



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

by **Rinaldo S. Brutoco**

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War of the Currents

From transmission lines to “freedom fuel”

Forest fires, cyber warfare, sabotage, and plain old utility company incompetence, greed, and malfeasance have brought us to the point where we must abandon the electrical grid. It isn't safe. It does cause a significant percentage of forest fires here in California, it supports a utility (PG&E) that has been convicted of multiple felonies for blowing up towns like San Bruno and wiping out other towns like Paradise, where 84 people lost their lives. Maintaining this fragile, aging grid isn't cheap, and now it is being intentionally turned off by utility-initiated Public Safety Power Shutoffs (PSPS). How on earth did we get saddled with such an expensive, inefficient, unreliable, and ultimately dangerous electrical power system? Better yet, why do we let it continue to exist?

Starting in the late 1880s a fierce intellectual battle raged on over how to best electrify New York City. On one side of the debate stood Thomas Edison, a brilliant man and one of the genius inventors of all time. On the other side was the genius physicist, Nikola Tesla, supported by a half dozen gifted engineers from two continents employed by one of the era's wealthiest industrialists, George Westinghouse. You can see why this wasn't a fair fight from the very beginning.

They were fighting to determine the future of electricity on a global basis. Edison had developed direct current (DC) as the most efficient way to power his recently invented incandescent lightbulb. DC is the use of electricity that comes down the wire one electron at a time in a constant one-way direction. Tesla favored Alternating Current (AC) where the flow of electrons changes directions. Backed up by a team of engineers he'd hired and by European breakthroughs in AC transformers, Tesla convinced Westinghouse to develop AC as the standard delivery system for electricity.

DC is cheaper, far more efficient (e.g., at least 75 percent more efficient for light bulbs), safer to handle, and is essential for our modern society to function. Every time you plug your laptop or smartphone into the wall, the little square thing your wire plugs into is a converter that takes the AC out of the electrical circuit and converts it to DC because your electronics can't run on AC. No computer chip can. Stop and think how dependent our society has become on DC power.

So, why do we have AC in the first place? AC's big advantage is that it can be powered up to very high voltages (DC tends to run on safer, more efficient low voltages) of alternating waves of electrons, can run in parallel as well as in sequence, and thus be sent long distances over high powered transmission lines (the same hi-voltage lines that cause forest fires in our state) with little loss of power. Nikola Tesla thought it would be esthetically preferable to locate massive, centralized power stations in places where no one (important) lived, rather than build small pocket stations every couple of miles within the city. (His example was to put the first one in Brooklyn on the belief everyone would continue to live in Manhattan.) Thus, the stage was set for what history refers to as the “War of the Currents.”

Regrettably, Westinghouse and Tesla won the “current wars” and we’ve been paying the penalty for it ever since. That it turned out this way is confounding, as both the physics and the economics of DC are preferable to those for AC. Plus, in the first couple of years of these “wars” for public acceptance, numerous people were electrocuted given the safety issues inherent in AC.

While Edison lost the battle for many reasons that no longer apply, once lost it has been extremely difficult to dethrone AC as our primary power carrier. Fortunately, three massive forces are coming together to drive power generation and distribution back to Edison’s original idea of DC, and lovers of the biosphere will rejoice when it does. Those three forces are: 1) the advent of the digital age which can only use DC and therefore has a strong bias for DC power 2) the necessity to tap 100 percent “green” energy sources, 3) the necessity for far greater efficiency, and 4) the requirement for far greater resilience.

How can we transition to the more efficient, more effective, more economical, and more “chip friendly” DC power when AC is all around us? The answer is simple: we must. The future is a future of interconnected microgrids that will use electricity generated locally and distributed locally—no more high-powered transmission lines. Thank God!

Microgrids are miniature generation and distribution systems as small as a single home (like mine) or as large as all the folks who live in the service area between Ventura and Goleta. Modern microgrids operate by tapping into local renewable energy sources like wind, solar, geothermal, hydroelectric, and related technologies and then distributing the electricity thus generated to the users who live and work nearby.

If you’d like to know how microgrids can be combined, like individual cells in a honeycomb, write or call the World Business Academy and we’ll share our library of materials on the subject. For today, all you need to know is that a microgrid that utilizes green energy as its primary source only needs one other thing to be 100 percent functional, inexpensive, reliable, and 100 percent resilient: a power assist from a hydrogen-powered fuel cell for “stand by” power. Amazingly, such technology (fuel cell assisted microgrids) exists today and will, not may, soon revolutionize power generation and distribution throughout the world.

That’s how Germany, and every other nation in the world, will be able to free itself from fossil fuel as the source of electricity, as well as the locomotive power for transportation (cars, buses, trucks, trains, airplanes, and ferry boats). In Germany, this is particularly critical as it attempts to wean itself off Russian fossil fuel, which accounts for 40 percent of Germany’s fuel supply. The war in Ukraine is an international crisis largely because the worse the war gets, the higher the price of fossil fuels, the more money pours into Russia to fund the war, which in turn drives fossil fuel prices up still higher.

What’s the key to ending this vicious Russian war cycle? Hydrogen. That’s why we call it the “Freedom Fuel.” More on this in next week’s column...

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