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Physics forecasts for fracking and fuels

November 20, 2017



To generate sand slurry requires a low-pressure manifold to mix water and polymers with sand.
Credit: Tadeusz Patzek

Society's demand for energy relies mainly on oil and gas, which are finite resources. Future technologies could reduce the consumption of energy, but until then, existing resources must be carefully managed. Director of the Ali I. Al-Naimi Petroleum Engineering Research Center at KAUST Tadeusz Patzek is using physics to tackle this challenge by modeling the production of gas from fracking.

Patzek and his coworkers describe two visions of global energy consumption. Optimists believe that human population, energy use and economies can continue to grow exponentially because humans will keep inventing innovative ways to survive. Others, however, note that the Earth imposes clear limits on growth, meaning that energy production will peak before tailing off.

Oil and [gas production](#) has indeed reached peaks in the past, but these have been usurped by discoveries of new reserves and technologies for extracting fuels from previously inaccessible areas. The most complex and controversial new process is fracking (hydraulic fracturing) of ancient ocean beds called

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Their resulting model requires very few parameters to [model](#) the diffusion of gas out of fracking wells, and the researchers validated it by accurately predicting the output of 14000 gas wells in the US.

Overall, the study showed that only 10-20% of natural gas in fracking fields is being extracted with today's techniques. This suggests that, while technical improvements could prolong the lifetime of fracking as a useful fuel source, the flood of gas predicted by some industrialists is not yet guaranteed.

Patzek won't state whether he is an optimist or a pessimist regarding [fracking](#). "I am neither," he says. "I am a scientist, and my outlook on nature is governed strictly by the chemistry and physics of the processes at hand. However, I am also an avid environmentalist, and from this perspective, business as usual is ending for humanity."

Patzek and coworkers have certainly shown that physicists have a role in developing new business models for future [energy](#) sources.

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More information: Michael Marder et al. Physics, fracking, fuel, and the future, *Physics Today* (2016). DOI: [10.1063/PT.3.3236](#)

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