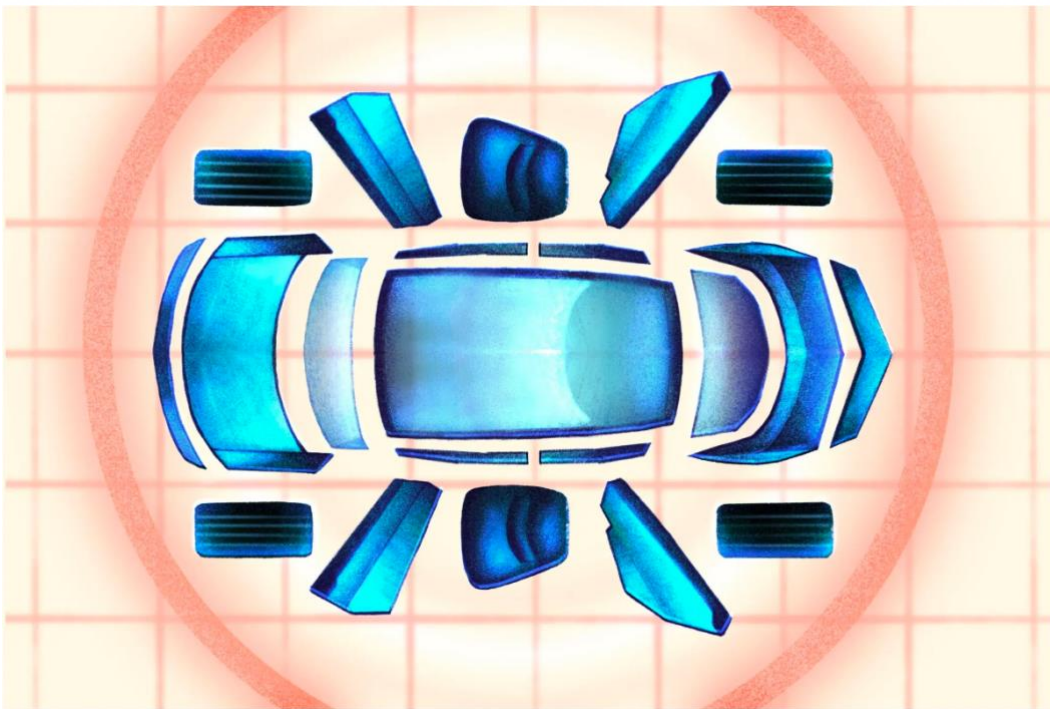


FUTURE OF TRANSPORTATION

Some Carmakers Say Recycling Car Parts Is the Future. But Is It Realistic?

“Circular manufacturing” has the promise to reduce waste by reusing parts to make new cars. There are glimmers of hope, but they are currently outweighed by challenges.



Matt Williams

By Roy Furchgott

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This article is part of our series on the [Future of Transportation](#), which is exploring innovations and challenges that affect how we move about the world.



SHAMIN ABAS
COMMUNICATIONS FOR ULTRA-LUXURY BRANDS

Car tailpipes belch out an estimated 4.6 metric tons of carbon dioxide yearly, but cars begin to pollute long before they ever hit the road. And they continue to pollute long after they are junked. They begin to use energy and emit carbon through extraction and production of the steel, rubber, plastics, glass, lithium and leather used to build them. When scrapped, they molder in junkyards, emitting chlorofluorocarbons, and dripping oils and acids that are a hazard to groundwater.

Now scientists, environmentalists, policymakers and car manufacturers are advancing an idea that could change that. An industrial concept called “circular manufacturing” aims to break the cycle of take, make, use and toss, by building cars whose components can be endlessly reused to make new cars.

The idea is new enough that there is no standard definition — there isn’t even an agreed-on name. It’s variously called circular manufacturing, the circular economy or manufacturing in a circular economy. Nevertheless, circular manufacturing is part of the European Green Deal, which establishes the groundwork for new regulations for car companies.



Although the idea is barely past the conceptual stage, car companies are already rushing to claim circular superiority. “GM Technology is a leader in Circular Economy,” crowed a 2020 news release. BMW, Ford, Toyota, Tesla and others have also made claims on the circular future. Industry observers caution that, for now, the circular economy’s chief value may be public relations.

“This is a ripe opportunity for a lot of greenwashing by automotive firms,” said Richard Gregory, an economics professor at East Tennessee State University who studies the practice. “Are they actively looking to mislead? At this point it’s hard to say because there are no federal regulations about what they are doing.”



The central characteristic of circular manufacturing — circularity — creates both a quandary and an opportunity: There is no one place to start, and each part of the cycle is as important as the next. That means there is no one central problem to address, but it also means even obscure elements of car-making can contribute to improvement.

Despite the challenges, there are glimmers of progress from companies as diverse as a super-car start-up in California, a student project in the Netherlands, and an automotive parts consortium.

“People think we are talking about only recycling, but it is very much larger than that,” said Abhishek Gupta, who leads the World Economic Forum’s [Circular Cars Initiative](#). Broadly, the idea is to reduce how much energy and material go into making a car. There are a number of ways to do that: using more wind and solar energy in the manufacturing process, for instance, or making parts of less or recycled material. “By looking at the measures of carbon and resources you consume, you can really look at your level of circularity,” Mr. Gupta said.



It sounds simple. But a study published in 1998 by the Society of Automotive Engineers found that midsize American sedans comprised about 20,000 components. Cars have only gotten more complex, which is a challenge for recyclers, said Greg Keoleian, lead author of the study, now a professor at the University of Michigan's Center for Sustainable Systems. "There's a lot of room for improvement at end of life of the vehicle," Mr. Keoleian said.

Car recyclers strip valuable parts, like working engines, for reuse. The remaining hulks go to scrap metal companies, which typically shred the rest. But the mixed alloy shred has limited use.

Take aluminum. "The aluminum stream in that case is a mix of a lot of different alloys, including cast alloy, which doesn't go well back into sheet," which is used in body panels, said John Weritz, vice president of standards and technology at the Aluminum Association. The demand for unmixed material is growing as carmakers increasingly use lightweight aluminum body panels, he said.

In circular manufacturing, the answer to the sorting problem is to change the design process to include a plan for dismantling, so a retired car is easy to separate into like sources of metal, plastic, rubber and glass. Setting cars up to provide easily recycled materials helps free manufacturers from supply chain issues: The car becomes its own supply chain.



One place the car industry says it is making tangible gains is in packing and shipping materials. “We reduced packaging by using reusable shipping containers,” said Kevin Butt, chairman of the Suppliers Partnership for the Environment, a consortium of companies and government agencies that deal with transportation. Although the idea isn’t new, Toyota North America, where Mr. Butt is director of environmental sustainability, said that since 2017 it has reduced 65 million pounds of cardboard and 171 million pounds of wooden crates, and has saved \$273 million by using containers molded of recycled plastic to ship parts like struts, catalytic converters and steering wheel shafts. The consortium wants to see the practice adopted by all of its members.

Between building and recycling there is, of course, use. The circular goal there is to extend how long a car remains on the road: Fewer new cars mean fewer materials and less energy needed to build a new one. But there is a hitch — at a certain point keeping an aged car running may contribute more to pollution than building a new one would.

“If we keep gas-guzzlers on the road too long, we are benefiting from a material point of view, but not from an emissions point,” said Jennifer Russell, who co-wrote [a U.N. report](#) on the circular economy.



One of the more ambitious projects to keep cars on the road is Renault's Refactory in Flins, France, a 915,000-square-foot facility dedicated to a vast experiment in making and refurbishing cars, and converting some to electric power. It is creating a dismantling line, to provide parts for discontinued cars, as well as unmixed streams of metals and plastics for recycling. It may also convert some gas-powered vehicles to electric, with a goal of recommissioning 25,000 vehicles this year.

The main element of the experiment concerns how to make circularity feasible as a business. "They can't do everything because it's good for the environment; they have to have business reason for it," said Alice Bodreau, global partners manager at the Ellen MacArthur Foundation, a nonprofit dedicated to the circular economy, which is partnering with Renault.

All of this has gained the attention of major carmakers. Last year BMW made a splash at the International Motor Show in Munich with the iVision, a concept car it said is completely recyclable. But those efforts are way behind a lesser known student effort at Eindhoven University of Technology in the Netherlands, which has been producing recyclable concept cars for years.





Students from the Eindhoven University of Technology team with the ZEM recyclable concept car model they helped develop. Eindhoven University of Technology

The students, who are now on their fourth generation of this vehicle, which this year is called ZEM, for Zero Emission Mobility, may still be ahead of the majors. BMW's lauded iVision was styled like an economy car: tiny, square-ish and simple. The students found the public indifferent to a similar aesthetic in their previous versions — but they have a plan to solve that problem.

“This year we wanted to make a really badass-looking car so people would want to interact with it,” said Louise de Laat, manager of the student team for the school's TUecomotive effort. The ZEM, built for approximately \$50,000, bears passing resemblance to the sporty BMW 4 M Coupe, and is made of 3-D printed plastic reinforced with glass or carbon fiber. The ZEM is currently being shipped to America for a tour.



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Of course, carmaker's concept models and student projects are unconstrained by safety regulations. But the car company Divergent 3D is now producing the Czinger 21C, which is not only designed using principles of circular manufacturing, but is also street legal and set a track speed record at Laguna Seca. The car is built using 3-D printing that reduces the amount of material used in a car by an average of 40 percent, without compromising strength. The parts, printed of aluminum, can be atomized and the powder reused, which would seem energy intensive, but the company founder, Kevin Czinger, said, "The amount of energy is far less when you take into account you are extracting materials through mining."

Unfortunately, for the time being, the "eco" in "eco-friendly" does not stand for economy. The first major manufacturer to use a Divergent 3-D printed subframe is Aston Martin, which will put one in the head-turning limited production DBR22 convertible. The price? A base model will cost you around \$2 million.

