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The New Nuclear Revolution

Safe fission power is our future -- if regulators allow it.

By BOB METCALFE

After the Internet, the next big thing will be cheap and clean energy. Coal, oil and gas pollute and are increasingly expensive: We need alternatives. Because nuclear energy (stored among particles inside atoms) is millions of times more dense than chemical energy (stored among atoms in molecules), nuclear reactors belong high on our long list of energy alternatives.

Nuclear energy is released during fission and fusion. During fission, large elements like uranium are split into smaller elements. During fusion, small elements like hydrogen are combined into larger elements. These two processes have occurred naturally since the beginning of time -- 13.7 billion years. The Earth is warmed naturally by its own nuclear fission reactors within and also by the sun, that big nuclear fusion reactor.

Today, 20% of our electricity is provided by 104 nuclear energy plants in the United States. These are already cheaper and cleaner than burning coal, oil and gas with all their pollutants, especially CO₂. But these plants are all run on big old nuclear reactors, which nobody but the utility companies likes very much.

The good news is that the big names in nuclear energy -- like Areva, Hitachi, General Electric and Toshiba -- have recently been joined by a bevy of high-tech start-ups seeking to develop advanced nuclear-reactor designs for both fission and fusion energy production. So far, there are five fission and two fusion start-ups, among them Hyperion, NuScale and Tri Alpha.

The fission-reactor designs of the start-ups are very

different from the existing plants and even from the advanced designs put out by the established players. Rather than proposing a few more big nuclear reactors, the start-ups are advocating many small nuclear reactors, variously called small, right-sized or modular. Though big power plants might still be built, they'll run on numerous small reactors.

These new small reactors meet important criteria for nuclear power plants. With no control rods to jam, they are far safer than the old models -- you might well call them nuclear batteries. By not using weapons-grade enriched fuels, they are nonproliferating. They minimize nuclear waste. And they're economical.

All of the new start-up reactors are tiny compared to the 104 old ones, each of which was custom designed for and constructed at the site of its utility power plant. Small enough to fit on a large kitchen table, the new reactors can be manufactured at very low cost and shipped by truck to power-plant sites. As an Internet guy, these small fission reactors seem to me like the microprocessors that took over from the huge, air-conditioned, glasshouse mainframe computers.

As venture capitalists, we at Polaris might have invested in one or two of these fission-energy start-ups. Alas, we had to pass. The problem with their business plans weren't their designs, but the high costs and astronomical risks of designing nuclear reactors for certification in Washington.

The start-ups estimate that it will cost each of them

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roughly \$100 million and five years to get their small reactor designs certified by the Nuclear Regulatory Commission. About \$50 million of each \$100 million would go to the commission itself. That's a lot of risk capital for any venture-backed start-up, especially considering that not one new commercial nuclear reactor design has been approved and built in the United States for 30 years.

The Nuclear Regulatory Commission and the Department of Energy were both formed in the 1970s to develop nuclear energy and thereby reduce our dependence on foreign oil. But neither has reduced our dependence on foreign oil, especially not with nuclear energy. To find out why start by watching the movie "The China Syndrome," which came out in the 1970s immediately before the Three Mile Island nuclear incident. Since then, the Greens have been anti-nuke obstructionists.

As we learned by building the Internet, fiercely competitive teams of research professors, graduate students, engineers, entrepreneurs and venture capitalists are the best drivers of technological innovation -- not big corporations, and certainly not government bureaucracies. So, if it's cheap and clean energy we want, we should clear the way for fission energy start-ups. We should lower the barriers at the Nuclear Regulatory Commission for the approval of new nuclear reactors, especially the new small ones. In particular, we should drop the requirement that the commission be reimbursed for reconsidering new fission reactor designs.

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