We have a problem: the fuel many of us use to run our cars and heat our homes is running out, and even while it lasts it is causing the Earth to heat up, allowing diseases to spread and damaging habitats, possibly including our own.

Fortunately, scientists publishing in Nature this past August have developed a strategy that may make it possible to use bacteria to generate low-cost biofuels, by reversing a metabolic process that the bacteria do naturally.

Beta-oxidation is the process by which bacteria and other organisms, including humans, break down fatty acids to generate energy. And since fatty acids are a great kind of molecule for storing energy (many organisms use them for that purpose, including humans), the scientists decided it would be worthwhile to try and get bacteria to produce some that could work as biofuel.

They did this by introducing mutations into *Escherichia coli*, replacing some genes that only turned on when needed with versions that were on all the time and deleting one that would keep the system from working. However, this alone was not enough.

So they turned on some genes to make *E. coli* produce butanol, which can be substituted for gasoline, and this worked well. After overexpressing and deleting some more genes, they ended up with a strain that produced more butanol at a higher rate than has been seen before in other attempts—about 10 times faster—all when grown only on simple, minimal food.

The researchers also discovered that the process they had developed generates a lot of different byproducts which could easily be converted into other useful chemicals besides fuel.

So these scientists, instead of trying to improve the efficiency of processes that bacteria normally use to make fatty acids, reversed the process they use to break them down, and ended up with a highly efficient system. This may make sense because bacteria in nature might need to be able to access the energy they had stored faster and more efficiently than they would need to store energy in a time of plenty.

Hopefully this process will be scalable and cost-effective enough to reduce our need for fossil fuels. And as a bonus, this method can be used to make other useful chemicals efficiently from bacteria, or can be re-engineered in other industrial organisms for various other processes. It’s quite a useful development.

This paper demonstrates just how amazingly far our understanding of *E. coli*’s genes and genetic functions has progressed. The researchers knew so much about how the bacterial enzymes and genes work together that they could go in and make fairly few specific changes, and then if that didn’t work perfectly they made some more specific changes to fix it. That sounds simple enough, but in my experience, making that many changes could take a long time even if everything goes right (and it’s rare that everything goes right).

But knowledge that the scientists possessed that allowed them to make the changes they did came from years and years of previous research by other people. It shows how science builds on itself, and how investigating questions like the function of a specific bacterial gene, questions that don’t seem to have any specific application for technology or society is important, because the knowledge gained could be essential for unforeseen applications in the future. And it can be pretty cool in the meantime!