TECH DEPT.

Gas, Naturally

> ANOTHER STEP IN MANKIND'S ASCENT FROM CARBON TO HYDROGEN.

The answer may have been under our noses all along. Natural gas (NG), the same energy source we use to fry our bacon and to warm our living rooms, is finally under serious scrutiny as a means of powering our cars and trucks.

Texas oil billionaire T. Boone Pickens has been singing NG's praises for more than a decade. President Obama, attacked by Republican candidates for his blue-sky energy policies, recently joined the chorus by proposing legislation to extend hybrid and electric-car incentives to this alternative fuel. FedEx and UPS are both in the early stages of converting their fleets to run on NG. By the end of this year, everyday consumers will be able to buy not just natural-gas Honda Civics but Chevy, Ford, GMC, and Ram pickups running on NG as well.

Enthusiasm is rising because of NG's attributes. It's significantly cheaper than gasoline on an energy-equivalent basis. It burns cleanly, spewing relatively little carbon into the atmosphere (more on this below). Few modifications are necessary to optimize both spark- and compression-ignition engines for its use. No foreign wars are needed to secure a stable supply. At our current rate of consumption, there's enough NG in the U.S. to last 90 years; the more we explore our shale formations, the more we find. And our network of 2.2 million miles of underground piping is a good start on the infrastructure we'll need when NG takes on an expanded transportation role.

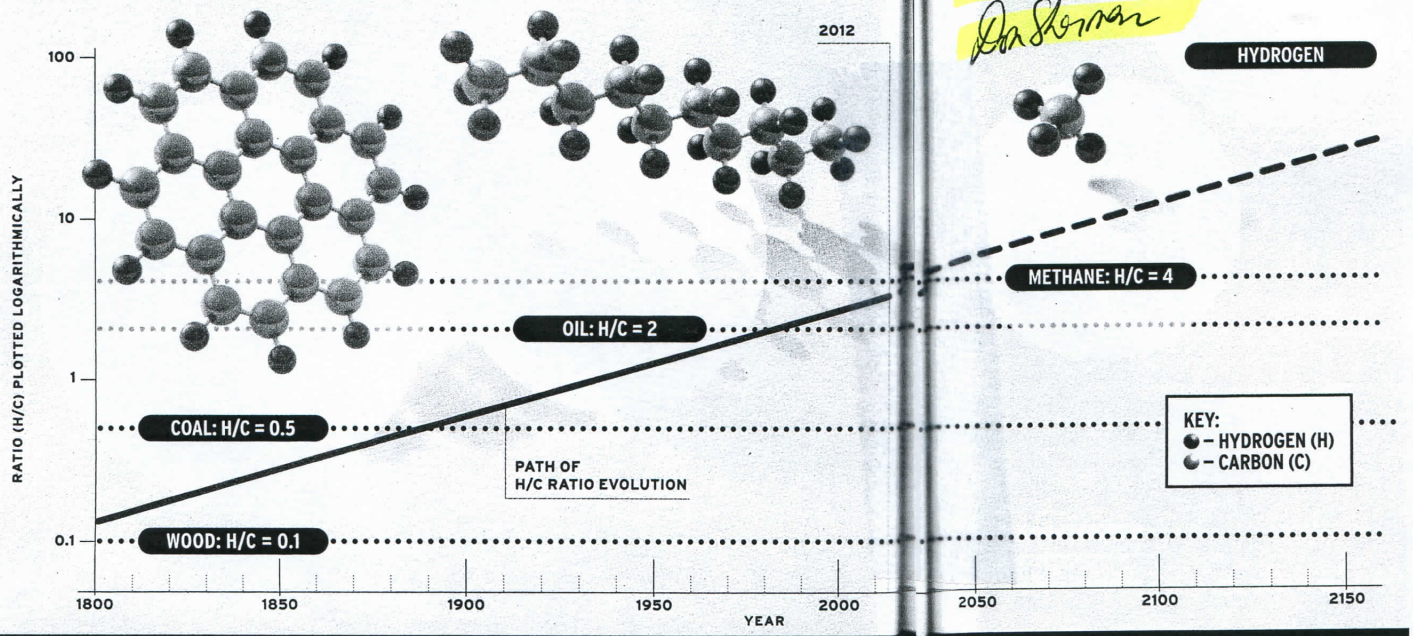
That this fuel is a gas at room temperature makes it more easily combustible than gasoline but more difficult to transport. One solution is to squeeze NG to 3600 psi, yielding compressed natural gas (CNG). Even at that pressure, NG requires 3.8 times the space to match the energy in a gallon of gasoline. This is why long-haulers such as UPS are leaping past CNG to liquefied natural gas (LNG) for both its long-haul rigs and brown in-town trucks. Refrigerating NG to –260 degrees Fahrenheit to liquefy it more than doubles its density.

Oceangoing ships have safely transported LNG for 50 years. Admittedly, though, the compressing and chilling consumes energy and can be troublesome. On the difficulty scale, making NG more portable falls between gasoline—practically no bother at all—and electricity, which requires heavy and expensive storage batteries. But lessons learned developing a new family of NG fuel tanks for cars and trucks will not be wasted.

These lessons are the next step in mankind's move from carbon toward hydrogen energy consumption [see graph]. As cavemen, we began with wood fires 750,000 years ago. The carbon-to-hydrogen ratio in wood is about ten-to-one. Coal, with carbon and hydrogen in a one- or two-to-one ratio (depending on the variety), represented a major step forward when it came into wide use during the 19th century—though we know better today. The 20th century brought petroleum, shifting the balance toward hydrogen in a two- (or so) to-one ratio with carbon. NG, which is mainly methane, continues this trend with four hydrogen atoms for every carbon atom. Extending the path we've followed for centuries will eventually take us to a full hydrogen economy where carbon is no longer part of the deal. —DON SHERMAN

Dr. Ausubel:
Thanks for your assistance,
Don Sherman

EVOLUTION OF THE HYDROGEN-TO-CARBON RATIO IN THE WORLD'S PRIMARY FUEL MIX



SOURCE: JESSE H. AUSUBEL, DIRECTOR OF THE PROGRAM FOR THE HUMAN ENVIRONMENT AT THE ROCKEFELLER UNIVERSITY

ILLUSTRATIONS *by* BRYAN CHRISTIE DESIGN