



TINTA's Dr Guillermo Berra attaching a harness and gas collection bag to the back of a cow. Each bag has a capacity of 150 litres.
CREDIT: INTA, ARGENTINA.

Cows as biodigesters with legs

Concerns about livestock's contribution to greenhouse gas emissions are not new. This represents an area in which the meat industry is working to lower its carbon footprint. One new idea to have come out of agricultural research in Argentina is to show that it is possible to capture, purify and compress some of the gas that cows produce and use it as a source of energy.

Scientists in Argentina have found a way to transform the gas created by the bovine digestive system into fuel, an innovation that could help the livestock industry make an important contribution towards curbing emissions of greenhouse gases such as methane.

The Intergovernmental Panel on Climate Change (IPCC), the world body for assessing the science related to climate change, has said in a new synthesis document (see separate article in this section) that reducing emissions of non-CO₂ climate forcing agents, including methane, can be an important part of the battle against global warming. It insists that low-cost options to reduce many of these emissions are available but says specifically that methane emissions from livestock "are difficult to mitigate" and that the main focus needs to be on other targets. Livestock

farmers still need to do everything they can to help, though, and this example from Argentina is one that, while unusual, could quite easily be copied in many parts of the world.

Using a system of valves and pumps, the experimental technique developed by Argentina's National Institute of Agricultural Technology (INTA) channels the digestive gases from bovine stomach cavities through a tube and into a container on the animal's back. The gases are then processed to separate methane from other gases such as carbon dioxide. "Once you get it compressed, it's the same as having natural gas," says Dr Guillermo Berra, head of INTA's animal physiology group. "As an energy source it is not very practical at the moment, but if you look ahead to 2050, when fossil fuel reserves are going to be in trouble, it is an alternative."



Methane from a cow's digestive gases can be purified, compressed and used as an energy source.

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Methane is the main component of natural gas, which can be used to fuel everything from cars to power plants. Each head of cattle emits between 250 and 300 litres of pure methane a day, enough energy to keep a refrigerator running for 24 hours, according to INTA's calculations.

In the bag

The method INTA has used consists of attaching a plastic bag as the container to the cow's back, held in place by a harness and connected to the cow's rumen by a tube. The tube has the same diameter as a ballpoint pen and a local anaesthetic is applied before its insertion. The whole package weighs up to two kilos, Guillermo Berra says. It looks as though more work would need to be done on the best way to prevent the bag from filling up with so much gas in the course of the day that it becomes too heavy for the cow to carry comfortably for any livestock farming operation to run this idea on a large scale, but Dr Berra repeats that INTA's aim is only to show that it is possible. The gas coming out of cows (and other ruminants) need not go directly into the atmosphere, or at least not all of it. There are ways in which we can capture some of it and put it to good use.

In its studies it used bags with a capacity of 150 litres; 150 litres of methane would weigh more than 60 kilos. "One of the fundamental aspects of the project is to cause no pain or discomfort to the animals," INTA has said. "So we worked exclusively with animals used to a milking parlour because of their temperament and docility. They were animals that were used to being put into pens; this made it easier to insert the tubes and to collect the gas from the bags on the cows' backs."

A challenging volume

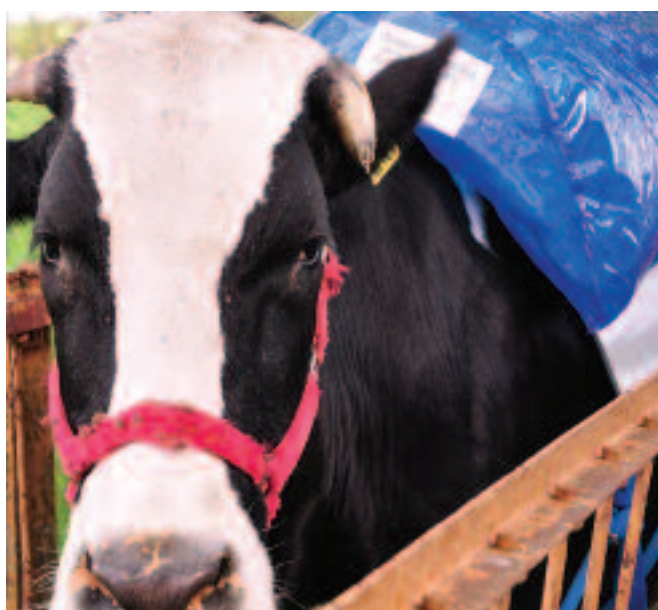
Doctor Berra points out that each adult cow is likely to produce the challenging total of 1,000 litres of intestinal gas per day, about 300 litres of which is methane. INTA's project demonstrates a method for collecting it so that farmers or other interested parties can purify it, compress it and use it. "What you end up with is gas that is similar in composition to the

biogas from a biodigester," he adds. "So, before you can use it, you have to purify it to eliminate hydrogen sulfide and carbon dioxide, substances that, if left in the mix, could cause damage to any motor or engine that you wanted to power with the biogas. To keep everything as easy as possible, the INTA team worked out a method of purification that typically results in a biogas that is 95% methane. This involves filtering the digestive gases from the cows through an amine solution (75% water, 25% monoethanolamine) using, believe it or not, an exercise bike as a pump in a process known as 'scrubbing' or 'sweetening' the gas. "The bicycle is one of the most effective machines we have for transferring energy from the human body," the institute insists. "A cyclist weighing 70 kilos travelling at between 10 and 20 kilometres per hour will consume between 245 and 410 calories per hour." To achieve a level of 95% methane in the purified gas, INTA found it best to run the gas through this simple system twice.

Practical uses

Following this, the next step is to compress the biogas at 12 bars of pressure and store it in containers for use when needed. Practical tests that INTA has carried out include using this gas to run a stove, a refrigerator, a lighting system and even a motor car, in this case a specially adapted 2010 model Chevrolet Corsa.

When news of the project first broke in Argentina in 2013, INTA received a number of protests complaining that the idea was cruel to the animals. Guillermo Berra says he understands this reaction, but insists the cows that have formed part of the study have not suffered in any way. Some adjustment of the harness holding the bag on the cow's back was necessary, as was a period of time for the animal to lose sensitivity in the skin around the tube, but cow comfort has been a major part of INTA's thinking throughout. "All we wanted to do," Dr Berra says, "was to show that the gas cows produce as a part of the digestion process can be used for energy, rather than just go into the atmosphere. It's true to say that cows are biodigesters with legs." 🐄



Each adult cow produces around 1,000 litres of gas each day. INTA's research team has come up with one way of mitigating the effects of this gas on the environment.

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