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PERSPECTIVE

Electric Shock!

By Jonathan Michaels

Last Wednesday, the latest entrant to the burgeoning electric car market went on sale, the cleverly-named Nissan Leaf. Rallying around claims of saving the environment and helping the nation rid itself of its dependence on foreign oil, consumers lined up in droves to buy the new commuter car. In fact, it seems like just about every car manufacturer is coming out with a hybrid or electric car. Toyota has the Prius, GM has the Volt, and Tesla has the...well, the Tesla.

So what's behind this movement toward electric cars? Good corporate responsibility? Auto manufacturers responding to consumer demands? Well, sort of. The truth is that in 2007 President George W. Bush signed into law a comprehensive overhaul to the U.S. energy policy, which sets forth new fuel economy standards that auto manufacturers must meet over the next decade, or face stiff penalties. The new fuel economy standards will be enforced through the Corporate Average Fuel Economy, or CAFE regulations, enacted in the mid-1970s. This has auto manufacturers jumping.

For those old enough to remember, in 1973 the United States was shocked to its core when the OPEC (Organization of the Petroleum Exporting Countries) nations responded to U.S. involvement in the Israeli-Arab War by imposing an oil embargo against the United States. The embargo resulted in an immediate shortage of oil, and in an instant, a nation that had become accustomed to having all the oil it could consume started to panic. As the price of oil quadrupled overnight, consumers were limited to the days on which they could buy gas and how much they could buy, and oil-dependent businesses scrambled for alternative sources of energy. Even Santa Claus was forced to stay home, as states banned residential Christmas lights and just about every other type of non-essential use of energy.

Recognizing that dependency on foreign oil made the United States vulnerable to oil rich countries, Congress sought to reduce the nation's oil consumption by regulating fuel economy standards in the automotive industry. In 1975, Congress enacted the CAFE regulations, which set forth minimum fuel economy standards that manufactures had to meet, or pay a gas-guzzler tax to the U.S. government. In 1978, the year the law went into effect, all manufactures had to meet an average of no less than 18 miles per gallon. This minimum was increased each year until 1985, when it was set at 27.5 mpg.

While the initial implementation of the CAFE regulations was aggressive, by the mid-1980s the sting from the oil crisis had begun to fade. Fears of OPEC had been replaced by new concerns, and the once stringent CAFE regulations stagnated. From 1985 through the late 2000s the minimum fuel economy remained at 27.5 mpg, despite quantum developments in technology. What's more, auto manufacturers began to exploit the distinction the CAFE regulations made between passenger cars and light trucks, leading to the development of the minivan and the SUV,

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both of which fell in the more lenient light truck category.

All of this changed on Dec. 19, 2007, however, when President Bush signed into law the Energy Independence and Security Act of 2007. Under this Act, the CAFE regulations received their first major update in nearly 25 years. The law requires fuel economy standards to begin increasing again, starting in 2011 with a standard of 30.2 mpg, through 2020, where it will be set at 35 mpg. Those who fail to comply will be hit with harsh penalties.

With this, the car of the future became the car of today, as auto manufacturers made a concerted effort to steer consumers toward fuel efficient hybrid and electric cars that would increase manufacturers' average fuel economy. But, is this necessarily a good thing? On the surface, it would seem that this is an obvious yes, as hybrid and electric cars consume less fossil fuel and emit fewer pollutants than traditional combustion engines. But, does the analysis end there? Perhaps not.

Hybrid and electric cars are powered by one of two battery technologies, either lithium ion or nickel metal hydride. GM's Volt uses lithium ion technology, while the Toyota Prius uses nickel metal hydride. If the names assigned to the batteries sound more like a Chemistry class and less like Autoshop, it is because battery technologies in general are derived from either rare earth elements or trace metals that are pulled straight from the Periodic Table of Elements, and the batteries being used to power hybrid and electric cars are no exception. Lithium ion batteries use the trace metal, lithium carbonate, and nickel metal hydride batteries use the rare earth element, lanthanide. Both elements are found in the earth's crust, but where and in what quantities?

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Geologists estimate that the world has about 6.2 million metric tons of usable lithium carbonate, the valuable trace metal used to produce lithium ion batteries. Currently, the world consumes about 80,000 metric tons per year, the majority of which goes to consumer products such as laptops and cell phones, with consumer demand increasing about 25 percent per year. If consumption were to remain static at today's rate (which it likely would not), the world's known resources would be depleted in about 75 years.

What happens when hybrid and electric cars are factored in? Initially not a lot, but given that the battery for an electric car weights about 400 pounds, this changes quite dramatically as more hybrid and electric cars are produced. The world currently produces about 60 million vehicles each year, a very small portion of which are hybrid or electric. If each of these vehicles were to use lithium ion batteries, this would increase the annual consumption of lithium carbonate to about 550,000 metric tons per year. At this rate, the world's known resources of 6.2 million metric tons would be depleted in just a little over 10 years.

But, there are larger problems. Unlike oil, which is generally subterranean, usable lithium carbonate is located almost exclusively in salt flats, and its extraction involves an invasive strip-mining process that is neither politically nor ecologically sound. Then, there is the matter of its location. Nearly 80 percent of the world's lithium carbonate is located in the South American countries of Argentina, Bolivia and Chile, whose governments would enjoy an oligopoly over the rest of the world in a manner far greater than that of the OPEC countries.

The other battery technology used by hybrid and electric cars, nickel metal hydride, is perhaps more concerning. Its rare earth element, lanthanide, is more plentiful than lithium carbonate, but it also comes with significant drawbacks. Because lanthanide is found mostly in massive rock formations, the procedure to extract it is costly and destructive. Then, as with lithium carbonate, there is the matter of its location. Ninety-seven percent of the world's supply of lanthanide is produced by one country: China. This is a fact that has not escaped China's attention. As former Communist Party leader Deng Xiaoping has stated, "There is oil in the Middle East, there is rare earth in China."

Despite these concerns, manufacturers are presenting hybrid and electric cars as the definitive solution to the fossil fuel problem. Could it be that it was easier, and hence less expensive, for auto manufacturers to expand upon established battery technology that has been in existence for years, rather than develop new alternative fuel technologies that were less mature? Whatever the answer, one thing is likely to be certain: if consumers begin adopting hybrid and electric cars, it will not be long before a nation-wide infrastructure of charging stations begins to develop; and at this point, any hope of other alternative fuel technologies will likely be lost — at least until it becomes time to repeat this process all over again.