

Fact Sheet: Plastic Waste to Fuel is a False Solution

On September 23, 2024, California Attorney General Rob Bonta filed a lawsuit against ExxonMobil to hold the company accountable for creating harm from plastic waste and pollution in the state while falsely claiming to the public that plastic recycling was the solution to the problem ExxonMobil created and profited from.¹ The lawsuit not only covers the long fraud of traditional plastic recycling but also breaks new ground by exposing ExxonMobil's highly touted chemical recycling — or what the industry calls “advanced recycling” — an unreliable and ineffective process that uses high heat, chemicals, or a combination, in an attempt to break down plastic waste into its basic chemical components. It has not worked and will not work in the future.

A key allegation is that ExxonMobil knows that its chemical recycling process actually converts 92% of the plastic waste to primarily fossil fuel products via pyrolysis gas and ethane steam cracking — not new plastic.²

In response to learning that plastic waste is primarily converted to fuels via pyrolysis, some questioned why that is objectionable if it avoids plastic waste disposal to landfills. At the high level, this type of question is outdated end-of-pipe thinking based on the false premise that plastic waste is unavoidable. The only real solution to the problem of plastic waste and pollution is to stop the waste before it starts by stopping the production and sales of single-use and unnecessary plastics.³ Plastic recycling doesn't work at scale, and there is no good solution to the problem of plastic waste once it is made. To paraphrase Albert Einstein: The genius solution is to prevent the problem.⁴

At the detailed level, converting plastic waste to fuel is not new, viable in the long term, or scalable. The plastics industry has tried to use pyrolysis processes to turn plastic waste into fuel since the 1950s in small demonstration units⁵ but failed because the process is uneconomic, challenging to operate, and more environmentally harmful than conventional production of

¹ California Department of Justice, THE PEOPLE OF THE STATE OF CALIFORNIA, ex rel. ROB BONTA, ATTORNEY GENERAL OF CALIFORNIA, Plaintiff, v. EXXON MOBIL CORPORATION, Defendants, September 23, 2024. [Lawsuit filing link](#).

² California Department of Justice, THE PEOPLE OF THE STATE OF CALIFORNIA, ex rel. ROB BONTA, ATTORNEY GENERAL OF CALIFORNIA, Plaintiff, v. EXXON MOBIL CORPORATION, Defendants, September 23, 2024. [Lawsuit filing link](#).

³ Organization for Economic Cooperation and Development (OECD), [Plastic Pollution is Growing Relentlessly as Waste Management and Recycling Fall Short, Says OECD](#), Feb. 22, 2022.

⁴ Good Read, Albert Einstein: “[Intellectuals solve problems, geniuses prevent them.](#)”

⁵ Sustainable Plastics, [Chemical Recycling Tracker](#): 1950s: Waste recycling based on pyrolysis technology first emerged midway through the twentieth century and was mainly seen in Japan, some European countries, and North America. At that time, the technology was used to produce liquid pyrolysis fuel.

fuel from new hydrocarbons.⁶ It is not technically possible to convert a meaningful amount of plastic waste into fuel due to inherent contamination and additives in the plastic waste.

In short:

1. Plastic waste to fuel is not recycling.
2. Converting plastic waste to fuel does not reduce the need to produce new plastics and is environmentally harmful.
3. Very little plastic waste can be used to make fuel or plastic and is not a scalable solution. According to the lawsuit, only 2% of the feedstock to the existing ExxonMobil refinery unit can be plastic waste due to inherent contamination and additives. Using ExxonMobil's chemical recycling process at 2% plastic waste feed, we estimate that the company would only be able to process 3.4% of the plastic it produces into primarily fuel and a small amount of new plastics and other products.

1. Plastic waste to fuel is not recycling.

Experts agree that consumers expect “recycling” to create a new material product, not a liquid that will be combusted.⁷ In 2018, a Dow Company representative agreed, stating this about plastic waste to fuel via pyrolysis: “We agree. It is not recycling.”⁸

Around the world, the conversion of plastic waste to fuel is not allowed by law or national policy to be claimed as recycling:

- **California:** As stated in the September 2024 Attorney General's lawsuit, California “Public Resources Code section 42355.51, subdivision (f), states that ‘recycling,’ ‘recyclable,’ and ‘recyclability’ do not include transformation, as defined in Section 40201, ... or production of fuels.”⁹
- **United States:** In its 2023 Draft National Strategy to Prevent Plastic Pollution, the U.S. Environmental Protection Agency (EPA) reaffirmed its position that it does not consider plastic waste that is processed into fuels or for energy production as “recycling.”¹⁰

⁶ Rollinson, Andrew, “[Why pyrolysis and ‘plastic to fuels’ is not a solution to the plastics problem,](#)” December 4, 2018

⁷ U.S. Federal Trade Commission, “[Talking Trash at the FTC: Recyclable Claims and the Green Guides,](#)” May 23, 2023.

⁸ C&EN, “[Should plastics be a source of energy?](#)”, September 24, 2018.

⁹ California Department of Justice, THE PEOPLE OF THE STATE OF CALIFORNIA, ex rel. ROB BONTA, ATTORNEY GENERAL OF CALIFORNIA, Plaintiff, v. EXXON MOBIL CORPORATION, Defendants, September 23, 2024. [Lawsuit filing link. Cal. Pub. Resources Code § 42355.51](#)

¹⁰ EPA Office of Resource Conservation and Recovery, U.S. Environmental Protection Agency, [Draft National Strategy to Prevent Plastic Pollution](#), July 23, 2023.

- **European Union:** The EU Waste Directive states that “‘recycling’ means any recovery operation by which waste materials are reprocessed into products, materials, or substances whether for the original or other purposes. It ... does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.”¹¹

2. Converting plastic waste to fuel does not reduce the need to produce new plastics and is environmentally harmful.

Converting plastic waste to fuel does not reduce the need to produce new plastic, nor does it reduce the environmental harms from exploration and production of fossil fuels and refining into new plastics.¹²

Converting plastic waste to fuel via pyrolysis ultimately turns it into carbon dioxide, air pollutants, and toxic residues. The production of more climate-warming fuels is not a desired outcome as countries around the world make massive investments in electric vehicles and renewable energy to replace internal combustion engine vehicles.¹³ For the fuels that are still needed during the energy transition, it is well known that converting plastic waste to fuel is more harmful to the environment than conversion of fossil feedstocks.¹⁴

- **Toxic emissions during production:** Due to inherent contamination and additives in plastic waste, the refining process for plastic-derived pyrolysis oil creates additional toxic emissions that impact nearby communities.¹⁵ The U.S. EPA recently announced the withdrawal of its approval to Chevron to produce fuel from plastic waste-derived pyrolysis oil, saying it “has substantial concerns” that the approval order “may have been made in error ” after a 2023 [investigation](#) by ProPublica and the Guardian “revealed that the U.S. EPA had calculated that one of the chemicals intended to serve as jet fuel was expected to cause cancer in 1 in 4 people exposed over their lifetime.”¹⁶

¹¹ European Union, “[Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on Waste and Repealing Certain Directives](#),” Pub. L. No. Article 3(17).

¹² Yale Environment 360, “[As Plastics Keep Piling Up, Can ‘Advanced’ Recycling Cut the Waste?](#)” June 1, 2023.

¹³ Morfeldt, et.al., “[Carbon footprint impacts of banning cars with internal combustion engines](#),” Science Direct, June 2021.

¹⁴ Yale Environment 360, “[As Plastics Keep Piling Up, Can ‘Advanced’ Recycling Cut the Waste?](#)” June 1, 2023.

¹⁵ State Impact Center, “[AG Actions: Comments of the AGs of MD, CA, MA, DC and other states on SNURs.](#)”

¹⁶ Lerner, Sharon, “[EPA Says It Plans to Withdraw Approval for Chevron’s Plastic-Based Fuels That Are Likely to Cause Cancer](#),” September 30, 2024.

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- **Toxic fuel products:** The fuels produced from plastic waste via pyrolysis also contain more toxic residues, dioxins, persistent organic pollutants), and a class of compounds that could cause liver and kidney damage or cancer than conventional fuels.¹⁷
- **Greater greenhouse gas emissions:** Creating pyrolysis oil from plastic waste and converting it to fuel produces more greenhouse gas emissions than conventional fossil fuel production and refining.¹⁸

Numerous scientific reports provide details of the many harms of converting plastic waste to fuel via pyrolysis, including:

- International Pollutants Elimination Network: [“Plastic Waste Management Hazards”](#)¹⁹
- Plastic Solutions Review: [“Plastic-to-Fuel”](#)²⁰
- GAIA: [“Plastic-to-Fuel: A Losing Proposition”](#)²¹

3. Very little plastic waste can be used to make fuel or plastics in ExxonMobil’s refineries.

ExxonMobil uses existing refinery equipment to co-process plastic waste.²² It first patented the co-processing of plastic waste in 1977.²³ Per its patent, the pyrolysis process that uses heat to break down plastic waste into oil and gas streams takes place in a refinery unit called a “coker.” “Delayed coker” and “flexicoker” processing units exist to refine residual refinery materials (materials such as heavy oils and asphalts). Table 1 shows the capacity of the delayed coker and flexicoker units at ExxonMobil’s refineries around the world, based on publicly available information and an oil density of 300 pound per barrel.²⁴ ExxonMobil’s plant in France is not included because a shutdown has been announced.²⁵

As stated in the lawsuit, inherent contamination in the plastic waste limits the plastic waste feed concentration to 2%: *“Oil and gas refinery and petrochemical units are not designed to process large volumes of plastic waste, which contains a wide range of corrosive additives and contaminants. In order to protect its expensive equipment, ExxonMobil caps the amount of plastic waste it feeds into its cokers at only 1% to 2% of the total amount inputted, meaning*

¹⁷ Plastic Solutions Review, [“Plastic-to-Fuel”](#)

¹⁸ Yale Environment 360, [“As Plastics Keep Piling Up, Can ‘Advanced’ Recycling Cut the Waste?”](#) June 1, 2023.

¹⁹ Takada, H. and Bell, L. [Plastic Waste Management Hazards. International Pollutants Elimination Network \(IPEN\)](#), June 2021.

²⁰ Plastic Solutions Review, [“Plastic-to-Fuel”](#)

²¹ GAIA, [Plastic-to-fuel: A Losing Proposition](#), March 2022

²² ExxonMobil, [“Video: ExxonMobil’s Exxtend technology for advanced recycling virtual tour”](#)

²³ Mobil Corp, [Conversion of solid wastes to fuel coke and gasoline/light oil](#), 1977, US Patent US4118281A

²⁴ Energy Education, [Barrels of Oil Equivalent](#)

²⁵ The Chemical Engineer, [ExxonMobil to shut down French steam cracker and cut 677 jobs](#), April 23, 2024

that 98% to 99% of the coker’s feed is comprised of virgin refinery residual materials. Accordingly, any pyrolysis oil or pyrolysis gas produced will be overwhelmingly derived from virgin materials.”

Based on a maximum plastic waste feed concentration of 2%, Table 1 shows that the total amount of plastic waste that could be co-processed in ExxonMobil’s existing refineries is 542,573 tons per year. **Since ExxonMobil’s total plastic production is 15,950,000 tons per year, there is only capacity to process 3.4% of the plastic waste that ExxonMobil itself produces via its chemical recycling process.**

ExxonMobil’s stated goal of processing 500,000 metric tonnes per year (550,000 tons per year) of plastic waste by the end of 2026 is consistent with the 2% feedstock limit due to contamination.²⁶

Table 1: ExxonMobil Global Facilities Plastic Waste Co-Processing Capacity Compared to ExxonMobil Global Plastic Production

Plant Name	Flexicoker Capacity (tons/yr)	2%: Plastic Waste Feed Concentration to Flexicokers (tons/yr)	Delayed Coker Capacity (tons/yr)	2%: Assumed Plastic Waste Feed Concentration to Delayed Cokers (tons/yr)
Baytown, Texas	<u>2,299,500</u>	45,990	<u>2,956,500</u>	59,130
Baton Rouge, LA			<u>6,761,625</u>	135,233
Beaumont, TX			<u>2,545,875</u>	50,918
Joliet, IL			<u>3,202,875</u>	64,058
Antwerp, Belgium			<u>2,737,500</u>	54,750
Rotterdam, Netherlands	<u>2,244,750</u>	44,895		
Singapore (Visbreaker)			<u>3,011,250</u>	60,225
Sarnia, Canada			<u>1,368,750</u>	27,375
Total	4,544,250	90,885	22,584,375	451,688
ExxonMobil Total Polyolefin production (tons/yr)	15,950,000 <i>(14.5 million metric tonnes Report in ExxonMobil Annual 2023 10k Report)</i>		Total Flexicoker & Delayed Coker Co-Processing Capacity (tons/yr)	542,573 (=90,885 + 451,688)
Limitation on co-processing plastic waste globally			3.4% (= 542,573/ 15,950,000)	

²⁶ ExxonMobil, “[Advanced recycling and the future of plastics.](#)” May 18, 2024