Viewpoint: Making fuels from plastics in Newaygo, Michigan, would be controversial

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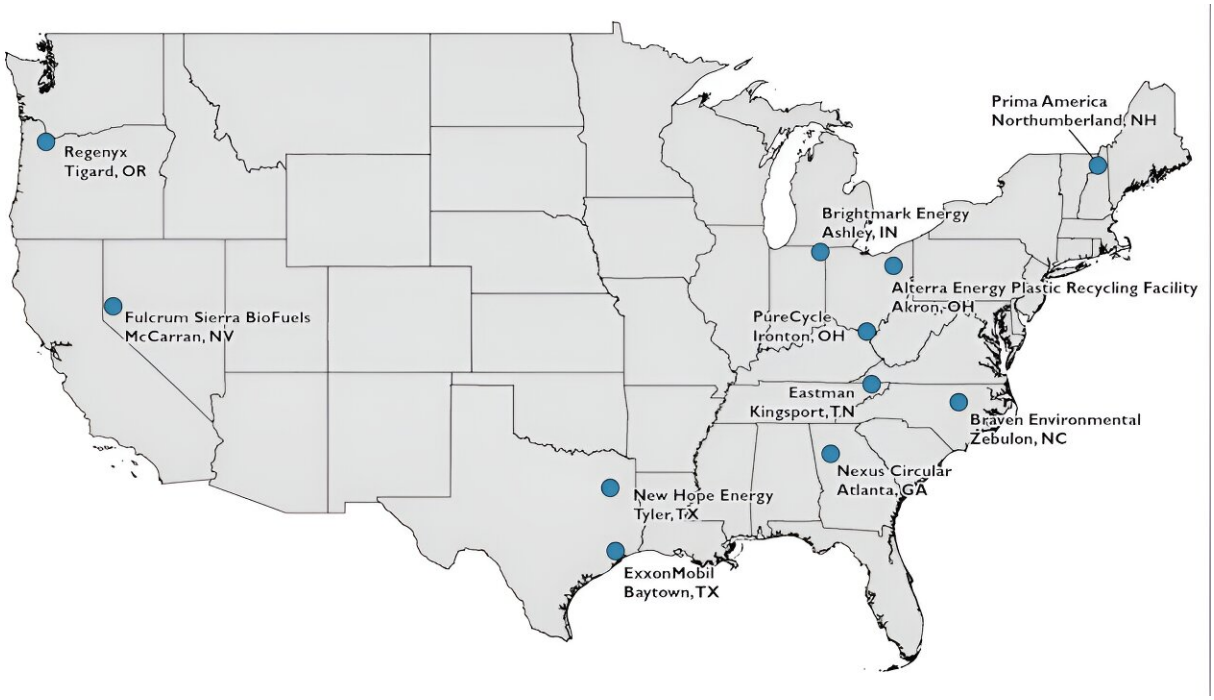

In 2023, 11 chemical recycling facilities were operating in the United States. At full capacity, these plants could process just 1.2% of the 35.7 million tons of plastic waste generated in the country each year. Three of these facilities have since closed. Credit: Beyond Plastics

Humans generate a lot of plastic waste—more than 400 million metric tons a year.

To bring this fact a bit closer to home, the U.S. produced an average of 0.75 pounds (0.34 kilograms) of plastic waste per person each day in 2010, which is equivalent in weight to an unopened can of soda.

Plastic products have been propelling our quality of life forward for over a century, from keeping food fresh longer to enhancing medical hygiene and making transportation more energy-efficient.

In the meantime, plastic waste has also accumulated. Today it is an unsolved and growing problem of gargantuan proportions. Worldwide, only 9% of plastic waste is recycled—largely through mechanical processing, creating products like drainage pipes—and 19% is incinerated. The rest is either buried in landfills or has escaped into the environment, where it damages ecosystems and harms human health.

To address existing and future plastic waste, new approaches beyond mechanical recycling are needed. Researchers have been studying chemical recycling, which converts the waste into new products by breaking the plastics down at the molecular level.

The concept of "chemical recycling" is controversial because it is used to describe many different processes, some of which may be worse for the environment than disposing the plastic waste in a landfill.

In 2023, a recycling center in Newaygo, Michigan, announced plans to open a new chemical recycling facility in partnership with Clean-Seas, a subsidiary of Clean Vision Corporation, a self-described clean-tech business.

When the project was announced, local journalists raised questions about what form of chemical recycling is planned, and whether it will be good for the community and environment. According to Clean-Seas' press release, plastics will be converted into precursors for fuels. The company

has not publicly updated its plans in the past year.

The Conversation reached out to Clean Vision Corporation for comment but did not receive a response.

As professors of chemistry who study chemical recycling at the universities of Michigan and North Carolina and at Kenyon College, we think that making fuel from plastic waste is the wrong way to deal with this problem. Not only does it harm the climate and pollute air and water, but it's also a stretch to even call it recycling.

Air and water pollution loophole

In late 2022, the Michigan Legislature passed an eight-bill package aimed at improving the statewide recycling rate of 23% for all types of waste.

A portion of these bills, which were contested by environmentalists and numerous lawmakers, redefined chemical recycling as manufacturing rather than waste management. Similar laws providing incentives for companies to invest in chemical recycling were recently passed in 24 other states, including Texas, Florida and Pennsylvania.

What may seem like a small distinction could have a big impact on how the proposed facility would be regulated by the state. The Newaygo facility—a partnership between the Michigan Recycling Coalition and California-based Clean-Seas—would be allowed to release more pollution into the air and water if it is defined as a manufacturer rather than as a waste management facility.

The partnership was finalized within months of Michigan's legislation passing in December 2022 with solid majorities in both the state House and Senate.

Is burning plastic-derived products really recycling?

Besides the air and water pollution implications, a more fundamental question is whether the Newaygo facility's planned chemical recycling process—called pyrolysis—is the best use of this waste.

Pyrolysis involves heating waste plastics to break them down into a mixture of small molecules, typically hydrocarbons. The resulting "pyrolysis oil" is then sold on the commodity chemical marketplace, replacing oils derived from crude petroleum. The most commonly suggested use of pyrolysis oil is diesel or jet fuel, both of which generate greenhouse gases when burned.

Not all the waste will be converted to pyrolysis oils at Newaygo. According to Dan Bates, CEO of Clean-Seas' parent company, half of the plastic fed into the Newaygo plant would be transformed into a complex mixture of light hydrocarbons, which would then be burned on-site to provide energy to operate the plant.

If burning plastic-derived oils and gases doesn't sound like recycling to you, the Michigan Legislature agrees, stating that "products sold as fuels are not recycled products."

Given this legal distinction, it is unclear how the Newaygo facility can actually move forward with pyrolysis to produce fuels and still qualify as a chemical recycler.

Are there benefits of chemical recycling?

So, will the chemical recycling practiced by Clean-Seas benefit western Michigan beyond the estimated 30 to 60 jobs it offers?

The main benefit of pyrolysis is supposed to be the diversion of plastic waste from landfills while producing fuels. The Newaygo facility aims to initially convert 50 tons per day, eventually growing to 500 tons per day.

The experience of other industrial pyrolysis projects casts doubt on these projections, with three ceasing operations in the past few months.

Energy giant Shell walked back its pledge to pyrolyze a million tons of plastic waste per year because apparently there isn't sufficient clean plastic waste available for them to use in the process.

Most waste plastic is too complex to be recycled. At every stage, from resin production to the manufacture of products, an assortment of molecules—often proprietary—are added to tailor the properties of plastics. During use, plastics are further contaminated with food waste and other nonplastic materials. Together, these impurities can lead to problems like reactor corrosion and the formation of contaminated outputs, which require inefficient separation steps.

To avoid these problems, most pyrolysis facilities are using postindustrial scrap, the plastic trimmings generated during manufacturing. These pristine plastics are often reused by manufacturers, meaning they wouldn't end up in a landfill anyway.

Drawing conclusions about the climate impacts of chemical recycling can be challenging due to different underlying assumptions used in individual studies. However, a recent meta-analysis, which analyzed the results of 30 journal articles, concluded that using chemical recycling to make new plastics can benefit the climate by reducing greenhouse gas emissions—but that chemical recycling to produce fuels has the opposite effect.

So far, the plans for Clean-Seas, as outlined in its white paper, is to

make fuels for transportation or to power the plant, not to produce plastics.

A focus on circularity

So what should be done with plastic waste?

We believe both consumers and manufacturers should aim to keep materials in use for as long as possible, a standpoint articulated by the Ellen MacArthur Foundation in its report on rethinking the plastics life cycle.

Once all other uses for a plastic product have been exhausted, chemically recycling it to generate new plastic or other durable products can address the entangled problems of plastic waste and climate change.

If the output of the Newaygo pyrolysis facility was new plastics, this circular approach would be better for the climate. But recycling plastics for fuel will not.

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