



Peaceful demonstration in front of Indramayu power plant in West Java. Source: TrendAsia

WASTED

How Japan's Biomass Push in Southeast Asia Lays Waste to Forest, Undermines Climate Progress and Drowns Recipients in Debt

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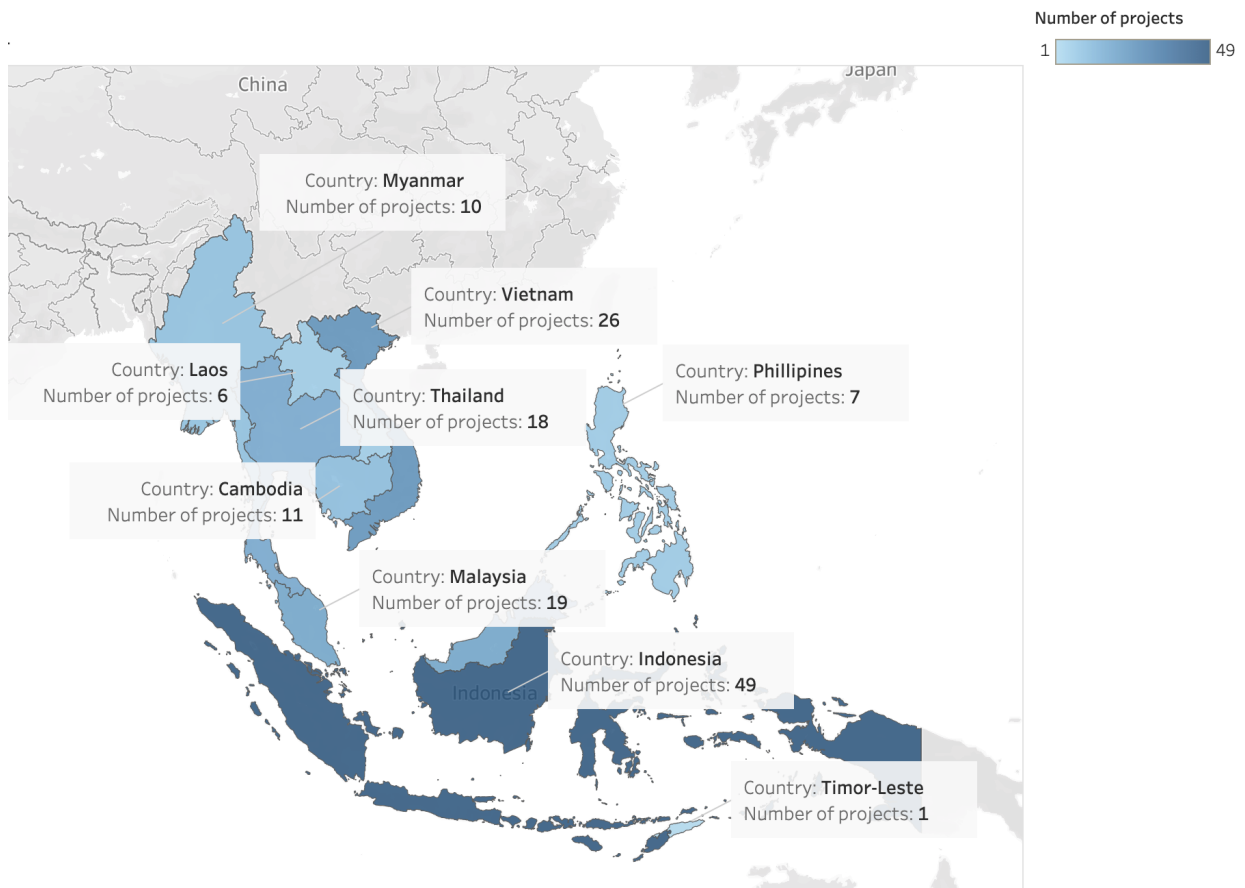
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Japan has made a substantial investment in biomass energy at home and is increasingly expanding investments throughout Southeast Asia. While Japan claims this is a strategy to achieve carbon emission reductions, this is only true on paper. Biomass is not carbon neutral; instead, it creates significant carbon emissions throughout its lifecycle with large variances based on the source of the wood. Co-firing with biomass extends the lives of coal power plants, one of the dirtiest methods of energy production. Biomass cannot scale without significant negative impacts to forest ecosystems, and this threatens global efforts to protect the biodiverse forests of Southeast Asia.

While there has been major international scrutiny of Japan's moves to co-fire fossil fuels with ammonia and hydrogen, burning biomass at coal power plants is happening at a significant scale today, but has received only a fraction of the attention. This strategy of promoting biomass diverts critical resources away from truly low-emissions energy sources such as wind and solar.

Biomass will not help Japan be self-sufficient in the power sector. Japan relies on imported fuels for 84.8% of its energy; the risks of importing energy are [well detailed](#). The associated costs, waste and logistical challenges make biomass importation an unsustainable and non-viable option. This heavy reliance on imports also exposes Japan to significant energy security risks.

By examining more than 130 projects across Southeast Asia, our findings show that these subsidized plants are not the realistic energy transition solutions they claim to be for these countries. When examined at the country level or by individual project, the projects detailed in our [Japan Biomass Collaboration Tracker](#) do not show a benefit for Japan or partner countries. The carbon reductions are not real when total emissions are considered, the supply needed to scale does not exist, increasing supplies creates significant environmental harm, and government subsidies are necessary in perpetuity to sustain these projects.



Map of biomass co-firing projects in Southeast Asia

Japan should not invest in promoting this impractical technology which has harmful environmental impacts on Southeast Asia, including risks to forests.

Biomass is not carbon neutral

Burning biomass appears to reduce emissions on paper, but this effect is misleading due to flawed accounting methodologies. Instead, biomass creates significant carbon emissions and, in reality, extends the life of coal plants.

- Co-firing with biomass is not an emissions abatement technology. Emissions from burning wood to produce electricity are higher than coal emissions due to the moisture content of biomass, which lowers combustion efficiency. Additionally, woody biomass is being used as a means to extend the life of coal-fired power plants.
- Emissions from biomass must be fully accounted for. Biomass is not considered zero emissions under the IPCC, GHG Protocol, SBTi, or other carbon accounting methodologies. Emissions from its full lifecycle must be counted, including stack emissions.

- Biomass creates [carbon debt](#). Carbon debt is the period of time during which emissions in the atmosphere from biomass burning are greater than the carbon new trees can absorb and store. The length of time of carbon debt varies by the source of wood and can range from a decade to centuries. Biomass usage must be limited to feedstocks that result in lower atmospheric emissions in the near-term to contribute to keeping temperature increases below 1.5C.

Biomass will not help Japan meet its climate goals

Currently, Japan's government sees biomass as a means of achieving its commitment to carbon neutrality by 2050, and heavily subsidizes electricity production from biomass. However, the global pushback against biomass is growing. Critics of biomass include [500 scientists who sent a letter](#) to Japan and other countries warning against its use and stating that it's not carbon neutral. Japan is wasting critical time by promoting this dead-end strategy, which will delay investment and expansion of truly low-emissions energy sources like wind and solar while perpetuating coal emissions in Japan and throughout Southeast Asia.

Further, these subsidies are not aligned with Japan's own goals and standards. Comparing biomass subsidies to Japan's global commitments reveals the lack of alignment between a biomass-forward strategy that destroys forests and its climate and biodiversity commitments:

- Japan's commitment to halt and reverse biodiversity loss by 2030 under the [Kunming-Montreal Global Biodiversity Framework](#) at the Convention on Biological Diversity Conference of Parties (COP) in Montreal, December 2022.
- Japan's commitment via the [Glasgow Leaders' Declaration on Forests and Land Use](#) in 2021 where signatories committed to halt and reverse forest loss and land degradation by 2030.
- Japan's reiterated support for both commitments in the [leaders' communique](#) at the 2023 Hiroshima G7 Summit, which added a commitment to identify and eliminate subsidies harmful to biodiversity by 2025.

Japan's pursuit of co-firing strategies, particularly with hydrogen and ammonia, has faced international [scrutiny](#), with the G7 setting clear criteria tied to the Paris Climate Agreement goals. The G7 [communique](#) noted:

"...some countries are exploring the use of low-carbon and renewable hydrogen and its derivatives in the power sector to work towards zero-emission thermal power generation if this can be aligned with a 1.5°C pathway and our collective goal for a fully or predominantly decarbonized power sector by 2035."

If biomass is co-fired in coal power plants in the same manner as hydrogen and ammonia, it should be held to the same standards. As discussions continue, it is imperative that biomass co-firing undergoes the same rigorous evaluation and accountability for lifecycle emissions as hydrogen and ammonia to ensure alignment with global decarbonization objectives.

Japan's strategy has a harmful impact on Southeast Asia

Our research shows a vast and growing number of Japanese projects that promote the production and consumption of biomass fuel and power production in Southeast Asia. Our [Japan Biomass Collaboration Tracker](#) lists these projects; we've currently documented 135 and continue to add to the Tracker as we uncover new ones. Shown in the map above, we found Japan to have major involvement in biomass projects in Indonesia, Vietnam, Thailand and

Though some of Japan's biomass projects in Southeast Asia are funded and executed entirely through private means, the majority are supported by the Japanese national government in some way through policy and regulatory assistance, financing, and the promotion of public-private partnerships.

Policy and Regulatory Assistance

Via the Asia Energy Transition Initiative (AETI), Japan has taken up the task of creating energy transition roadmaps for countries in Southeast Asia. Some private Japanese corporations have also managed to carve out a role for themselves in shaping energy transition policy, such as [Mitsubishi Heavy Industries](#) which has drafted a co-firing policy for Indonesia.

Financing

AETI's accompanying financial support makes co-firing projects an attractive option for developing nations. In addition to AETI's financial support, the Japan Bank for International Cooperation (JBIC) has also been providing huge loans to support biomass-related energy transition projects, and Nippon Export and Investment Insurance (NEXI) and private Japanese financial institutions are involved in accelerating blended finance for energy transition support in ASEAN nations.

Public-Private Partnerships

Many other projects are being supported via initiatives spearheaded by the Japanese national government through official public private partnerships, such as the [Asia Zero Emissions Community \(AZEC\)](#) and the [Asia Green Growth Partnership](#). At the AZEC Public-Private Investment Forum held in March 2023, 26 MOUs were signed between Japan and southeast Asia. At least 7 of those MOUs are [directly related](#) to biomass energy initiatives.

In most instances, large-scale biomass projects are not economically viable without a constant infusion of subsidies. The Japanese government's role in promoting these problematic projects expands biomass production while devastating forests in Indonesia, Vietnam, Thailand and Cambodia and producing harmful carbon emissions.

Country summaries

Indonesia

Indonesian forests have been under significant pressure for years, and cannot keep up with growing biomass demand. With the largest installed power capacity in Southeast Asia, Indonesia has a [history of cooperating with Japan on biomass](#) projects, dating back to the 1980s. Indonesia and Japan's biomass relationship is made up of various funding mechanisms that make biomass projects possible. In early 2020, Indonesia's Ministry of Energy and Mineral Resources (MEMR) and state-owned power company PT Perusahaan Listrik Negara (PT PLN) unveiled a plan to implement biomass co-firing at [52 coal-powered stations nationwide](#). To aid in this transition, Mitsubishi Heavy Industries was tasked with conducting feasibility studies. Meanwhile, the [Just Energy Transition Partnership Indonesia](#) was established by Japan and the United States, aiming to mobilize \$20 billion in public and private financing with co-firing, accounting for 5-10% of annual generation from coal plants over 2030-2050. The Japan Bank for International Cooperation and Nippon Export and Investment Insurance also committed financial support for biomass energy-related projects, but only for those involving Japanese companies.

TrendAsia conducted thorough quantitative [research regarding PT PLN's co-firing initiative](#), revealing that woody biomass fuel production in Indonesia falls short of meeting PT PLN's co-firing goals. With current annual production of wood pellets at less than 1 million metric tons, and much of the waste from palm oil and other agriculture already being shipped overseas to Japan, a large-scale biomass fuel industry would need to be established.

To achieve PLN's ambitions, a 66% increase in forest plantation land would be needed which would likely come at the expense of intact, carbon-rich and carbon-absorbing forests. Even counting biomass emissions at the smokestack as zero, Trend Asia calculated significant lifecycle CO₂ emissions from biomass plantation management, harvesting, production, and distribution. To meet PT PLN's co-firing target, those emissions would range from 7,945,837 and 26,483,498 tons of CO₂ annually. Scaling biomass projects across Indonesia will not be remotely carbon neutral.

Vietnam

Vietnam has a wealth of biomass, and is the second-largest exporter of wood pellets in the world. Wood pellets from Vietnam account for [over half](#) of Japan's total pellet imports. Erex, as well as other Japanese companies, purchase feedstock, operate pellet factories, and are building biomass power generation plants throughout Vietnam. Biomass projects in Vietnam face substantial challenges, particularly with respect to sustainability and economic feasibility. Much of the wood used as pellet feedstock is [not produced sustainably](#) and is the product of deforestation. Sustainably produced pellets are in limited supply, and even these are often the product of [environmentally damaging monoculture plantations](#) that replaced the native forests. Worse still are scandals showing pellets are the product of [fraudulent sustainability certification](#) which would violate even the bare minimum standard of legality mandated as part of Japan's Feed in Tariff ([sustainability criteria](#)).

A biomass technical feasibility co-firing trial is now underway at the Na Duong thermal power plant, with Japanese company Erex Co. Ltd. leading the trial. In addition to the co-firing trial, Erex has [14 other PDP 8-related biomass projects](#) currently underway in Vietnam. In order to fund their Vietnam projects, Erex has received loans from Japan Bank for International Cooperation (JBIC) to the tune of \$15.6 million USD.

In May 2023, the Vietnamese government released the Eighth National Power Development Plan ([PDP 8](#)), laying out the country's new roadmap for energy sector development through 2050. PDP 8 emphasizes wind and solar power, but also utilizes biomass to serve as a co-firing agent at coal power plants. Plants which have been in operation for over 40 years will be required to either switch to biomass or ammonia co-firing, or be shut down. Plants which have been in operation for over 20 years must switch to co-firing biomass or ammonia if and when the use of alternative fuels becomes economically viable.

Vietnam's lax oversight and lack of traceability and transparency puts the country in a position to become a hub for wood harvested under murky circumstances and imported from other parts of Asia. As power companies are mandated to switch to biomass co-firing, Vietnam is prolonging the use of coal and is becoming an unsustainable supplier for the volume of biomass needed both domestically and by Japan.

Thailand

Thailand has yet to develop biomass co-firing at an industrial scale, but recent developments signal that biomass production will expand in the near future. In 2018, a study by the Economic

Research Institute for ASEAN and East Asia (ERIA) states that a possible co-firing solution at the Mae Moh plant will include torrefied wood pellets, regular wood pellets and coal. At this facility, the minimum co-firing ratio would be between [2% and 10%](#).

Japan became involved in Thailand's biomass industry in 2023 when the Ministry of Economy, Trade and Industry (METI) and the Electricity Generating Authority of Thailand (EGAT) signed an MOU regarding the "development of biofuel technology and value chain management for power generation." Although the MOU does not specifically mention the Mae Moh facility, the photo accompanying the [MOU overview](#) suggests that the implementation of co-firing torrefied biomass pellets at the Mae Moh plant is a primary goal.

Co-firing at the lowest ratio under consideration would require approximately 75% of Thailand's total annual production of wood pellets. Co-firing at a higher ratio would require more pellets than the entire nation of Vietnam, the industry leader, currently produces. Co-firing at 10% would require nearly quadrupling the nation's production. Even if it was possible to massively scale pellet production, availability of raw materials would remain an issue. For just the Mae Moh plant alone, co-firing would require between 5% to 26% of Thailand's entire feedstock supply. The lack of existing co-firing projects in Thailand makes the amount of feedstock and pellets needed to produce biomass at scale unrealistically high.

Cambodia

Cambodia has one of the [highest deforestation rates in the world](#), and cannot afford further deforestation caused by increased biomass demand. Outside of Special Economic Zones, Cambodia is far less developed than other Southeast Asian countries. A lack of demand for electricity and profitability issues will challenge biomass-related development for a [project commissioned by Japan NUS](#). In March 2023, an MOU was signed between Nippon Export and Investment Insurance (NEXI) and the Ministry of Mines and Energy (MME) of Cambodia, with a goal to prepare an energy transition roadmap for Cambodia. While Cambodia's roadmap is not yet released, biomass co-firing at coal plants is considered a means to achieve "carbon neutrality" in other countries where Japan has had a hand in preparing these roadmaps. Japan's involvement in developing an energy plan for Cambodia will likely push for biomass production in order to meet Japanese demand.

Cambodia currently has [plans underway](#) to have 73 MW (0.00000628 mega tonnes of oil equivalent or MTOE) of biomass-fueled power capacity installed by 2030. In these plans, feedstock for commercial power generation would largely be restricted to rubber tree plantation residues. Rubber tree plantation and sawmill residues amount to 0.016 MTOE of energy potential; however, these residues are [already being used](#) as fuel for kilns in brick

factories neighboring the plantations. These brick factories are entirely [reliant](#) on the rubber tree plantation residues to fuel their kilns, and repurposing these residues as fuel for power generation at scale would cause significant disruption to local manufacturing and livelihoods; therefore some other fuel source would likely need to be developed. Cambodia's Ministry of Mines and Energy (MME) [recommends fuel tree planting](#), but a concrete plan for implementation has yet to be created. An ongoing UN REDD Program that is researching and providing guidance to develop forest land and timber industries in Cambodia may abet this search. The first phase of this project was managed by the Japanese International Cooperation Agency (JICA); the project is now in its [second phase](#), slated to be completed in 2026. Cambodia's current plans to expand biomass power capacity do not account for the actual available biomaterials needed, making Cambodia's own ambitions circumspect and an infeasible source of significant biomass supply for Japan. Already-high deforestation rates should deter Japan from making Cambodia a new frontier for biomass projects.

Biomass is not the solution

Wood biomass is increasingly being used as a means of extending the life of coal-fired power plants and should not be treated as an emissions abatement technology. Biomass electricity is not considered zero emissions under the IPCC, GHG Protocol, SBTi or other carbon accounting methodologies. Emissions from burning wood to produce electricity are higher than coal due to its lower efficiency. The period of "carbon debt" during which emissions in the atmosphere are greater than new trees can absorb and store carbon varies based on the source of the wood and can range from a decade to centuries.

While dedicated biomass power plants and low-ratio co-firing of wood biomass in coal plants are technologically mature, they have only been adopted in locales where there are substantial ongoing subsidies. The operating costs of biomass power have not fallen over time as they are tied to the price of wood. This suggests that biomass is not an economically feasible means of energy production at scale and not well-suited to developing economies.

The current large number of feasibility studies and projects in southeast Asia are primarily funded and supported through a variety of subsidies and other temporary mechanisms. Many biomass projects, even if successful at the feasibility study level, have been unsuccessful at scale due to supply chain issues. While economies of scale could drive down cost, the necessary fuel supply is not available because fundamentally, low-cost waste does not scale.

Supplies of various forms of biomass from wood are not sufficient to meet projected demand. To meet the ambitious goals set out in these proposals, much more biomass will need to be produced globally. A large-scale increase in biomass production competes with other roles for forests including providing carbon storage and ecosystem services and the manufacture of

various products from pulp to timber to plastic substitutes. This new pressure on biomass fuel stock production comes as forests are under serious threat of being cleared to expand agriculture. Cutting down and burning trees to produce electricity is the least effective use of a valuable resource.

Biomass is simply not a realistic energy option for Japan or for Southeast Asian nations due to significant logistic and technological constraints — not to mention harmful environmental impacts. Ultimately, Mighty Earth recommends excluding co-firing and standalone biomass power projects from multilateral finance tools including transition finance and JETPs. We urge the Japanese government to redirect its investments and efforts away from biomass power technology. Mighty Earth urges Japanese companies to put their efforts into scalable forms of renewable power rather than establishing plantations for wood biomass production in Southeast Asia and building biomass power plants abroad or at home.