Electrified methane reformer produces far less carbon dioxide

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A team of researchers from several institutions in Denmark, along with colleagues from Sintex and Haldor Topsoe, has developed an electrified methane reformer that produces far less CO_2 than conventional steam-methane reformers. In their paper published in the journal *Science*, the group describes their new technology and how well it works. Kevin Van

Geem, Vladimir Galvita and Guy Marin with the Laboratory for Chemical Technology and Center for Sustainable Chemistry in Ghent have published a Perspective piece on the work done by the team in the same journal issue.

Production of hydrogen is big business. Approximately 60 million tons are made each year. It is used primarily to make methanol and ammonia for fertilizer. Some researchers estimate that collectively, steam-methane reformers account for approximately 3 percent of all global CO_2 emissions.

The steam-methane reformer is a very large device that is used to extract hydrogen from methane. It is also a major emitter of CO_2 into the atmosphere. It is typically housed in a large, six-story building where natural gas is burned to heat methane and water under pressure causing the molecules to form syngas—a mixture of carbon monoxide and hydrogen. It also produces CO_2 when some of the mixture does not combust properly and as the natural gas is burned. In the new effort, the team in Denmark sought to build a methane reformer that uses electricity instead of natural gas to heat the methane and water. The goal was to reduce both CO_2 emissions and costs associated with making hydrogen.

The team reports that the resulting device is significantly smaller than a conventional methane reformer and far cleaner. By using electricity, they were able to heat the methane/water mixture more evenly, which resulted in fewer CO_2 emissions. Also, the heating process itself produced no CO_2. The researchers point out that if their device were powered by electricity generated from a renewable resource, they could reduce the footprint of hydrogen production dramatically. They suggest that if all the steam-methane reformers in the world were replaced by electrified systems, the world would see a 1 percent drop in CO_2 emissions.

More information: Sebastian T. Wismann et al. Electrified methane reforming: A compact approach to greener industrial hydrogen production, *Science* (2019). DOI: 10.1126/science.aaw8775