heavily engaged in research. It needed the means to move information around among different research centers more quickly than it could by courier or the mails—there was no FedEx. The Defense Advanced Research Projects Agency (DARPA) funded an experiment designed to create a network of computers that could communicate data and files to each other at a distance. The creation was called ARPANET. It was developed at some cost and effort for a highly specialized use. ARPANET, of course, evolved into the Internet, and its essential architecture and protocols were designed and administered by the Department of Defense and its contractors until well into the 1990s.

As with the automobile superhighways, the information superhighway might have come about on its own, but it did not. The basic cost of creating it was a military undertaking designed to solve a problem the military was experiencing. To push this analogy a bit, the energy superhighway will have its origins in the same kinds of necessities. It will be built for the military, and therefore its economics will make it more competitive than other energy sources. Since the military will absorb the basic capital cost and will deploy the systems, the commercial cost of this energy will be enormously lower than it might be otherwise. Cheap energy in the civilian sector will be critical, particularly as robots become more and more prevalent in the economy.

Military space programs will, quite literally, reduce the cost of commercial endeavors by piggybacking them. Advances in commercial launches into space will reduce the cost of lifting payload but will never have the capacity to handle a massive project such as the development of space-based solar power generation. The military program of the 2050s and 2060s will solve this problem in two ways. First, one of the important parts of the project will be reducing the cost per pound of payloads. The United States will be putting a lot of stuff into space and will need to dramatically lower the price of a launch. Partly through new technology and partly through the sheer volume being launched, cost will begin to decline dramatically, even over that of commercial vehicles developed earlier.

Second, there will be surplus capacity built into the system. One of the lessons of the war will be that not having spare space-lift capacity left the United States scrambling to deal with the initial attack. That will not be allowed to happen again. So the nation will have a huge surplus of usable lift capacity. Private sector utilization of the project will be essential to reduce costs.

The period when the interstate highway system and the Internet came into being was a period of explosive economic growth. The interstate highway system stimulated the economy by employing armies of construction crews and civil engineers, but it was the entrepreneurial spin-offs that really drove the boom. McDonald's was as much a creature of the interstate highway system as was the suburban mall. The Internet's construction involved a lot of Cisco servers and PC sales. But the real boom came with Amazon and iTunes. Both had massive entrepreneurial consequences.

NASA has been involved in research on space-based energy since the 1970s, in the form space solar power (SSP). In the war of the 2050s the United States will really start using this new system. And in the space-based energy project of the 2060s, it will become a feature of everyday life. Vast numbers of photovoltaic cells, designed to convert solar energy into electricity, will be placed in geostationary orbit or on the surface of the moon. The electricity will be converted into microwaves, transmitted to the earth, reconverted to electricity, and distributed through the existing and expanded electric grid. The number of cells needed could be reduced by concentrating sunlight using mirrors, thus reducing the cost of launching the photovoltaic arrays. Obviously, the receivers would have to be installed in isolated areas on earth, since the localized microwave radiation would be intense, but the risks would be far less than that from nuclear reactors or from the environmental effects of hydrocarbons. One thing that space has available is space. What would be unbearably intrusive on earth (say, covering an area the size of New Mexico with solar panels) is swallowed up by the limitlessness of space. Plus there are no clouds, and collectors can be positioned to receive continual sunlight.

These advances will lead to reduced energy costs on earth, and thus many more energy-intensive activities will become feasible. The entrepreneurial possibilities that emerge will be astounding. Who could have drawn a line between ARPANET and the iPod? All that can be said is that this se