



## We May Have Solved Our Burping Cows Problem

Cows release methane, a potent greenhouse gas, when they burp, pass gas, and exhale. With more than 1 billion cows on the planet, that's a lot of heat-trapping methane being emitted. In this video, we investigate the ways scientists are developing Solutions to methane-producing cows beyond simply persuading humans to eat less meat and dairy.

**0:03**

*Images of emissions sources.*

When you think about stuff that contributes to climate change, you might picture you'd smoke stacks or traffic in Los Angeles or something that generally looks dirty. But how about a huge field full of big eyed, adorable, grazing cows. It might sound a little silly, but when you get enough cows in one place they burp and exhale a lot of methane, a greenhouse gas even better at trapping heat than carbon dioxide. In fact if cows were a country that nation would be one of the biggest methane producers in the world, if not the biggest. One way to reduce this is to just eat less meat and dairy and there will be fewer cows created. But while that is a great option, it's not likely that most people will go vegan anytime soon.

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*Images and models of cows and their digestive system.*

So, researchers are turning to other solutions and they're easier to implement than you might think. One option is to change what cows eat. Right now the average cow mainly eats fibers like hay or grass. And they can do that thanks to their complex four-part stomachs, which are great at breaking down tough starches. So those stomachs are also the problem. When a cow swallows hay, it ends up in their first stomach chamber called the rumen. There microbes get to work fermenting those fibers and preparing them for digestion. The issue is that fermentation releases a bunch of hydrogen and carbon dioxide. And then other microbes turn those compounds into methane gas, which the cow then burps or breathes out.

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*Image of seaweed.*

Over the years, scientists have tried to find food or supplements that reduce the amount of methane, those microbes make, and they've explored everything from corn to various oils. But one promising option seems to be seaweed. It's not clear exactly why this works, but scientists think some components and certain types of seaweed can interfere with one of the catalysts involved in methane production. People have been looking into this for a pretty long time but a study published in 2019 demonstrated just how effective it can be. In it 12 dairy cows were randomly assigned to 3 groups, All cows ate some hay but one groups diet consisted of 1% seaweed, a second group of 0.5% seaweed, and the third group got no seaweed.

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Over several trials, each of which lasted three weeks, the cows ate their fancy meals and breathalyzers were used to measure how much methane they were exhaling. And the results were more dramatic than you would think. The cows that received half a percent seaweed yielded about 20% less methane and the 1% group yielded about 43% less for 1% seaweed Still, even though the trial went well, there were some side effects. Like the cows were fine, but they did release way more hydrogen and carbon dioxide than usual. That makes sense because those compounds would normally combine to form methane. But they are greenhouse gases, they're just not as potent as methane. So that's something we should keep in mind.

**2:58***Video clip of cows grazing.*

Also this solution probably would not be cheap. Some expense is to be expected, of course. After all, nobody said that reducing greenhouse gas emissions would require zero sacrifices. But then there is the bigger problem: Where do you get all that seaweed? There are more than a billion cows on Earth, so even if we wanted to scale this up a little that's still millions of kilograms of seaweed to grow. And that's not something anyone has really tried to do. So scientists are trying to find some other options. And they might have found a pretty cool one. Instead of changing a cow's diet, you go straight to the source and change their gut microbes. In a big paper published in *Science Advances* in 2019, researchers studied more than a thousand cows, analyzing both their DNA and the genetic material of the microbes and their digestive system.

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Now, as expected, not every animal had exactly the same microbes. About 500 of them were shared among 50% of the animals. Some of those 500 seem to be involved with the cows methane production. And many of them were at least somewhat heritable. In other words they were passed from cow to cow through the generations. So if you know which microbes cause cows to make methane and you know that they're heritable, well the researchers proposed you could breed cows to produce less methane. Alternatively, since that breeding would take time and we need climate solutions like yesterday, it might be possible to use a probiotic to change a cow's microbiome after birth.

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The biggest benefit to this would be that you get to ditch the fancy diets. The cows would be exhaling less methane all by their bad selves. The lower methane emissions isn't exactly a moneymaker as far as cow traits are concerned. The animals are usually bred for things like size or milk production. So, for this to take off the cattle industry might need some kind of encouragement. At the end of the day, it's important to remember that neither of these solutions by themselves will fix climate change, or even cows contributions to it.

**5:01***Image of family making dinner.*

To really make an impact, we're gonna have to combine things like this, and, honestly, we'll have to combine it with eating less meat, which is a really effective option as well for those who can make that choice. But the thing is, climate change is a big complicated problem and one we will have to approach from dozens, if not hundreds of angles. So, when people work to find and implement real solutions like these, there are real reasons to get excited. This episode of *SciShow* was supported by Bill Gates, who, through breakthrough energy, is working with some of the world's top tech and business leaders to advance clean, reliable, and affordable energy and to scale the technologies we need to help the world reach a net zero emissions future.



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