shipping. There are reports of exports shipped by Precious Shipping PCL, which is a subsidiary of Premthai, a key coal distributor in Thailand. Particularly in Nakhodka, residents have suffered from dust pollution, one claiming that "I have to clean my apartment every day and it is still not enough to get rid of the dust. If I had the chance I would have left this place long ago." (Pigni, 2018). Thousands of residents have protested against the polluted conditions.

LAOS

Since 2017, Thailand has been importing small but increasing amounts of lignite from Laos. A key source of this coal is the Thai-owned Vieng Phou Kha mine in Luang Namtha Province, Northwest Laos. The mine is Thai-owned under Vieng Phou Kha Coal Mine Company Limited and it covers 800 hectares, with a capacity around 300,000 tons per year (USGS, 2016). From here it is 120 km to the Thai border at Chiang Khong, with coal presumably transported by truck. This is not the whole story of coal between Thailand and Laos. In Xayabouri Province, both Banpu and Ratchaburi Electricity Generating Holding have 37.5% shares in Hongsa coal mine, together with Lao Holding State Enterprise (25% share). Rather than export directly over the nearby border to Nan Province, the coal feeds Hongsa power plant adjacent to the mine, with electricity then transmitted to Thailand by EGAT (Suk, 2018). The plant is owned by Hongsa Power Company Ltd, and Ratchaburi has a 40% stake, Banpu 40%, and Lao Holding State Enterprise 20%. It has been operational since 2015. The site covers some 60 km^2, and involved the relocation of 2,000 local residents (The Mekong Eye, 2016).

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4. DISTRIBUTION OF IMPORTS IN THAILAND

Figure 13 places the key sites of coal imports, from arrival to distribution to usage. These sites are discussed throughout this report, with particular attention given in the following sections.

Sea Port	
1	Ko Si Chang Ancharage Area
2	Map Ta Phut Industrial Port
3	IRPC Port
4	Yusob International Kantang Port
Land Crossings	
1	Chiang Khong (Coal from Vieng Phou Kha mine, Laos)
2	Nan Province (Electricity from Hongs a power plant, Laos)
Domestic Mine	
1	Mae Moh, Lampang Province
Distribution Centre	
1	Nakhon Luang District, Ayutthaya Province
Power generation plants	
1	Mae Moh
2	Map Ta Phut Industrial Estate (Multiple plants)
3	IRPC Power Plant
4	National Power Supply Company plants, Prachinbhuri Province
Industrial Plants	
1	Saraburi Province (e.g. cement factories & quickline Kilns)
2	Prachinburi Province (304 Industrial Estate)
3	Chachoengsao Province (e.g. pulp and paper factories)
4	Nakhon Si Thammarat Province (cement factory)
5	Lampang Province (cement factory)
6	Samut Sakhon Province (Textiles, food, paper factories)

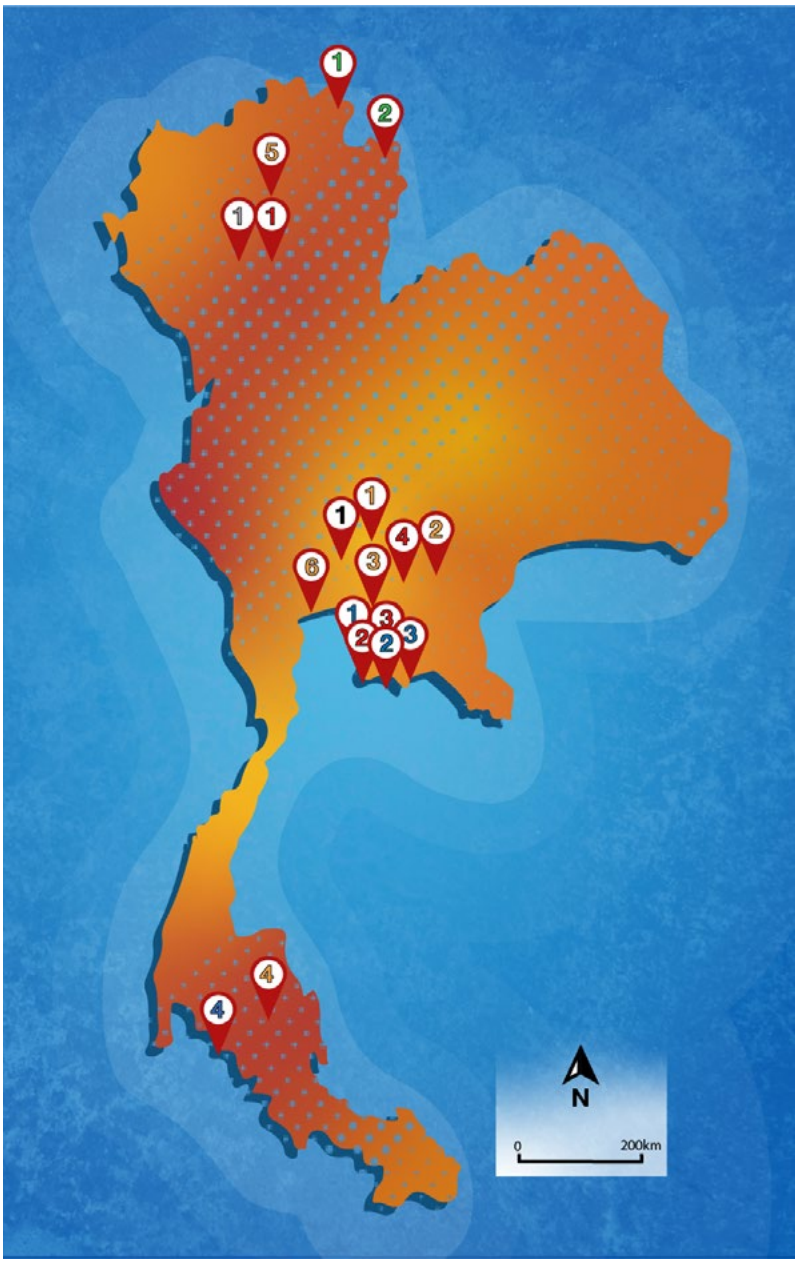


Figure 13: Key sites of coal imports to Thailand (N.B. – the information is not intended to be exhaustive)

ARRIVAL

The Thai Customs Department supervises the import and export of goods in Thailand, including that of coal. There are controls on transportation, loading and unloading of goods outside of designated port areas, and inspection of goods. The Customs Act (2017) declares that all goods arriving in Thailand must be declared to customs (Section 51), with duty paid (Section 13), although in the case of coal the import tax has been set to 0%. Under the Minerals Act (2017) and its notifications, which are implemented under supervision of the Department of Primary Industries and Mines, a special licence is not necessary for established domestic coal companies to import coal.

The majority of coal arrives at two locations. Figure 14 correlates data from the Industrial Estate Authority of Thailand (coal trade through Map Ta Phut Industrial Estate), and the Marine Department (coal transported from Ko Si Chang to Ayutthaya), and UN Comtrade (total imports). The primary arrival point is Ko Si Chang Anchorage Area, where in 2019 the share reached over 66%. At this site, bulk coal carriers drop anchor and remain at sea rather than docking at a deep sea port. From here, the fuel is transferred onto barges using cranes with mechanical grabs (Figure 15). The ship's captain must submit a request to the Director - General of Customs, with a manifest of goods subsequently delivered by the barge into the customs house port in Bangkok. The coal is then transported onwards to distribution centres in Nakhon Luang District in Ayutthaya Province.

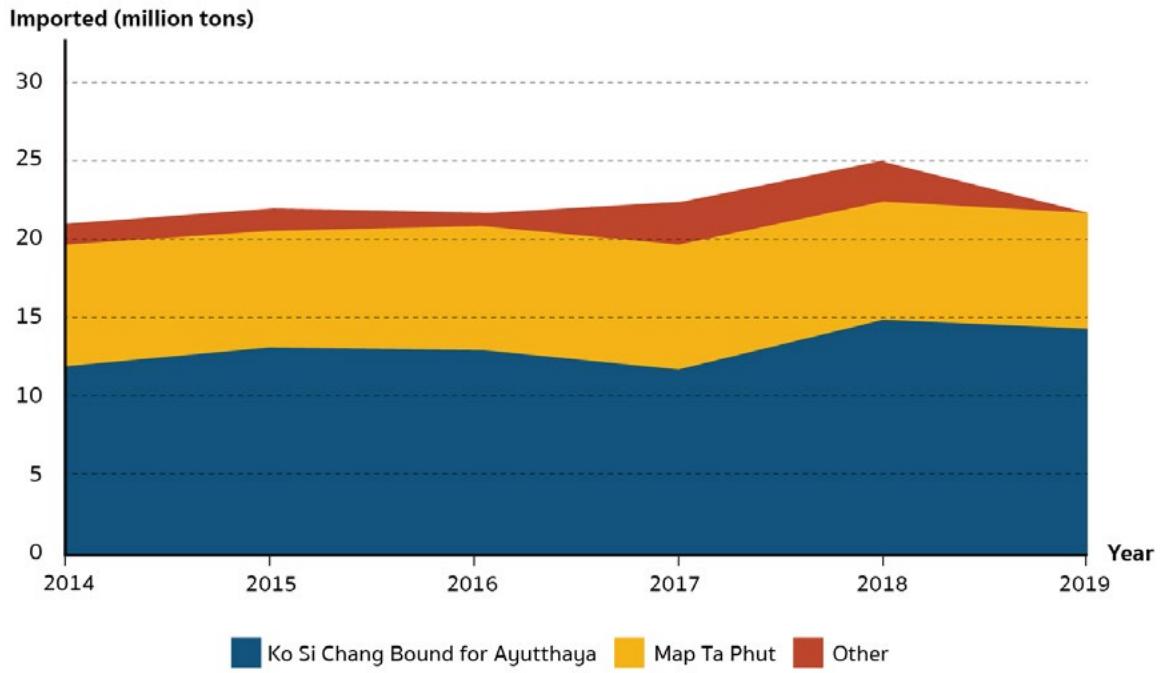


Figure 14: Arrival points in Thailand for coal imports
(Source of data : IEAT, 2016, 2019; ITC, 2020; Marine Department, 2020)

The second main arrival point is Map Ta Phut Industrial Port, on the southern coastline of Rayong Province, which is mainly receiving coal from Australia and Indonesia. As a deep sea port, ships are able to dock and use unloaders to transfer the coal to conveyer belts. It is transported directly to a number of power plants onsite at the industrial estate, including Banpu co-owned BLCP and plants belonging to Glow Energy (see Table 3 on p. 17). There is an onsite customs office dealing with regulations and duties around imports and exports.

From Figure 14, there is a small amount of coal imports arriving at other locations. This includes a deep sea port at IRPC Industrial Zone, Rayong Province, where logistics services handle customs needs, and coal is transported to the IRPC Power Plant. At Kantang, Trang Province, a private port receives coal imports from Indonesia. It was set up in 2008, and is operated by Yusob International Kantang Port Company Limited, supplying an SCG cement factory in Thung Song District, Nakhon Si Thammarat Province, about 100 km away. There is also lignite imported overload from Laos through Chiang Khong border crossing in Chiang Rai Province. However, the one clear anomaly in the data is that the 2019 share does not account for imports of lignite overland from Laos (382,568 tons). Nevertheless, the data clearly shows the dominance of the two main arrival points.

Figure 15: With the compartment doors open, a bulk carrier transfers coal using cranes and mechanical grabs onto adjacent barges at Ko Si Chang anchorage area

THE JOURNEY ONWARDS

Coal arriving at Ko Si Chang is transported by barge to a distribution centre in Nakhon Luang District, Ayutthaya Province (Figure 16). After being loaded onto barges pulled by sea-faring tugs, there may be an exchange for smaller river tugs once entering the Chao Phraya River, before branching onto the Pa Sak River at Ayutthaya.

However, many tugs are retained for larger barges that now make their way upstream. According to sample surveys on river traffic kept by the Thai Marine Department, 96% of barges loaded with coal have a capacity between 400 and 1,300 tons, with 69% carrying a capacity of more than 700 tons (Marine Department, 2020).

Figure 16: A barge makes its way downstream, passing under the Krung Thon Bridge on the Chao Praya River

Overall, maritime transport accounts for 17% of the total transport of goods within Thailand (Tantipidok, 2018). The Thai Marine Department reports each year on the amount of traffic and goods navigating these inlands waterways. It does so by taking three detailed surveys over two-week periods during the year, and then extrapolating the results to reach annual figures. For 2019, total goods reached 56 million tons, of which 23.6 million tons or 42.2% of all goods were transported upstream (Marine Department, 2020). The main products transported are sand, stone, coal, soil, cement, cassava and rice (Tantipidok, 2018). All coal travels upstream from Ko Si Chang to Nakhon Luang District. In 2019, 14.4 million tons of coal were transported, which represents 25.8% of all goods carried both up and downstream. This makes coal the largest single product that is transported on these inland rivers. The amount is also 66.7% of all coal imports in 2019, measured at 21.7 million tons according to data from UN Comtrade (see Table 4 on p. 27). Table 6 shows the amount of coal transported on Thai rivers since 2010, both in terms of the total weight and its proportion of total cargo. Figure 17 shows that these absolute and relative increases closely mirror each other over the past ten years.

Coal arriving at other sea ports generally have a prescribed destination for usage, such as power plants in Map Ta Phut and IRPC industrial estates, and SCG cement factory for Yusob International Kantang Port. For coal arriving by land from Laos, the destination is unclear, although it is noted that key sites of usage in northern Thailand include Mae Moh power plant and SCG cement factory, both in Lampang.

Year	Amount of coal (tons)	Proportion of total cargo (%)
2010	5,195,840	10.78
2011	9,041,600	19.26
2012	9,674,800	20.4
2013	8,753,800	19.27
2014	12,083,000	24.11
2015	13,243,800	26.01
2016	13,130,560	26.09
2017	11,733,400	22.12
2018	14,926,510	26.77
2019	14,443,270	25.79

Table 6: The transportation of coal on Thai rivers by weight and as a percentage of total cargo (Source of data: Marine Department, 2020)

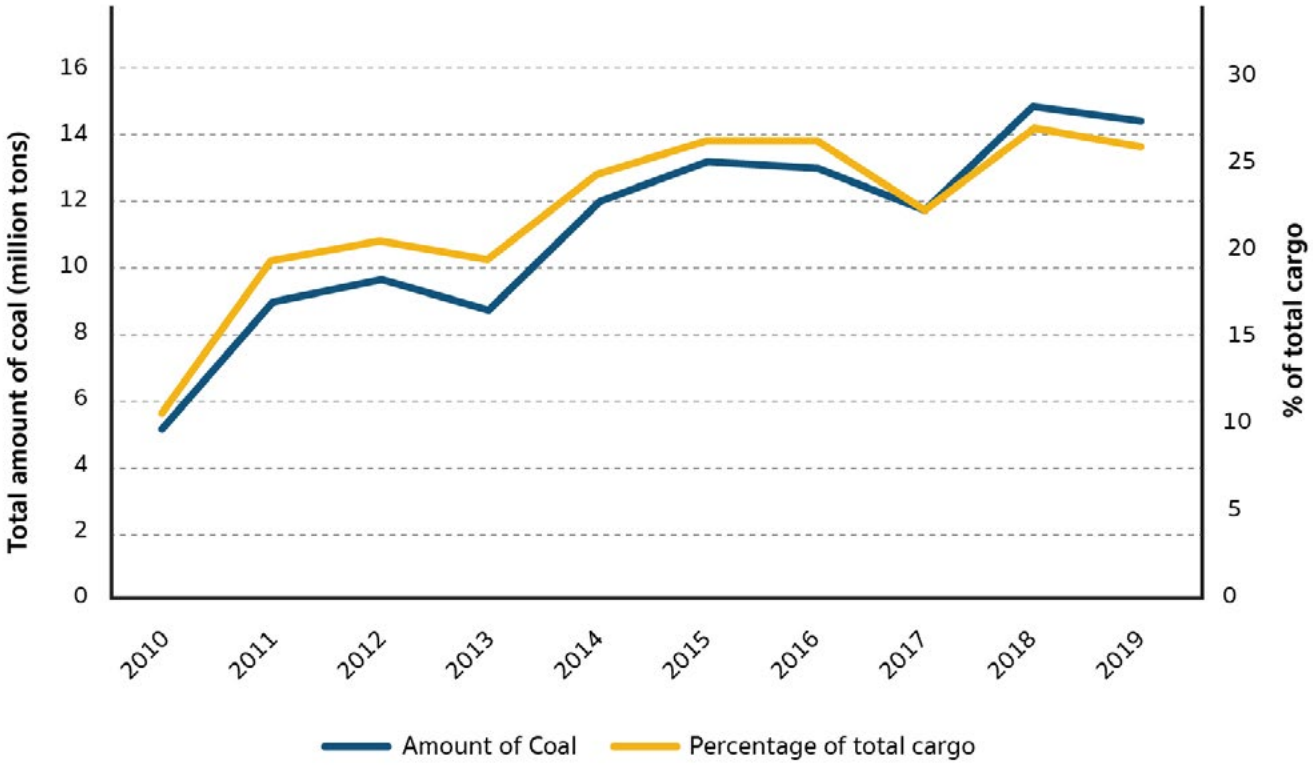


Figure 17: Graph showing the transportation of coal on Thai rivers by weight and as a percentage of total cargo (Source of data: Marine Department, 2020)

NAKHON LUANG, AYUTTHAYA

Nakhon Luang District, approximately 7 km north of Ayutthaya town, is a key distribution centre for a number of goods, including agricultural products, cement, fertiliser and flour. In 2000, the first coal factory was set up by Lanna Resources, with its own port, storage and distribution centre. This covers an area of 31 rai and 29 square wah, and can support 200,000 tons of coal at one time (Lanna Resources, 2019, p. 16). The district has subsequently become the main centre for imported coal over the last ten years. Previously, such a centre for imports was located in Samut Sakhon. However, following the murder of a local anti-coal activist in 2011, the court ordered a shutdown of local operations (Box 5). As a result, coal companies shifted to Nakhon Luang. They were welcomed by local sub-district and municipal authorities looking to capitalise on industrial development in the district. The area represents a useful strategic location. As Thailand's first river port, it serves the gulf of Thailand to the south by river and road, and both the north and northeast by road. It is situated close to numerous industrial activities in central Thailand, including a concentration of cement factories in neighbouring Saraburi Province.

BOX 5: PROTESTS AND MURDER IN SAMUT SAKHON

From 2006 onwards, many coal distribution companies operated on the River Tha Chin in Samut Sakhon Province. In a situation echoing the subsequent story of Nakhon Luang, residents around the coal centres complained of river pollution through a sinking tanker, air pollution through coal dust, fears for public health, and economic impacts on local flower and fish farms (Thai Rath, 2011). On 10th March 2011, more than 300 people gathered at Samut Sakhon City Hall to protest against the effect of coal. They claimed that companies were not properly authorised to operate, were not abiding by environmental regulations, and were failing to assist with any clean-up. The protestors called for effective pollution monitoring and control measures, enforcing regulation and issuing fines where appropriate. On 28th July 2011, Mr Thongnak Sawakchinda, a prominent anti-coal leader, was shot dead by criminal gangs (Corben, 2013). Arrests were made linking the murder with a coal transport operator, although a key conspirator was also killed before being able to testify in court. In August 2011, the Central Administrative Court suspended all coal operations and the landing of shipments on the River Tha Chin. Although it is unclear whether the shipping ban remains in place, in the intervening period, the distribution business shifted to Ayutthaya. However, many factories in Samut Sakhon, involved for example in canned food, textiles and paper, use coal as a power source. Asia Green Energy (AGE – see Box 6) has a distribution centre, acting as the main supplier to these factories.

In the present day, barges travelling upstream to Nakhon Luang carry coal, with a few transporting fertiliser, while barges travelling downstream mostly transport agricultural goods and cement. The distribution centre comprises a number of private companies who have gained licences to construct a jetty, and allow the landing of commercial goods for storage, treatment and further transportation (Figure 19). Following a visit to the district, and secondary data search, a list of companies operating in the area was compiled. While this may not be an exhaustive list, it nevertheless gives a thorough overview. In total, there are around 50 port and distribution areas in Nakhon Luang, of which 19 companies handle coal. Table 7 lists these companies, and their sites of operation are shown in Figure 18.

No.	Company name	Port	Storage	Dressing
1	The Agricultural Co-operative Federation of Thailand Limited (ACFT)	●		
2	Suvarn Gleaw Thong Company Limited	●		
3	N.S.P. Gypsum Mine Company Limited (Nam Sin Pier)	●		
4	Jumbo Jetty Company Limited	●		
5	Siam Cement Group (SCG) Trading Company Limited		●	●
6	Unique mining services (UMS) Public Company Limited	●	●	●
7	Mod Thongkha Company Limited	●		
8	Lanna Resources Public Company Limited	●	●	●
9	Lucky Resources & Logistics Company Limited	●	●	●
10	Sing Heng Seng Company Limited		●	●
11	CPC Corporation Company Limited		●	●
12	Eastern Pearl Company Limited	●	●	●
13	Marco Polo Ventures Company Limited (subsidiary of Energy Earth PCL)		●	●
14	P.H. Resources Company Limited		●	
15	Premthai Energy Limited	●	●	●
16	P. R. Inter Trade Company Limited (part of P.H. Resources Company Limited)	●	●	●
17	S.P. Inter Marine Company Limited (Sinwattana warehouse)	●	●	●
18	Thanawat Rattanamongkol Transport Company Limited	●		
19	Siam Cement Group (SCG) Trading Company Limited	●	●	●
20	Jumbo Jetty Company Limited	●	●	●
21	PANDS Nakhornlung Company Limited (subsidiary of P & S Barite Mining Company Limited). N.B.: this company did distribute coal for a time, but ceased operations due to protests by local residents.			
22	Pathara Transport Company Limited	●		
23	Asia Green Energy Public Company Limited (AGE)	●	●	●

Table 7: Companies distributing coal in Nakhon Luang District, including specialist activities

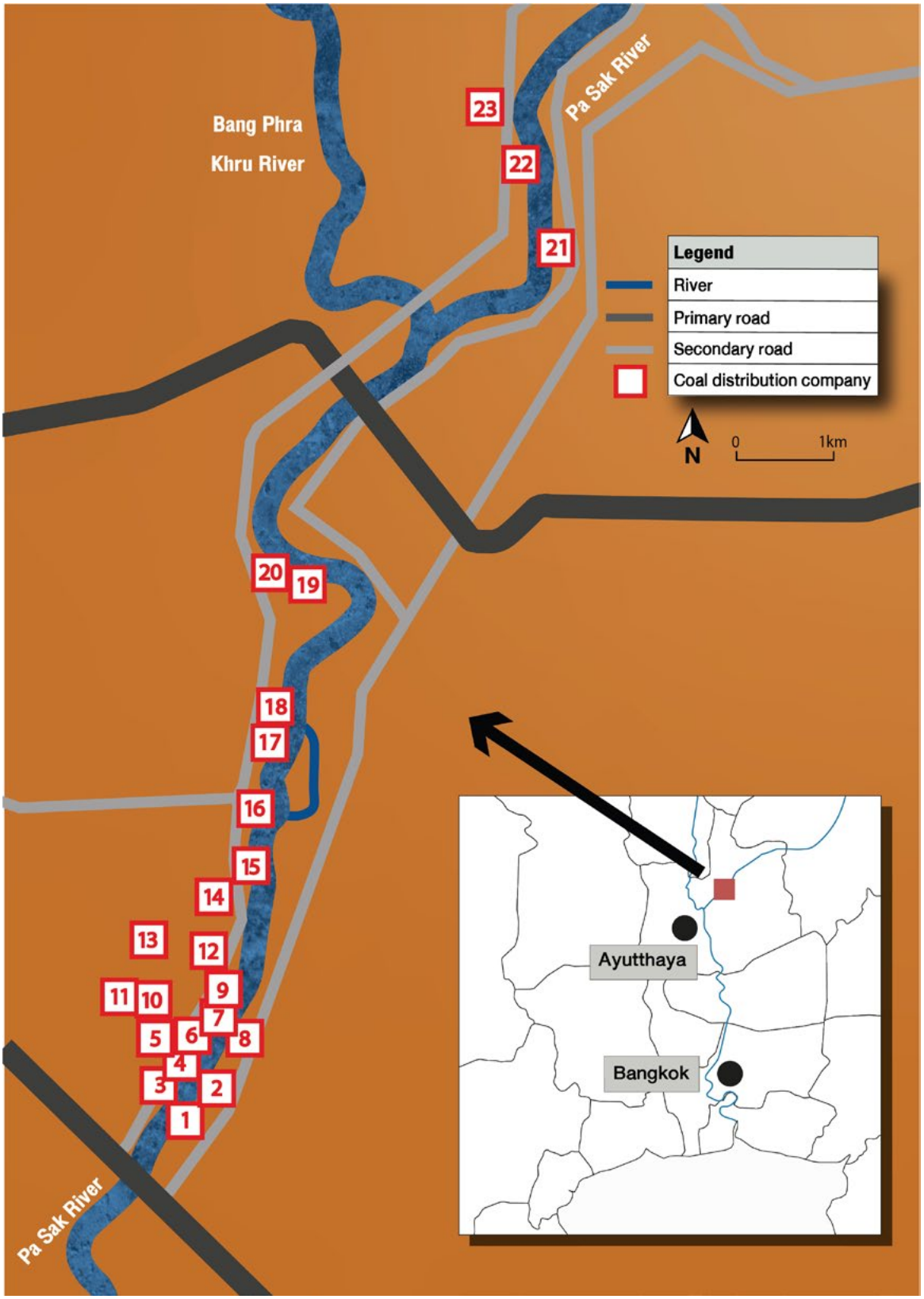


Figure 18: The location of coal distribution companies in Nakhon Luang District. The numbers refer to the list in Table 7.

BOX 6: ASIA GREEN ENERGY (AGE)

Founded in 2004, AGE is a key coal distributor in Thailand, with various subsidiaries providing services for overseas shipping, inland transportation by river and road, and storage (AGE, 2020). They import coal from Indonesia, Australia and Russia, but are looking to access other resources in lands such as Mongolia, Iran, Colombia, and Kazakhstan. The main distribution centre in Thailand is found at Nakhon Luang. It uses over 334 rai, containing three screening plants, two ports, with the maximum stockpiling capacity of 700,000 tons of coal. There are further warehouses in Samut Sakhon and Phetchaburi Provinces, and a fleet of trucks aid overland delivery. As well as operating in Thailand, AGE also distributes in an international context, supplying China, India, Vietnam, Cambodia, Korea, Japan, and Taiwan. In 2017, the subsidiary VINA AGE was established with its offices in Ho Chi Minh City, to develop business in Vietnam.

Figure 19: Coal distribution centre at Nakhon Luang District with port, unloading area onto trucks, and storage area beyond

Six companies only operate a port area, where coal is delivered and then immediately transported onwards or stored at the facilities of another distribution company. For example, a jetty run by Jumbo Jetty Company Limited (no. 4 in Figure 18) is rented out for use by the adjacent SCG facilities (5). Ten companies have extensive facilities, including a port area, storage facilities, and machinery to grade and sort the coal (dressing) into different sizes. These companies are frequently involved in multiple components of the value chain, with a potential stake in overseas mining, sea and river transportation, and coal consumption. They include Lanna Resources, SCG, and AGE (Box 6). Storage facilities include enclosed warehouses. However, much coal is stored outside in piles covered with plastic sheeting. The facilities of three companies are situated away from the river, and so their operations only include storage and coal grading/sorting. They have relationships with port-based companies, who handle the delivery and unloading of the coal.

There is one corporation, PANDS Nakornluang Company Limited (subsidiary of P & S Barite Mining Co., Ltd.), which previously focused on agricultural products but moved into coal early in the 2010s. After experiencing dust pollution, in 2013-2014 local residents protested against company operations, blocking roads to the site. Due to the community pressure, when existing corporate agreements on coal distribution ended soon after, Pands ceased handling the product, and have now returned to a focus on agricultural goods.

Once arriving at distribution centres in Nakhon Luang on barges, there are two basic forms of activity to handle the coal:

1. Using mechanical diggers, the coal is loaded directly from barges onto trucks, for immediate transportation to points of consumption (Figure 20).

2. The coal is unloaded but then put into storage, either outdoors, or in warehouses, before later transportation for consumption. During this period, the coal may be graded and sorted by size using machinery owned by the distribution company.

The opening of the first coal distribution centre in 2000 was soon felt by those living in its proximity, unused to the impact of dust pollution. Within the first year of Lanna Resources operating this centre, a complaint was already lodged to the local village head, Bo Pong Sub-District council, and Nakhon Luang District council. Concerns increased as new coal centres appeared. In 2014, the pre-junta Thai Senate invited local activist Mr. Amnat Uomphakdee to speak on the polluting influence of coal. As a result, the Senate set up a committee, led by the governor of Ayutthaya Province, to solve the issue, leading to a statement that the law should be enforced in the following ways:

- Local sub-district authorities must enforce the Public Health Act (1992) in relation to noise, dust and odour from coal distribution.
- The Marine Department must enforce the Navigation in Thai Territorial Waters Act (1913) in relation to noise, dust, odour, river bank erosion and the parking of barges from coal distribution.

Figure 20 : Coal can be unloaded directly from barges onto trucks for immediate onward distribution

- The Provincial Industry Office must enforce the Factory Act (1992) in relation to the loading, unloading, storage, grading, and sorting of coal.

Despite these rulings, in 2015, local sub-district authorities continued to renew their authorisation for coal distribution companies to operate, a tacit legitimisation of their practices. Perceiving that the authorities were taking no action, a collective of 81 local residents, with the support of Srisuwan Chanya, a lawyer and chairman of Stop Global Warming Association Thailand, sued the following actors:

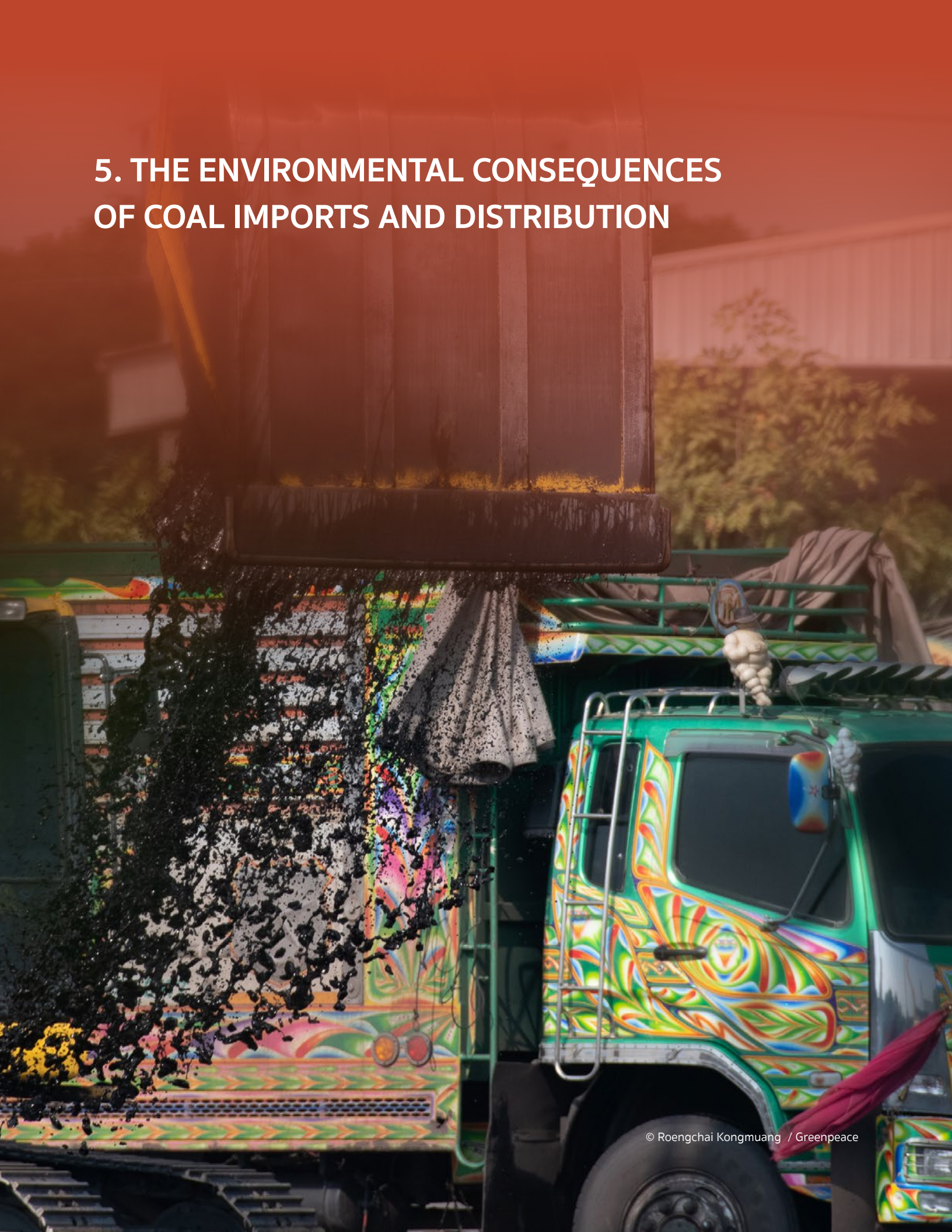
- Ayutthaya Provincial Industry Office
- Director General of the Department of Industrial Works
- Director–General of the Marine Department
- Director–General of the Department of Health
- Director–General of the Pollution Control Department
- Pollution Control Department Committee
- The National Environment Board
- Seven out of eight Sub-District Administrative Offices in Nakhon Luang District (covering areas where the plaintiffs live)

On 30th September 2019, the Thai Administrative Court provided the following actions in its deliberation:

- All ports supporting boats that carry more than 500 tons should cease, downsizing the jetty where necessary.
- Following this action, each company must undergo an Environmental Impact Assessment (EIA) to receive the licence to continue operating.
- The local sub-district authorities must enforce the Public Health Act within 90 days.
- The Provincial industry Office must enforce the Factory Act within 90 days.

The reaction to these rulings has been similarly lacklustre. The named authorities failed to enforce laws as instructed. All companies continue their operations while they conduct an EIA, without first adapting their jetties. This is despite Marine Department data showing that the vast majority of boats travelling upstream may be carrying loads up to 2,000 tons of coal, and ignore the fact that the Pa Sak River is not large enough to support such large sizes and weights. Companies were also allowed to maintain piles of coal that surpass the legal height of three metres, thereby continuing to contribute to dust release. Local activists fear that all EIAs will be passed by local authorities regardless of whether companies are adhering to the law, particularly since such an assessment relies on a simple reporting rather than being contingent on environmental performance. This would legitimise the continued licencing of distribution companies without any significant change in their operations. As a result, residents are considering a new lawsuit around Section 157 of the Thai Criminal Code, which legislates against a wrongful exercise of duties by officials. To take on the distribution companies themselves would involve suing each company individually, a cumbersome and lengthy process.

5. THE ENVIRONMENTAL CONSEQUENCES OF COAL IMPORTS AND DISTRIBUTION



GREENHOUSE GAS EMISSIONS DURING TRANSPORTATION

It is true that coal is safer to transport in comparison to the risks of an oil leak or the flammability of natural gas. Nevertheless, the very nature of importing coal from overseas contributes to greenhouse gas (GHG) emissions through the combustion of fuel for shipping, barges and trucks. Shipping transports 80% of the world's trade by volume, and emits around 800 $MtCO_2$ per year (Bullock et al., 2020). This would make shipping as a whole the sixth highest global emitter if the sector were considered as a country. Due to the long lifetime of ships, and older models being high emitters, bringing down emissions remains a challenge. The International Marine Organisation (IMO) aims to cut emissions from shipping by 50% between 2008 and 2050. However, in its Fourth Greenhouse Gas Study, the sector reports an increase of 10% from 2012-2018, and business-as-usual modelling threatens a further increase of 50% by 2050 (ICCT, 2020). Taking the issue in isolation, for coal imports not to contribute to the increase of GHG emissions, local energy sources would be more favourable.

SEA POLLUTION

When coal is unloaded from ship to barge at Ko Si Chang for inland transportation to Ayutthaya, there is an unavoidable escape of fugitive dust into both water and air (Chadwick et al., 1987). Residents of Ko Si Chang have highlighted the issue of fugitive dust and coal pieces falling into the sea to local authorities, with a need for ships to moor at a greater distance from the island. For example, in 2015 an inspection of coal transported from MV Crested Eagle to barges identified negligent operations, resulting in significant deposits into the sea (MGR Online, 2015). Five workers were arrested under the Navigation in Thai Waters Act (1913). The deposits of coal threaten the surrounding marine ecosystem and water sources used by islanders, in both cases with implications for local tourism. On 1st August 2019, two coal barges with a combined capacity of 2,400 tons, sank in stormy seas off Ko Si Chang (Bangkok Post, 2019). They broke free from the cargo ship MV Southampton from which they were being loaded, and deposited their contents, polluting the sea.

RIVER TRAFFIC

The risk of water pollution continues during the journey of barges inland on the Chao Phraya and Pa Sak Rivers. As well as accidental deposits of coal, the cleaning of barges involves pumping water through storage compartments, which is then emptied into the river as untreated coal slurry. For communities using water directly from these rivers, there is a high chance of contamination. For example, during a visit to Nakhon Luang District, we interviewed a villager in Bang Phra Khru sub-district who pipes water from the river into vegetable gardens for her and her neighbours. Although this water was not formally tested for pollution, she questioned whether deposits of coal were effecting its purity and causing decreased yields from the gardens. If nothing else, this demonstrates the need for water testing to clarify such issues, and act accordingly.

Figure 21: Barges are strewn across the Pa Sak River at Nakhon Luang District, making life difficult for all other river traffic

The increased volume and size of barges is influencing how communities live in relation to the Pa Sak River. In the last decade the increase of traffic correlates with increased in coal transport. This frequently results in the river becoming blocked as multiple barges moor parallel to each other (Figure 21). Tug boats are also larger. Previously, they would change at Bangkok Port from larger sea-faring vessels to a smaller river tug. However, due to the increase in barge size, the larger tugs may be retained. These barges have contributed to the erosion of river banks, both through direct collisions and also changes in water flow patterns. Greenpeace heard of 30 households affected by such erosion in one riverside village, either having to rebuild their properties or moving away altogether. We were shown the small boat of one villager, damaged when a coal barge collided with it. While it is possible to reinforce river banks to counter erosion, this action results in the loss of ecosystems along the riverside.

DUST AND HUMAN HEALTH

With 19 identified companies storing and distributing coal in Nakhon Luang District, there is a significant amount of fugitive dust affecting communities situated close to the Pa Sak River. This reaches its peak during the hot dry season of Thailand from March to June each year. The risk is over a number of distribution activities, including river transportation, unloading directly onto trucks for further transportation or for storage (Figure 22), and during storage, grading and separation (EndCoal, 2014b). Driving around the district, one immediately spots large outdoor piles of coal without any sheeting to cover it, and where the wind can easily disperse dust (Figure 23). Large piles also carry a risk of spontaneous combustion. There do exist means to limit emissions, such as by making trucks drive slower, or spraying water, chemicals and dry fog to stop dust particles becoming airborne (Sloss, 2017, p. 60). However, this only acts to limit rather than prevent fugitive dust, and any technological support in Nakhon Luang has been negated by the increase in distribution.

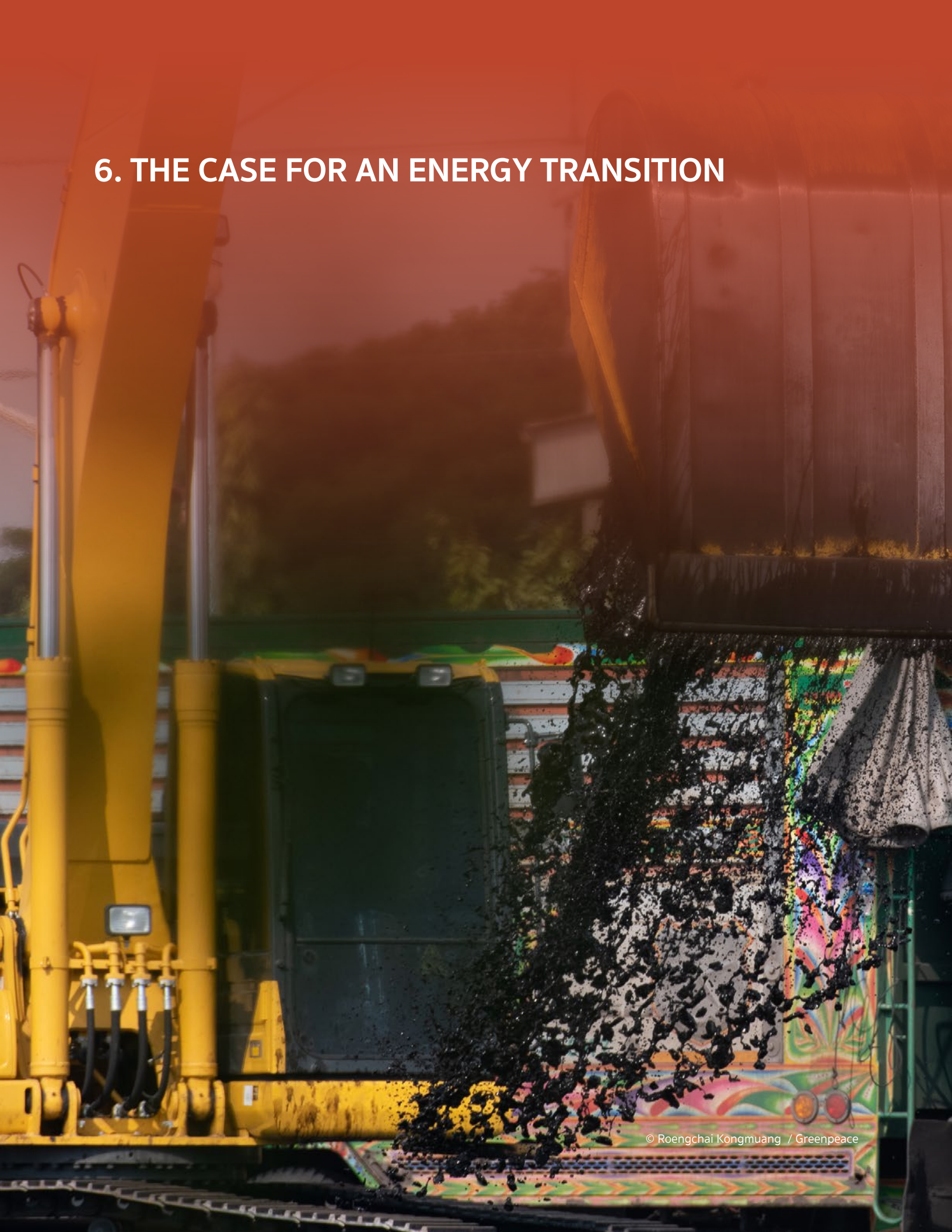
Figure 22: Unloading coal is a far from clean operation

Communities in Nakhon Luang District are unable to open up their homes, otherwise coal dust enters the house. We interviewed one riverside resident who explained that she was unable to hang her washing outside to dry, since it would become coated in dust She also reported on cases of itchy skin and respiratory problems with local residents. These were not directly attributed to coal dust, but the symptoms are certainly consistent with the associated risks of close contact with dust particles, and warrant further investigation. Scientific studies point to different impacts depending on the size of the particles (Sloss, 2017). PM_{10} to PM_{100} are larger particulates and can occupy the nose, throat and upper respiratory tract, resulting in discomfort or coughing. Smaller particulates (PM_{10} or $PM_{2.5}$) can travel deep into the lungs and alveoli with more serious respiratory consequences.

There are further negative outcomes for local communities around coal distribution centres. Villagers in the area speak about accidents involving trucks transporting coal, which drop pieces of the fuel to the road below. There have also been complaints about noise pollution from grading and separation machinery, which was a significant source of discontent leading to protests against PANDS company in 2013-2014 (p. 47).

Figure 23: An aerial view over coal storage areas at Nakhon Luang District shows some part of the fuel covered by sheeting, but much left in the open air with a risk of dust dispersal

6. THE CASE FOR AN ENERGY TRANSITION



INTERNATIONAL COMMITMENTS INTO DOMESTIC POLICIES

Thailand is committed to a number of international agreements that place it on a path moving away from fossil fuel use in general, and coal specifically. To start with, there are commitments to minimise the impacts of human-led climate change. Thailand ratified membership of the United Nations Framework Convention on Climate Change (UNFCCC) on 28th December 1994, where countries must introduce effective measures to reduce greenhouse gas (GHG) emissions. Subsequently, the Kyoto Protocol set out legal obligations for members to reduce emissions, and Thailand became a signatory on 28th August 2002. However, as a non-Annex I member (outside of the Annex I developed nations), Thailand is not bound to set targets. The second commitment period of the Kyoto Protocol ends in late 2020, and will be replaced by measures set out in the 2015 Paris Agreement, which were reached during the 21st Conference of the Parties (COP), and ratified by Thailand on 21st September 2016. The broad aim of the Paris Agreement is to:

1. Keep the average global temperature below 2°C above pre-industrial levels, limiting the increase to 1.5°C

2. Increase adaptability and recovery from climate change

3. Sustain financial equilibrium in order to reduce GHG emissions and recover from climate change

(Prurapark & Asavaritikrai, 2020, p. 33)

A further international commitment is to the Sustainable Development Goals, setting targets to achieve by 2030. These relate to fossil fuel use in the following ways:

- SDG 7: Affordable and Clean Energy – with targets including an increased share of renewable energy, and improvements in energy efficiency.
- SDG 8: Decent Work and Economic Growth – with the target to improve resource efficiency and decouple growth from environmental degradation.
- SDG 12: Responsible Consumption and Production – with the target to realign fossil fuel subsidies and taxation to account for their environmental impacts.
- SDG 13: Climate Action – with the target to integrate climate measures into national-level policies, strategies and planning.

There are various ways in which Thailand has started to filter these commitments into domestic policy. For example, the targets of the Paris Agreement can be achieved through Nationally Determined Contributions (NDCs), and a National Adaptability Plan (NAP). Thailand has drawn up an NAP as part of a Climate Change Master Plan (2015-2050). Climate change is also a key integrated development issue through the 12th National Economic and Social Development Plan (NESDP) for 2017-2021, highlighted through the aim for 'promoting greenhouse gas reduction and raising adaptive capacity to climate change' (NESDC, 2017, p. 20).

Among the targets for the NESDP, there is an aim to:

- increase food, energy, and water security
- reduce greenhouse gas emissions in the energy and transportation sectors by at least 7% between 2017 and 2020
- increase the share of alternative energy as a proportion of total energy consumption

A further linkage to domestic policy is the economic visioning of Thailand 4.0, which aims to:

- build economic prosperity (particularly through innovation and technology) to escape the middle income trap
- build social security to escape an inequality trap
- build sustainability to become a low carbon society which can adapt to the impacts of climate change

Biofuels and biochemicals are placed as a new industry of focus, although it must be noted that these can lead to damaging levels of greenhouse gas emissions, as well as unsustainable land use practices. Nevertheless, the industrial sector, which the state wants to promote for example through the Eastern Economic Corridor (EEC), is being fuelled by coal imports. This runs counter to the aim of a low carbon society and contradicts the vision. Indeed, there is a significant absence in the application of SDG 12 by incorporating external costs into coal.

The Climate Change Master Plan (2015-2050), the NESDP (2017-2021), and the Power Development Plan (2018-2037) align, together with a number of other policies. These include:

- Thailand Smart Grid Development Master Plan (2015-2036)
- Energy Efficiency Plan (2015-2036)
- Alternative Energy Development Plan (2015- 2036)
- Environmentally Sustainable Transport System Plan (2013-2030)
- National Industrial Development Master Plan (2012-2031)

The Energy Efficiency Plan aims to reduce energy intensity in Thailand by 30% from its 2010 level by 2036. The Alternative Energy Development Plan aims for a 30% share from renewables in total energy consumption by 2036. Thailand also has commitments at the ASEAN level, where a Plan of Action for Energy Cooperation (APAEC) 2016-2025 carries an aim to achieve a 23% share in renewables for total primary energy consumption by 2025 (IRENA, 2017, p. 3).

The collective image of international commitments and domestic policies point towards the need to increase renewable power sources and phase out fossil fuels, including coal. A recent scorecard on Thai energy policy criticised EGAT for remaining focused on coal and gas, failing to put renewable energy as the forefront of policy and instead only considering it as a supplementary form (Greenpeace, 2020b, p. 18). As things stand, the best case scenario for renewables is for a 29% share by 2030, which would fail an IPCC target of 50%. The report even questions the ability of Thailand to reach 30% renewables

by 2036. Overall, any prioritisation and expansion of coal-fired power plants "is at odds with both Thai energy policy and the interests of the vast majority of Thai people" (Greenpeace, 2015, p. 5). Furthermore, a 2017 report suggests that demand will increase by 78% in 2036 (IRENA, 2017, p. 45). This means that even if the share of coal use decreases, its contribution in absolute terms may still increase, adding to greenhouse gas emissions and other forms of localised pollution. Various reports emphasis the need to shift away from imports of energy sources, reducing energy insecurity and susceptibility to international politics (Prurapark & Asavaritikrai, 2020; Suk, 2018). Yet barriers remain to achieve this transition. Despite the downwards revisions for coal in the 2018 PDP, EGAT continues to push for new coal-fired power stations, and in general overstates its energy forecast to encourage new investment (Suk, 2018). A recent report in the Guardian newspaper highlights how private sector actors are actively defying global climate commitments in their aims to expand the international coal value chain (Ambrose, 2020b). This is the case for the Thai private sector in industry and power generation, which exerts considerable influence on energy policy. Even where renewables are promoted, a prioritisation of biomass undermines the potential for increased investment into other sources, especially solar and wind power (IRENA, 2017, p. 35). Other cited barriers include cross-sectoral coordination, technical capacity, and grid variability to cope with the variability of renewable energy inputs (Greenpeace, 2020a; IRENA, 2017; ONEP, 2015).

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THE POTENTIAL FOR RENEWABLES

Bringing together these policies, there are a number of proposals to increase the use of renewable energy sources over the coming two decades. On a positive note, the plans signal that Thailand is ahead of other regional countries in promoting renewables, and seeking alternatives to controversial increases in hydropower that have a negative impact on water sources and local communities (Kammen & Opperman, 2020). There has already been massive growth in the renewable sector in Thailand, from 1,000 MW capacity in 1994 to over 5,000 MW in 2016 (Greenpeace, 2018b, p. 6). By 2015, the Thai Board of Investment had approved 845 renewable energy projects (IRENA, 2017, p. 22). Furthermore, despite the poor scorecard for Thai energy policy detailed in the previous section, there are existing studies which offer more progressive options. These are shared below.

100% Renewable Energy in Krabi Province by 2026

A 2018 study by Greenpeace puts forward a model to make Krabi 100% based on renewable electricity by 2026 (Greenpeace, 2018a). It would do so using biomass, biogas, solar, wind, and mini-hydro (Figure 24), within a decentralised smart grid network and adapted modes of transmission. The study claimed at the time of writing that Krabi could be dependent 100% on renewables for 2 hours a day by 2021, supported by an electricity grid with no limitations on energy carrying capacity. Despite the fact that initial costs would be higher than coal or natural gas, they become considerably lower taken over a 20-year frame. The model demands the support of public policy to prioritise and incentivise renewables, and reorient state enterprises towards them.

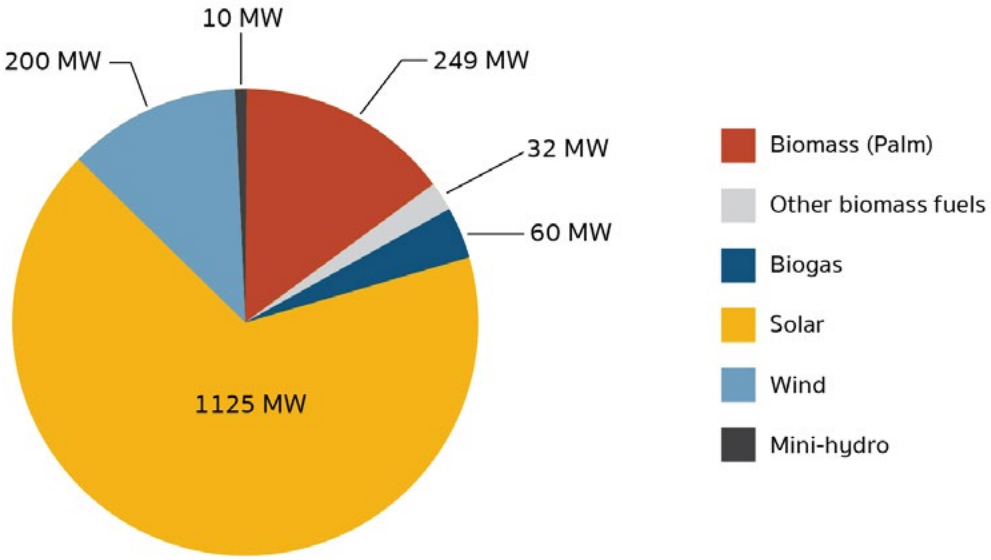


Figure 24: Summary of potential electricity generated by renewable energy in Krabi (Source of data: Greenpeace, 2018a, p. 41)

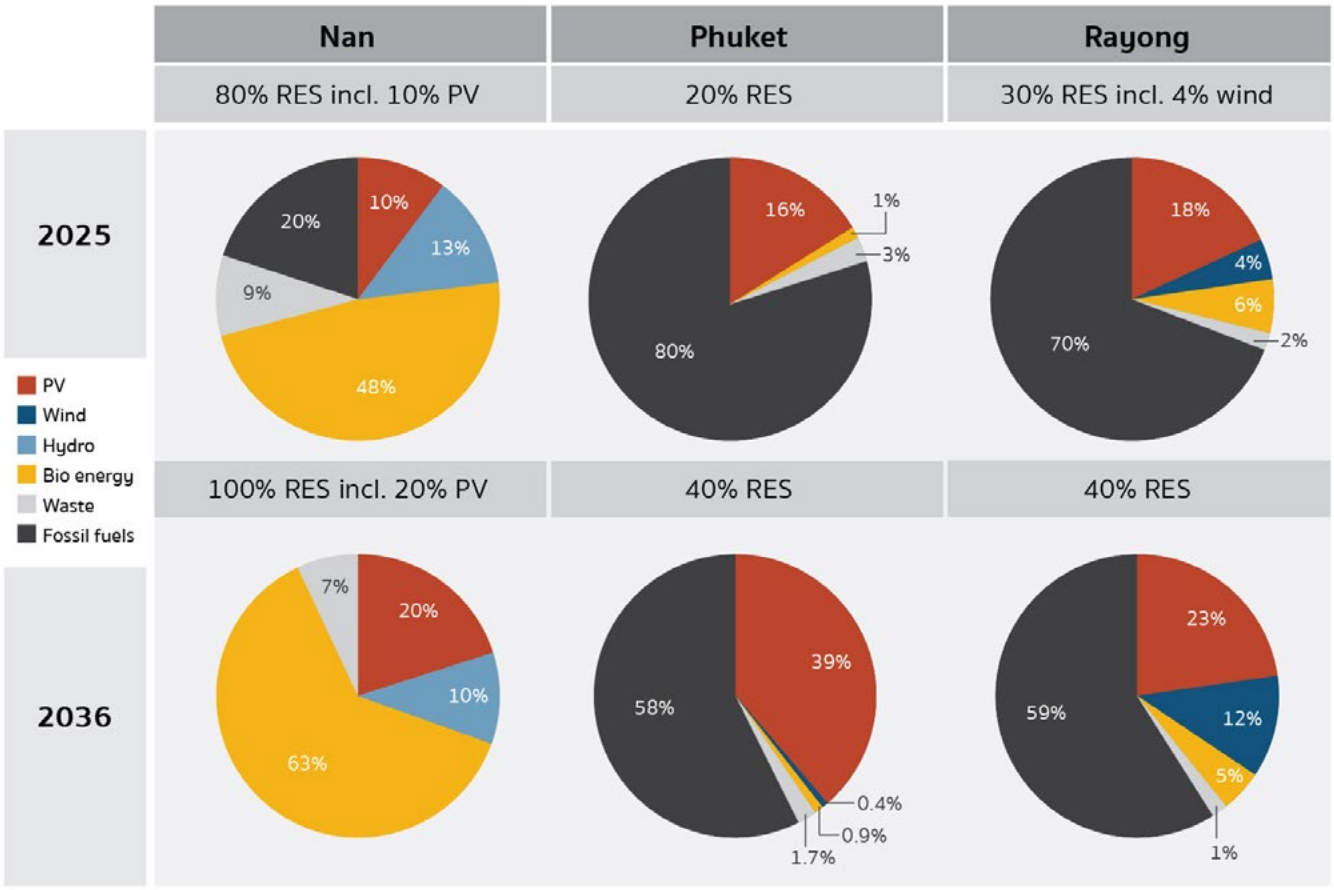


Figure 25: Distribution of electricity generation by source for recommended scenarios (Source of data: Stryi-Hipp et al., 2015, p. 1)

100% Renewable Energy in Nan Province by 2036

In 2015, a study by the German Fraunhofer Institute for Solar Energy Systems (ISE) and the Thai Ministry of Energy looked at opportunities to supply renewable energy in three Thai provinces, namely Nan, Phuket, and Rayong (Stryi-Hipp et al., 2015). By utilising low cost bioenergy, some high potential (but higher cost) solar (PV), hydropower from a plant already in construction, but accepting a low potential for wind due to low speeds, it was shown that Nan Province could reach 80% renewable use by 2025 and 100% by 2036 (Figure 25). Despite initial investment for PV batteries, costs over time would be less than the existing fossils fuel-based energy system, along with clear reductions in greenhouse gas emissions. For Phuket and Rayong, where demand is higher, and with higher population concentrations, a cost-effective model reduces but does not phase out fossil fuel usage. Rayong mixes PV, wind and bioenergy to cater to the highest demand. However, in a wider perspective, there is the possibility for Phuket and Rayong to be supplied with renewable energy from other provinces in Thailand.

100% Renewable Energy in the Greater Mekong Region by 2050

In 2016, the World Wide Fund for Nature (WWF) release a report modelling the potential extent of renewable energy in the Mekong countries (Cambodia, Laos, Myanmar, Thailand and Vietnam) (IES & MKE, 2016; WWF, 2016; WWF et al., 2016). The report recognises a regional dependency in the region on hydropower, gas, coal, and electricity imports, with a likelihood for high increases in consumption over the coming years. Under both Sustainable and Advanced Sustainable Energy Scenarios, the study claims that 100% renewable energy can be achieved by 2050, both in technical and economic terms. The models draws on a less than 11% share from large-scale hydropower in 2050, which has been problematic in terms of impacts upon water sources, enforced land relocations, and other environmental outcomes. Instead, an emphasis is placed on the development of solar, bioenergy, and wind sources. The promotion of energy efficiency leads to 30% less consumption than a business-as-usual scenario. The Sustainable Energy Scenario would maintain some gas and coal up to 2050 and then cut them out, while the bolder Advanced Sustainable Energy Scenario would already have phased them out completely (Figure 26). This represents a reduction of carbon emissions at 85-100%. Further, 80-90% of energy would be produced domestically within Mekong countries, creating energy security and moving away from imports. Economically, the scenarios provide cheaper electricity than the business-as-usual scenario, and could save up to 40 billion USD per year by 2050 under a program of renewables and energy efficiency.

These examples show that there is much potential to move towards renewable power generation, helping Thailand match targets in the fight to limit global warming. An important proviso is that the use of biofuels as part of the solution must be treated with extreme care due to their potential contribution to climate change through GHG emissions from indirect land use change, forgone carbon sequestration, and destruction of ecosystems in unsustainable land usage, among other concerns. Nevertheless, it is clear that there is no place for coal (along with other fossil fuels) in this quest. The economics of such transitions to reduce GHG emissions are cost-effective, and renewables are getting cheaper all the time as technology improves, economies of scale grow, and supply chains become more competitive. For example, more than half of the renewable capacity added in 2019 proves less costly than even the cheapest new coal-fired power station (IRENA, 2020). Particularly in the context of rebuilding economies from the disaster of COVID-19, there is little sense in remaining with fossil fuels, with renewables now the least-cost option. A further positive knock-on effect from a renewable energy transition is the potential to stimulate new jobs. A 2018 report by Greenpeace projects that a 100% renewable energy sector by 2050 could create 172,164 jobs (particularly in operation and maintenance), compared to 1,950 in the coal sector if it were to match the renewable output (Greenpeace, 2018b, p. 3). The promotion of rooftop solar systems in Thailand has the potential to create more than 50,000 jobs (Greenpeace, 2020a, p. 5). Such job creation would easily consume any losses in the fossil fuel sector.

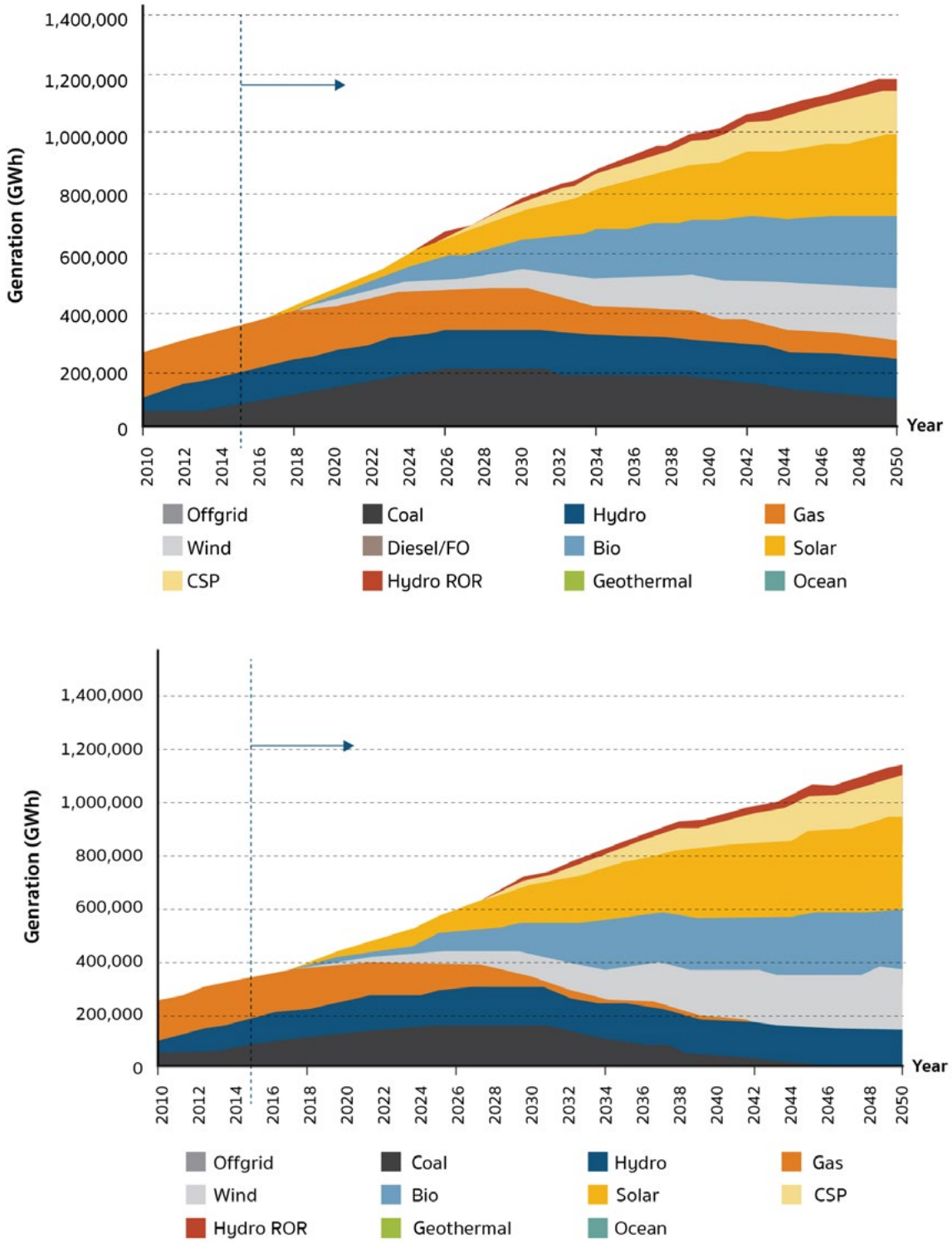


Figure 26: Greater Mekong future electricity generation mix until 2050 in the Sustainable (above) and Advanced Sustainable (below) Energy Scenarios (Source of data: IES & MKE, 2016)

With the onset of the COVID-19 pandemic in 2020, power consumption has decreased in Thailand. For the moment there are too many power plants compared to demand. This gives an opportunity to take stock, permanently cancel all proposals for new fossil fuel power stations, and develop a progressive energy plan that encourages investment into the renewable sector. Indeed, 90% of the global increase in power capacity in 2020 has come from renewables, showing better adaptation to the COVID crisis (IEA, 2020b). In Thailand, solar has great potential, as shown when unexpected increases became a factor in the 2018 PDP revision. Rooftop solar PV remains an untapped market, albeit one demanding a net-metering scheme, and close engagement with the Metropolitan and Provincial Electricity Authorities (MEA and PEA) (ibid, p. 32). Even wind, despite Thailand on the whole having low average speeds, has potential at multiple on and offshore locations, particularly if modern low-speed turbines are used (ibid, p. 33). Yet there needs to be greater incentivisation for the private sector to invest in renewables, and help set up a decentralised transmission system. Larger energy companies are already doing so in diversifying their power portfolio. For example, Banpu has solar capacity in China (177MW) and Japan (63MW), with a 80MW wind project in Vietnam (Banpu, 2019). It is looking to grow business in solar rooftops, electric vehicles, smart technology, and energy storage. Lanna Resources has a secondary business of ethanol-for-fuel in Thailand with two production plants in Suphan Buri Province (Lanna Resources, 2019, p. 13). Appropriate financial incentives could accelerate such projects and align private sector practices with a renewable energy transition, providing economic returns to these companies. A push is needed to move corporate rhetoric and action from 'lower carbon' to 'non-carbon'.

CONCLUSION AND RECOMMENDATIONS

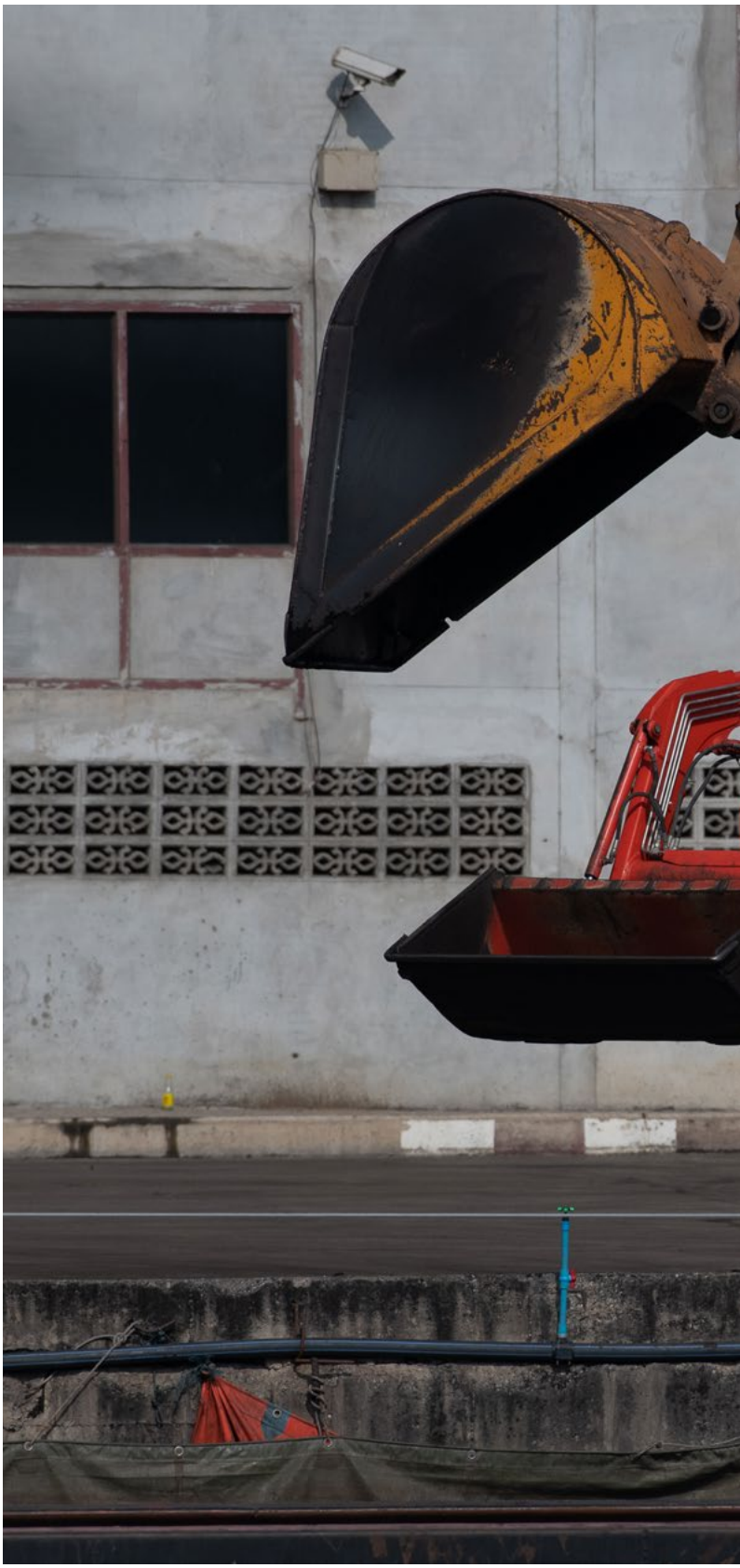
Coal imports are fundamentally a private sector activity, and any industrial growth, as promoted through policy such as Thailand 4.0, threatens to increase imports. As part of a move towards multinational operations, numerous Thai companies own foreign mines, and participate in shipping, the distribution, and final consumption. A mine in Kalimantan can now serve import markets around Asia and beyond. Two key routes within Thailand involve the arrival of coal at Ko Si Chang Anchorage Area for transport by barge to Nakhon Luang, and at Map Ta Phut Industrial Port for usage in local power plants. During transportation and distribution, there is pollution of sea and river water, air, and soil, impacting upon the health and livelihoods of local communities, as well as the contribution to greenhouse gas emissions.

Coal is neither cheap nor a clean source of energy, once the external costs for its social and environmental impacts are taken into account. No amount of technological innovation can shield this fact. There is now a compelling case for renewable power, both in pricing and job creation. It is up to policy makers to step away from an addiction to fossil fuels, including coal, and honour commitments to create a low-carbon, zero-emission society. This requires the incentivisation of the private sector by representing the true cost of coal, and giving the push for companies to complete an energy transition.

Drawing upon these observations, the following recommendations are put forward to take steps for a transition away from coal imports.

On the Importing and Distribution of Coal:

- At present, there is no import and excise tax placed on coal. This makes no sense in terms of achieving domestic energy security, and acknowledging the external costs of environmental and social impacts. It is time to change the tax regime, aligning it closer to other fuels like diesel, petroleum, and natural gas. A special license should also be required by importers.
- There needs to be proper enforcement of Thai regulations on shipping, customs, river use, and environmental impacts in the importing and distribution of coal in Thailand. In particular, the Central Administrative Court has called for laws to be followed in Nakhon Luang District, yet companies are conducting business as usual with implicit support from local authorities. Stringent measures are urgently needed to clamp down on malpractices.
- To support monitoring, there needs to be transparent testing of water and air quality, soil erosion, noise pollution, and human health, to better understand the impacts of coal distribution in Nakhon Luang.
- There is a need for careful reporting and monitoring of VSPPs and other small factories as to the amount of coal used to generate power. Particularly for VSPPs that are based on renewable power sources, there must be minimal use of fossil fuels and coal should be prohibited entirely.
- It is important that communities, and national and international NGOs work together in campaigns against the harmful effects of coal and other fossil fuels, and the promotion of renewable power.
- Private sector interests in the coal trade risk undermining Thailand's climate commitments, and there is a need to keep them in check. There must be a clear policy guide to incentivise a transition for renewables,



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but there must also come a point where companies unwilling to do so are treated with harsh punitive actions.

For an Energy Transition:

- Due to the COVID-19 pandemic, power demand has decreased, meaning that at present Thailand has too many power stations for its needs. There is a perfect opportunity to explore a revised Power Development Plan that can put renewable energy at its heart, set out a corresponding policy agenda, and put Thailand on a pathway to honour its climate commitments in a non-carbon future. It is time to show political will to operationalise these commitments.
- As part of the transition to renewable energy, a long-term prohibition on new coal-fired power plants and domestic coal mines, as well as a coal phase-out strategy, should be implemented.
- Domestic power production should be prioritised over fossil fuel imports, and renewable power production offers the means to achieve this aim. There are numerous models now available, showing how renewables can speedily take a central role in provincial energy plans around Thailand. Policy makers should draw on these, setting ambitious new targets for a quick transition to, where possible, a 100% share of renewables.
- To help incentivise the private sector to invest in renewables, the grid system must be overhauled to facilitate the widespread sale of renewable energy back to distributors. This includes a net-metering scheme which for example can include individual households using rooftop solar.

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APPENDIX 1: LIST OF COAL-FIRED POWER PLANTS IN THAILAND

Power Plant	Location	Capacity (MW)
Mae Moh	Lampang	2,180
BLCP Power	MTP IE, Rayong	1,434
GHECO-One	MTP IE, Rayong	660
National Power Supply (P2)	Prachin Buri	164
National Power Supply (P1)	Prachin Buri	164
Glow SPP 3 (Project 2)	MTP IE, Rayong	160
Glow SPP 3 (Project 1)	MTP IE, Rayong	160
IRPC public company limited	Rayong	108
Siam Kraft Industry	Kanchanaburi	85
TPT Petrochemicals	MTP IE, Rayong	55
Siam Kraft Industry	Ratchaburi	53.4
Panjapol Pulp Industry	Bang Sai, Ayutthaya	40
Environment pulp and paper	Takhli, Nakhon Sawan	32
Thai Acrylic Fibre	Kaeng Khoi, Saraburi	27.3
Thai Cane Paper PLC	Kabin buri, Prachin Buri	26
Elite-KraftPaper	Muang, Sa Kaeo	9.8
United Paper	Mueang, Prachin Buri	9.5
Inter Pacific Paper	Bang Sang, Prachin Buri	9.5
Ajinomoto (Thailand)	Lat Lum Kaeo District, Pathum Thani	8.6
Ekarat Pattana	Kaeng Koi, Saraburi	6
TPI Polene	Takhli, Nakhon Sawan	3
Nanyang Energy	Krathum Baen, Samut Sakhon	1.8

(Source of data : Watchalayann et al., 2018)


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