Fossil Fuel Alternatives

by Peter Ciesielski

For years, the United States had been reliant on the fossil-fuel reserves in the Middle Eastern countries. Because the land is so rich in this currently invaluable resource, the U.S. military has occupied these countries, especially Saudi Arabia, to protect the production and trade of the oil therein. It is this military presence that has fueled the conflicts between our country and the Muslim countries of this region. Operation Desert Storm was the first war spurred by this conflict. When the war was over, the problem was far from resolved. Osama bin Ladin, the perceived perpetrator of the recent September 11 attacks on the World Trade Center and the Pentagon and also a Saudi Arabian native, was outraged by the United States' military actions in his homeland. He considered the U.S.'s "infidel presence a desecration of the Prophet Mohammed's birthplace"(Beyer 54). In an interview in Time Magazine in 1998, bin Ladin himself clearly stated the objectives of his regime, the Taliban, when he said, "Our work targets world infidels. Our enemy is the crusader alliance led by America, Britain, and Israel"(qtd in Beyer 58). Currently the war still rages on in Afghanistan, as bin Ladin calls on Muslims to support the Taliban and resist "the American crusade forces and their allies in the lands of Muslims in Pakistan and Afghanistan"(qtd. in L.A. Times). Clearly, the military establishments of the United States in these countries has angered their inhabitants and caused severe political and diplomatic problems for both sides involved.

The heavy reliance on fossil-fuel is more than a damper to our country's diplomatic relationships; it is a hazard to the very planet that supports our lives. Scientists increasingly agree that fossil-fuel combustion products such as carbon dioxide, sulfur dioxide and other "greenhouse gases" are contributing to global warming, as well as polluting the atmosphere and the ecosystem (Cassedy 3-4). The total annual emission of carbon dioxide worldwide has been estimated at over twenty billion metric tons, and that number is expected to increase dramatically into the twenty-first century (3). These figures alone are enough to augment the need for an alternative energy source, and time is running out.

Is there a perfectly feasible, seemingly utopian solution to these pressing issues? Jonathan Vigh, a student working toward his Ph.D. in atmospheric science at CSU seems to think so. In a personal interview, Vigh states that the development of a hydrogen based fuel cell could revolutionize our energy needs, not to mention our economy. A fuel cell operates like a battery, generating electricity via a chemical reaction, except that a fuel cell requires a constant input of the reactants to prolong the reaction. These fuel cells also have a higher conversion efficiency than do combustion reactions for the same fuel type (Cassedy 170). Fuel cells can use a variety of chemical reactants, including gasoline and natural gas; however, hydrogen is the best choice because it not a fossil-fuel and produces virtually no pollutants. A hydrogen fuel cell basically works by reacting hydrogen fuel with oxygen from the air. Hydrogen (H^+) and hydroxyl ions (OH^-) exchange charges, producing a direct current of electricity. The only excretion of this reaction is water vapor, making it very environmentally friendly (Cassedy 217). This technology may seem distant and futuristic, but hydrogen powered fuel cell vehicles have already been constructed and tested, and the first fuel cell vehicles could be on the market as early as 2004 (Vigh). Hydrogen fuel is ideal in many ways. It is extremely efficient, doesn't pollute, and is an inexhaustible resource. Some scientists have promoted hydrogen fuel as the "universal fuel of the future, with all of society's needs supplied in a 'hydrogen economy'" (Cassedy 207).

Hydrogen power is a good goal to work toward, but there are many obstacles yet to be overcome. Fuel cell technology is still extremely developmental. Storing enough hydrogen to make it competitive with current petroleum powered vehicles is one setback. With the current technology, a fuel cell vehicle (FCV) with a 100 pound compressed hydrogen storage system can only travel 36 miles without refueling (Cassedy 171). This figure could be improved by storing liquid hydrogen, but that can only be done at cryogenic temperatures. This is fine and dandy until you spill some on your hand while refilling the tank and your hand freezes instantly and breaks off; and in addition it requires energy to keep the hydrogen at this temperature.

Fortunately, these efficiency figures are projected to improve rapidly with technological advances. However we are still left with an obstacle that will take a lot more change to overcome: delivery and production of this new type of fuel. In order to make hydrogen accessible, a system must be developed for its production, transportation, stationary storage, and distribution. This would require the construction of a new transit system and filling stations, or the conversion of the ones we are already using, to accommodate hydrogen fuel.

This would not only be extremely expensive, but it would require the commitment of a good percentage of the population. Before these issues could be tackled, the base of the new system must be established, and it is here that possibly the largest barrier for hydrogen power is found (Vigh). Although hydrogen is very abundant on our planet, it doesn't occur in its pure state (H_2 gas) anywhere in nature, therefore it takes energy to it disassociate it to the required state. The most direct technique used to do this is called electrolysis. This technique inserts electrodes into solution of water that contains an electrolyte chemical. When an electrical current runs through the solution, oxygen gas evolves at one electrode and hydrogen at the other. The procedure is relatively simple and easily executed, but it presents the fundamental dilemma to its developers; if it takes energy to make hydrogen fuel that is used for energy, where can we start? The answer may have always existed right in front of us, in nature (Vigh).

Renewable energy is energy that will never run out because it is constantly being replenished. The main types of renewable energy are solar energy, biomass energy, wind power, hydropower, geothermal energy, and ocean energy (nrel.gov). Many of these resources are already in use, such as solar power cells, hydroelectric dams, wind turbines, and ethanol in gasoline. The technology used in harvesting these energies is developing steadily, and could offer a lot of immediate relief to the heavy fossil-fuel dependency, but could not likely replace it. However, these types of energy could be used in the production of a hydrogen fuel (Vigh). Some of the best prospects for this idea are solar, wind, and hydropower energies because they do not pollute and are already used to produce electricity in many parts of the world. The majority of present advocates of such a system are focusing on solar-electric sources. This technology is already functional, and some scientists have even gone so far as to design a prototype solar-hydrogen plant (Cassedy 211).

The main drawback in using renewable energy to replace fossil-fuels, either directly or indirectly, is the cost. The means of harvesting these types of energy are newer and more complicated than those of fossil-fuels, making them more expensive to execute. For example, the cost of the energy produced from the current solar-hydrogen technology is $71 per giga-joule, which is about fifteen times the cost for the same amount of energy from natural gas (Cassedy 211). The only way to increase the cost efficiency of these renewable energy sources is to develop the technology used to harvest it. However, with the current electrolysis technologies, only a zero cost of electricity would put the cost of hydrogen fuel in a range that is competitive with current fossil-fuel prices (Cassedy 212). This may seem like an unachievable goal, but no one knows what scientific advances or breakthroughs the future holds.

The unquenchable thirst of humanity for energy and power may never be satisfied. However, if this need can evolve itself into a cycle that does not take away from or damage what we started out with, it could theoretically become a natural part of the ecosystem. Such a cycle would develop its efficiency along with the rest of the planet and its creatures, allowing the planet to advance and adapt as a unit as it was intended to do in the beginning. It would take a collective effort from the entire human race to make such a dramatic change, if such a thing is even possible. It has to start small. It may mean paying a little more for a different type of fuel or vehicle and boycotting others. The ultimate energy source is one that works in harmony with forces already operational in nature; only through intense determination and a unified willingness will mankind achieve this goal.