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An upper bound to gas delivery via pressure-swing adsorption in nanoporous materials JORDAN POMMERENCK, CORY SIMON, DAVID ROUNDY, Oregon State University — The transportation sector accounts for 38% of US energy-related carbon dioxide emissions and generates toxic air pollution (particulate matter, ozone, NO_x, SO_x, carbon monoxide, volatile organic compounds) . Alternative transportation fuels, such as natural gas or hydrogen, are therefore critical to mitigate climate change and improve air quality. Both natural gas and hydrogen (gas) possess a very low volumetric energy density compared to (liquid) gasoline. Consequently, under storage space constraints in passenger vehicles, they must be densified such as through physical adsorption on nanoporous materials in order to drive a reasonable distance on a full tank of fuel. The US Department of Energy (DOE) set storage targets for adsorbed natural gas and hydrogen onboard light vehicles. To assess the feasibility of these targets, we provide a theoretical upper bound on the density of natural gas and hydrogen that can be stored in and delivered by nanoporous materials via a pressure swing. We conclude that, while the DOE storage targets are theoretically possible, the material would require a void fraction that is outside the range of void fractions in known materials exhibiting sufficient interactions with the gas.

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