Refuse Derived Fuel in Australia: Burning Hazardous Plastic Waste.

Country status report.

November 2024

Toxics Free Australia (TFA) is a not for profit, civil society network working towards pollution reduction, protection of environmental health and environmental justice for all. As the Australian focal point for the International Pollution Elimination Network (IPEN), we are committed to creating a Toxics-Free Future. Toxics Free Australia envisions a world where the food we eat, the products we use and the waste we generate is free from toxic substances and materials that can harm our health and environment. A key campaign of TFA is Zero Waste Australia which promotes Zero Waste and Circular Economy policies and an end to waste incineration. Jane Bremmer is the Chair of TFA and campaign coordinator for the Zero Waste Australia campaign, providing advocacy, referral and support to communities across Australia facing environmental health and justice impacts from industrial and chemical pollution sources.
https://www.toxicsfreeaustralia.org.au/

for a toxics-free future

IPEN is a global network of public interest non-governmental organizations (NGOs) forging a toxics-free future. IPEN is comprised of over 550 NGOs in more than 122 countries. Together we work to ensure that toxic chemicals and metals are no longer produced, used, or disposed of in ways that harm human health and the environment. IPEN and its Participating Organizations have become a leading force in chemicals and waste regulation and are catalyzing an international movement to promote chemicals without harm and an end to the production of the world's most hazardous substances.

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Executive Summary

Australia faces significant challenges ahead as it navigates the commitments it has made to the International High Ambition Coalition to End Plastic Pollution, and other related international chemicals conventions and treaties, where it considers itself a modern international leader upholding human rights, robust environmental protections and industrial standards.

Australia's extractive and fossil fuel based economy, undermines the best intentions and international reputation of Australia, especially when it comes to addressing the global plastic waste crisis whose origins are concretely embedded in the very industry Australia is expanding.

Australia's natural gas reserves are being heavily exploited with one of the worlds largest expansions planned for the Burrup Gas Field in northern Western Australia.

While the Australian government has committed $60 million to building out plastic recycling infrastructure, the extraction and processing of fossil fuels into plastics is set to see massive petrochemical expansions in Australia's Northern Territory.

On the one hand Australia reassures the world and its own people that they are committed to stopping the continued pollution of the marine environment, an end to plastic pollution and a cap on production, yet in reality they are building out more and more petrochemical facilities and investing in false solutions like waste incinerators and Refuse Derived Fuel production – the stealthiest way to hide and burn plastic waste.

This report highlights this alarming trajectory for Australia, where the greenwash is thick on the ground and happening in a void of national and state regulation, at a time when hopes are so high for a robust Global Plastics Treaty that addresses the full life cycle impacts of plastic.

Australia has the opportunity to turn this around though. Already Australia has shown considerable, global leadership in classifying Process Engineered Fuel (PEF) as a hazardous waste under the Basel Convention. This is to be congratulated. Australia is the first country in the world to recognise the inherent dangers of exporting this material to less developed nations by putting in place safeguards to ensure especially that our Asia Pacific neighbours no longer continue to carry the burden of our plastic waste, especially as a fuel made from plastic waste.

The challenge for Australia now, will be to ensure that this same hazardous waste does not impact the health and environment of Australian communities. This would mean recognising that the promotion of PEF as a clean, renewable fuel for the cement

industry cannot be supported with any credibility while Australia implements laws that protect other countries from using this same hazardous waste.

The Australian Cement Industry, like other largescale industries, claim they are committed to moving to cleaner renewable energy sources such as green hydrogen, solar and wind backed up with battery energy storage systems. The promotion of Process Engineered Fuel to burn in the cement industry and in the new waste incineration sector, especially in gasification and pyrolysis plants, is at stark odds with Australia's clean, renewable energy agenda.

It is also completely at odds with Australia's investments and commitments to a Circular Economy – an agenda that Australia takes pride in but one that has been heavily influenced by false solutions such as waste incinerators and waste derived fuel production. The misclassification of waste definitions and concepts is reflected in sub-national policies that redefine burning waste (including PEF) as recycling and resource recovery. And while Australia has no nationally harmonised waste management regulatory framework, the defence of environmental justice falls to frontline communities and those with the least power and influence to change national and sub-national policies that directly affect them and our shared environment.

Australia has a unique opportunity to leapfrog ahead of the mistakes made by the EU and US after decades of waste incineration and other false plastic waste solutions which are driving the global plastic waste and pollution crisis our planet now faces.

Australia should continue to commit to the decarbonisation of our world by acknowledging the role Australian gas and fossil fuel extraction has in driving plastic production increases. Australia must also commit to detoxifying our world, including through the proliferation of dangerous false solutions like the manufacture and incineration of plastic waste fuels – otherwise known as Process Engineered Fuel and Refuse Derived Fuel. These front and backend parts of the plastic lifecycle are critical challenges for Australia's reputation and commitment to the High Ambition Coalition to End Plastic Pollution.

We know that plastic recycling has failed to stem the tide on plastic pollution. After just a few revolutions through the recycling system most plastic waste heads for disposal. This climate and health threatening, linear process will continue unless we cap plastic production and redesign the plastic production system so that it can truly be part of a chemically safe Circular Economy.

By banning the production and incineration of Refuse Derived Fuel, Australia could lead the world towards the climate safe, detoxified future we all want and desperately need.

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Introduction

Australia is in the midst of the biggest waste recycling and reprocessing infrastructure build out in its history. This follows a Federal Government announcement in 2019 that *all waste exports would be banned from Australia*[1], after China's National Sword policy and associated actions in other Asia Pacific countries, which resulted in rejection of most foreign waste plastic imports.

This decision unfortunately led to the collapse of one of the only soft plastic recycling industries in Australia and many subsequent plastic waste stockpile fires. (See figures 1, 2 & 3)

The Australian Federal Government reversed its waste export ban in 2023 for 10 waste management operators, giving them a one- year extension, to allow time for the resource recovery industry to upgrade and build the necessary infrastructure to meet Australia's new waste export laws which require waste exports to be 'upgraded'. The Australian government has now finalised regulations to ensure that all waste exports from Australia are adequately reprocessed and ready for recycling, without the need for further reprocessing in the receiving countries.

However, Australia's approach to waste exports is being staged over time to allow industry to build the necessary infrastructure to meet the new export standards. For example, paper and cardboard exports have been allowed to contain up to 5% contamination with a plan to reduce this over time to 2% - which is more in line with other OECD countries and the standards required of those countries importing Australia's waste products.

In our previous report on Refuse Derived Fuel (RDF) in Australia we exposed the predicted boom in refuse derived fuel exports from Australia to southeast Asia announced by industry sources. The Australian version of RDF is called Process Engineered Fuel (PEF) and is made from mixed plastic waste, paper, cardboard, timber scraps and other combustible waste. The PEF was destined for cement kilns and other smokestack industries in southeast Asia, to burn as cheap fuel in place of traditional fossil fuels.

The mixed plastic waste component (which can be up to 50% of the total waste mix) is of great concern as the PEF was being treated as a fuel product and not a waste material and was therefore subverting the Basel Convention rules on the transboundary

[1] Recycling and Waste Reduction Act 2020, *Australian Government, Department of Climate Change, Energy, the Environment and Water*. https://www.legislation.gov.au/C2020A00119/latest/text

movement of hazardous waste. Under the Basel Convention plastic waste amendments, mixed plastic waste was now considered a notifiable waste under the Prior Informed Consent procedures of the Convention.

This meant that any export of mixed plastic waste should effectively be considered hazardous waste, and the importing country had to be informed of the shipment prior to its export and this includes the right to refuse the shipment. Further, the entry into force of the Basel Ban Amendment, which entered into force in December 2019, prohibits the member states of the Organization for Economic Cooperation and Development (OECD), the European Union (EU), and Liechtenstein from exporting hazardous wastes, as defined by the Convention, to other countries – primarily developing countries or countries with economies in transition. This raised the question of whether PEF shipments from Australia were compliant with the Australian waste export ban, the Basel Ban Amendment or the Basel plastic waste amendments.

Following the release of our first report exposing the PEF export loophole, Australia toughened it regulations on PEF which now require a *hazardous waste export license* under the Australian Hazardous Waste Act (this mirrors the Basel Convention) which is a major leap forward in ensuring adequate regulatory oversight, monitoring, compliance, accountability and reporting of this hazardous waste. Australian regulators were specific in their position on PEF stating:

"Exports of PEF to be used as a fuel (other than in direct incineration) or other means to generate energy, fall under the Y48 category in Annex II of the Basel Convention and the Hazardous Waste (Regulation of Exports and Imports) Act 1989 (the Hazardous Waste Act) which gives effect to the Basel Convention in Australia. These types of exports therefore require a hazardous waste permit."

As a result of this strict new Australian regulation, PEF exports appear to have been dramatically reduced with only 2 shipments to Japan, reported in 2024 and no exports to developing countries.

These new Australian laws have particular relevance for plastic waste due to the inherent toxicity risks and hazards this petrochemical based material holds and the burgeoning quantities of plastic waste Australia generates. Given the plastic industry's planned and projected five-fold increase in production by 2050, and Australia's high single use plastic waste generation[2] (highest in the world after Singapore), keeping track of Australian plastic waste and the generation of RDF, has never been more important.

The use of RDF both in Australia and overseas, inherently comes with serious toxic air pollution and hazardous waste residues. Given Australia's lack of recycling

[2] Charles D & Kimman L 2023, *Plastic Waste Makers Index 2023*, Minderoo Foundation

infrastructure and new export laws, increasing volumes of RDF production are likely. However, the tightening of RDF export laws in Australia means that the RDF industry is now switching its attention to cement kilns and other customers in Australia as an alternative to export. Domestic expansion of the RDF industry is now well underway, despite a current lack of any specific regulatory framework to assess the full climate, health and environmental impacts of using RDF as an industrial fuel source in Australia.

This report shows that the industry poses increasing environmental health and justice burdens on Australian communities, countries Australia exports RDF to, and adds to the overall global burden of pollution, climate change, ecological and human health impacts.

Figure 1. Fire at Materials Recovery Facility, Perth, Western Australia Nov. 2019 (source Jane Bremmer)

Figure 2. Toxic smoke billows over houses, Perth Western Australia. Nov. 2019 (source Jane Bremmer)

Figure 3. Waste is dragged out of the MRF following weeks of smouldering plastic waste. Nov. 2019 (source Jane Bremmer)

What is Refuse Derived Fuel?

Refuse Derived Fuel (RDF) is an umbrella term used to describe a mixture of waste materials derived from municipal and industrial sources that are combined and used as an alternative to fossil fuels in industrial combustion processes such as cement kilns, waste incinerators, thermal power plants and pulp mills. The mix of wastes can vary but must have sufficient calorific value to burn and produce energy needed for the industrial process. Typically refuse derived fuel is considered to be a crude form of fuel which can be optimised into better quality material by changing the blend of wastes that it contains. The mixture of wastes is generally around 35-50% plastic waste, 10% textiles (of which 60% is plastic), 20-30% paper and/or cardboard waste, 20% timber scrap and small quantities of other assorted wastes including rubber. These fractions of waste type can vary significantly but non-combustible material such as glass, metal and ash are typically screened out.

RDF may be processed into pellets or compressed into bales before being combusted in industrial processes or exported. In some countries RDF is available in a loose form know as ‘fluff’ but is used for the same purpose.

Figure 4. Bales of RDF (source: Waste Recycling Technologies Ltd)

Figure 5. Refuse derived fuel in pellet form (Source: ENDS Waste and Bioenergy)

Figure 6. A type of RDF known as 'fluff' (Source: WastAway)

Figure 7. Process Engineered Fuel (Source: ResourceCo Australia)

These types of fuel often have different names including Waste Derived Fuel (WDF), Process Engineered Fuel (PEF), Tyre Derived Fuel (TDF), Solid Recovered Fuel (SRF), Alternative Fuels (AF) and so on. In Australia, the main forms of RDF are Process Engineered Fuel (PEF) and Tyre Derived Fuel (TDF). For the purpose of this report, we focus on PEF and its potential to act as a hidden form of plastic waste exports undermining the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (hereafter 'the Basel Convention'). While many companies claim they are reducing GHG emissions by burning RDF instead of traditional fossil fuels, they do not take into account that RDF consist of between 30-60% plastic waste which is formed from petrochemicals and is therefore a form of fossil fuel.

While Toxics Free Australia opposes all forms of waste burning for energy and seeks to prohibit the use and export of PEF from Australia, we have been seeking, since 2018, that all shipments of PEF from Australia are treated as hazardous waste requiring the Prior Informed Consent (PIC) in writing, from importing countries. All mixed plastic waste exports from developing countries now require a PIC reporting procedure following the Basel Convention plastic waste amendments which added mixed plastic waste to its annexes (A3210) and came in into effect on January 1, 2021. In addition, Toxics Free Australia has been calling for a harmonised commodity tracking code (HS

code) to be specifically allocated to RDF and similar waste derived fuels to allow for tracking and assessment of the international trade in RDF. Currently HS codes are so broad that RDF may fall under much broader categories of waste such as MSW or plastic scrap and data on the trade in RDF cannot be disaggregated from other unrelated waste trade.

Toxics Free Australia is of the view that RDF use in cement kilns, the primary end-use of RDF, should be prohibited and cement companies should be directed to use ultra-low emission fuels such as hydrogen for their energy requirements. Many cement companies have already begun this transition to clean fuels.[3]

Australian Cement Operations

In Australia, there are five integrated cement manufacturing facilities operating in NSW, Queensland, Victoria and Tasmania, that are owned and operated by Boral Australia Ltd, Adelaide Brighton Ltd and Cement Australia Pty Ltd. (see fig 8)

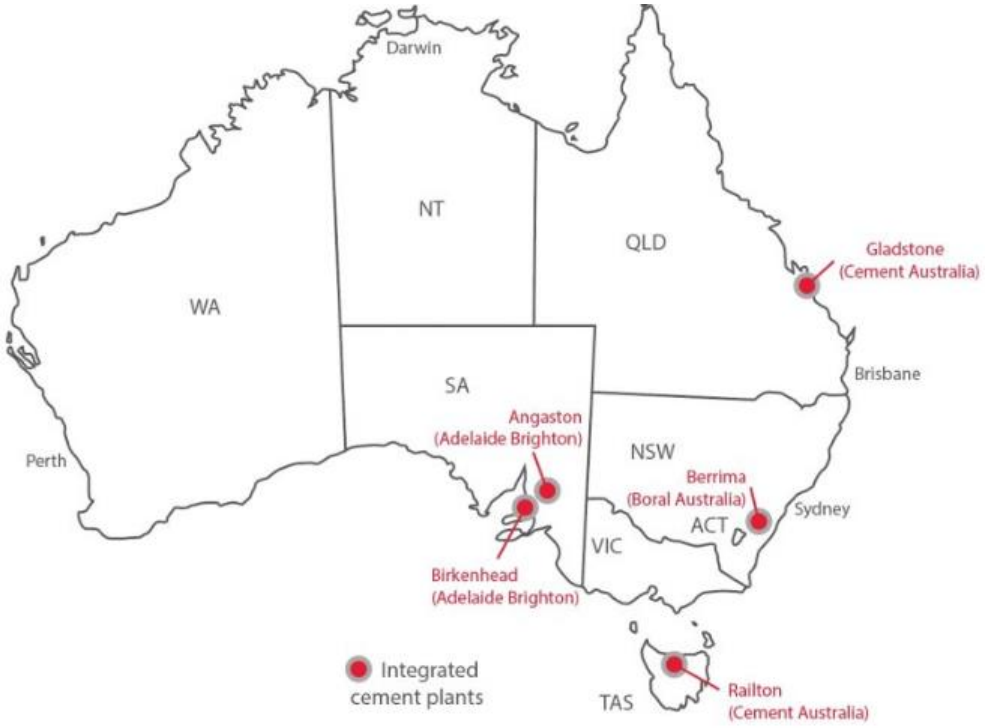


Figure 8. Cement kilns operating in NSW, Qld, Vic and Tasmania, (source: Cement Industry Federation)

[3] https://www.heidelbergmaterials.com/en/pr-01-10-2021
https://www.cemex.com/w/cemex-to-introduce-hydrogen-technology-to-reduce-co2-emissions-in-four-cement-plants-in-mexico

In addition, there are several cement kilns operating in Western Australia under Cockburn Cement (a subsidiary of Adelaide Brighton). See figure 9.

Figure 9. Cockburn Cement operations in Western Australia (source: Cockburn Cement)

Australian Regulatory Framework

Australia's waste export ban.

Following China's Blue Sky/National Sword policy (2018), the Australian government declared and introduced legislation to ban waste exports in 2020.

These actions followed China's progressive move in 2011 - known as the Green Fence program – to improve and tighten inspection efforts in a bid to reduce the volume of contaminated materials entering the country and adversely impacting waste recyclers, their communities and the environment, as well as getting into the hands of illegal traders and operators leading to poor outcomes such as dumping and open burning.

Building on this work, China's National Sword policy (2018) further restricted the importation of 24 streams of recyclable materials. China's Ministry of Ecology and Environment, set stringent[4] "maximum contamination thresholds", such as for example, plastic and cardboard at 0.5% contamination, Australia was effectively banned from continuing to export waste to China. This is because for decades prior, Australia had been exporting plastic and cardboard waste to China that had much higher levels of contamination. Australia's waste management systems in effect were generating highly contaminated waste streams, while lacking the waste management infrastructure to reprocess its own waste, choosing instead to rely on exports to China and southeast Asia. It is fair to say that ending this kind of "waste colonialism" had far reaching impacts, not only across Australia, but more widely across the world.

The Australian Federal parliament passed its legislation banning the export of unprocessed waste overseas via the Recycling and Waste Reduction Act 2020. This legislation gives effect to the definitions of permissible waste exports. Table 1. provides details on the types of waste banned for export under Australia's regulations.

Figure 20. Exported Australian plastic waste open burned in Indonesia 2019. Source: Ecoton and Nexus 3

[4] Chinho Lin, Parinyakorn Paengsri, Yiwen Yang, *Impact of China's National Sword Policy on waste import: A difference-in-differences approach*, Economic Analysis and Policy, Volume 78, 2023. https://doi.org/10.1016/j.eap.2023.04.033

Table 1. Waste Export Ban materials

Export Material Permitted	Start date	Notes
Plastic	July 2021	
• sorted into single resin or polymer type and further processed, for example flaked or • processed with other materials into processed engineered fuel.		Recycled Plastic Pellets are no longer regulated under the Recycling and Waste Reduction Act 2020 and can be exported without a permit. Process Engineered Fuel is no longer regulated under the Recycling and Waste reduction Act 2020 and is now regulated solely under the Hazardous Waste Act and requires a Hazardous Waste Export Permit.
Glass	March 2020	
You can only export waste glass that has been processed into, for example, furnace-ready or non-furnace-ready glass cullet or fines.		
Paper and Cardboard	July 2024	
a. mixed or unsorted paper and cardboard that is discarded, rejected or left-over from an industrial, commercial, domestic, or other activity; or b. mixed or unsorted paper and cardboard that is surplus to, or a by-product of, an industrial, commercial, domestic, or other activity.		• This waste is generally (but not necessarily) sourced from commingled recycling • contains more than one type of wastepaper and cardboard and has not been sorted into a single grade/material type • is exported under the 47079000 Australian Harmonised Export Commodity Classification (AHECC) code • has been separated from other materials/contaminants to meet country/importer requirements. • In addition: Wastepaper and cardboard may be controlled under the Hazardous Waste Act if it is: • listed in, or contains contaminants listed in, Annex I of the Convention. This is unless you can demonstrate the material doesn't have any hazardous characteristics under Annex III of the Convention. Common materials found in paper and cardboard that can make it hazardous include PFAS, mineral oils, and adhesives. You should also consider the source of your material. This may lead to it being hazardous - for example, medical wastes. • contaminated with other wastes collected from households, including mixed plastics, metals, or food waste. This contamination does not necessarily need to have hazardous characteristics, or high contamination levels

		for the paper and cardboard to be controlled under the Hazardous Waste Act.
Tyres	March 2020	
• tyres that have been processed into shreds or crumb of not more than 150 millimetres for use as tyre derived fuel • tyres for retread by an appropriate retreading facility, for example, one that is verified by Tyre Stewardship Australia's Foreign End Market program • tyres to an appropriate importer for re-use as a second-hand tyre on a vehicle • tyres that have been processed into shreds, crumbs (when the shred or crumb are not for use as tyre derived fuel), buffings or granules.		You cannot export whole baled tyres or tyres in pieces larger than 150 mm.

This legislation now underpins a large-scale reform of Australia's waste management system so as to be able to deliver these new waste export requirements but also to support Australia's ambitions for a Circular Economy. Fundamental to this goal is the need for improved resource recovery and reprocessing infrastructure so as to create materials eligible for export and able to be recycled and remanufactured into products in Australia. This includes Australia's plans to export and use Processed Engineered Fuel, Refuse Derived Fuel and Solid Recovered Fuel.

Figure11. Veolia's Solid Recovered Fuel

Process Engineered Fuel

Processed Engineered Fuel (PEF), also known as a Refuse Derived Fuel (RDF), is plastic waste that is processed with other waste materials, which can include paper and cardboard, biomass (including forestry waste), textiles, other non-recyclable plastics ready for direct use as a fuel in high energy intensity facilities such as cement kilns.

In Australia exports of PEF to be used as a fuel (other than in direct incineration) or other means to generate energy, fall under the Y48 category in Annex II of the Basel Convention and the Hazardous Waste (Regulation of Exports and Imports) Act 1989 (the Hazardous Waste Act) which gives effect to the Basel Convention in Australia.

On the 9th December 2022, the Australian Government amended the Waste Plastic Exports List to remove PEF from regulation under the existing Recycling and Waste Reduction Act, where it was previously listed with plastic waste requiring an export license under this Act. (see table above)

Instead, PEF is now regulated under the Hazardous Waste Act and the Hazardous Waste (Regulation of Exports and Imports) (OECD Decision) Regulations.

Process Engineered Fuel exports therefore now require a hazardous waste permit in Australia.

This decision is a major leap forward for the regulation of PEF, its export and recognition that this material is hazardous by definition, in Australia. It upholds Australia's

participation and commitment to the Basel Convention by ensuring that any PEF exports from Australia are labelled hazardous waste and tracked by customs and border authorities.

The Australian Harmonized Export Commodity Classification (AHECC) is the product classification used to identify goods being exported from Australia. The AHECC is an extension of the Harmonized Commodity Description and Coding System (Harmonized System, or HS). The HS is a multipurpose international nomenclature for goods, developed and maintained by the World Customs Organisation (WCO).

The Australian Border Force (ABF) implements the rules for classification of goods in Schedule 2 of the Tariff Classification.

Australian Harmonised Export Commodity Classification (AHECC) codes

Table 2.

Processed engineered fuel

The following table lists the AHECC codes for processed engineered fuel.

Waste type	AHECC	Description	Unit
Processed engineered fuel	38251001	Processed engineered fuel	T

Processed Engineered Fuel Exports from Australia

According to the Australian Governments, Department of Climate Change, the Environment, Energy and Water's (DCCEEW), Hazardous Waste Export Permit database, since the changes to the export requirements and classification of Process Engineered Fuel in December 2022, there have been two PEF export permits granted totally 24 000 tonnes of PEF exported to Japan from Australia.

Table 3. Process Engineered Fuel exports from Australia.

Permit No	Export details	Quantity	Timeframe	Import details	Use
AUH22-017	Faralga Pty Limited, trading as Doyle Bros (ABN 60 126 816 939), 87 Lisbon Street, Fairfield East, NSW 2165 (Telephone: 02 9999 2111)	12 000 tonnes	14th August 2023 – 16th July 2024.	Cellmark Japan, 7F, Shinjuku I-Land Tower 6-5-1, Nishi-Shinjuku, Shinjuku-Ku, Tokyo 163-1307, Japan (Telephone: +81 3 6380 8258).	The waste is to undergo a recovery operation at Tokuyama Corporation, Tokuyama Factory, Yamaguchi, Japan. The waste is to undergo recovery operation R1 - Use as a fuel (other than in direct incineration) or other means to generate energy.
AUH24--006	Faralga Pty Limited, trading as Doyle Bros (ABN 60 126 816 939), 87 Lisbon Street, Fairfield East, NSW 2165 (Telephone: 02 9999 2111)	12000 tonnes	21st October 2024 – 31ts July 2025.	Cellmark Japan, 7F, Shinjuku I-Land Tower 6-5-1, Nishi-Shinjuku, Shinjuku-Ku, Tokyo 163-1307, Japan (Telephone: +81 3 6380 8258).	The waste is to undergo a recovery operation at Tokuyama Corporation, Tokuyama Factory, Yamaguchi, Japan. The waste is to undergo recovery operation R1 - Use as a fuel (other than in direct incineration) or other means to

					generate energy.

Prior to the Australian plastic waste export amendments for PEF coming under hazardous waste legislation, it is difficult to ascertain exactly what quantities of PEF were previously being exported from Australia. This is because PEF would have been exported under a plastic waste export HS code (3915) and not the new specific HS code of PEF 32851001. Before this time PEF would have been exported as a fuel product and not a plastic waste or hazardous waste.

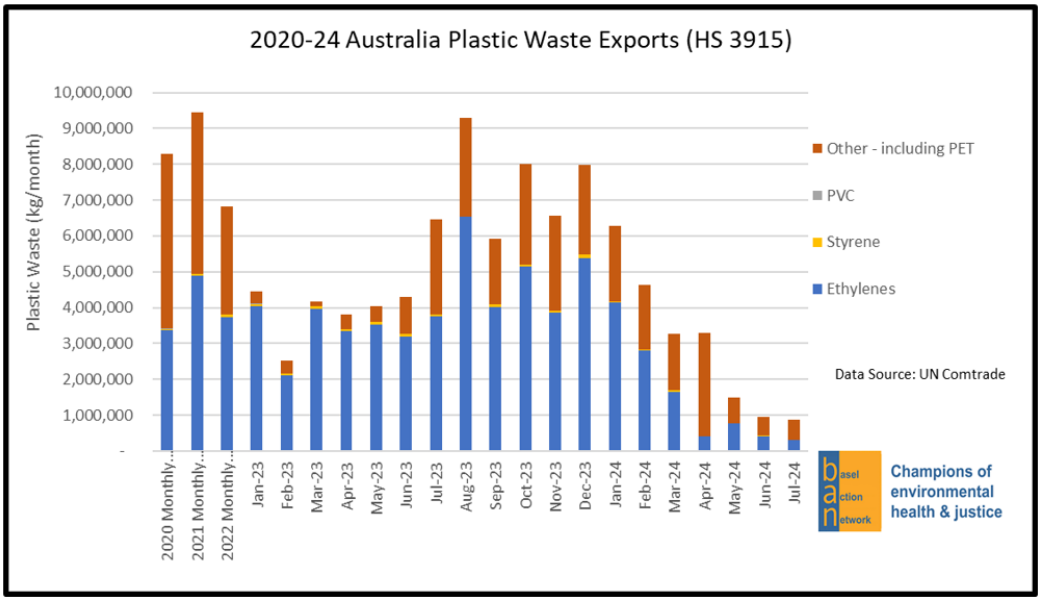
However, it is worth noting that in the years prior to the new PEF export rules, plastic waste exports were significantly higher. This suggests that the recent significant declines in Australian plastic waste exports are attributable to the new plastic waste export classifications (i.e. single polymer requirements and removal of recycled plastic pellets from regulation under the RAWR Act 2020), including the classification of PEF as a regulated hazardous waste. See table 4.

In addition, prior to the Australian classification of PEF as a hazardous waste, ResourceCo - Australia's largest PEF manufacturer - had significantly expanded its reach into the Asia Pacific region. Not only had ResourceCo expanded production at its major facility in Ipoh, Malaysia, and its exports from Australia to the Asia Pacific region, but the company was also implementing project partnerships to establish waste to energy facilities in Indonesia and securing a range of waste streams to provide the Process Engineered Fuel to burn in cement kilns and incinerators.

As they stated in 2019, "Pavel says the company is only just scratching the surface, so the opportunity is huge regarding what it can achieve to turn relevant waste streams into PEF in the Asian markets. As well as operating a Singapore hub, ResourceCo Asia is on track to further expand in key local areas, including the Philippines, Indonesia and Thailand." [5]

[5] Waste Management Review, *ResourceCo's rapid growth in Asia*. https://wastemanagementreview.com.au/resourceco-pef/

Table 4. 2020-2024 Australian Plastic Waste Exports (Basel Action Network 2024).



Refuse Derived Fuel Production in Australia

Australia's policy direction.

In addition to the above PEF (RDF) exports from Australia, there are a number of Australian companies that manufacture PEF for use in Australian cement kilns. The RDF industry is pitching their business model as the solution to Australia's failed waste reduction and resource recovery targets. The term "Resource Recovery" is used loosely in Australia across government and industry to imply that it is in fact a form of recycling, including to "recover energy". Yet the production and use of PEF is clearly as a fuel for large scale industry – a linear process where the resource is lost forever to the atmosphere as carbon emissions and toxic air pollution, with some solid waste residues that are not feasibly recyclable.

In October 2024, 'Resource Recovery' companies came together for the inaugural National Resource Recovery Conference in Adelaide, South Australia, with the purpose of promoting the resource recovery industry and their role in achieving Australia's waste management policy agenda.

According to the event hosts, the Waste Management and Resource Recovery Association (WMRR) – Australia's peak waste management representative group, *"The waste and resource recovery (WARR) sector receives 76 million tonnes of material each year of which we are currently recovering 62% nationally. With Australia committed to a resource recovery target of 80% by 2030, as well as a goal to reduce total waste generated by 10% in the same timeframe, we have a lot to do."*

The Platinum Sponsor for this national conference was ResourceCo – Australia's largest PEF manufacturing company. The second plenary of the conference was an industry panel titled, '*Can we hit 80% resource recovery by 2030?'*.

It is interesting, although not surprising, that three out of the four panel speakers were industries who either manufactured PEF or who have waste incineration projects in Australia. In a sign that the PEF manufacturing industry is set to play a key role in Australia's resource recovery and national policy agenda, ResourceCo published on their website on the 30th October 2024[6] -

"How do we reach 80% resource recovery by 2030, the need for policy change across the country, creating circular economies and technological innovation were some of the key themes to come from the inaugural Australian Resource Recovery Conference in Adelaide recently. The event, hosted by the Waste Management and Resource Recovery Association of Australia, saw more than 200 industry professionals come together, with ResourceCo the platinum sponsor. ResourceCo Energy Chief Executive Officer Henry Anning opened the conference, before taking part in a panel discussion regarding the goal of achieving 80% resource recovery by 2030. Henry emphasised the need for policy changes across the country if the current landfill diversion rate of 63% has a chance of increasing to the target of 80%. "The current state of various government policies across the country that impact the sector, particularly landfill levies, will continue to be a major hurdle for the resource recovery industry until change is made," he said. "The positive is that these challenges can be overcome, it just needs a bit of work, of which our sector stands ready to assist governments with."

Shortly after the National Resource Recovery Conference, the National Waste Expo was held in Melbourne, Victoria on the 23rd and 24th October 2024 , coinciding and co-locating with the All-Energy Conference – an energy industry conference. Waste management industries and businesses held displays and events. Of note was the display by Finnish Company BMH Technology who provide infrastructure for the manufacturing of Refuse Derived Fuel and Solid Recovered Fuel. I spoke to the agent for Australia, who advised that there was a keen interest in Australia for their business model and technologies to redirect residual waste from disposal, from both landfill and

[6] https://resourceco.com.au/strong-resourceco-presence-at-inaugural-conference/

incineration to the manufacture of Refuse Derived Fuel. They believed there was a strong market in Australia, especially related to the Blue Gum plantation industry (a eucalyptus tree grown in mass plantations), in diverting biomass waste and residual waste (from all sectors) into RDF for the cement kiln sector and other combustion industries, such as paper mills. As such they were working to achieve contracts with local governments in the Gippsland region, where Australia's largest paper mill operates and has submitted a waste to energy incinerator proposal to the Victorian Government who has granted a works approval for the project[7].

It is clear that the Refuse Derived Fuel manufacturing industry sees a strong future in Australia – a country with an economy firmly based in raw materials extraction, mining and heavy industry.

It is reassuring to acknowledge that the Australian government has classified Process Engineered Fuel as a hazardous waste requiring an export permit and is attached to a robust regulatory framework for monitoring and tracking Australian waste exports. The clear challenge for Australia now will be to reconcile the classification of PEF as a hazardous waste for export while embracing the PEF industry as a waste management leader in achieving Australia's waste reduction targets and supporting the burning of PEF as a safe, clean, renewable fuel for industry at home in Australia.

This classification conundrum, where residual waste resources can on the one hand be regarded as a safe, benign fuel source, while at the same time be classified as a hazardous waste export, demonstrates a stark contradiction that is likely to play out in Australia as a major pollution threat, greenwashed as a waste management and Circular Economy good news story.

Is the PEF industry a Renewable Energy and Carbon Abatement industry?

Following Australia's waste export ban and subsequent waste management policy reform, the PEF production industry is positioning itself as not only a leader in waste management recycling solutions, with a keen eye on accessing Recycling Modernisation Infrastructure Funds but also as a key solution to climate change. As ResourceCo's CEO states:

"Henry says the waste sector has huge potential for carbon abatement, both in helping other industries decarbonise their waste and in providing Waste-Derived Fuel and Waste-to-Energy that can provide renewable heat and renewable baseload electricity."

[7] https://www.epa.vic.gov.au/about-epa/publications/1717

Key to the promotion of PEF being classified as a renewable energy source, is the claim that biomass and other organic wastes diverted from landfill to PEF production, prevents the release of significant volumes of methane – a potent greenhouse gas emitted when organic waste decomposes in landfill. This claimed carbon emissions avoidance allows the PEF production industry to access both Recycling Modernisation Funds (for reprocessing organic residual wastes) and Renewable Energy Funds under the Australian Government's Renewable Energy Act which defines biomass waste or the biogenic fraction of PEF, as a source of renewable energy. The industry promotes the production and use of PEF as a way to abate carbon emissions on a large scale by reducing the generation of methane in landfill.

However, two issues stand out.

1. Australia has a national Food and Organic waste policy that obliges all states in Australia to separate their organic waste and redirect it to composting. Therefore, organic waste (including biomass) in Australia should not be going to landfill where it generates methane and should subnational governments be mandated to implement this policy, given states are responsible for waste management policy and services, then organic waste, generating methane in landfill, becomes a redundant claim for the PEF industry.

Most states in Australia are already implementing this important policy even though both the PEF production and waste to energy incineration sectors, use this argument to justify their industry. The recovery and composting of organic waste sits higher on the waste hierarchy, well above energy recovery. It is well understood internationally that composting organic waste provides better outcomes for our environment than burning organic waste, as not only are methane emissions avoided but Soil Organic Carbon (SOC) is sequestered back into the biosphere where it is needed, unlike the release of this carbon to the atmosphere in the form of GHG's which are driving irreversible and dangerous climate change impacts. Composting organic waste can also generate energy recovery, without the associated massive infrastructure costs associated with manufacturing and using PEF, and the adverse climate, environment and health impacts that come from burning biomass as a key component of PEF.

2. The production of PEF serves the purpose of generating a fuel to be burned in combustion-based industries such as the cement kiln industry. To separate the production of PEF from its intended use as a fuel, only serves to hide the associated pollution burning PEF inevitably creates, including the significant volumes of GHG's and toxic air pollution. In addition, as Australia's economy moves toward an increasingly renewable energy-based economy, built around solar, wind, wave and green hydrogen energy sources, the demand for biomass-based fuels is set to decrease.

The replacement of coal with PEF in the cement industry is similarly shortsighted as fossil fuels are in decline with many coal mines and power stations being closed in Australia and around the world. In addition, Australia's Safeguard Mechanism Policy applies to industrial facilities emitting more than 100,000 tonnes of carbon dioxide equivalent (CO_2-e) per year and includes the waste sector. Access to carbon abatement credits will therefore decline in lockstep with the emissions reduction levels required under the Safeguard mechanism, making the PEF production industry increasingly unattractive to largescale combustion-based industries.

PEF manufacturing plants in Australia

ResourceCo *is developing several projects in Queensland, Victoria, New South Wales and Western Australia to divert more construction and demolition (C&D) and commercial and industrial (C&I) material from landfill. Leading the charge is a $50 million waste-to-energy facility in the Southeast Brisbane suburb of Hemmant to process C&I and mixed construction and demolition waste into Process Engineered Fuel (PEF).* *https://wastemanagementreview.com.au/switched-on/*

ResourceCo South Australia is Australia's largest PEF manufacturer, producing 300 00tpa, operating for more than 10 years both in Australia and Malaysia. Located at Level 1, 162 Fullarton Road, Rose Park, SA 5067.

ResourceCo/Cleanaway Resource Recovery Facility in NSW is the second largest PEF manufacturing plant, producing 150 000tpa, located at 35-37 Frank St, Wetherill Park NSW 2164. The regulatory documents can be found here - https://resourceco.com.au/Documents/

ResourceCo Brisbane Resource Recovery Facility Pty Ltd (Southeast Brisbane) is located at 126 Anton Road Hemmant, Queensland.

A purpose-built facility (the first of its kind in Queensland) is currently under construction and due for completion in April 2024. Establish a resource recycling facility to process commercial and industrial and mixed construction and demolition waste streams primarily into process engineered fuel. A first of its kind in Queensland, the new facility will focus on the diversion and sorting of landfill construction waste, and in turn converting this into fuel to power cement kilns.

Faralga P/L (Trading as Doyle Brothers) is located at 87 Lisbon St, Fairfield East, NSW 2165. They manufacture and export 12000 tpa of PEF to Japan under the Federal governments hazardous waste export regulatory framework. As their website states:

TRANSFORMING WASTE INTO SUSTAINABLE ENERGY

At Doyle Bros, our commitment to sustainability extends to the innovative creation of Processed Engineered Fuel (PEF). This cutting-edge process involves converting non-recyclable waste materials into a clean, efficient fuel source, offering an eco-friendly alternative to traditional fossil fuels. Our PEF is utilised in various industrial applications, significantly reducing greenhouse gas emissions and contributing to a circular economy. By choosing Doyle Bros, you're not just disposing of waste; you're contributing to a greener, more sustainable future.

Australian PEF manufacturing plant map

	ResourceCo South Australia 162 Fullarton Road, Rose Park, SA 5067
	ResourceCo/Cleanaway Resource Recovery Facility 35-37 Frank St, Wetherill Park NSW 2164
	Faralga P/L 87 Lisbon st, Fairfield East, NSW 2165
	ResourceCo Brisbane RRF Pty Ltd 126 Anton Road Hemmant, Queensland 4174

Figure12. Map of Australian PEF manufacturing plants

Conclusion and Recommendations

Australia is on track to burn significant quantities of residual wastes from the Municipal Solid Waste, Commercial and Industrial, Construction and Demolition waste streams as well as biomass waste streams from the agricultural and forestry sectors, in the form of Processed Engineered Fuel, Refuse Derived Fuel and/or Solid Recovered Fuel.

Currently 12000 tonnes per annum of PEF is exported from Australia to Japan. It is however unclear if, or how much, PEF is being exported from other companies that manufacture PEF in large volumes, who may be exporting this material under a different HS code, such as a raw material or a fuel code.

The Australian government and its associated consultancies contracted to report on Australia's national waste data, including volumes, types, trajectories and exports, does not specify Process Engineered Fuel as a category for monitoring or assessment. Specific data on exactly what types of materials, their volumes and final uses is difficult to identify.

The Australian Hazardous Waste Export branch does record all hazardous waste permits which allows for the tracking of PEF that is exported as a hazardous waste. This is a critical and necessary database so as to be able to track and monitor the volumes and use of PEF being exported from Australia.

It is concerning that while the export of plastic waste has dropped dramatically in Australia, the export of hazardous waste has increased.

According to export data, from 2020 - 2023 plastic waste exports dropped from 124 096 tonnes to 45 138 tonnes, while hazardous waste increased from 41 519 tonnes to 105 061 tonnes exported from Australia.

Through several federally funded industry and infrastructure support programmes, it is clear that the PEF manufacturing industry is set to increase significantly over the new few years, expanding production plants in several Australian states and partnering with the waste recovery and cement sectors significantly. The cement industry reports a clear intent to use more PEF as a prime fuel source, increasing the use of RDF to 50% of its fuel requirements by 2024, with the aim becoming net zero by 2050. Until recently, the majority of PEF production and use has been in Adelaide, South Australia. However, driven by Australia's bioenergy, waste to energy and resource recovery policy agendas, which appear to be based on a series of conflated and misinformed claims in relation to carbon accounting, waste and renewable energy classifications, the expansion of PEF production and its use, are set to expand significantly over the next 10 years at least.

While the PEF production industry secures a market in the cement and waste to energy incineration sectors initially, any combustion-based industry is in their sights.

The use of PEF in pyrolysis and gasification technologies to create chemicals and fuels, is an area of great concern. The continued production of relatively dirty fuels and petrochemicals used to make plastic and other industrial chemical applications, cannot be supported given the widespread global contamination of the marine and terrestrial environments, its biodiversity and human health with plastics and novel entities, causing extreme and irreversible harm and driving the Triple Planetary Crisis[8].

Simply, the expansion of the PEF (RDF) production industry and the subsequent increased use of PEF, represents a surrender to climate change and adverse pollution impacts at a time when we must not only decarbonise, but more importantly, detoxify our energy sources, industrial processes and our material production systems.

The Australian government should instead continue to pursue and implement policies and legislation for

a) clean and renewable energy sources based on solar, wind, wave and green hydrogen with energy storage and investment in localised, small scale renewable energy models that partner well with zero waste policies and other social justice initiatives in both the urban and regional areas with a goal to becoming self-sufficient for these essential services.
b) sustainable zero waste policies that shift the financial, infrastructure and policy supports to waste reduction and education, better collection and source separation(including residual waste elimination research) and non-combustion residual waste management technologies.
c) A commitment to full decarbonisation and detoxification of our energy and materials production systems.
d) A commitment to a chemically safe and regenerative Circular Economy.

[8] Persson, Linn & Carney Almroth, Bethanie & Collins, Christopher & Cornell, Sarah & de Wit, Cynthia & Diamond, Miriam & Fantke, Peter & Hassellöv, Martin & MacLeod, Matthew & Ryberg, Morten & Jørgensen, Peter & Villarrubia-Gómez, Patricia & Wang, Zhanyun & Hauschild, Michael. (2022). Outside the Safe Operating Space of the Planetary Boundary for Novel Entities. Environmental Science & Technology.