



Getting off oil

Investing in energy efficiency will be good business, argues **Amory Lovins**, CEO of Rocky Mountain Institute, a not-for-profit consultancy on natural resources

The world uses a cubic mile of oil a year, costing almost \$2 trillion. Oil and cars are the world's biggest and most entrenched industries. Yet an inexorable half-century transition beyond oil has begun, squeezing oil between efficient use and alternative supplies.

Lamp oil from whales lit most American homes in 1850. Yet in the next nine years, just before Drake struck oil in Pennsylvania, five-sixths of whale oil's lighting market fled to cheaper competitors. Likewise in 2007 powerful ways to save and replace oil, which have been quietly emerging for 30 years, will visibly start to rout oil from its strongholds.

Fleet turnovers take time: putting the first half-million hybrid cars on the road took nearly a decade. Yet in 2007 20 new hybrid models will enter the American market, and operating efficiency will finally become entrenched as carmakers' top design priority, locking in oil savings for decades. Biofuels, too, will continue double-digit growth as Brazil's 2006 oil independence and Sweden's 2020 off-oil goal spur emulation.

Some 94% of the world's oil reserves are held by governments, which do not know or will not reveal the size of their holdings. But no matter how much oil there is, we should save it whenever doing so is cheaper than buying it, and nowadays that is always. Unlike short-term behavioural changes, efficiency investments are irreversible: you do not scrap fuel-frugal boilers or remove roof insulation when fuel prices drop, so efficiency ratchets up. And frugality will involve more than incrementalism: efficiency often yields expanding returns.

Each day a modern car burns fuel derived from 100 times its weight in ancient plants; yet a mere 0.3% of that fuel moves the driver. Tripled-efficiency, ultralight petrol-hybrid suvs were designed in 2000, paying back in one year at European and Japanese fuel prices or two years at America's much cheaper pump prices. In 2007 the Auto-

erage cost: \$12 per saved barrel. Saved natural gas and advanced biofuels could replace the remaining oil for \$18 per barrel. So eliminating American oil use by the 2040s costs \$15 per barrel—one-fifth its 2006 price. It surely follows that getting off oil—thus abating 42% of global carbon-dioxide emissions—will be led by business for profit.

That transition already shapes competitive strategy. Wal-Mart's new heavy trucks will be a quarter more efficient in 2007 than in 2006. By 2015 they will be twice as efficient, saving over \$300m a year. Next will come trebled efficiency, which yields a 60% internal rate of return.

In 2007 Boeing's 20%-more-efficient but same-price 787 will take flight. In Detroit, Schumpeterian "creative destruction" will accelerate as smart money favours leapfrogs; markets will change managers or their minds, whichever happens first. Ford's new chief executive, Alan Mulally, whose efficiency-based Boeing strategy is beating Airbus, will bring to Ford Boeing's focus on ultralight materials (the 787 is 50% advanced composites), systems integration and breakthrough design.

The greening of the Pentagon

In Washington, dc, a surprisingly strong voice in 2007 for getting off oil will be the world's biggest buyer both of oil and of renewable energy—the Pentagon. This is not just because oiligarchs tend not to be freedom-loving democrats and sometimes foment instability and conflict. Rather, the risk and cost of vulnerable fuel convoys, easy prey to roadside bombs, will persuade military leaders that only super-efficient platforms dragging dramatically slimmer fuel logistics tails, or none, can fight persistent, dispersed, affordable wars.

This strategic shift will not just save hundreds of lives and tens of billions of dollars a year. It will also speed key technologies, like ultralight materials, that can triple the efficiency of civilian cars, trucks and planes—just as military r&d created the internet, gps, and the jet and chip industries. Thus the Pentagon will start to lead America, and the world, off oil so nobody need fight over it.

A vision will form of a United States that can treat countries with oil the same as countries without oil, and gives others no reason to suppose it is motivated by oil. The bet of Russia's President Vladimir Putin that he could hold fuel customers to ransom will eventually turn sour. China's 2005 adoption of energy efficiency as a top development priority will start paying off. Decisive evidence will emerge that stabilising the earth's climate is in fact not costly but profitable (because saving fuel costs less than buying it). And as we all drill for wasted oil to power our buildings, factories and vehicles, the market- and community-driven rise of energy saving—or "negabarrels"—will begin laying visible foundations for a richer, cooler, fairer and safer world. ■

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motive X Prize will start moving such designs to market. Just in America, they will ultimately save 8m barrels of oil a day—equivalent to finding a new, secure and inexhaustible Saudi Arabia under Detroit.

In 2007, too, Toyota will emerge as the leader in super-efficient plug-in hybrid cars: electric for short commutes, petrol-hybrid for long trips. This could double the already doubled petrol efficiency of a Prius. Next, make that car ultralight and its petrol efficiency redoubles. Biofuel it and you quadruple petrol efficiency again, to 30 times today's norm. Sound like the whale-oil story yet? Oil prices will drop—but efficiency will remain cheaper still.

Full practical use of the best efficiency technologies in all applications would halve American barrels burnt per dollar of gdp, to a quarter of the 1975 level. The av-