FOCUS QUESTIONS

1. Why is it not appropriate to compare only the "costs" of various forms of energy? What issues are often overlooked or ignored in attempting to do that?
2. Many argue that we cannot "afford" to shift from our current fossil fuel economy to one that relies more heavily on renewable energy. Why, according to Fridley, is this shift more "affordable" than continuing our current system, and what are the costs of not making it?
3. What ethical issues do you see in the imbalance of per capita energy consumption between the developed and less-developed areas of the world? Is it possible or desirable for underdeveloped regions to start consuming energy at a pace comparable to that of developed regions? What are some different ways that the developing world might gain access to this energy? Which approach would be best? Which would be worst? Please explain your answers with specific reference to Fridley's article.

KEYWORDS

baseload, biomass, bioreactors, capacity factor, conversion efficiency, corn ethanol, deployment, energy bounty, energy return on investment (EROI), feedstocks, footprint, full-cycle water requirement, Hirsch report, hybrid vehicle, input costs, intermittency, megajoules (MJ), net energy, oil shale, photon-absorbing silicon panels, physical accounting, post-carbon world, rare-earth elements, scalability, smart-grid, storage, substitutability, tar sands, thin-film solar, timing

The scramble for alternatives is on. High oil prices, growing concerns over energy security, and the threat of climate change have all stimulated investment in the development of alternatives to conventional oil. "Alternative energy" generally falls into two categories:

- Substitutes for existing petroleum liquids (ethanol, biodiesel, bio-butanol, dimethyl ether, coal-to-liquids, tar sands, oil shale), both from biomass and fossil feedstocks.
- Alternatives for the generation of electric power, including power-storage technologies (wind, solar photovoltaics, solar thermal, tidal, biomass, fuel cells, batteries).

The technology pathways to these alternatives vary widely, from distillation and gasification to bioreactors of algae and high-tech manufacturing of photon-absorbing silicon panels. Many are considered "green" or "clean," although some, such as coal-to-liquids and tar sands, are "dirtier" than the petroleum they are replacing. Others, such as biofuels, have concomitant environmental impacts that offset potential carbon savings.

Unlike conventional fossil fuels, where nature provided energy over millions of years to convert biomass into energy-dense solids, liquids, and gases—requiring only extraction and transportation technology for us to mobilize them—alternative energy depends heavily on specially engineered equipment and infrastructure for capture or conversion, essentially making it a high-tech manufacturing process. However, the full supply chain for alternative energy, from raw materials to manufacturing, is still very dependent on fossil-fuel energy for mining, transport, and materials production. Alternative energy faces the challenge of how to supplant a fossil-fuel-based supply chain with one driven by alternative energy forms themselves in order to break their reliance on a fossil-fuel foundation.

The public discussion about alternative energy is often reduced to an assessment of its monetary costs versus those of traditional fossil fuels, often in comparison to their carbon footprints. This kind of reductionism to a simple monetary metric obscures the complex issues surrounding the potential viability, scalability, feasibility, and suitability of pursuing specific alternative technology paths. Although money is necessary to develop alternative energy, money is simply a token for mobilizing a range of resources used to produce energy. At the level of physical requirements, assessing the potential for alternative energy development becomes much more