

# Sunlight travels 93 million miles to reach the earth

None of them through the Strait of Hormuz

[Bill McKibben](#), March 6, 2026

Fossil fuel is the ultimate Rube Goldberg machine, a colossal waste at every step

A week ago, I made my geopolitical point about the then-new Iran war—**any leader with a brain would be trying to build up their clean energy capacity to avoid the kind of fossil fuel squeeze now underway.** The message has spread ([eloquent](#) explanation from the venerable Paul Krugman this morning).

But since this is a teachable moment like few others, I wanted to in a sense make the same point again, but this time in a way that I hope is useful to all of you as you try to explain the possible futures to friends, neighbors, and perfect strangers. I think it's an exercise perhaps worth copying and pasting, because it highlights something important: **the incredible simplicity of clean energy, as compared to the Rube Goldberg contraption that is fossil fuel.**

We're very used to the fossil fuel paradigm, and so it doesn't strike us as complicated. But consider.

If you want a gallon of gas for your car, someone first needs to have drilled for oil—in a few places (Saudi Arabia) this is still relatively easy, but increasingly it means figuring out how to go a mile beneath the surface of the sea, or frack the subsurface geology, which is to say blow it apart. **Once you've collected your crude, you need to carry it to a port, often through a pipeline that must cross mountain and desert, and there load it on to a giant ship,** which must sail the seas. **Upon arrival somewhere, it needs to be piped to a refinery,** which is among the most complicated pieces of machinery known to man. **There it must be separated by heating in a distillation column, so that the light products—gasoline—rise to the top, and heavy products—say, asphalt—sink to the bottom.** You use heat and pressure and chemical catalysts to “crack” some of the heavier molecules into lighter, more valuable products, and then you treat what you've got to remove impurities like sulfur. **You pipe it part of the way to its final destination, and load it into trucks for delivery to gas stations, where it is stored in underground tanks,** until someone appears with a credit card to pump it into his vehicle. **In the engine of the car** it is mixed with air inside a cylinder and compressed; a spark plug fires, forcing a piston to move; this linear motion is converted by a crankshaft into rotational energy to move the car; meanwhile the piston pushes out the burned gases.

This “works”—the proof is all around us, in a society built for cars. But man is it inelegant. Think of all the things that can go wrong. **Your oil well can leak, coating the surrounding water with oil;** if you’re fracking, you can trigger earthquakes. **The pipeline can leak too**—and they do so fairly routinely, coating waterways or farm fields with crude. **Your ship might run aground and spill oil**—or it might be held in place by oh I don’t know an ill-advised regime change war because it must travel through a narrow strait. **Refineries can catch on fire**—in wartime because they become **easy targets for your enemy**. The underground **storage tank at the gas station can leak too, often polluting groundwater**. And the engine where you’re burning this gas can break, because the drivetrain—depending on how you count—has hundreds of thousands of moving parts. (A crankshaft, say, typically rides on five main bearings, each with two bearing shells).

**And even when they work perfectly, internal combustion engines waste enormous amounts of that gasoline—only about 25 percent of its energy actually moves the car, with the rest spent on heat, friction, and idling.** And when you burn that gas, you produce a fair amount of pollution. The quantities of carbon monoxide and particulates can be reduced fairly dramatically with good pollution control equipment, like a catalytic converter that needs some platinum or palladium or rhodium. But there is no way to reduce the amount of carbon dioxide per gallon of gasoline burned—indeed, if you make the engine “cleaner,” it actually **produces slightly more CO<sub>2</sub>**. How much carbon dioxide? A gallon of gasoline weighs about six pounds. When you burn it, the carbon atoms mix with oxygen atoms in the air to form about 19 pounds of carbon dioxide. **The average American car driven the average American distance releases about its own weight in CO<sub>2</sub> each year.** And that is why the polar ice caps are melting. That is why we just had the second-warmest winter in American history. That is why hundreds of millions of people have to flee their homes.

***Now think about an EV instead. The sun produces energy by fusing hydrogen atoms into helium. It travels 93 million miles in about eight minutes and 20 seconds (seven seconds more when our orbit takes us furthest away). Those photons then strike the silicon atoms in a photovoltaic panel, knocking loose electrons that produce a stream of direct current electricity; an inverter, now usually contained in the panel, converts that to AC power, which can be pumped directly into the battery of an EV where the motor uses electromagnetism to create a rotating magnetic field in a stator, which spins the inner rotor to propel the car. There are about 20 moving parts in the engine, and it is 80 to 90 percent efficient. There is no exhaust and almost no noise. That’s it. And if you poured those electrons into an e-bike instead of an EV, it’s even better: a penny’s worth of power is good for three miles or so. The same principles apply to electric buses, electric ferries, and so on.***

**This method cuts maintenance and operation costs in half for drivers, and the EV is at this point not much more expensive than the average car** (in China and most of the rest of the world, it’s

less). More to the point, it produces no pollution—this would reduce global health costs by a trillion dollars a year or so. And it produces no carbon dioxide, whose warming effects are expected to cost the planet \$38 trillion annually by mid-century. Those numbers represent millions upon millions of people who would get to live instead of die.

**Also, no one can use a missile to shoot down a photon in mid-air. It is essentially war-proof.**

**Also, you can do it on your roof or your balcony, or in your community. You don't require an oligarch. It would impoverish Vladimir Putin, Mohammed bin Salman, the CEO of Exxon. (And that's why we don't work harder to get it done; they're in the way).**

For a long time we **couldn't** do this. The solar cell wasn't invented until 1954, and for decades it produced very expensive power. But now, thanks to activists and engineers, it produces the cheapest power on planet earth.

In a sane world we would be spending all our time and money building solar panels just as fast as we could. The Trump administration is expected to ask Congress next week for \$50 billion in supplemental funding for its war in Iran—we're spending roughly \$2 billion a day to blow up schoolgirls. Bringing solar power to 380 million Africans who currently have no electricity would require about \$91 billion.

**Sooner or later we'll wake up. Let's hope this absurd war helps speed up the timetable.**