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Divestment trends in Japan's international coal businesses

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ABSTRACT

Continued investments in coal-fired power plants (CFPPs) and coal mining are incompatible with the Paris Agreement. As a major investor of both upstream coal mining and downstream CFPP construction, Japanese firms play a large role in sustaining the international coal market. Yet since mid-2018 numerous Japanese companies have announced a range of coal divestment policies. This situation, however, has not been unexamined by scholarship. Additionally, divestment literature outside Japan has focused overwhelmingly on financial institutions rather than the roles of other industry players driving the coal market. To address this gap, this paper examines four industries comprising Japan's international coal market (trading companies, electric utilities, plant equipment manufacturers and financial institutions) to empirically assess the extent of divestment behaviour and identify drivers and barriers. The empirical data reveal a slowdown, but not a cessation, of new and existing coal-related investments. Results also show that the extent of divestment trends can be largely explained by commercial factors, although institutional and structural factors are also at play. These findings have important policy implications.

1. Introduction

New investment in coal mines and the construction of coal-fired power plants (CFPPs) are incompatible with the Paris Agreement's objective to limit global warming to 1.5 or 2° [1–3]. Globally, however, some 236 GW worth of projects are under construction, with a further 339 GW in planning [4]. Meanwhile, world coal consumption rose in 2017 and 2018 after a three-year pause, mostly due to rising demand from electricity generation [5]. Although CFPP construction is concentrated in emerging economies, it is supported by private and government actors in developed countries that benefit commercially from exporting coal technology [6,7]. In addition to private and government financial institutions, beneficiaries in exporting countries include plant equipment manufacturers, electric utilities and fuel suppliers. This nexus of economic and political interests has been referred to as the 'coal complex' [8] or coal 'regime' [9,10].

Japan plays a major role in sustaining the international coal market [11]. As the world's fourth largest coal consumer [12], trading companies hold extensive offshore investments in upstream extraction. In parallel, Japan is the largest international developer of coal power after China [7]. Since 2013, state agencies have provided around $17 billion of financial support (comprising loans, guarantees, insurance etc.) to some 22 GW of CFPP projects across developing Asia (including Indonesia, India, Vietnam and Bangladesh) and Africa [13,14]. In addition, private actors (trading companies, utilities, equipment manufacturers and banks) are currently involved in the development of around 15 GW [15,16]. While coal power can contribute to electrification and economic development in poor countries [17], CFPPs commonly operate for around 40–50 years [18]. Carbon and air-pollutants emitted from these investments will thus negatively affect the air quality and decarbonisation prospects of these countries for decades.

Japan's coal industry has received much attention from NGOs and think tanks [19–24] as well as scholars [6,25,26]. Of recent interest, since mid-2018 private financial institutions and general trading companies (i.e. *sōgō shōsha,* explained in Section 2.1) have unveiled tighter policies for upstream coal mining and CFPP development [27]. However, the implications of these divestment trends for the international coal market and steering Japan's coal players towards decarbonisation are yet to be examined by literature. Meanwhile, most energy scholars examining Japan have overlooked the resurgence of the coal industry after the Fukushima disaster (elaborated in Section 2.1 and 2.2) by

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focusing on nuclear and renewable energy policy [28–32].

Accordingly, this study examines the extent to which divestment is occurring in the four industries that broadly comprise Japan's international coal market: general trading companies, electric utilities, plant equipment manufacturers and financial institutions. The analysis covers the divestment and decarbonisation strategies of the major players in each industry with either *upstream* (mining development) or *downstream* (CFPP development) activities. Using data sourced from documents and semi-structured interviews, the four industries are examined in turn to consider the: (i) respective roles played in the overseas coal market; (ii) extent of divestment; and (iii) drivers and barriers to divestment.

The empirical data suggest there has been a slowdown, but not a cessation, of new and existing coal-related investments. Findings also reveal that the extent of divestment behaviour is largely a function of commercial factors. These include losses incurred from falling coal prices between 2014 and 2016, which have encouraged divestment of thermal coal holdings. Meanwhile, other commercial factors have acted as a barrier to downstream divestment, such as long-term power purchase agreements. That said, institutional and structural factors are also at play. Furthermore, in many cases they too have hampered divestment, particularly business models that have been historically dependent on coal.

This paper contributes to three strands of scholarship. First, in contrast to fossil fuel divestment literature, which has focused on financial institutions and universities [33–35], this paper breaks new ground by examining the business strategies of other private actors driving the coal market. It does so by adopting a widened interpretation of 'divestment' to encompass both: (i) any reduction or cessation of investment/financial support for upstream or downstream coal activities, and (ii) any shift in business priorities (e.g. from coal to renewables). The broadened analysis of divestment trends beyond the financial sector reveals a plurality of actors and motivations that underpin the coal market. This allows the industry-by-industry identification of unique drivers and barriers with important implications for public policy. Second, by examining the market forces influencing the trajectory of Japan's coal-related industries, this study provides new insights into existing research on path dependency and carbon lock-in within the fossil fuel industry [10,36–38], especially in relation to Japan [6,39–43]. Third, the focus on business actors—as opposed to *state* actors—contributes new empirical insights for literature examining the preferences and strategies of private players in energy-centric industries that are significant contributors to climate change [9,44–49]. This is especially important given the dearth of research on these actors in Japan.

In what follows, the next section provides a background on Japan's international coal market. It then identifies from literature three factors (i.e. commercial, institutional and structural) that can drive or hamper divestment for business actors. After summarising methods in Section 3, findings for each of the four industries are reported separately in Section 4. Findings are discussed in Section 5 while the conclusion extracts implications for scholarship and policy.

2. Background on Japan's international coal market and business behaviour

2.1. The upstream coal market

The majority of Japan's coal imports are thermal (a.k.a. 'steaming coal') and consumed by power stations. The Japanese government has historically supported upstream extraction overseas to secure steady coal supplies [50,51] by providing subsides and public-private investment options for exploration and initial development [52]. Following the Fukushima nuclear disaster in 2011, reliance on coal-fired electricity has deepened. While originally a short-term strategy for substituting nuclear power, coal dependence continues as idled reactors struggle to meet tougher safety requirements and overcome public opposition [11]. As a result, coal's share of annual electricity generation rose from around 27% in 2010 (pre-Fukushima) to 31% in 2018 [139]. Annual imports of combined thermal/coking coal mirror this trajectory, increasing slightly from 185 million tonnes in 2010 to 190 million in 2017/18 [[53]]. From a long-term perspective, Japan's current consumption of thermal coal has tripled from 1990 levels [54].

In Japan, general trading companies[1] (e.g. *Mitsui Bussan* or *Mitsubishi Corporation* and so on) rather than utilities or steel mills etc. are the principle actors involved in importing and supplying coal to domestic customers. Trading companies hold extensive investments in overseas mining operations through joint stake acquisitions. Since around 60% of imported thermal and coking coal [53] originates from Australia, the majority of offshore coal extraction businesses are concentrated there. This dependence on Australia stems from its high-grade coal, geographical proximity and political stability. Since this situation inevitably carries risks of supply chain interruptions, the Japanese government is working to encourage new investments in other countries, such as in Indonesia, to exploit lower grade coal deposits [51,52].

2.2. The downstream market

The export of Japanese CFPP technology is tightly linked to the domestic market, which has seen significant new construction activity after the Fukushima disaster [19,20]. Government policy is promoting new CFPP development both domestically and internationally. For example, the *Long-term Outlook for Energy Supply and Demand* [56] projects and thereby promotes a 26% share of coal in the national electricity mix for 2030. The *Fifth Basic Energy Strategy* also posits coal as a cheap and reliable baseload fuel and calls for construction of high-efficiency plants (i.e. mostly ultra-supercritical[2] but also coal gasification) to replace aged facilities. Construction of large, modern CFPPs requires several billion dollars [11]. Since the economic benefits for Japanese industry are significant, the national government has enthusiastically promoted overseas CFPP development by linking export ambitions with domestic economic policy. For example, in 2013 Prime Minister Abe announced ambitions to expand power generation exports [57]. Operationalised in the *Infrasystems Export Strategy* [58], this policy affords special emphasis to electricity generation, including high-efficiency coal power. The three government agencies charged with financing overseas exports (i.e. *Japan Bank for International Cooperation*, *Japan International Cooperation Agency* and *Nippon Export and Investment Insurance*) are mandated to support this agenda.

Offshore contracts to build CFPPs are typically won though international competitive bidding arranged by the host country government. Consortiums comprising Japanese trading companies, utilities and equipment manufactures typically compete with Chinese and Korean counterparts to win independent power producer contracts [7,59]. While China's advantage lies in low construction costs, Japanese proposals emphasise technical reliability, fuel efficiency and lower life-cycle costs. To lure foreign investments, host countries typically supplement contracts for independent power producers with long-term power purchase agreements that provide 'take-or-pay' clauses and capacity payments [60].

[1] 'General trading companies' (i.e. sōgō shōsha) have played an important historical role in securing overseas resources for Japan's post-war economic development. Import portfolios range from minerals and energy (e.g. iron ore and natural gas) to fiber and agricultural commodities. By investing across the entire value chain (i.e. extraction, trading of raw materials and export of finished products [e.g. cheese and machinery]), business models are robust to massive price fluctuations which inevitably effect year-to-year profits in the minerals/energy sector [55].

[2] Ultra-supercritical plant technology achieves higher efficiency than older types (e.g. supercritical and sub-critical) by generating steam at a higher temperature and pressure.

Japan's CFPP exports appear to have increased in recent years [7]. While gas-fired projects dominated state-financed power generation constructed during 2000–2017, coal's share has recently risen to 73% [22]. In addition, Japanese supported CFPPs have emerged in developing countries with no or limited coal reserves such as Morocco and Egypt. This trend appears to be an emerging strategy for Japanese companies to open new markets by taking advantage of international supply chain know-how to create an advantage relative to Chinese and Korean competitors.

2.3. Divestment and business behaviour

The fossil fuel divestment movement seeks to interrupt financial flows supporting fossil fuel extraction and related infrastructure. Researchers have recently examined the scale and influence of the global divestment movement on investment norms and public policy as well as particular strategies used by universities and non-state actors to undermine the social licence underpinning the fossil fuel industry [33,35,61,62]. Others have examined the development, logic and diffusion of anti-fossil fuel norms in climate governance [41,63,64]. The divestment movement's moral imperative to 'keep it in the ground' is yet to affect drastic changes in the extraction policies of many major coal producing nations [42]. Nevertheless, multiple studies point to increasing recognition in society, business and government institutions that extraction of fossil fuels and construction of carbon-intensive power plants must be reduced if global climate targets are to be met [39,65].

While this literature focuses mostly on civil society and state actors engaged in diffusing anti-fossil fuel norms, a growing number of energy transition studies draw on broader scholarship in political science, business management, regulation and governance to interrogate the preferences and strategies of business actors in fossil fuel industries [45,48,66–69]. Although scholars have mostly focused on Europe and North America rather than Asia, literature reveals the logics underpinning the positions of firms with regard to particular policies that aim to curb fossil fuel extraction and consumption [44]. Studies also reveal divisions amongst particular industries [70], which can be leveraged by policymakers to win support for new climate or energy policies that threaten the interests of incumbent players [47].

To guide this study on divestment trends in Japan's international coal market, we briefly draw on literature on political science, business management, economics and innovation studies to identify three factors that might act as drivers or barriers to fossil fuel divestment: 1) commercial; 2) institutional; and 3) structural.

First, are commercial factors. The conventional assumption of many studies is that business preferences will be a function of commercial interests. Hence, the position a business takes on a particular policy will be shaped by the distributional impact of that policy [71,72]. For example, if the Japanese government proposes policies that support coal, such as export subsidies, firms in the coal sector are likely to support it, just as they may oppose policies that restrict coal production or consumption. Firms are also expected to take into account the relative gains and losses that a policy might bring about for their competitive position in the market [73]. Two Japanese firms may stand to lose from a proposed policy, but if one loses less relative to their competitor in the same market, they may well support the policy.

Second, are institutional factors. While commercial interests primarily drive business behaviour, business actors are embedded in institutional contexts that also shape internal decisions [74,75]. Institutions refer to established norms, rules, beliefs and practices that are shared across networks and communities of business and government actors [76]. As Geels [77] explains, normative institutions provide 'behavioural templates' that dictate norms and expectations around business strategies. These institutional contexts vary highly across countries and types of industries [67,68,78]. Normative positions on fossil fuel investment are often influenced by such external institutional environments, especially by frontrunners that set a precent for other network members [64]. Conversely, established norms in institutional networks can restrict new practices [79].

Third, are what might be termed structural factors. These include internal capabilities such as established business models, knowledge, technology, R&D and human resources, which influence a firm's ability to innovate and formulate new strategies [77,80]. Such capacities are largely shaped by historical activities. Drawing on the concept of path dependency, scholars have highlighted how once an organisation starts down a particular path it can be difficult to change course [81,82]. For example, once a firm has built an established business model, made investments in a particular technology and amassed relevant know-how, they may become 'locked-in' to a certain trajectory [10,83]. Thus, incumbent firms hold an economic incentive to invest in incremental improvement rather than new, disruptive technologies [79].

3. Methods

3.1. Overview: scope, approach and sample

This study focuses on the state of divestment in two segments of Japan's international coal market: 1) *upstream*: mining of thermal/coking coal, and 2) *downstream:* construction/investment/operation of CFPPs. Although findings hold relevance to the coking coal market and steel industry, our principle interest is thermal coal and electricity generation (which comprises the majority of Japanese and global coal consumption). Also, given the overseas focus, this paper does not specifically examine the proliferation of new CFPP development occuring within Japan since the Fukushima nuclear disaster in 2011 as this is covered by earlier research [11,20,25].

To explore the extent to which Japanese firms are divesting from upstream or downstream businesses in the international coal market, we assembled a sample of 17 companies. This covers the following four industries, which broadly comprise Japan's international coal market:

- **General trading companies (n = 5):** Involved both upstream (mining and import) and downstream (investment/construction/operation of CFPPs).
- **Electric utilities (n = 4):** Involved downstream only (investment/construction/operation of CFPPs) although one holds upstream mining stakes.
- **Plant equipment manufacturers (n = 3):** Involved downstream only (manufacturing, installation and maintenance of equipment like turbines, boilers, generators and electric systems).
- **Financial institutions (n = 5):** Involved in finance and investment for both upstream and downstream activities. This category comprises both private banks and insurance firms.

Sampled companies were identified from databases [13,84,85], third-party literature [16,22,86] and knowledge from previous research [25]. The general approach was to target the most influential entities in each industry by including between three to five (depending on data availability) of the companies holding the largest coal-related businesses. As shown in online Supplementary Material, the scale of coal-related businesses was considered with indicators such as:

- Annual production of thermal coal in tonnes/year (for general trading companies)
- Capacity of overseas coal-fired electricity generation portfolios (for electric utilities and general trading companies)
- Amount of financing/investments to coal mining and CFPPs (for banks/insurance firms)
- Volume of plant equipment sales (for equipment manufacturers).

3.2. Data collection and analysis

Data was collected over 24-months, ending in December 2019.

Primary data are derived from 23 semi-structured interviews with 53 respondents (see Appendix 1). These were mostly conducted in Japanese and on-site by the first author and mainly targeted the sampled companies. To triangulate findings, government agencies, industry think-tanks and NGOs/research institutions were also interviewed. In most cases, respondents were sent questions in advance, with interviews recorded and transcribed. Secondary data included official documents from companies (e.g. annual reports, company press releases and websites) in addition to grey literature (e.g. media articles, policy documents, research reports and presentation materials) from third parties such as NGOs, think-tanks and government agencies.

Business divestment strategies were determined by analysing published qualitative statements. The analysis focuses mostly between January 2018 and December 2019 since divestment was absent before this. Official statements were triangulated with interview results and third-party documents. In a case of conflicting findings, priority is given to statements from interviews with that company. The degree of divestment activities observed either upstream or downstream were classified into three categories, according to Table 1.

4. Findings

The following sections report findings industry-by-industry. Each section is organised to report the: (i) role and scale of business activities in the overseas coal market; (ii) extent of divestment trends; and (iii) driving or hampering influence of the previously identified factors (i.e. commercial, institutional and structural) on divestment behaviour. Summary tables provide a snapshot of divestment trends in each industry. Black circles refer to upstream businesses (i.e. coal mining) and white circles refer to downstream activities (i.e. CFPP development).

Table 1
Degrees of divestment measured in this study.

Degree	Definition	Explanation
*None**	No explicit change in investments or engagement with coal-related businesses (i.e. financing, equipment manufacturing, plant operation etc.).	For example, Firm A might disclose a strategy aiming to increase investments in renewables that makes no explicit mention of reducing investments in coal-related businesses.
Partial	Partial reduction of either new or existing investments and engagement with coal-related businesses either upstream or downstream.	For example, Firm B might disclose a commitment to refrain from building coal-fired power plants that implicitly or explicitly allows continued investment or involvement with existing power plants. Similarly, Bank Y might pledge to no longer finance coal mining of one type (e.g. mountain top removal) but continue to finance other forms of upstream coal extraction.
Complete	Complete cessation of all new and existing investments and engagement with coal-related businesses both upstream and downstream.	For example, Firm C might pledge to no longer invest in any kind of coal-related project and withdrawal all kinds of existing investments with coal-related businesses. This was degree of divestment was not observed.

Note: This signifies 'none observed' and does not exclude the possibility that some firms might possess differing but undisclosed policies.

4.1. General trading companies

4.1.1. Role

The general trading companies identified in Table 2 are commonly referred to in Japan as 'the big five'.[3] All are active across the entire coal value chain. Upstream, they invest in and operate coal mines via subsidiary companies located in the country of activity (typically in Australia). They also trade and deliver coal to electricity, steel, cement and chemical industries in Japan and Asia.[4] Indeed, the extraction and sale of both thermal and coking coal contribute a large share of total company profits. For example, coal mining revenues for *Mitsui* and *Marubeni* in FY2017 each contributed around 11–12% to total profits from all energy and non-energy businesses (which were US$ 3.82 billion[5] and US$ 1.93 billion respectively) [87,88].

Downstream, general trading companies develop generation and grid infrastructure as independent power producers and then invest in these by acquiring equity (i.e. shares). Several companies own between 10 and 15 GW of power generation capacity, mostly in developing countries in Asia, the Middle East, Africa, and South America. For instance, *Marubeni's* power business includes a 12 GW portfolio that contributed around 19% to total profits in FY2017 [88]. Although gas-fired electricity dominates most portfolios, coal commonly makes up around 20–30% of installed capacity. For example, *Mitsui Bussan* and *Marubeni* currently own 2000 MW and 2824 MW of coal-fired electricity, comprising 21% and 24% of respective overseas portfolios. In addition, all five trading houses are actively constructing or planning several GW of new CFPP projects overseas. *Sumitomo* and *Marubeni*, for instance, are reported to be involved in around 4.5 GW and 5 GW of new construction and planning, mostly offshore [84].

4.1.2. Extent of divestment

Since late 2018, the general trading companies announced a string of policies to clarify and disclose investment stances for upstream and downstream coal businesses as well as decarbonisation strategies. This followed the earlier lead of financial institutions, discussed in Section 4.4.

Downstream, three companies (*Itochu*, *Marubeni* and *Sumitomo*) have pledged to refrain from new CFPP development. However, policies for the latter two grant exceptions where coal power is important for economic development or consistent with Japanese government policy. Seemingly, such exemptions will be applied. For instance, *Sumitomo* recently cited its exemption clauses to justify breaking ground on the *Van Phong I* project in Vietnam only days after announcing its coal investment policy [89]. Meanwhile, another firm explained its exemption clauses as: 'Our policy does not say "we will not do any more coal-fired power." If there is a strong need in the host country, we will continue to investigate projects using ultra-supercritical, the best-available technology from a CO2 emission perspective' (int. 1). Interestingly, policies for three companies explicitly outline intentions to reduce absolute coal power capacity. Yet reduction targets for two companies (*Mitsui* and *Sumitomo*) only concern relative shares. Since all companies are aiming to increase the aggregate size of power generation portfolios, the latter two policies still could still permit an absolute growth of coal capacity. Moreover, all policies permit the continued holding of existing assets. Given that multiple firms are still developing new CFPPs (which typically entail long-term purchase agreements ranging from 15 to 30

[3] This refers to the economic significance of these firms relative to other smaller general trading companies in Japan in terms of annual sales and profits.

[4] While coal trading also generates important revenue for trading companies, this was outside the scope of this paper given that divestment strategies do not concern these business activities. In addition, company-specific data on precise trading volume and sales was not readily available.

[5] Japanese yen amounts from hereon were converted using 100 yen = $US 0.91 as per the rate of May 16, 2019.

Table 2
Extent of coal divestment trends in general trading companies.

	Complete	Partial	None	Current strategy aims to:	New CFPP construction allowed?	Main official sources
Marubeni		●○		**Upstream** • Focus investments on coking coal. **Downstream** • Half capacity of coal power in electricity generation portfolio from current 3 GW by 2030. • Increase share of renewables from current 10% to around 20% by 2023. • Refrain, in principle, from new CFPP development. If constructing, invest in ultra-supercritical projects only.	Yes	Marubeni [90,91]
Mitsui Bussan		●○		**Upstream** • Refrain from acquiring new thermal coal mine projects and investigate the sale of existing assets. • Focus investments on coking coal. **Downstream** • Reduce gradually the share of coal power in electricity generation portfolio (currently 21% of 9.3 GW). • Increase share of renewables in electricity generation portfolio to 30% by 2030 (from current 16% of 9.3 GW).	Yes	[87,92]
Sumitomo Corporation		○●		**Upstream** • Refrain from acquiring new coal mine assets. • Maintain production size of current portfolio. **Downstream** • Refrain from new CFPP development. However, exceptions may be granted if a project a) is essential to economic/industrial development in the host country or b) complies with Japanese government policy. • Downsize by 2035 current share of coal power from 50% to 30% while expanding gas from 30% to 40% and renewables from 20% to 30%.	Yes	[93]
Mitsubishi Corporation		●○		**Upstream** • Refrain from acquiring new coal mine assets (all thermal mines have been disposed). • Concentrate existing assets in coking coal. **Downstream** • Reduce capacity of coal power in current portfolio (no target). • Refrain from new CFPP development (except for current projects under consideration). • Increase share of renewables in electricity generation portfolio to over 20% by 2030.	Yes	[94–96]
Itochu		●○		**Upstream** • Refrain from acquiring new thermal coal mine projects. **Downstream** • Refrain from new CFPP development. • Increase share of renewables in electricity generation portfolio to over 20% by 2031 (equity interest basis).	No	[97,98]

Notes.
●Black circles represent upstream businesses (coal mining) and white circles downstream businesses (coal-fired power plants).
●Generation capacity refers to portion owned. E.g., 50% ownership of 2 GW facility would represent 1 GW of assets.
●For *Marubeni, Mitsui Bussan* and *Mitsubishi Corporation*, descriptions of divestment strategies are also based on interviews.

years), many power generation portfolios will possibly include coal for the next one to two decades and beyond.

For upstream investments, similarly, policies in many cases do not necessitate the immediate disposal of mining stakes. For example, another respondent from the above firm clarified (int. 1): 'The statement "we will *investigate* asset disposal (of thermal coal)" is not as proactive as it sounds. What we mean is, *if* a chance presents itself, we will consider selling'. Nevertheless, even if existing assets are maintained, companies anticipate (int. 8) that annual coal production volumes will decline in coming years as current operations exhaust recoverable reserves. Meanwhile, all companies are explicitly concentrating upstream investments in coking coal (mostly in Australia, but also in Mozambique, Columbia etc.).

4.1.3. Drivers and barriers

The empirics largely support the expectation outlined in Section 2 that commercial interests are the principle determinant of divestment behaviour. In the upstream market, interviews (int. 1,3,8) indicated that decisions to downscale or abandon thermal coal investments were made after the collapse of coal prices between 2013 and 16. This period triggered massive profit losses for trading companies such as *Mitsubishi Corporation, Sumitomo Corporation* and *Mitsui Bussan.* Likewise, decisions to focus investments in coking coal are driven by convictions that future demand for thermal coal will decline given the expansion and increasing

cost-competitiveness of renewables. Coking coal is seen as a surer bet given the dearth of cost-efficient alternatives for coal in steel making and its relatively higher sale prices per tonne. As one company (int. 3) underscored: 'Our strategy is to concentrate investments in coking coal, where profit generation is easier … I'm sure it's the same for general trading companies Y and Z as well' (company names removed). Seemingly, firms have been successfully selling-off existing stakes in Australian thermal coal mines to either foreign or fellow Japanese buyers at prices sufficient to recover sunk investments (int. 8). Also, given that many coking mines also produce thermal coal as a by-product, companies intend to maintain sales of this fuel into the future (int. 1,3).

Commercial factors are also at play downstream, both as drivers and barriers. On the one hand, multiple firms (int. 1,3) underscored that increasing opportunities to generate profits from overseas renewable projects had driven divestment decisions. On the other hand, commercial imperatives are inhibiting the early sale of CFPPs. Asset disposal involves selling-off equity (shares). In theory, this can occur anytime during the plant's lifecycle. Moreover, asset sales are facilitated by the fact that many institutional investors still regard CFPPs as relatively safe investments (int. 9,18) due to long-term power purchase agreements and guaranteed capacity payments from the host country utility. However, commercial imperatives make early asset sales unlikely. First, companies mostly intend to achieve targets to reduce shares of coal-fired power capacity by selling equity at the *termination* of power purchase agreements, rather than midway (int. 1,3). Second, since most overseas power generation businesses are consistently generating significant profits, firms lack an economic rationale to dispose of assets prematurely. This differs to thermal mining operations, which incurred large losses during 2014–16.

Finally, institutional factors—largely normative ones—are also influencing behaviour to some extent. Two companies (int. 1,3) emphasised how international normative frameworks such as ESG criteria (i.e. Environmental, Social and Governance) are increasingly integrated into investment decisions for energy projects. Meanwhile, international carbon disclosure norms are also influencing behaviour. All companies have outlined in annual reports for 2019 a commitment to disclosing policies and financial information about coal-related businesses in accord with the recommendations of the United Nation's Task Force on Climate-related Financial Disclosures. That said, no interviewed firm cited pressure from NGO divestment campaigns as a significant divestment trigger.

4.2. Electric utilities

4.2.1. Role

The utilities listed in Table 3 perform three key roles relevant to overseas CFPP development: 1) investment; 2) operation; and 3) consulting. Similar to general trading companies, the first role of investment involves acquiring equity in power generation projects via share procurement. To increase returns on investment, they perform a second role of engaging in plant operation and management by dispatching domestic engineers and training local counterparts. A third—albeit less financially significant role—involves providing consulting services to overseas electricity generation projects and drafting national master plans for grid/power sector development. As mentioned, Japanese utilities do not typically invest directly in coal extraction. *J-Power* is the notable exception, holding three equity stakes in Australian thermal mines.

With the bulk of electricity generation portfolios located in Japan, all utilities are seeking to expand overseas generation capacity in response to forecasts for a shrinking domestic electricity market due to depopulation and economic contraction (int. 2,6). The combined overseas generation capacity of Japan's utilities in late 2017 was around 20 GW (based on ownership) with roughly equal shares in gas, coal, hydro and renewables [99]. The majority of this belongs to the four utilities in Table 3. Each holds overseas portfolios of around 6–7 GW and is engaged in new CFPP construction, particularly across developing Asia [84]. *J-Power*, for example, holds 911 MW of coal-fired capacity under construction while *Kansai Electric Power Company (KEPCO)* holds 764 MW (see Supplementary Material).

4.2.2. Extent of divestment

In contrast to trading companies, no explicit coal divestment was observed in the upstream or downstream businesses of the electric utility industry. Downstream, *TEPCO* and *J-Power* have recently explicated intentions to continue constructing new plants at home that integrate high-efficiency or next-generation coal technologies such as ultra-supercritical and gasification [100,101]. Both emphasise ambitions to continue exporting high-efficiency thermal power technologies (which presumably includes coal). These strategies are framed as global contributions to greenhouse gas emission reductions, the United Nation's Sustainable Development Goals, and economic development. One utility's vice-president (int. 10) explained: 'We are not pursuing a shift away from coal but a shift away from *carbon*' in reference to the coal gasification and carbon capture and storage technologies the company hopes to commercialise overseas. Meanwhile, *J-Power*'s latest annual report [100] also explicates intentions to maintain upstream thermal coal investments.

Despite a lack of coal divestment intentions, all utilities announced ambitious targets in 2018 to pursue decarbonisation through the large-scale development of renewable energy. For example, *TEPCO* is aiming to develop around 6–7 GW of renewable power (especially offshore wind and hydro), mostly overseas [102]. Meanwhile, *JERA* (which unites the overseas and thermal power arms of *Tokyo Electric Power Company [TEPCO]* and *Chubu Electric Power Company*) and *J-Power* are investing aggressively in offshore wind projects in Europe and Taiwan.

4.2.3. Drivers and barriers

While policies for general trading companies include explicit ambitions to downsize coal power capacity, the utility industry holds a distinct preference for pursuing decarbonisation through construction of high-efficiency thermal power plants and diversification of portfolios with renewables. Two barriers help to explain this situation.

The first is commercial interests. Similar to the situation faced by trading companies, the early disposal of equity held in electricity generation projects is inhibited by the long-term nature of power purchase agreements. Investors are expected to remain in the project until termination of the agreement, and utilities have a commercial incentive to maintain their investments given the predictable and steady nature of IPP paybacks.

The second barrier is structural. Utilities have significant historical experience in constructing, operating and maintaining thermal power plants. Further, all are currently involved in new CFPP construction on home soil [85]. At the same time, they lack knowledge with large-scale renewable projects (int. 9,22). This is particularly so for offshore wind, which remains nascent in Japan. Since most engineers and management teams are specialised in gas, coal, nuclear or hydro, Japanese utilities need to first build domestic experience in the large-scale renewables market before expanding businesses overseas (int. 2). Utilities are making efforts to overcome this knowledge deficiency. *TEPCO* [102] and *J-Power* [103], for example, are seeking to enter the offshore wind market by pursuing joint investments with overseas giants *Ørsted* and *Engie*.

Table 3
Extent of coal divestment trends in electric utilities.

	Complete	Partial	None	Current strategy aims to:	New CFPP construction allowed?	Main official sources
J-Power			●○	• Expand overseas power generation to 10 GW by 2025. • Pursue decarbonisation through low-emission coal power (especially ultra-supercritical, coal gasification, co-fired coal/biomass, carbon capture and storage etc.), nuclear and renewables. • Add 1 GW of domestic and international renewables capacity (especially offshore wind and hydro) by 2025. • Maintain stakes in thermal coal mines.	Yes	[100,104, 105]
Kansai Electric Power Company (KEPCO)			○	• Expand overseas power generation. • Pursue decarbonisation through high-efficiency thermal power (including coal and gas), nuclear and renewables. • Add 2 GW of domestic and international renewables capacity (especially offshore wind and hydro) by 2030.	Yes	[106–108]
Tokyo Electric Power Company (TEPCO)			○	• Expand overseas power generation. • Pursue decarbonisation through high-efficiency thermal power (including coal and gas), nuclear and renewables. • Add 6–7 GW of combined domestic/international renewables capacity (especially offshore wind and hydro).	Yes	[101,109, 110].
Chubu Electric Power Company			○	• Expand overseas power generation. • Pursue decarbonisation through high-efficiency thermal power (including coal and gas), nuclear and renewables. • Add 2 GW of domestic and international renewables capacity by around 2030.	Yes	[111–113]

Notes.
●Black circles represent upstream businesses (coal mining) and white circles downstream businesses (coal-fired power plants).
●Upstream divestment is considered only for *J-Power*, which is the sole utility with significant upstream investments.
●Generation capacity refers to portion owned. E.g., 50% ownership of a 2 GW facility would represent 1 GW of assets.
●For *J-Power* and *TEPCO*, descriptions of divestment strategies are also based on interviews.

4.3. Plant equipment manufacturers

4.3.1. Role

The three companies[6] listed in Table 4 play a key role in Japan's coal power industry by supplying and installing equipment such as turbines, boilers and generators. *Mitsubishi Hitachi Power Systems* (henceforth *MHPS*) and *Toshiba Plant Systems and Services* (henceforth *Toshiba*) also provide engineering, procurement and construction services for CFPP development. Each can thus oversee a plant's entire lifecycle from design and site preparation to construction, test-firing and maintenance. While less profitable than new construction, manufacturers also generate income by retrofitting existing plants with air-pollution control devices and by providing maintenance services (e.g. replacing worn equipment). Plant equipment portfolios are broad, ranging from nuclear and hydro, to coal and gas. With nuclear sales declining after Fukushima, thermal-power equipment has provided an increasingly important share of revenue. For MHPS, for example, coal will provide around 60% of thermal power sales over 2017–20, peaking at around US$ 6.85 billion in 2019 [114]. While manufacturers have historically prospered by focusing on domestic markets, they are aggressively seeking to expand overseas businesses as new domestic construction opportunities are projected to decline (int. 21).

4.3.2. Extent of divestment

None of the three manufacturers have unveiled an explicit strategy to shift business models away from coal. All three have enjoyed large profits from an overseas boom of equipment sales and construction contracts over several years leading up to 2017. Since then, however, profits in thermal power have sharply decreased as new construction opportunities have decreased. This has necessitated restructuring and downsizing of personnel (int. 14,21). Marketing departments have been reduced and new hires for thermal power have been frozen, while existing factory workers are being retrained and moved to other production lines.

Interviews (int. 14,21) and public statements reveal that manufacturers are acutely cognisant that the good times are over and the global thermal electricity market as a whole—even if increasing in certain countries—will continue to contract. *Mitsubishi Heavy Industries,* the parent company of *MHPS,* cites industry data that predicts a global shrinkage of new annual additions in CFPP capacity from around 90 GW in 2015 to 10 GW for 2019, and then around half this after 2025 [114]. Similarly, annual additions of gas power are predicted to drop globally from 60 GW in 2015 to around 35 GW in 2025 before rising back to 2015 levels afterwards. Since large CPFF projects require around 3–4 years of factory and construction work, the full brunt of this situation is not expected until after 2021. While the economic implications of this shrinking market are understood, firms are still committed to maintaining business activities in this area and to seeking new projects in Asia, the Middle East and Africa, [114,115]. In June 2018, the President of *Mitsubishi Heavy Industries* told shareholders: 'From hereon, our on-hand (factory) jobs are going to rapidly disappear. So during the next one, two or three years we have to somehow secure as many coal and gas-fired power projects from around the world as possible. If we don't, after around 2021 our work will start dropping off' [116]. Manufacturers are also looking to minimise the adverse impacts of reduced opportunities for new construction by expanding services for maintenance and retrofitting air-pollution control and higher-efficiency boilers in existing CFPPs [117,118]. Thus, they continue to maintain R&D programmes focused on the commercialisation of next-generation technologies such as coal gasification, advanced ultra-supercritical, and carbon capture [11]. This is despite widespread awareness that diffusion potential is highly limited due to prohibitive costs—not just overseas, but even at home (int. 4,9,14).

4.3.3. Drivers and barriers

While commercial, institutional and structural factors are hampering divestment in this industry, structural issues appear the most significant.

[6] Both Mitsubishi Hitachi Power Systems and Toshiba Plant Systems and Services are the subsidiaries of parent companies Mitsubishi Heavy Industries and Hitachi, and Toshiba.

Table 4
Extent of coal divestment trends in plant equipment manufacturers.

	Complete	Partial	None	Current strategy aims to:	New CFPP construction allowed?	Main official sources
Mitsubishi Hitachi Power Systems (MHPS)			○	• Continue efforts to sell high-efficiency thermal power technology domestically and internationally (especially Asia and Africa by utilising government export finance mechanisms) while also providing maintenance and retrofitting. • Decarbonise coal power via high-efficiency and emerging technologies such as Integrated Coal Gasification Combined Cycle (IGCC). • Continue developing and deploying zero-carbon technologies such as nuclear and renewables (e.g. offshore wind and geothermal) and carbon capture.	Yes	[114,116, 117,119]
Toshiba Plant Systems and Services (Toshiba)			○	• Continue efforts to sell high-efficiency thermal power technology domestically and internationally while also providing maintenance and retrofitting. • Decarbonise coal power via high-efficiency and emerging technologies such as Advanced Ultra-Supercritical (A-USC) and carbon capture. • Develop and deploy zero-carbon technologies such as nuclear, renewables (hydro, solar, geothermal, biomass etc.) and hydrogen.	Yes	[120,121]
IHI			○	• Continue efforts to sell high-efficiency thermal power technology domestically and internationally while also providing maintenance and retrofitting. • Decarbonise coal power via through high-efficiency, biomass and co-firing of coal and biomass. • Develop and commercialise emerging technologies such as ammonia combustion and production of syngas and hydrogen (from coal and biomass).	Yes	[115,118, 122]

Notes.
●White circles represent downstream businesses (coal-fired power plants).
●Analysis for *Mitsubishi Hitachi Power Systems* and *Toshiba Plant Systems and Services* also extends to parent companies *Mitsubishi Heavy Industries* and *Toshiba.*
●Divestment strategies for all three firms are also based on interviews.

Much like large electric utilities, equipment manufacturers have amassed formidable technological expertise in coal-fired electricity. However, they lack international competitiveness in manufacturing renewable energy equipment such as photovoltaic panels and wind turbines (int. 9). Reflecting on the company's past decision to abandon solar energy, one manufacturer (int. 14) conceded: 'I don't know if this is the right expression, but we disposed our renewables business a long-time ago'. Therefore, for Japanese equipment manufacturers to be globally competitive in the large-scale renewables market, much like utilities, they need to acquire the expertise of overseas competitors through takeovers or joint ventures. *MHI* has notably achieved this by launching a collaborative venture *MHI Vestas Offshore Wind* in 2014 with Danish global leader *Vesta.* This operates independently, however, to MHPS.

Linked to this is the second issue of commercial barriers. An industry analyst (int. 9) emphasised that Japanese manufacturers are increasingly wary of risks associated with such merger strategies. This is primarily due to the abundance of specialised players in the global market and declining profits for these incumbents owing to plummeting wholesale prices of renewable electricity. This informant explained that although coal-electricity projects are increasingly scarce, the lack of specialised overseas competitors and higher profits relative to renewables meant that Japanese manufacturers still perceived a strong commercial incentive to continue pursuing CFPP contracts.

Third, institutional factors are also at play. Indeed, the complete abandonment of historical thermal power business models would necessitate dismantling factory production lines and either laying off or moving workers *en masse* to other operations such as gas power. *MHPS* is noticeably starting to reduce personnel in thermal plant manufacturing by freezing new hires, retraining and shifting to growth areas like fuel-cells [117]. Yet laying off large numbers of workers while publicly acknowledging the need to forsake coal-related business models appears culturally difficult for all firms. This is largely because domestic corporations prefer to avoid retrenching workers due to the widespread norm of providing lifetime employment. Reflecting on the lack of more aggressive efforts to reduce dependence on coal power in Japan's plant equipment manufacturing industry, the above analyst (int. 9) emphasised a 'detachment from reality' and argued: 'even faced head-on with a crisis, clearly, they are doing nothing (…) It's not as if Siemens was doing much coal-fired power, yet even they decided to change course.'

4.4. Financial institutions

4.4.1. Roles

Private banks and insurance firms in Table 5 support the overseas coal market by providing finance to companies carrying out coal-related businesses. Financing support takes two forms: 1) *loans*: either by *(i)* directly providing credit or *(ii)* underwriting share/bond issues to raise equity; or 2) *investments*: by purchasing shares/bonds [16]. The three 'megabanks" listed (i.e. *Mitsubishi UFJ, Mizuho* and *Sumitomo Mitsui Financial Group*) have reportedly provided around US$ 4.9 billion, US$ 4.3 billion and US$ 502 million respectively to companies with upstream and downstream projects (both domestically and internationally) over the four-year period 2015–18. While NGO divestment campaigns generally target both financing and investment activities, loan support outweighs investments roughly by a factor of ten (see Supplementary Material). The lion's share (around 93%) of financing is directed downstream to support CFPP construction. Japan's megabanks also support renewable energy projects. *Mitsubishi UFJ, Mizuho* and *Sumitomo Mitsui Financial Group* financed some US$ 44 billion of renewables projects over the period 2008–2017 [123]. Insurance firms are also targeted by divestment campaigners but do not typically engage in project financing. Their role is mainly limited to investments in companies with coal-related businesses via bonds, securities and shares (though the scale of these investments is inferior to banks).

Alongside the private sector, government finance[7] also plays a central role [14,124]. As mentioned, the construction of large-scale CFPPs requires several billion dollars of capital. Since this exceeds the risk capacity for private banks alone, the bulk of financing to overseas CFPP construction is provided by the *Japan Bank for International Cooperation*

[7] Although interviews and document analysis also targeted the three government financial institutions supporting coal exports, (i.e. *Japan Bank for International Cooperation* [JICA], *Nippon Export Insurance* [NEXI] and *Japan International Cooperation Agency* [JBIC]), these are not examined in this section. This is due to our focus on private market actors and the absence of divestment strategies in government institutions.

Table 5
Extent of coal divestment trends in private financial institutions.

	Complete	Partial	None	Current commitment to:	New CFPP construction allowed?	Main official sources
Megabanks						
Mitsubishi UFJ (MUFG)		○●		• Refrain from financing new coal power generation projects. Exceptions may be granted when considering the policies and circumstances of host countries, international guidelines such as the OECD Arrangement on Officially Supported Export Credits (which permit ultra-supercritical in most countries), and the suitability of other technologies. • Support high-efficiency coal power generation and carbon capture. • Refrain from financing mining projects using mountaintop removal techniques. For other coal mining projects, consider environmental, social and health impacts when investigating finance.	Yes	[128]
Mizuho		○	●	• Consider the economic feasibility of other lower emission technologies when considering financing or investment in any CO2 emitting energy project.	Yes	[129]
Sumitomo Mitsui Financial Group (SMFG)		○	●	• Limit finance to ultra-supercritical projects or higher regardless of country or region. • Finance other CPFF projects less efficient than ultra-supercritical if approved by the Japanese government or if located in countries suffering severe lack of access to electricity. • Support carbon capture.	Yes	[130]
Life insurance firms						
Nihon Seimei Life Insurance (Nippon Life Insurance)		○	●	• Refrain from financing and investing in all kinds of new CFPP projects domestically and internationally. • Support carbon capture.	No	None
Meiji Yasuda Life Insurance		○	●	• In principle, refrain from providing project finance for new CFPPs domestically or internationally as of October 2018. • Limit any new CFPP finance to domestic plants using USC technology. • Suspend new loans and investments to companies with coal power generation.	Only domestic	None

Notes.
●Black circles represent upstream financing (coal mining) and white circles downstream (coal-fired power plants).
●For *Mitsubishi UFJ, Mizuho* and *Meiji Yasuda Life Insurance,* descriptions of divestment strategies are also based on interviews.
●For *Nihon Seimei Life Insurance and Meiji Yasuda Life Insurance*, rules on coal-related financing were also sourced from media or third part reports [e.g. [131, 132].

(JBIC). In addition, *Nippon Export Insurance (NEXI)* provides loan guarantees to projects in countries with uncertain political conditions, while the *Japan Agency for International Cooperation* (*JICA*) provides financing via loans and grants through overseas development assistance.

4.4.2. Extent of divestment

Beginning downstream, in late 2018 Japanese private banks and insurance firms responded to increasing pressures from domestic and international NGOs to cease financial support to coal by clarifying and disclosing their financing policies. In May 2019, *Mitsubishi UFJ* tightened its policy by pledging to refrain from financing new CFPP development. Policies from the other two banks (announced in 2018) simply restrict financing 'in principle' to projects using high-efficiency technology (i.e. ultra-supercritical etc.); a stance which mirrors Japanese government policy (i.e. the *Fifth Basic Energy Strategy* [50]) and OECD rules [125].[8] Policies from all three megabanks include exceptions and thus still allow new construction. Meanwhile, Japan's two largest private life insurance firms have pledged to cease financing all types of overseas CFPPs. No policy from either banks or insurance firms listed in Table 5 forbids the continuation of current investments in coal-related businesses or projects.

For the megabanks, the effect of polices to curtail new construction activity is uncertain (int. 9). If limiting financing as stipulated to ultra-supercritical technology or higher, this would disqualify many less-efficient plants (e.g. supercritical) that Japanese banks have previously supported [126]. However, CFPP development takes several years and many projects were under planning when policies were formulated. Indeed, banks are already exempting such projects from investment rules. For instance, all three are collaborating with the general trading company *Sumitomo* and the Japanese government to finance construction of the aforementioned *Van Phong 1* in Vietnam, which uses low-efficiency supercritical technology [127].

Finally, no policy forbids upstream financing (except mountaintop removal projects by *Mitsubishi UFJ*). Although in theory this leaves the door open for supporting new investments in coking or thermal coal mines, credit and underwriting opportunities for new upstream development will likely be limited in coming years. This is principally due to a market-wide shift away from thermal coal (int. 6,11,20) as visible in the already discussed policies of trading houses, which forbid the acquisition of new thermal assets.

4.4.3. Drivers and barriers

As in the other three industries, commercial factors have heavily influenced the behaviour of financial institutions, most particularly by hampering more ambitious divestment strategies. Banks have a distinct commercial interest to continue financing CFPPs given that such investments are lucrative and generally secure (int. 6,18). The profitability of overseas CFPP projects is typically assured by long-term power purchase agreements. As mentioned, these typically extend for 15–30 years, well beyond the standard 5–7 years required to recuperate initial capital expenditures. For this reason, multiple financial industry respondents (int. 5,6,16) rejected the idea that their underwritten CFPPs might become 'stranded assets'.

At the same time, institutional factors also explain behaviour in this industry—both as drivers and barriers. In terms of drivers, the clarification of coal financing policies by private financial institutions reflects a broader international shift toward transparency on climate-related

[8] The OECD *Arrangement on Officially Supported Export Credits* (agreed in 2015 and enacted in January 2017) forbids the financing of projects with less than ultra-supercritical efficiency unless specific host country conditions are met. For example, conditions include host countries with eligibility for International Development Assistance (IDA), low electrification rates, and geographically isolated conditions such as remote islands.

risks, such as the Task Force on Climate-related Financial Disclosures noted above (int. 16,18). Moreover, concerns about 'reputation risk' and the effect of domestic and international divestment campaigns on public sentiment surfaced across multiple interviews (int. 9,16,18,19). Concretly, finance industry representatives expressed concern about how their practices were perceived by the public since their business models depend on deposits entrusted by individual account holders.

Conversely, while sensitivity to anti-coal norms in society appear to be driving improved transparency around coal financing, in parallel, institutional factors are seemingly hampering the ability to deny financing to some projects. The first issue concerns the inertia of the long-term planning process for CFPPs. A megabank respondent (int. 16) explained that since the development of new, large-scale CFPPs unfolds over several years, denying finance to a particular project at the end of the planning cycle would be 'a betrayal' to that company if the relevant policy had not been publicly disclosed well beforehand. A second issue concerns national institutions. Indeed, banks are in the uncomfortable position where not only would tightening rules to ban coal financing run counter to current government policy, it could potentially damage relationships with large corporate customers and prospects for future underwriting opportunities (int. 9,18,22). Seemingly, in the absence of government leadership, private and government banks are unlikely to further tighten policies to rule out support for all types of coal power (e.g. ultra-supercritical projects, which are supported under government policy). This is because financial institutions strongly perceive the support of business activities for Japanese industry as a core responsibility (int. 9,19,22). This is especially so for *Mitsubishi UFJ* and *Sumitomo Mitsui Financial Group*. Both these banks reside within larger families formed by *Sumitomo Corporation* and *Mitsubishi Corporation*. In this sense, by providing financial support to companies with coal-related businesses, banks are largely responding to demands from clients such as plant equipment manufacturers and general trading companies (int. 18). A respondent explained (int. 9): 'If we refuse one project, we don't know the effect this would have on future dealings (with that customer) (…) Until national government policy bans all types of coal-fired power (construction), we have a responsibility to fully support the needs of (Japanese) corporations'.

5. Discussion

The preceding analysis reveals the varying degrees to which divestment is occurring in the four chief industries comprising Japan's international coal market. With no industry or firm completely exiting from coal-related businesses, findings reveal slowing momentum—but not a stoppage—for upstream and downstream investment activity. As expected, commercial, institutional and structural factors are influencing divestment trends in each industry differently.

5.1. The upstream market

Partial divestment was observed upstream. Four of the five general trading companies have unveiled policies prohibiting new thermal coal investments. This is a significant development given that Japan's trading companies have historically supplied coal to domestic utilities and industry, particularly by investing directly in upstream extraction offshore. Additionally, several like *Mitsubishi* have already disposed of existing assets, with others like *Mitsui* pledging to do so when market opportunities arise. This said, although the trading companies are concentrating investments in coking coal, all will continue involvement in the thermal market. This will occur by maintaining existing thermal stakes, by selling thermal coal by-products from coking mines and by trading thermal coal sourced from those still in the business. Moreover, no financial institutions have unveiled explicit intentions to reduce financial flows to the upstream market beyond a withdrawal of support for mountaintop removal methods.

Findings indicated that the partial divestment observed upstream is largely driven by commercial factors. In particular, massive losses incurred from plummeting thermal coal prices between 2014 and 16 have provided firms with sound commercial incentives to shift investment priorities from thermal to coking coal. This state-of-affairs is likely to continue given the lack of market ready, low-carbon alternative fuels for steel making and the projected growth of steel demand in Asia. Conversely, findings did not reveal evidence of upstream divestment polices driven primarily by normative considerations. This corresponds with a global analysis of coal mining policies in major producing nations such as the US, Australia and China [42].

5.2. The downstream market

Partial divestment among general trading companies and financial institutions was widely observed regarding CFPP development. Yet, in most cases, policies include exemptions for projects observing OECD rules or Japanese government policy (which promotes construction with ultra-supercritical technology). Also, their effect on preventing new construction for projects under planning over the last few years appears limited since financing and ground-breaking has occurred even after policies were tightened. Meanwhile, policies from utilities and equipment manufacturers have signalled no ambitions to reduce CFPP construction. Thus, although the market forces propelling Japan's coal-fired power export agenda are weakening, there is insufficient evidence to suggest that new construction will completely cease. Moreover, all policies permit the holding of existing assets.

In terms of downstream drivers, interestingly, the empirical evidence highlighted the potential influence of global norms. This is particularly visible for financial institutions, but also for general trading companies. For example, multiple financial institutions expressed sensitivity to the possibility of anti-coal norms strengthening amongst domestic customers. Since the global institutional environment around coal investments is clearly beginning to impact investment behaviour in Japan's finance industry and general trading houses, it is feasible that these institutional influences may strengthen in the future. While this trend provides empirical support for observations that anti-fossil fuel norms can diffuse through institutional and international networks [33,63,64], it is notable how these external, moral pressures are yet to trigger divestment strategies within the utilities and equipment manufacturers (presumably for reasons discussed below).

The empirics identify three barriers hampering more exhaustive coal divestment downstream. The first is commercial and concerns the widely observed long-term power purchase agreements and capacity payment arrangements between independent power producers and host country utilities. By guaranteeing a steady and predictable income for a period extending well beyond that required to recuperate capital, these commercial arrangements provide a compelling financial incentive to delay the disposal of CFPP assets. Furthermore, investing utilities and trading companies are generally *expected* to maintain such assets until the expiry of purchase agreements. Given this, it is not surprising that no industry respondents raised concerns that CFPPs constructed under Japan's export agenda might become 'stranded', as others have suggested [23,24,26]. The effect, evidently, is that these agreements are locking-in carbon-intense baseload power for the next 15–30 years while also imposing unnecessary power generation costs on host country governments when renewables costs fall below coal [21,133].

Second, institutional factors help to explain why existing policies do not forbid new construction in the banking industry. As respondents explained, there is a reluctance to formulate tighter coal financing policies due to concerns over running counter to government policies and state export credit agencies that support high-efficiency coal power. Since banks are expected to support corporate and government activities, concerns were raised that opposition to all forms of CFPPs might damage future financing opportunities for non-coal projects with government or corporate clients (int. 9,18). Thus, not only are institutional contexts influencing the behaviour of business actors [67,68], findings

also demonstrate how government policy and norms around expected roles and missions of firms can limit the degree to which particularly divergent decarbonisation paths can be pursued [10,75,134].

Third, consistent with the literature on path dependency and lock-in [81,82], structural factors are also acting as a barrier. This was most evident in the equipment manufacturing industry, where aggressive strategies to reduce business model dependency on coal power are notably absent. Not only do profits in this industry depend on winning new contracts to 'keep the production lines turning' (int. 1), these firms also lack expertise and global competitiveness in manufacturing and installing large-scale renewables equipment, such as wind turbines and solar panels. Given the widely acknowledged projections that export opportunities for thermal power equipment will decline significantly in coming years, Japan's plant equipment manufacturers are faced with a pressing need to create strengths in emerging renewable markets, most probably by partnering with overseas giants already leading the field.

6. Conclusion and policy implications

This paper examined the behaviour of Japanese firms engaged in the overseas coal market to assess the extent to which divestment is occurring. It expands the conventional interpretations of 'divestment' to examine investment and decarbonisation strategies in four key industries with either upstream (coal mining) or downstream (CFPP development) businesses. Results point to a slowdown, but not a complete stoppage, of coal-related activities. In the upstream market, many existing investments in coking coal, thermal coal and CFPPs will remain active for the foreseeable future. In the downstream market, in the absence of government regulation, coal power investments look set to continue for at least the next decade and beyond due to company policies and long-term power purchase agreements.

Consistent with the existing literature on coal and fossil fuel divestment, the analysis of private actors in the international coal market reinforces the difficulty of reducing coal consumption in line with the temperature targets of the Paris Agreement. It reveals that significant private (and public) investments from Japanese firms continue to sustain the global coal market. Yet, in doing so, it highlights that these investments cannot be explained by economic reasoning alone (i.e. the cost superiority of coal power). Previous studies have emphasised upstream factors such as the presence of mining communities, which understandably can oppose policy measures to reduce coal extraction or consumption [39–41]. Yet what is unappreciated in this literature—but significant in our study—is that downstream factors are also significant. Specifically, the business model dependency of plant equipment manufacturers and utilities on coal power technologies, combined with their lack of expertise in large-scale renewables deployment are barriers to transitioning the energy sector in Japan. Such structural obstacles for carbon-intensive industries are widely acknowledged in literature on path-dependency and lock-in [77,79,135]. Yet divestment discourse that emphasises the need for a 'just transition' in mining communities [136,137] might also consider the economic and employment implications of phasing-out coal for large manufacturing firms and utilities, which have built historically prosperous business models from this market.

As well as contributing to existing scholarship, the analysis has two central policy implications for the upstream market. The first concerns Japan's energy security. Strategically down-scaling thermal coal investments runs counter to the current government policy of offering incentives to industry to encourage new mine development, which enhance Japan's energy security. It also transforms historical, symbiotic relationships between domestic trading companies and utilities. With fewer trading companies investing upstream, utilities are now forced to negotiate coal purchase contracts with other countries entering the thermal coal market. Given that trading companies perceive significant commercial risks from this market transformation, a sounder strategy for bolstering energy security would be to reduce domestic *demand* for coal, instead of trying to secure a stable *supply* via new upstream investments.

Second, the reluctance of trading companies to sell-off coking coal investments points to a pressing global challenge of leveraging government policy to hasten a transition in the steel-sector to alternative zero-carbon energies (e.g. hydrogen and synthetic gas) before new investments are sunk into upstream extraction and downstream steel mills using conventional technology. Given the expectations around coking coal as a sound investment relative to thermal coal amongst general trading companies, it appears unlikely that coking investments will be reduced in the near-term. This is particularly so given the technological and cost challenges associated with alternative fuels and the absence of tighter lending rules for coal mining.

In the downstream coal market, three further policy recommendations flow from the analysis. First, it is difficult to foresee a complete cessation of financing to CFPPs without the government and the OECD taking the lead. This is because the data reveal a high level of sensitivity and conformity in banks and general trading companies around Japanese government policy and OECD rules, which both allow export of CFPPs using ultra-supercritical technology.

Second, government leadership is required to steer Japan's historically accumulated heavy engineering expertise towards growth areas like renewables and hydrogen and away from the dependence on thermal power. A notable precedent here is the current government-lead vision (called *xEV*) of guiding Japan's automotive manufacturers to produce electrified or emission-free passenger vehicles by 2050 [138]. Introducing a similar roadmap for industry to accelerate the transition beyond coal power would evidently require a reversal of the many policies promoting high-efficiency coal power in both the short- and long-term. In addition, significant structural barriers would also require tackling. These are most salient amongst utilities and equipment manufacturer where companies are unable to easily abandon their historical strengths in coal power and radically restructure human resources and factory assembly lines. In contrast, trading firms appear the best-suited to increasing renewable energy investments by virtue of their highly diversified business portfolios and a role that is principally limited to investment in CFPP construction.

Third, and finally, there is a need to reform the commercial divestment barriers related to the long-term power purchase agreements and capacity payments in host countries. Not only do these economic incentives promote new investments by shielding CFPPs from becoming 'stranded', they also potentially lock-out alternative low-carbon sources during that period. Reforming commercial arrangements via existing international frameworks such as the OECD Arrangement on Officially Supported Export Credits could thus help to minimise the extent of locked-in carbon emissions and air pollution by reducing the attractiveness of new coal power projects for funders and investors.

Author contributions section

GT designed the study, collected and analysed data, and wrote the manuscript. CD assisted with study design, data analysis and drafting of the manuscript. KH and JA also helped to design the study and refine the manuscript.

Declaration of competing interest

The authors declare no conflict of interests.

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Appendix A

Details of interviews (n=23).

Organisation	No. of respondents	Date
Electric utilities		
JERA	1	January 18, 2018
J-Power	1	November 12, 2018
Tokyo Electric Power Company (TEPCO)	3	November 26, 2018
Plant equipment manufacturers		
Toshiba Energy Systems	3	May 14, 2018
IHI	1	January 16, 2019
Mitsubishi Hitachi Power Systems (MHPS)	1	December 19, 2018
Export credit agencies (government)		
Japan Bank for International Development (JBIC)	2	June 5, 2018
Japan International Cooperation Agency (JICA)	2	November 27, 2018
Nippon Export and Investment Insurance (NEXI)	3	January 15, 2019
Financial institutions (banks/insurance firms)		
Mizuho	1	January 16, 2019
Mitsubishi UFJ	4	February 05, 2019
Meji Yasuda Life Insurance	1	December 13, 2018
General trading companies		
Mitsubishi	2	December 10, 2018
Mitsui	5	November 19, 2018
Marubeni	4	November 20, 2018
Industry organisations		
Keidanren (Japan Business Federation)	2	December 18, 2017
Japan Coal Energy Centre (JCOAL)	7	February 6, 2018
Government		
Japan, Oil, Gas and Metals National Corporation (JOGMEC)	4	March 8, 2018
Research institutions (NGO/university/thinktanks)		
Japan Centre for a Sustainable Environment and Society (JACSES)	1	December 25, 2017
National Resources Defence Council (NRDC)	1	January 30, 2018
Greenpeace Japan	2	March 22, 2019
University of Tokyo (Graduate School of Public Policy)	1	February 5, 2018
The Japan Research Institute (Nihon Sohken)	1	December 11, 2018
Total	53	

Appendix B. Supplementary data

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