

The second Valley of Death

By Kenneth Berlin

Almost everyone in the United States agrees that we should be energy independent; whatever we use to travel, heat, cool, light, and make things ought to come from home-found, home-made and home-delivered energy. We shouldn't depend on other countries to sell us their oil and gas and energy technology at a fair price, we need to be self-reliant.

Almost everyone in the energy sector knows that American ingenuity has produced and will produce a cornucopia of energy breakthroughs - chemical compounds that let windows bring in light but not heat; films as thin as cellophane that turn sunlight into electricity; whirring blades that make energy out of wind; mile deep drills that bring up vast reservoirs of natural gas; and on and on. Yet when any of us look around us, we see systems that would be recognizable by Thomas Edison more than a century after he commercialized electricity; recognizable by Henry Ford a century after he popularized internal combustion gas-driven transport.

What has happened to the breakthroughs? Why does the pace of change in energy and transport seem to be zero even while we know technology is racing ahead in labs and tests and model projects all across our inventive land?

The answer is found in what the industry calls the "valley of death" - the space between the invention and the very expensive deployment in large scale of that same invention. In energy the large scale is the final testing ground, but to operate at a large scale requires not tens of millions but hundreds of millions of dollars. And the whole energy sector is arranged to minimize capital investment and reduce reward for risk-taking. If a utility wants to make a big bet on a new technology - something that is encouraged for almost every company in almost every sector - in the energy sector regulations are designed to discourage the utility from taking the risk that goes with the prospect for proving at scale that something new could be something really insanely great. And if the utility does take the risk, regulation limits the return.

The status quo is that we are dependent on countries that do not love us for our energy needs, we are not moving forward into the long-term sustainable technological platforms we will need for the future generation of energy, and we are falling far behind China and other rising nations that are making the necessary big bets to assure global leadership in energy for centuries to come. China estimates that one-eighth of its economy will be based on clean energy and similar industries by 2015. The Chinese government's National Energy Administration (NEA) has released a plan that outlines direct investments totaling 5 trillion Yuan (\$746 billion USD) in clean energy development over the next ten years in China. The amount of direct investment under the NEA's plan is roughly 9-10 times the amount of investment in energy under the 2009 stimulus package in the U.S.

There is, however, a persistent misunderstanding about what is meant by the valley of death. Many refer to it to include the difficulty that technological innovators face in raising funds for the development of their products. This indeed can and does create a valley of death for many products. But there is a second valley of death that is far too often ignored - the equal difficulty new products have in being deployed after they are developed.

Let's look at a few examples.

- Hybrid vehicles were introduced into the United States in 1997. In 2009, 12 years later, they still made up only 3% of cars on the road even though most of the hybrids are superb cars from a performance standard.
- Shell Oil Company noted in its 2001 scenario on how energy use is likely to evolve over the next five decades that it has taken an average of 25 years after the commercial introduction of a primary energy form for it to obtain a 1 percent share of the global market.
- In the automobile industry, a study concluded that it took 10 to 30 years after the introduction of a new technology before it was deployed on half of the new vehicles.

Failure to recognize this valley of death arises in part from a rigid economic orthodoxy. Economists argue that in a free market system once a new product is developed, it should be able to stand on their own., otherwise the government is interfering in the market and picking winners and losers. But the fact is that there are often severe market and non-market barriers to the deployment of new technologies. One can support broad products categories like clean energy without coming close to picking individual winners or losers.

Failing to recognize this valley of death has several critical consequences. First, other countries have no such inhibitions and they provide the kind of incentives needed to break through the barriers. If other countries do this and the U.S. doesn't, production of new technology developed in U.S. laboratories, often with government support, will flow out of the U.S. That is exactly what is happening far too often. America's great technological prowess is resulting in vast new industries in China and other countries, but not in the U.S.

Meanwhile, failure to recognize the barriers to deployment will erode our technological ability and result in U.S. companies starting to lose their technological edge. Technological development doesn't stop when the first version of a product is made. Usually manufactures learn from experience and continue to improve their products based on customer feedback and experience. If that feedback and experience is taking place outside the U.S., the U.S. version of the technology becomes obsolete and the U.S. loses its edge.

Third, there is a strong argument that technological innovation flourishes when there is market demand for a product line, not as the result of pure innovative research. Richard Kaufmann, a Professor at the Yale School of Management, the Former CEO of Good Energies; and a former Partner at Goldman Sachs argues that:

"As much of the recent VC experience in renewable energy has sadly demonstrated, creating more companies without adequately developing end markets puts the innovation deployment cart and horse backwards. We know from the PC industry where computer chips are ever cheaper and have greater performance that innovation follows commercialization, not the reverse. Moore's Law is not an independent law of physics but rests on the role of markets; without a vibrant market into which to sell integrated circuits, the shape of the performance curve would look very different. However, in renewable energy technology, we keep waiting for breakthrough technology that will achieve cost parity with conventional sources before deployment."

There are several reasons why there is a valley of death blocking the deployment of new technologies. The first and most obvious is that many and perhaps most products are far more expensive to produce in small quantities than when they are mass produced. This leads to high initial prices that make can make the product uncompetitive and because the product is uncompetitive, it cannot achieve mass market sales. This is a chicken and egg problem that can only be overcome if it is understood and addressed.

Second, adopting a new technology is risky--it might take years of operating experience before the new technology is understood well enough for it to work as well as promised, and first-generation plants using a new technology are unlikely to work as well as second- and third-generation plants. Second- and third-generation plants are also likely to cost less to operate and build than first-generation plants. Waiting is the most cost-effective and economically rational way to act, but the resulting delay in deployment can often stretch over decades.

Third, in the clean energy field there is one other critical factor that makes the deployment of new technologies difficult - they are not playing on a level field with existing technologies. Today, the market fails to take into account the cost of pollution from fuels that emit large quantities of greenhouse gases and to a lesser degree other pollutants. It also fails to take into account the national security risk from reliance on petroleum for transportation. This failure gives coal and petroleum a tremendous competitive advantage that clean fuels find very difficult to overcome. As long as the market fails to account for the cost of carbon or the security implications of petroleum, we have to compensate for this market failure if we want a clean energy economy that is competitive and earn a significant share of what will surely be a gigantic world market.

What can be done to cross this valley of death? The key in the absence of a price on carbon - which we assume will not happen at least through the next Congress - is to develop measures that lower the cost of clean energy projects while reducing the market, regulatory and infrastructure barriers to their deployment. The Coalition for Green Capital (CGC) has released a first draft of a comprehensive, integrated legislative proposal designed to do accomplish these goals (more at www.coalitionforgreencapital.com).

The CGC proposal is designed to bridge the valley of death in a manner that will have great political resonance. It would make clean energy and energy efficiency projects cost effective by providing low-cost financing and long-term tax incentives that encourage private investment and are implemented by and to benefit the private sector. It would reform energy markets, simplify regulations without adversely affecting the environment, help return the United States to a lead position in developing clean energy markets, enable the U.S. to compete with the Chinese and

others in this market, create demand pull for innovation, add to our energy independence, and require minimal federal appropriations except in a limited area of supporting infrastructure development that would create a significant number of new jobs. The proposals would not create new federal bureaucracies. Taking steps that enable the clean energy industry to cross the second valley of death would ensure that the United States rapidly transitions to a new clean energy economy and maintains its competitive position in a major market of the future.

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