Bilateral finance organizations and stranded asset risk in coal: the case of Japan

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Abstract

We evaluate the treatment of climate-related financial risk by bilateral finance organizations and related policymaking bodies involved in the design and implementation of thermal coal power generation technology financing. Our empirical focus is Japanese bilateral financing of thermal coal power generation in the Asia-Pacific. We differentiate between three approaches that organizations can adopt to assess climate change risk. In the first, the organization assesses climate risk and includes consideration of stranded asset risk. In the second, the organization assesses climate risk but does not take into account stranded asset risk. In the third, an organization does not explicitly consider climate risk although it may use alternative criteria for deciding whether to support an investment, such as the broader environmental implications of a proposed project. We review publicly available documents from nine organizations, supplemented by interviews, and find that while some Japanese lending and policy-setting bodies take climate risk into account, none are required to consider the risk that infrastructure investments may become stranded. Our paper contributes to the study of stranded asset risk in two ways. First, while export finance plays a crucial role in thermal coal power plant investments in the Asia-Pacific region, lending by bilateral finance institutions has not been a focus of such research to date. Second, we extend research into stranded asset risk to bilateral finance organizations and related policy bodies. Our approach can be adopted to understand how finance decision-making bodies in other geographic contexts and technology-types assess the risk that assets may become stranded.

Key Policy Insights

- Bilateral finance organizations are important in infrastructure exports for thermal coal power plant technologies.

- Japanese bilateral finance organizations and policy bodies take climate risk into account when making lending decisions for thermal coal power plant technologies, but until recently have not explicitly addressed stranded asset risk.

- Impairments to the asset value may be incurred by the asset holders or the government. This risk should be taken into consideration in investment decisions.

1. Introduction

Reducing the likelihood of catastrophic climate change requires a rapid reduction in greenhouse gas (GHG) emissions (UNEP, 2019). A substantial share of the necessary GHG emissions reductions must come from reducing demand in the energy sector. Despite the remarkable increase in the installed capacity of renewable energy technologies in the power sector in many countries, global carbon dioxide emissions related to energy use continue to increase, growing from 23.1 $GtCO_2$ in 2000–33.5 $GtCO_2$ in 2020 (IEA, 2021).

One strategy for reducing energy emissions is restricting investments in GHG-intensive facilities, such as coal mines and thermal coal-fired power plants. There is an increasing interest in 'supply side policies' that could advance a low-carbon energy transition by restricting investment in fossil fuel related infrastructure, including the mining and production of fossil fuels upstream, and power production technologies (Green & Denniss, 2018; Lazarus & Van Asselt, 2018).

Supply side policies can increase stranded assets, defined as those 'that have suffered from unanticipated or premature write-downs, devaluations, or conversion to liabilities' (Caldecott, 2017; Caldecott et al., 2013, p. 7). Considerable work has been done on climate-related financial risk, and stranded asset risk therein (Caldecott, 2017; Dietz et al., 2016), including assessments about how stranded asset risk is managed by private sector actors (Johnson et al., 2020; Linnenluecke et al., 2015). Yet there are few assessments of how bilateral finance organizations (BFOs), or public decision-makers, treat stranded asset risk in decision-making.

Accordingly, we evaluate the treatment of climate risk by BFOs and related bodies involved in the design and implementation of thermal coal power generation technology financing. We focus on the case of Japan. Historically, Japanese public finance for coal projects in other countries has dwarfed that of any other OECD country, including the United States, South Korea, Germany and France (Bast et al., 2015), and its financial support for coal outweighs that provided to international renewable energy projects (Chen & Schmidt, 2017). The Japan Bank for International Cooperation (JBIC) and the Japan International Cooperation Agency (JICA), for example, committed US$13 billion to coal projects between 2000 and 2018 (Chen et al., 2021).

Our empirical focus is on thermal coal power generation-related lending in the Asia-Pacific. The Asia-Pacific region is crucial to climate change mitigation; between 2006 and 2019 the Asia-Pacific recorded 1,318 GW (92.7 percent) of thermal coal power additions, against 104 GW in the rest of the world (EndCoal, 2021). A large number of thermal coal generation plants continue to be built in Southeast Asia, threatening global climate mitigation goals (Clark et al., 2020). An analysis of the ten largest utilities in Southeast Asia found that 90.7 percent of current and planned fossil fuel generation is inconsistent with a 1.5°C pathway, and 26.6 percent is incompatible with a 2°C pathway, after accounting for national carbon budgets (Caldecott et al., 2018).

We use qualitative content analysis methods (QCA) to assess how BFOs and policy bodies assess climate change related financial risk. We differentiate between three approaches. In the first, public finance institutions and related policy bodies include an assessment of climate risk, and

also explicitly address the risk that projects may become stranded. In the second, public finance institutions and related policy bodies assess climate risk, but do not explicitly take into account stranded asset risk. In the third, public finance institutions and policy bodies do not explicitly consider climate risk, although they may use alternative criteria for deciding whether to support an investment, such as the domestic fiscal, or broader environmental implications of a proposed project.

If assets become stranded, which is plausible given the multi-decadal lifespan of a typical thermal coal power plant, this may undermine the developmental goals underpinning support by BFOs. Yet the documentary evidence we review suggests that while Japanese lending and policy-setting bodies take climate change and other forms of risk into account, none appear to be formally required to consider the risk that infrastructure investments may become stranded.

Our paper contributes to the study of stranded asset risk in two ways. First, while export finance plays a crucial role in thermal coal power plant investments in the Asia-Pacific region, lending by BFOs has not been a strong focus of research to date. Second, we extend research into stranded asset risk to examine whether and how public finance lending organizations and policy bodies assess stranded asset risk. Our approach can be adopted to understand how similar decision-making bodies in other geographic contexts assess the risk that asset investments may become stranded.

2. Material and methods

2.1. Climate risk and stranded assets

Climate-related financial risks are commonly classified as physical risks or transitional risks (Colas et al., 2019; ESRB, 2016; Goldstein et al., 2019; PRA, 2015). Physical risks arise from the direct effects of a changing climate, including increased frequency and severity of floods, storms and bushfires, or longer term changes, such as sea-level rise (ESRB, 2016; PRA, 2015; TCFD, 2017). Transition risks are associated with the transition to a low carbon economy and include policy, legal, technology and market changes resulting from mitigation and adaptation to climate change (TCFD, 2017). The removal of fossil fuel subsidies, climate litigation, and falling technology costs, are examples of transition risk.

Stranded asset risk is a sub-set of climate-related transition risks, referring to the possibility that the value or profitability of assets exposed to climate change could fall due to the implementation of more stringent environmental policies and regulations (Caldecott, 2017). The potential value of stranded assets is large. Among the G20 countries, the value of stranded assets in the power sector between 2015 and 2050 created by the turnover of capital stock of fossil fuel power generation has been assessed at US$927 billion, with thermal coal power plant assets representing approximately 75 percent of the total (Saygin et al., 2019). An assessment of the macroeconomic impact of stranded fossil fuel assets globally found a discounted loss of wealth of between 1 and 4 trillion USD (in 2016 USD), over the period 2016–2035, a loss similar to the global financial crisis in 2008 (Mercure et al., 2018).

Research examines how stranded asset risk is being managed by private actors. Proposals have been made, for example, for institutional investors to play a role in stress-testing capital expenditures in order to ensure that they produce returns under a 2°C mitigation scenario (Robins, 2014). Barriers to the consideration of stranded asset risk include insufficient time horizons in investment decisions, the difficulty of coordinating among large numbers of investors, risk methodologies, and the culture and incentive structures within the investment community (Kruitwagen et al., 2019; Silver, 2017; Thomä & Chenet, 2017). Decisions to take a loss on an asset are also linked to a variety of causes, making it difficult to assess which assets have already become stranded due to climate change; yet this link has been made in the case of mining conglomerate Rio Tinto (Linnenluecke et al., 2015).

The majority of research on stranded assets focuses on fossil fuel reserves in crude oil, coal, and natural gas (Saygin et al., 2019). A smaller number of studies address the power sector. Caldecott et al. (2015, p. 8), for example, focus on 5-, 10- and 15-year closure scenarios and subcritical coal technologies, noting that the Inter- national Energy Agency (IEA) calculates 290 GW of subcritical coal generation needed to be shut globally by 2020 in order to keep global GHG emissions at a level that is consistent with a 2°C warming scenario. Farfan and Breyer (2017) carry out a plant-by-plant analysis of fossil fuel power plants globally, while Pfeiffer et al. (2016) calculate committed emissions from global thermal coal power plants against 1.5 and 2°C warming goals, finding that 51–58 percent of all plants operating, planned and under construction would become stranded. Caldecott et al. (2016) analyze the scale of potential stranded coal assets in Japan (existing and planned coal-fired power stations) over 5-, 10-, and 15-year periods. They find that stranded coal assets could be equivalent to 4.5-5.9 percent of total assets of Japan's power utilities.

2.2. The role of bilateral finance organizations

There is a growing interest in policies that could advance a clean energy transition by restricting investment in fossil fuel related infrastructure, such as coal mines and power plants (Erikson et al., 2018; Green & Denniss, 2018). One set of supply side policies is the restriction of public financing for fossil fuels (Lazarus & Van Asselt, 2018). BFOs are an important source of public financing, as funding for coal power generation from multilateral lending bodies has decreased, and commercial bodies committing to divestment from fossil fuels has increased from 180 in 2014 to more than 500 in 2016 (Baruya, 2017). Between 2007 and 2014, export credit agencies from OECD countries provided US$34.17 billion of public financing for coal; Chinese and Russian public finance provided an additional US$16.82 billion in this period while multilateral development banks provided US$15.77 billion (Bast et al., 2015, p. 18).

There is increasing interest in the lending practices of BFOs. Chen and Schmidt (2017) find that public financing by G20 countries continues to focus on fossil fuels. In the Asia-Pacific, Gallagher and Qi (2018) show that Chinese public financing continues to invest in fossil fuels. Son et al. (2019) analyse Japanese public finance specifically, noting that it is the only G7 country actively supporting the construction of thermal coal plants internationally. In terms of climate risk, Dunlop et al. (2019) find that lending practices at six key development banks in the Asia-Pacific are not aligned with the Paris Agreement. Monasterolo et al. (2018) apply a climate-stress

test to overseas assets financed by two Chinese policy banks, finding substantial potential losses associated with climate policy risk. De Angelis (2018) argues that OECD public financing bodies should phase out all lending to coal generation, regardless of technology.

A reason for focusing on BFOs is the rationale for lending. A justification for lending is that it meets the economic development needs of recipient countries. Yet if an asset is stranded, this has the potential to realize losses for the asset owner, with implications for development outcomes. It is thus reasonable for stranded asset risk to be considered when assessing the implications of fossil fuel project development for recipient country development.

We extend existing research on public finance of fossil fuel assets by examining the treatment of climate risk by Japanese public organizations involved in thermal coal power generation technology exports in the Asia- Pacific. Japan is an important lender in the region. Between 2010 and 2019, Japan provided US$2.98 billion (inflation adjusted from 2019) of overseas development finance to coal-fired power generation in the Asia- Pacific, representing 18.5 percent of total assistance provided in the energy sector (OECD, 2021). As Figure 1 shows, from 2009–2020 Japanese public lending bodies lent funds, or insured lending, in support of thermal coal power generation projects in Bangladesh, India, Indonesia and Vietnam, with a combined total of approximately 22 GW of capacity.

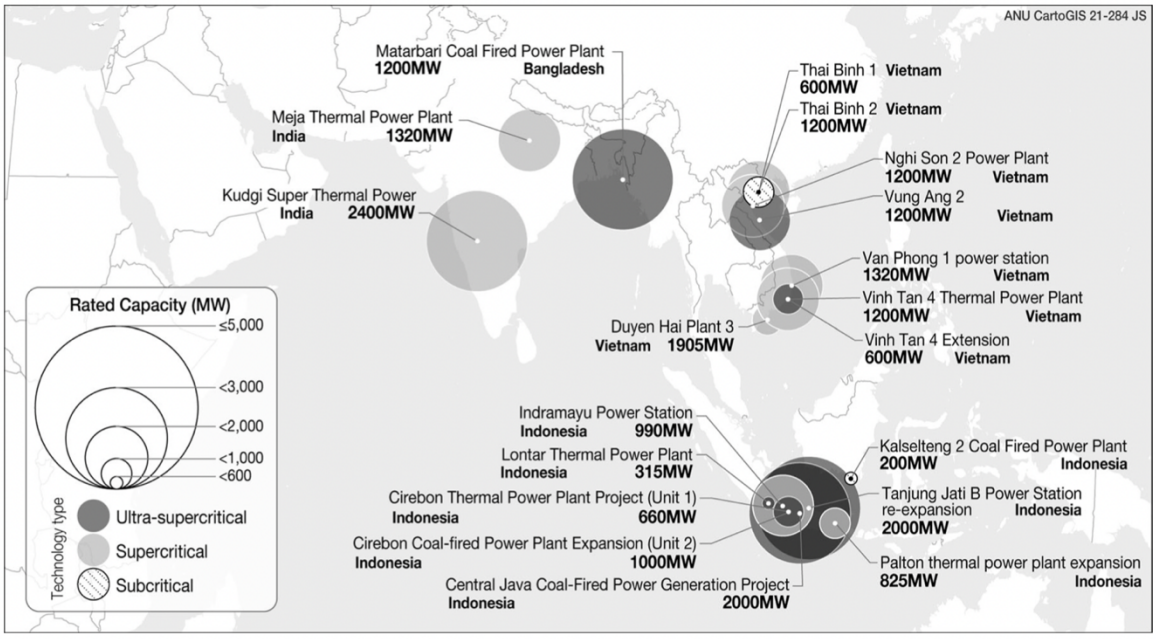

Figure 1. Japan-sponsored Coal Power Generation Projects, by Location, Output, and Technology.[2]

2.3. Methods

We utilize Qualitative Content Analysis (QCA) methods, centred on thematic analysis. Thematic analysis is an inductive method used to identify themes extracted from textual data (Guest et al., 2012). We use documents issued by government organizations responsible for public financing

of coal-fired power generation infrastructure in the Asia-Pacific region. We examine nine organizations involved in technology research and development and policy development, including the Japan Bank for International Cooperation (JBIC), Japan International Cooperation Agency (JICA), and Nippon Export and Import Insurance (NEXI).

We apply purposive sampling to select documents used to analyze how organizations involved in Japan's bilateral financing of coal technology treat stranded asset risk, choosing those that describe an organization's approach to climate risk relevant to lending for coal-fired power generation infrastructure, and environmental risk within project assessments, such as foundational laws, mission and policy statements that establish criteria used in lending decisions, and reports of these criteria included in annual reports or statements in policy pro- cesses. Where a document is submitted in a process requiring cabinet or legislative approval, we treat it as expressing the position of the drafting organization.

We code the treatment of climate-related policy risk into three categories (see Table 1). The first considers climate-related risks, including the specific sub-set of stranded asset risks within transition risk. The second approach also considers climate-related risks, but does not consider the specific sub-set of stranded asset risks. And in the third approach, climate risk is not incorporated in assessment of environmental risk, although the organization may take into account other forms of risk associated with an investment. In addition, we interviewed 11 people across a number of offices and organizations responsible for designing and implementing policy. Nine of the respondents were from government agencies and two were from civil society. Interviews were semi-structured and conducted in person, were between 30 and 45 min in length, and were carried out in either English or Japanese. We interviewed the 11 people in 5 interview sessions in 2019. Questions were designed to probe the function of the office or organization in finance policy design and implementation, the criteria used to determine finance decisions, and the role of climate change in conditioning those decisions.

Table 1. Criteria for categorizing treatment of climate risk.

Climate & stranded asset risk inclusion	Climate risk incorporated in assessment of environmental risk, including the specific sub-set of stranded asset risks. e.g. project assessment criteria require consideration of the policy, regulatory and legal risks due to climate change that impact the value of investments.
Climate risk inclusion; stranded asset risk exclusion	Climate risk incorporated in assessment of environmental risk. Stranded asset risk not incorporated in assessing climate risk. e.g. climate risk assessed; calculated using marginal improvement in greenhouse gas emissions relative to baseline technology.
Climate risk exclusion	Climate risk not incorporated in assessment of environmental risk. Organization may take into account other forms of risk associated with investment. e.g. technology risk assessments; financial assessment, but no inclusion of climate risk.

3. Results

Organizations are categorized into those directly involved in lending and insuring thermal coal power generation technology, government bodies that develop policy guidance, and those that carry out research and development (Figure 2). Financing bodies support thermal coal power technology internationally, but the policies that inform the approach taken by these bodies are created by the Japanese Cabinet, ministries, and institutes involved in research and development. This reflects the fact that thermal coal power generation technology is embedded in Japan's infrastructure export strategy (Trencher et al., 2019). We adopt a broad approach to evaluating whether the major public organizations involved in coal technology financing internationally

collectively assess climate risk and stranded asset risk, although we do not expect every public organization that plays a role in thermal coal technology exports to take climate risk or stranded asset risk into account.

3.1. Bilateral finance organizations

Three Japanese public financing bodies support thermal coal-fired power generation projects in the Asia- Pacific: the Japan Bank for International Cooperation (JBIC), the Japan International Cooperation Agency (JICA), and Nippon Export Import Insurance (NEXI).

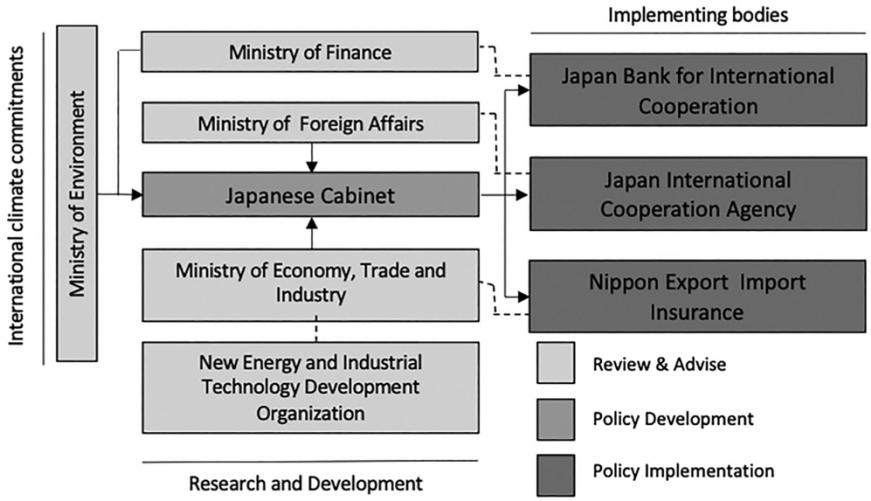

Figure 2. Japan's Thermal Coal Technology Export Regime.

3.2. Japan Bank of International Cooperation (JBIC)

JBIC's organizational mission is to 'contribute to the sound development of Japan and the international economy and society' through promoting the international development of natural resources used in Japan, promoting the competitiveness of Japanese industry, helping private sector activities internationally in support of the global environment, and preventing financial disruption. (JBIC, 2020a). As part of this mandate, JBIC provided loans and guarantees of approximately US$69 billion in the energy sector between 2008 and 2018, which included crude oil, natural gas, coal, iron ore, copper, and other mineral resources (JBIC, 2019).

Article 1 of the Act establishing JBIC states its purpose is to 'promote the overseas business having the purpose of preserving the global environment, such as preventing global warming' (JBIC, 2018, p. 2). JBIC's Infrastructure and Environment Finance Group, which plays an important role in thermal coal power plant financing aims to support government policy by increasing the 'international competitiveness of Japanese companies by promoting the export of high-quality infrastructure contributing to global environmental protection backed by Japan's advanced technology' (JBIC, 2018, p. 28).

JBIC produces the 'Guidelines for Confirmation of Environmental and Social Considerations' to guide project proponents in considering environmental risk. JBIC assesses whether projects comply with environmental laws in the recipient country and meet World Bank Environmental, Health, and Safety Guidelines, and compliance can be required as a condition of funding (JBIC, 2015). Projects classified as having higher risk face more stringent assessment. The guidelines note that transboundary and global environmental problems should be assessed, and that GHG emissions can be included in this assessment.

For thermal power projects, JBIC implements an Environmental Checklist, which includes five criteria to be reviewed: 1) permits and approvals; 2) anti-pollution measures; 3) natural environment; 4) social environment; 5) other. For thermal coal power generation, the checklist requires an assessment of coal quality. It also states that 'if necessary, the impacts to transboundary or global issues should be confirmed (including the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, and global warming' (JBIC, 2013, p. 5).

Reviewed documents do not appear to require an assessment of stranded asset risk. JBIC addressed the issue directly during hearings on Japan's coal technology export strategy implemented by the Ministry of Environment. Officials noted JBIC confirms that projects are aligned with the recipient government's energy policy prior to lending decisions. JBIC further noted that loan repayments for thermal coal plant projects are typically supported by recipient governments, meaning the risk to JBIC from early plant retirement is low (JBIC, 2020b, p. 11).

3.3. Japan International Cooperation Agency (JICA)

JICA's organizational mission, outlined in the Act that founded the agency, is to support economic and social development and economic stability in developing countries. JICA provides technical assistance, financing and investment, and grant aid. It assesses projects across the life-cycle, applying criteria drawn from the OECD's Development Assistance Committee (DAC) Evaluation criteria to rate projects across a four point scale (JICA, 2019).

JICA addresses the problem of climate change in relation to lending in the energy sector. In a 2013 position paper on energy, JICA identifies its role as improving energy access by promoting renewable energy, while ensuring coal and gas-related investments are through high efficiency and lower emissions technologies under the agencies 'Low Cost, Low-Carbon, Low-Risk' policy (JICA, 2013, p. 3). JICA's position paper on climate change notes climate risk is required to be assessed in supporting economic development, emphasizing the need to ensure high efficiency thermal coal, while investing in reducing transmission losses and other measures (JICA, 2016, pp. 2–4). It also recognizes the need to take into account physical risks associated with climate change and assist in capacity building in national climate planning in developing countries. JICA's pos- ition on the United Nations Sustainable Development Goals (SDGs) 7 ('energy access') and 13 ('climate change') similarly address climate risk, recognizing the need to limit CO_2 emissions by investing in higher efficiency thermal coal generation and energy efficiency measures, while improving climate planning.

Documents detailing JICA's post-assessment of project performance that suggest the transition risk – that an asset will be stranded – are not required for new projects. The authors' review of documentation provided for new thermal power projects supported by JICA between 2000 and 2020 do not document assessments of CO_2 emissions, although measurements were collected for sulfur dioxide, hydrocarbons, dust, nitrogen dioxide, and noise levels. Two projects focused on the rehabilitation of existing thermal facilities reported CO_2 abatement relative to the technology being replaced. The specific issue of stranded asset risk was referenced by JICA in 2020 during the hearings implemented by Japan's Ministry of Environment. When asked whether the agency takes into account the risk that coal-related investments will be stranded, the agency stated that all lending activities are assessed according to whether the project is appropriate given the operational plans of the recipient, and the project is likely to be completed as planned. This suggests some consideration of stranded asset risk, although the response did not identify a specific policy or rule that required such an assessment is carried out (JICA, 2020).

3.4. Nippon Export Import Insurance (NEXI)

NEXI provides risk insurance in international transactions (Government of Japan, 1950), including the reinsurance of liabilities incurred by entities supplying insurance. Japan's Minister of Economy, Trade, and Industry has the authority to determine the criteria for underwriting international trade insurance and reinsurance for NEXI, and business plans for NEXI must also be approved by the minister under the law establishing the organization.

NEXI's activities extend to the power sector, where it insures lenders against commercial and political risks associated with power investments. The Guidelines for Consideration of Environment and Society in Trade Insurance determines how environmental risks are considered (NEXI, 2017). Under NEXI rules, environmental risks are managed by the entity implementing a project, with NEXI assessing risk against these guidelines. Following review, NEXI may recommend improved environmental management as a result of its assessment, or may choose not to insure. Projects are categorized into three groups, with Group A identified as those with the potential for complex or high environmental impacts. Thermal coal plants are included in this group.

NEXI provides a checklist that requires developers to identify categories of harm, including atmospheric pollution. NEXI's general environmental checklist does not include CO_2, but does includes SO_2, NO_2, CO, O_2, particulates, and mineral dust and fine particles. The environmental checklist for thermal power plants notes coal quality should be checked, and that where necessary assessment should be made of transboundary and global environmental problems, identifying transboundary waste, acid rain, ozone pollution, and global climate change. For thermal power plants, the checklist also asks developers to consider whether measures are in place to reduce GHG emissions from the project. Thus, similarly to JBIC and JICA, key documents reviewed do not include a review of stranded asset risk.

3.5. Government ministries and administrative agencies

Taken together, this suggests JBIC, JICA, and NEXI take climate risk into account in project implementation, but they appear not to require the assessment of stranded asset risk therein. Evidence from JBIC suggests one reason is that transition risks such as stranded asset risk is judged to be small due to the commitment to pro- jects by governments in recipient countries.

International agreements also regulate the financing of coal power generation, centred on the OECD Arrangement on Officially Supported Export Credits, to which Japan is a signatory (Baruya, 2017). Within inter- national frameworks, the Japanese cabinet and Japan's ministries and agencies also determine the policies under which Japan's BFOs operate. It is thus also important to examine the treatment of stranded asset risk by these organizations.

3.6. Cabinet

Japan's mid-term energy policy settings are established in the Basic Energy Strategy (BES), passed by Cabinet every three years. The July 2018 BES notes four principles governing support for thermal coal power internationally: 1) it should be limited to countries that have no choice but to select coal due to energy security or economics; 2) the recipient country requests higher efficiency coal technologies; 3) it is consistent with partner countries' energy and climate policies; 4) in principle, support will only be provided for Ultrasuper Critical (USC) technologies or above (Government of Japan, 2018). A second policy underpinning Japan's support for infrastructure investment internationally, including in the power sector, is the Infrastructure System Export Strategy. The strategy was first released by the Japanese Cabinet in 2013, and identified a goal of exporting 30 trillion yen of infrastructure systems in 2020 (Yoshimatsu, 2017). The 2020 update of the strategy commits the government to support the export of higher efficiency coal generation technologies, consistent with OECD rules, based on increased energy demand, if aligned with recipient countries' energy policies and climate change goals (Government of Japan, 2020, p. 42).

3.7. Ministry of Economy, Trade and Industry (METI)

METI is responsible for promoting economic growth and external economic relations, and policymaking in the energy sector. A summary of the infrastructure export strategy for the energy sector presented to Cabinet in October 2017 notes that Japanese companies face stagnant electricity demand domestically and competition is growing in the markets for power generation technologies in the Asia-Pacific, but that Japanese manufacturers retain a competitive advantage in USC power generation technologies. The proposed approach is to secure Integrated Gasification Combined Cycle (IGCC) projects to drive costs down, and increase competitive- ness through the sale of USC systems using financing available through JBIC, and JICA, and NEXI. Key risks identified are opposition among developed countries led by the European Union, some opposition in developing countries, and restrictions on coal financing. The proposed response is to engage in public communications emphasizing the benefits of coal technologies, centred on South East Asia (METI, 2017).

METI also addressed the issue of financing thermal coal technology power plants internationally through a report released in November 2020 in preparation for a revised infrastructure export

strategy. The document states that in addition to renewable energy deployment, the continued use of fossil fuels is required to meet rapid growth in electricity demand. In addition, it notes that stopping support for thermal coal generation may lead to the construction of less efficient technologies unbound by OECD rules. Given this, the appropriate response is identified as continuing with financing consistent with the four principles outlined in the Basic Energy Strategy (METI, 2020, pp. 21–22).

Stranded asset risk is not directly addressed in the energy infrastructure export review. Instead, it notes high quality infrastructure is needed given an increased risk of disasters and resource and energy constraints. It also notes the presence of risk from sales and price volatility, currency risk in the power sector, country risk, and risks from new technology (METI, 2020, p. 17). In relation to thermal coal power plants specifically, the report notes that OECD member states are bound to limit financial support for less efficient technology, but the same

constraints do not exist for emerging economies involved in export financing. This implies that if Japan stopped financing coal power plant technologies internationally, emerging economies could step in to fill finance gap leading to worse environmental outcomes (METI, 2020, p. 17, 21). It also implies a range of risks associated with infrastructure exports in the energy sector, including climate risk, but proposes that climate outcomes would be worsened by ceasing to support thermal coal projects in the Asia-Pacific. Documents reviewed did not specifically identify stranded asset risk.

3.8. New Energy and Industrial Technology Development Organization (NEDO)

NEDO is an independent administrative agency that promotes the research and development of new energy technologies, with METI setting the direction of research. In 2019, NEDO had a budget of US$1.43 billion and an estimated staff of one thousand (NEDO, 2019a).

NEDO enters into agreements with international counterparts focused on information sharing, joint research, and technology demonstration. For related coal power plant technology, in addition to research and development, NEDO implements feasibility studies and demonstration projects internationally ‘in an attempt to encourage widespread adoption of these technologies’ (NEDO, 2019b, p. 24), and NEDO ‘can help to determine the feasibility of different technologies’ (Interview 2019).

The guidelines for the NEDO programme supporting the deployment of coal plant related technologies require monitoring, reporting, and verification of GHG reductions achieved via project implementation. Sup- ported projects are also required to align with international rules, including on coal financing (NEDO, 2021, pp. 2–3). A review of NEDO-led feasibility studies show the inclusion of financial evaluations that consider the internal rate of return for projects, financial risks from fuel price and a five percent variation in the mean load factor through sensitivity analyses. Documents identified showed no assessment that considered substantial variation in the operating life of the plant, or larger variation in the load factor, as might be expected should the project be stranded (NEDO, 2016, 2017, 2018).

3.9. Ministry of Environment (MOE)

The MOE is responsible for domestic and international environmental issues. Under the Basic Environment Law the MOE must 'promote policies for environmental conservation', including global warming. The law requires the MOE to establish a Basic Environmental Plan. The Cabinet approved the fifth Basic Environment Plan in April 2018, which acknowledges the adoption of the UN SDGs and the Paris Agreement (MOE, 2018).

Addressing climate change is central to the MOE's mission. It has no formal role in decision-making on inter- national coal projects, however, and does not provide environmental impact assessments for projects in partner countries (Interview, 2019). Officially, the MOE supports the provision of public finance for the export of Japanese technologies that reduce emissions in partner countries (MOE, 2018).

The tension between coal power generation technology financing and the MOE's organizational responsibility for Japan's international commitments under the Paris Agreement emerged in 2020. In February 2020, the environment minister announced MOE would review the conditions associated with export finance for coal fired power plants, as part of the new Infrastructure System Export Strategy (Nippon.com, 2020). The minister made clear that the review aimed to tighten restrictions on lending to take account of climate related risks (Obayashi, 2020).

The minister established the Expert Fact Gathering Committee on Public Support for Thermal Coal Export in April 2020. The committee reviewed the four principles placed on Japanese thermal coal power technologies noted above, in preparation for the review of the national infrastructure export strategy (MOE, 2020b). The final report of the expert committee addressed transition risk, and explicitly stranded asset risk, stating that assessments of project risks should adopt a long-term perspective that includes consideration of decarbonization, changes in the composition of energy supply, and emerging business and financial risk (MOE, 2020c).

3.10. Ministry of Foreign Affairs (MOFA)

MOFA is responsible for managing diplomatic relations and promoting the interests of Japan internationally. It coordinates official development assistance (ODA) in pursuit of this goal. The Minister of Foreign Affairs has a supervisory role over JICA operations.

MOFA notes its diplomatic role in the energy sector given the importance of energy supply to Japan (MOFA, 2020a, p. 289). MOFA's ODA Charter notes Japan's role in supporting economic infrastructure under- pinning developing countries' chosen development strategies (MOFA, 2003). MOFA also states ODA has an important role in the Infrastructure System Export Strategy to support development and promote the international expansion of Japanese companies (MOFA, 2020a, p. 236). MOFA has appointed 200 personnel in 96 diplomatic missions who 'gather and consolidate information on infrastructure projects' (MOFA, 2020a, p. 285).

MOFA addresses climate-related risks, noting that Japan is actively engaged in international efforts to combat GHG emissions (MOFA, 2020a). The 2019 White Paper on Development Cooperation notes Japan's support for transferring Japanese low carbon technologies as a response to climate change (MOFA, 2020b, p. 73). The reviewed documents do not, however, note consideration of stranded asset risk, which is consistent with the ODA Charter's formal emphasis on meeting the self-determined needs of recipient countries.

3.11. Ministry of Finance (MOF)

Japan's MOF plays a role in the implementation of policy lending to thermal coal facilities through its super- visory role over the lending practices of Japan's BFOs. MOF supervises the activities of JBIC under the JBIC Act, for example, and the Minister of Finance has the right to request changes to budgets. JBIC is also required to submit its balance sheet and list of assets to the Minister of Finance for review, and the Minister of Finance also oversees financial assistance under the law establishing JICA.

MOF developed criteria for assessing yen-based loans associated with infrastructure exports following agreement by governments to the 2016 G7 Ise-Shima Principles for Promoting Quality Infrastructure Investment, including an overall assessment of life-cycle costs, project quality, sustainability, whether projects are aligned with the development and economic strategies of recipient countries, in addition to other factors.

In technology specific measures, the criteria note the requirement for a generating efficiency of at least 40 percent, stating this enables fuel saving and a reduction in GHG emissions, relative to subcritical power plans (MOF, 2017). Thus, relevant technology-specific guidelines assess the criteria against an alternative technology baseline that is more emissions intensive. More generally, MOF co-signed the Japanese government statement on the Ise-Shima Principles, which notes the importance of ensuring the ongoing financial strength of Japan's BFOs in order to expand the supply of financing.

4. Discussion

Research shows that substantial coal-fired power generating capacity will become stranded if internationally agreed climate targets are met (Pfeiffer et al., 2016). Yet the documents reviewed here suggest that stranded asset risk has not been systematically incorporated into lending decisions by Japan's BFOs and related policy bodies have supported the development of coal power plans in the Asia-Pacific region.

Japan also has an infrastructure export strategy that incorporates coal power technology exports. One reason stranded asset risk is not included may be that investors in the power sector in Southeast Asia may not adequately incorporate climate risk when making investment decisions because of established routines, a bias towards large-scale investments and financial governance mechanisms (Johnson et al., 2020). Demand for thermal coal power generation in India, Indonesia, Vietnam, and Bangladesh is also supported by domestic policy settings that prioritize economic growth (Gallagher et al., 2021). A justification for bilateral lending for thermal coal

technology is that it meets the developmental goals of recipient countries. If those countries deter- mine that a proposed project is consistent with development goals, this limits the rationale for BFOs to incorporate stranded asset risk into lending decisions.

There is some evidence that stranded asset risk has increased in visibility (MOE, 2020c). Nevertheless, without the adequate consideration of this risk into investment decisions, such as through incorporation in project-level feasibility studies, it is possible that long-run developmental benefits may not be accurately assessed. If an asset is owned by a local utility, for example, then expected or realized losses from an asset being stranded may be passed onto households via higher electricity tariffs. Related, Barney and Souksakoun (2021) find that lending by Chinese BFOs in Lao PDR, principally in hydroelectric power, have led to large liabilities for the state-owned power utility Électricité du Laos, with negative implications for national developmental goals.

5. Conclusions

BFOs play an important role in supporting investment in thermal coal power generation projects in the Asia- Pacific region. We assessed the treatment of climate risk, and stranded asset risk therein, by Japanese organizations involved in thermal coal power generation-related infrastructure exports. From the sample of documents used in the analysis, we find that stranded asset risk appears largely unaddressed. Our findings complement those of Johnson et al. (2020) and Gallagher et al. (2021), which find climate risks more generally are not significant as a factor in decision-making concerning investments in the power sector amongst governments and private investments in the Asia-Pacific region.

The findings are based on a review of publicly-available primary documents, selected using a purposive sampling method, from nine organizations., which was supplemented by interviews with a number of government officials. However, there are potential limitations to this approach. First, it is possible that findings are biased by the documentary evidence reviewed. A second possibility not captured through our approach is the propensity for policy change. In 2020 the president of JBIC stated that the bank would not finance new thermal coal generation projects, although a JBIC spokesperson later stated formal government policy had not changed (Sheldrick, 2020). The Infrastructure Export Strategy, released by the Japanese government in July 2020 which continues to allow for coal technology exports, suggests a narrowing window under which Japan's public BFOs will lend to support coal power generation investments (Government of Japan, 2020, p. 41), a change repeated in a government statement following the G7 agreement to stop lending to unabated coal power projects (Obayashi, 2021). It is thus important to continue to track BFO and related policy bodies' approaches to addressing stranded asset risk, not only in Japan but also China, South Korea, and other lenders.

A second issue is identifying what factors affect change. In announcing a review of the conditions around the financing of coal fired power plants in 2020, Japan's Minister of Environment noted mounting global criticism of Japan's approach to coal power plant technology exports (Obayashi, 2020). Of particular interest is whether the spread of anti-fossil

fuel norms affects the policy approach taken towards supporting coal plant technologies internationally (Green, 2018).

In addition, a number of Japanese project developers have placed limits on investments in new thermal coal power generation projects (MOE, 2020a). The analysis here can be complemented by examining how domestic lenders, developers, and technology providers manage stranded asset risk, and the implications for the approaches BFOs adopt.

Notes

1. Calculated using public sector, public-private partnerships, and private sector institutions for 2010–2019 for Bhutan, Myanmar, Sri Lanka, India, Maldives, Nepal, Pakistan, Bangladesh, Brunei Darussalam, Cambodia, China, Taiwan, Hong Kong, Indonesia, North Korea, South Korea, Macau, Malaysia, Mongolia, the Philippines, Singapore, Thailand, Timor-Leste, and Vietnam.
2. Data on plants, included rated capacity, from End Coal Finance Tracker. For methodological notes see: https://endcoal.org/ finance-tracker/. Technology type and location from Global Energy monitor. Data cross-checked using Global Energy Monitor, and organisation press releases where available. Figure created by Australian National University CartoGIS.

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Appendix: Primary Documents Used in Coding Treatment of Climate Risk

Organization	Document
Japan Bank for International Cooperation (JBIC)	GOVERNMENT OF JAPAN. 2011. Japan Bank for International Cooperation Act [Dokuritsu gyosei hojin kokusai kyoryoku kiko ho]. Tokyo: Government of Japan.
	JBIC. 2013. Environmental Checklist: 12. Thermal Power. Tokyo: Japan Bank for International Cooperation.
	JBIC. 2015. Japan Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Considerations. Tokyo: Japan Bank for International Cooperation.
	JBIC. 2019. JBIC Annual Report 2019 [JBIC Nenji Hokoku 2019]. Tokyo: Japan Bank for International Cooperation.
	JBIC. 2020. JBIC Profile: Role and Function. Tokyo: Japan Bank for International Cooperation.
	JBIC. 2020. Submission to expert committee on coal generation [Sekitan karyoku yushikisha fakuto kentokai you shiryou]. April. Tokyo: Japan Bank for International Cooperation.
Japan International Cooperation Agency (JICA)	GOVERNMENT OF JAPAN. 2002. Act of the Incorporated Administrative Agency-Japan International Cooperation Agency.
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	JICA. 2016. Position Paper on Climate Change [Kiko hendo taisaku bunya pojishon pepa]. Tokyo: Japan International Cooperation Agency.
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	JICA. JICA's Approach for Achieving [SDG] Goal 7 [Goru 7 no tassei ni muketa JICA no torikumi hoshin]. Tokyo: Japan International Cooperation Agency.
	JICA. 2010. JICA Environmental and social consideration guidelines [Kokusai kyoryoku kiko: kankyo shakai hairyo gaidorain]. April. Tokyo: Japan International Cooperation Agency.
	JICA. 2020. Document 1-3: Explanatory Material for Expert Fact Committee [Shiryo 1-3: yushikisha fakuto kentokai go setsumei shiryo]. Tokyo: Japan International Cooperation Agency.
Nippon Export Import Insurance (NEXI)	GOVERNMENT OF JAPAN. 1950. International Trade and Investment Insurance Act.
	NEXI. 2017. Guidelines for Consideration of Environment and Society in Trade Insurance [Boeki hoken ni okeru kankyo shakai hairyo no tame no gaidorain]. April. Tokyo: Nippon Export Import Insurance.
	NEXI. Environmental Checklist: Thermal Power (I) [Kankyo chekku risuto: 12, karyoku hatsuden (I)]. Tokyo: Nippon Export Import Insurance.
National Cabinet	GOVERNMENT OF JAPAN. 2018. Infrastructure System Export Strategy (FY2018 Revision) [Infura shisutemu yushutu senryaku (Heisei 30-nendo kaiteiban)]. 7 June. Tokyo: Government of Japan.
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	GOVERNMENT OF JAPAN, G7 Ise-Shima Summit 'Expanded Partnership for Quality Infrastructure'. Tokyo: Government of Japan.
Ministry of Economy, Trade and Industry (METI)	METI. 2017. Overseas Expansion Strategy (Electricity) [Kaigai tenkai senryaku (denryoku)]. November. Tokyo: Ministry of Economy, Trade and Industry.
	GOVERNMENT OF JAPAN. 2018. Basic Energy Strategy [Enerugii kihon keikaku]. Tokyo: Government of Japan.
	METI. 2020. METI Infrastructure Overseas Export Expert Committee Final Report [Keizai sangyo sho infura kaigai tenkai kondankai: saishu torimatome]. November. Tokyo: Ministry of Economy, Trade and Industry.
Ministry of Environment (MOE)	MOE. 2018. The Basic Environment Plan. Tokyo: Ministry of Environment.
	MOE. 2019. The Long-term Strategy under the Paris Agreement. Tokyo: Ministry of Environment.
	MOE. 2020. Document 2: Proposed Fact Book on Public Support for Thermal Coal Power Exports (Draft) [Shiryo 2: Sekitan karyoku hatsuden yushutu e no koteki shien ni kan suru fakutoshu (an)]. April. Tokyo: Ministry of the Environment.
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	MOE. 1993. The Basic Environment Law. Tokyo: Government of Japan.

Organization	Document
Ministry of Foreign Affairs (MOFA)	MOFA. 2003. Official Development Assistance Charter. Tokyo: Ministry of Foreign Affairs. MOFA. 2018. Annual Report on Japan's ODA Evaluation 2018. Tokyo: Ministry of Foreign Affairs. MOFA. 2020. Diplomatic Bluebook 2019: Japanese Diplomacy and International Situation 2018. Tokyo: Ministry of Foreign Affairs.
Ministry of Finance (MOF)	MOF. 2017. Basic Position on High-Quality Lending [Hai-supekku shakkan no kihonteki na kangaekata nit suite]. Tokyo: Ministry of Finance.
New Energy Development Organization (NEDO)	GOVERNMENT OF JAPAN. 2002. Act on the New Energy and Industrial Technology Development Organization.Tokyo: Government of Japan. NEDO. 2016. Feasibility Study for High Efficiency Environmentally Responsible Urban Thermal Coal Power Project in India [Indo ni okeru shigaichi taiogata/kankyo hairyogata kokoritsu sekitan karyoku hatsudensho purojekuto no anken keisei chosa hokokusho]. Tokyo: New Energy and Industrial Technology Development Organisation. NEDO. 2017. FY2016-2017 Final Report: IPP Project Survey for USC Coal Power in Bangladesh, [Banguradeshu kokku ni okeru chocho rinkaiatsu sekitan karyoku IPP purojekuto anken hakkutsu chosa]. Tokyo: New Energy and Industrial Technology Development Organisation. NEDO. 2018. Supplementary Survey for Promoting Coal Power Expansion in Indonesia [Indonejia koku ni okeru suraraya sekitan karyoku kakucho jigyo donyu sokushin no tame no hokyo chosa]. Tokyo: New Energy and Industrial Technology Development Organisation. NEDO. 2019. About NEDO: Background Information. Tokyo: New Energy and Industrial Technology Development Organisation. NEDO. 2019. NEDO's Environmental Technology Activities in 2019. Tokyo: New Energy and Industrial Technology Development Organization. NEDO. 2019. Profile of NEDO. Tokyo: New Energy and Industrial Technology Development Organization. NEDO. 2021. Basic Plan for Promoting the Deployment of Low Carbon Technology Led by the Private Sector [Minkan shudo ni yoru teitanso gijutsu fukyu sokushin jigyo kihon keikaku]. Tokyo: New Energy and Industrial Technology Development Organization.