Forbes.com

Energy

Oil's Customers Will Go Away Before Oil Does

Amory Lovins 07.24.09, 3:00 PM ET

In 1850, whaling was big business. Whale oil lit most houses. But as whales got shy and scarce, the price of whale oil drifted up. This elicited competitors, chiefly synthetic oil and gas made from coal, that grabbed more than five-sixths of whale oil's lighting market in the nine years before even cheaper oil was first struck in Pennsylvania in 1859. The astounded whalers ran out of customers before they ran out of whales. Whales were actually saved by profit-maximizing capitalists. The whalers were soon reduced to begging for federal subsidies on national-security grounds.

Oil feels like this today. Over the last few decades, the U.S. has built a vast portfolio of powerful technologies to save and replace oil. Yet nobody had totaled exactly how much oil these new technologies could save, until my team at Rocky Mountain Institute did in 2004. Our largely Pentagon-funded study *Winning the Oil Endgame* showed these technologies could more than replace *all* U.S. oil use, at an average cost of $15 per barrel (in 2000 dollars). Five years later, that finding looks conservative. Oil, as I'd long predicted, has become uncompetitive even at low prices before it became unavailable even at high prices.

Read more about how soaring energy prices will transform our lives in our special report on $20 a Gallon.

Buy a good hybrid vehicle, drive it properly, and you'll halve your oil use per mile. Make that hybrid out of very lightweight materials and make it aerodynamic, and you'll halve your oil consumption again. Fuel it with 85% ethanol made from woody, inedible cellulose like switchgrass, and you'll save three-fourths of the remaining oil. Make it a plug-in hybrid, and your savings rise to 97%.

Some plug-in hybrids, like Rocky Mountain Institute spin-off Bright Automotive's *IDEA*--a 100mpg, 1-ton van slated for market in 2012--need no government subsidy because their high efficiency eliminates most of the costly batteries. Even greater efficiency is possible, as illustrated by Hypercar's 2000 *Revolution*, a halved-weight mid-size SUV design getting 67mpg with gasoline or 114mpg with hydrogen, or Toyota's 2007 *1/X* concept car, a plug-in hybrid with half the fuel use and one-third the weight of a same-size Prius. If cars were that efficient, then it could be cost-effective to use batteries or hydrogen fuel cells to power them, so they'd need no liquid fuel at all.

Winning the Oil Endgame road-mapped how to redouble U.S. oil productivity (we have already doubled it since 1975) at an average cost of $12 per "saved barrel," chiefly via uncompromised, safer, but threefold more efficient cars, trucks and planes.

The key to greater efficiency is integrative design using light-but-strong materials. The lightest, carbon-fiber composites, were too costly for cars until one of Rocky Mountain Institute's spin-off companies, Fiberforge Corp. in Colorado, developed an automated manufacturing process. When that process is matured and scaled up, it should produce carbon-fiber structures with near-aerospace performance but at automotive volume and cost. Compared with the equivalent steel vehicles, such ultralight materials can halve weight and fuel use, improve crashworthiness, yet cost no more per car. That's like America's finding a Saudi Arabia under Detroit.

Such new technologies don't just save oil, lives and money; they redefine markets. By using more fuel-efficient designs, Wal-Mart and its suppliers have already cut diesel use per ton-mile in the world's biggest civilian truck fleet by one-fourth, and will halve it by 2015. Replicate that nationwide, and 6% of U.S. oil use vanishes. The Pentagon, too, is leading the nation off oil. Most military fuel is wasted because military equipment is designed as if fuel cost $1 to $2 per gallon. New policies influencing future designs are valuing saved oil at roughly 10 to 100 times as much to reflect the huge cost, in blood and treasure, of *delivering* the fuel to the battlefield. This accounting change will drive radical innovation not just in military but also in civilian vehicles, much as military research gave us the Internet, GPS and the jet-engine and the microchip industries.

Or consider Boeing's bold 2004 riposte to an ascendant Airbus. Boeing's *787 Dreamliner,* half of which is made from

lightweight carbon-fiber composite materials and integrates advanced engines, better aerodynamics and other improvements to save one-fifth of the fuel at no extra cost. This plane has had the fastest order takeoff of any jet in history: It's sold out into 2018, with 850 orders and 78 commitments. Now Boeing is spreading those innovations to every plane it makes, leapfrogging Airbus and turning an efficient plane into a breakthrough competitive strategy.

In 2004, I suggested Detroit do likewise. Two years later, Ford hired the CEO of Boeing Commercial Airplanes as its own CEO. Alan Mulally came to Dearborn with transformational intent. Ford no longer looks like General Motors or Chrysler. With its new leadership in developing lighter, electrified cars it is set to surge ahead.

To strengthen automakers' emerging realization that incrementalism is the high-risk strategy--to make Detroit as bold as in 1942-43, when it switched in six months from automaking to producing one-fifth of all the materiel that won the war--how about a real carrot, not just sticks painted orange? Our government could pay automakers for how much oil they save how quickly by selling large numbers of cars far more efficient than required. Valuing saved barrels at the low end of credible estimates of their avoided external costs could cancel the bailout loans (rewarding private investors and taxpayers), rebuild Detroit's competitive edge and industrial strength, enhance security, and save carbon.

After saving half the oil through more efficient use, we can replace the rest with a mix of three-fifths saved natural gas and two-fifths advanced biofuels (not corn-based ethanol, but nonfood materials like prairie grass or algae) at an average cost of just $18 per barrel. The needed investment--half to retool the car, truck and plane industries, half to build a modern biofuels industry--will total $180 billion, which used to sound like a lot. But it would return $155 billion a year gross and a handsome $70 billion a year net, assuming $26-a-barrel oil (more if oil were pricier). It could also save one-fourth of U.S. carbon emissions and a million at-risk jobs (mainly in automaking) while making a million new jobs, mainly rural jobs in the biofuel sector.

All of this could be accomplished without any new federal energy taxes, subsidies, mandates or laws. Of course, it could be sped up by innovative public policies, like a U.S.-tailored version, starting at state level, of the French "feebate" policy that in 2008 alone slashed French sales of inefficient cars by 42% and raised sales of efficient models by 50%.

The journey beyond oil--led by business for profit, not forced by public policy--is already under way. Of the six sectors needing transformation--cars, trucks, planes, fuels, finance and military--three or four are already near or past their tipping point. There's still lots of hard work to do, but it's starting to get easier. Helping that happen is Rocky Mountain Institute's "institutional acupuncture": We figure out where the business logic is congested and not flowing properly, then stick needles in it to get it flowing.

This reprise of the whale-oil story is gaining speed. Those who suppose oil has no alternatives but privation, huge changes in lifestyle or ruinously costly substitutes will be as blindsided and bewildered as the whalers were.

Market economics ultimately works. The unbeatable combination of innovation--in technology, design, competitive strategy and public policy--with the push of prices and the pull of civil society will make the oil problem obsolete. In a few decades, we'll wonder what all the fuss was about.

Physicist Amory Lovins is chairman and chief scientist of Rocky Mountain Institute and chairman emeritus of Fiberforge, Inc. Author of 29 books, he has won many top academic, business, technology, design and environmental awards, and advises major firms and governments worldwide on advanced energy efficiency. His latest visiting academic chair was in Stanford University's School of Engineering.

Read more about how soaring energy prices will transform our lives in our special report on $20 a Gallon.