

The Evolution of Energy Density

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Laying down the scientific groundwork, energy density is the amount of energy stored in a system or region of space per unit volume. For purposes of conducting measurements, it is only the useful, extractable energy that is measured.

During the 20th century, developing and developed countries observed a major technological advance and improvement in the quality of life that was fueled by fossil fuels. According to the World Bank, 100 percent of Americans have electricity, unlike nearly 1.4 billion people in the nonurban communities of Africa and Asia that lack electricity. Unfortunately, as the population growth of those communities rises, so too does

the number of people without electricity. Furthermore, over the last 50 years, there has been no reduction in the energy consumption gap between developing and developed countries. As it is apparent, new ideas for access to basic energy services are apparent and necessary in order to reduce the number of nonurban communities lacking power.

Energy density plays a major role in the evolution and comparison of various fueling sources that may be capitalized upon for purposes of producing electricity within all communities and markets. Evaluating transportation fuels is a great means of understanding the importance of energy density as it applies to nearly all countries. Considering strictly fuel for transportation, energy density, in addition to the cost, weight and size of energy storage are also important characteristics that are considered. Some fuels that require large, heavy, or expensive storage may reduce their attractiveness from a cost and efficiency standpoint. In this circumstance, gasoline and diesel fuels have been superior to liquefied natural gas, or LNG, and compressed natural gas, or CNG, based on their larger energy densities per unit volume.

Lower prices at the pump are certainly attractive to the consumer, but so too are the reduced costs in renewable energy. At the rate that the price per barrel of Brent crude is falling, the crossover point where fossil fuels cease to be cost-competitive could occur soon, making the cost to refine crude oil into gasoline well below its marginal production cost. As a result, many have been turning to electric-powered vehicles as their primary source of transportation. However, the lower energy density per unit volume in the lithium ion batteries of these vehicles results in a limited driving range relative to gasoline-powered vehicles. Looking outside of the transportation lens, from an energy density standpoint, gasoline and diesel fuel may be the short-term answer for low-cost energy production in developing countries. However, with advancements in the development of renewables, they are the

low-cost, long-term answer.

So lots of evolution and flux occurring, but one sure way to lower your costs is to lower your density if at all possible. That's easier said than done here in America.