



# P E R S P E C T I V E S

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## **Freedom Fuel in the USA and Abroad**

### *Severing the Umbilical Cord*

On April 14th this column introduced the concept of “Freedom Fuel.” It outlined the potential unlocked by shifting from a planetary fuel system based on fossil fuels to a system based on the wide availability of hydrogen created by electrolyzing water with renewable energy (so-called “Green Hydrogen”) at prices below fossil fuel. As that transition rapidly progresses, particularly in Germany and France, shifting to hydrogen as *the* dominant fuel will not only free Europe from Russian domination of Europe’s biggest economies, but it will also free the entire planet from the ravages of climate change.

Can you imagine two more critical goals: freeing Europe from Russian fossil fuel control (thereby providing an end to Russia’s ability to finance Ukraine or any future Ukraine-type misadventure), and releasing human civilization from the certainty of biosphere destruction? The question is, how will this twin miracle actually occur?

The first phase of the hydrogen revolution is now well advanced. There are over 20 production plants in the world today that are already creating liquid hydrogen in massive quantities (Australia), are scheduled to open in the next 8 months (Neom, Saudi Arabia), or are at advanced stages of development in countries ranging from the Middle East to Latin America and everywhere in between. Both Saudi Arabia (which has committed to building 10 Green Hydrogen plants) and the United Arab Emirates have formally declared that the future “export fuel commodity” from the Middle East will be Green Hydrogen—not oil or gas! What a remarkable statement this is! When the oil sheiks of Arabia conclude that Green Hydrogen is inevitable, you can bet everyone else in the capital markets world has come to the same conclusion. Including Goldman Sacks in a major new report, McKinsey in a major report only a couple of months old, and internal work at Boston Consulting Group, just to name a few.

Initially, much of this hydrogen will be going to Europe, but ultimately it will be going everywhere in the world that currently uses fossil fuels.

Hydrogen is used in fuel-cell cars (Toyota and Hyundai are leading in this race); in semi-trucks for long haul (clearly, Toyota currently holds the lead, soon to be challenged by the Daimler-Volvo joint venture); in buses (Emeryville and the Big island of Hawaii are very advanced with these); locomotives (Germany has them running, the French are releasing theirs as we write, General Motors in final development mode); ferry boats (now operating on SF Bay); “green” steel and cement plants now on the drawing board; and, most importantly, fuel-cell assisted microgrids.

Of all these uses for commercial hydrogen, the biggest could be this last category: fuel-cell assisted microgrids.

A microgrid is a localized source of energy (i.e., primarily solar or wind for the foreseeable future) that can be supplemented by a hydrogen-powered fuel-cell. So, the proverbial question is finally answered.

“What do you do when the sun doesn’t shine, or the wind doesn’t blow?” You turn on your supplemental fuel-cell to power the microgrid until the sun resumes shining or the wind resumes blowing.

Best of all, the hydrogen to power that fuel cell itself will have been made from converting solar, wind, and geothermal energy into hydrogen to begin with so the microgrid will be 100% green while still costing less to operate than the existing electric grid.

This idea has been a central focus of our research over the past several decades at the World Business Academy. It is outlined in our “The Clean Energy Moonshot” films that explore the concept of how California could convert to a 100 percent green interconnected microgrid system within 10 years or less at zero additional cost to the ratepayers—best of all we wouldn’t have all those forest fires created by the grid because we’ll allow the grid to fall into disuse. A distributed energy system of interconnected microgrids is possible, and the only tenable path for a clean energy future.

How would these interconnected microgrids operate? Picture the individual cells in a honeycomb where every side of the honeycomb is touching an adjacent honeycomb. In that way, power can be passed back and forth to those cells that need extra power to those which are producing excess power all without using a “wire” (i.e., a high-powered power line like the one that wiped out Paradise California).

What about microgrids that are in the middle of, say, the San Joaquin Valley in Fresno? No problem, put adequate hydrogen storage on site for them to receive from a central distribution point and they’ll be 100 percent resilient and 100 percent reliable no matter the weather from day to day. Storing excess sun and wind energy in electrolyzed Green Hydrogen, which is portable and long-lasting is the missing piece to this puzzle.

No more rolling power blackouts! No more forest fires. No more constantly escalating electrical bills to continuously rebuild and pay over and over again for all the power lines that otherwise have to be maintained and rebuilt every few years because they keep burning down.

So how do we phase in the new inter-connected microgrid system while we’re still on the grid? Simple, every electrical substation becomes the heart of each new microgrid. All the power continues flowing to that substation until the microgrid has enough installed capacity of photovoltaic solar (Santa Barbara doesn’t have wind resources good enough for energy, but Lompoc has an awesome amount of sun and wind too!) that it can constantly use less and less grid energy as it builds out its renewable resources.

When it’s done, the grid as an “umbilical cord” will become a useless appendage, as all umbilical cords are after the birth of a newborn. That grid as an umbilical cord will be allowed to pass, as it should, into the dustbin of history without any disruption of electrical service, and only as the microgrids power up to enlighten our clean energy future.

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