GEOG-100-75

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March 9th, 2013

Extra Credit Essay

Addressing Global Water Supply, Drinking Water, Water Pollution, and Power Demands All by Using Hydrogen Fuel Power Plants and Fuel Cells.

This essay addresses many of the issues listed in the Elemental Geosystems textbook chapters 6 “Water Resources” and some of the relevant topics from chapter 5 as well.

Technologies, markets, and needs may finally have found solutions addressing the needs of the world to find a means to efficiently clean polluted water, supply sufficient energy without pollution and other negative effects, and even create water from scratch by using the aforementioned generated power to effectively make use of the formula $2H2 + O2 = 2H2O + Energy$ to create fresh water from scratch.

Though this does not immediately have the scale to address the much larger consumption of non-saline water by agriculture, it does potentially address the critical drinking water supply for many countries, while at the same time addressing critical electrical power needs so critical for the advancement of any modern society. Over time the scale could be increased to actually address purifying water sufficiently as supplement to agriculture as well.

India suffers an estimated 1,500 deaths per day due to contaminated water (Vieru, 2008). Some current projects underway include, among other multi-pronged approaches, a solution to use hydrogen fuel cell power plants to generate power from processing waste water and as a by-product also clean drinking water (Czernik, 2007). I first stumbled across this when I was looking up information I had heard on the Science Channel relating to the plans to try to create water for the moon base project, by shipping up hydrogen to the moon, and then using home appliances and solar energy to mix the elements (O2) in the Lunar soil with the Hydrogen to create water (Atkinson, 2008).

While the hydrogen fuel-cell plants, and water creation technologies will be useful in high-population density areas, less expensive solutions have also been developed using solar power for water purification for very dispersed rural communities like the Navajo in the Four Corners area of the U.S. (Allen, 2012)

The final piece that makes of this come together to solve so many fundamental issues regarding

water, is the recent breakthroughs at the University of Illinois to create water from scratch by basically combining hydrogen and oxygen to create pure water. This formula has been known for a few centuries, but only the recent breakthroughs using inexpensive and aluminum compounds (Kloeppel, 2007), combined with the aforementioned hydrogen fuel cell energy systems, and efficiency breakthroughs at Purdue University (Singh, 2012), may finally have come up with an affordable, efficient, safe, and ecologically friendly set of systems to address the water demands of the near term, and long term, future.

Fuel cell power plants have the advantages of have no moving or rotating components like many other systems such as wind and fossil-fuel systems, so they tend to be noiseless, and of course do not have the ecological impact of fossil-fuel systems.

These affordable systems can be setup in specific regions, reducing the additional expense, burden, and loss from long-distance power transmission lines. This further increases the already 55% efficient system (compared to the 30% efficiency of conventional thermal-powered systems) (Sen, 2013) by reducing the loss from transmission. These systems are modular and can already range from 5kW to over 2MW, with the potential to add additional systems easily and inexpensively to meet future growing demands as needed.

While other “renewable” energy sources currently being adopted, such as solar, wind, hydro-electric, ocean wave kinetics, geothermal, and biomass can potentially provide clean electricity, these sources tend to be highly variable in their availability and power generated, and so require energy storage or hybrid systems to adjust to daily and seasonal variance in demand. The hydrogen-fuel-cell systems do not suffer from any of these issues, and so are able to provide continuous power to reliably meet varying demands.

This chain of solutions addresses the following:

• Clean water supply

• Decreasing dependency on foreign petroleum supplies

• Decreased localized pollution from coal-based systems

• Decreased global pollution from petroleum-based systems

• Decreased risks from nuclear-based systems

• Decreased impact on river ecological systems by reducing dependency on hydro-electric systems

• Can become highly scalable for different levels of demand and multi-use in a small physical foot print, unlike large banks of solar or wind systems.

• Consistent energy supply, rather than the regional, daily, and weather-affected water, wind, and solar power systems.

References

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Additional Resources

Battery University – The Miniature Fuel Cell http://batteryuniversity.com/learn/article/the_miniature_fuel_cell

NREL – National Renewable Energy Laborator

http://www.nrel.gov/hydrogen/proj_production_delivery.html

Fuel Cell by Arnab Sen

Viewed March 9th, 2013

http://www.academia.edu/1619271/Fuel_cell