CHAPTER 7

Peak Oil Will Get Us First Anyway

The worst of all deceptions is self-deception.

Plato

A FORMER COLLEAGUE OF MINE HAS A COUSIN NAMED DIEGO who lives in the mountains of New Mexico, about 10 miles from the nearest town. He supports his wife and three kids as a jack-of-all-trades who can fix anything: machinery, vehicles, electrical, foundations, plumbing, carpentry, you name it. He does great work and charges little. Because of his multiple talents, Diego is the first person people call no matter how complicated the problem. But he doesn't need much money, so he only accepts jobs when funds are low.

His family doesn't travel. The kids are home-schooled. They grow their food, make and repair their clothes, and have minimal needs. The family doesn't interact much with others: the kids don't partake of sports or other youth activities, and the parents avoid clubs and socializing. They occasionally come to town for supplies and once a month for church. Otherwise, they stick to themselves.

I asked why the family was so self-reliant and isolated.

"Diego is a 'survivalist.'"

"A what?"

"You haven't heard of survivalists? 'Doomsday preppers'? 'Peak oil catastrophists'?"

"I've heard of peak oil catastrophists. They believe we'll soon run out of oil. When that happens, many horrors follow, from food shortages to suburban wastelands to mass migrations – a game of Survivor in which self-reliant people will fare better. Isn't that it?"

"That's it. Armageddon is nigh, and these people are ready."

"But wait a minute. Living on a mountain seems vulnerable."

"Diego has that covered."

He described Diego's hill-top bastion. Being off-grid, he generates his electricity from solar panels, a small wind turbine, and a micro-hydro generator in the stream 300 yards down the hill. Power from these sources is stored in a bank of batteries under the barn, next to an underground bunker. This has emergency living quarters for the family and is fully stocked with preserved food and other critical supplies like first-aid and extra clothing. He has a wood-burning air-tight stove in the main house and another in the bunker if needed. A rooftop solar hot-water system provides domestic hot water, augmented by heat from the wood stove.

Diego runs his truck on gasoline. But in his barn he has an oversized golf cart, with extra seating and a large cargo bed. It can run on an electric motor powered by a rechargeable battery. It also has an internal combustion engine, for which Diego can make ethanol from a wood-burning still that converts grains and vegetable waste into ethyl-alcohol. He rarely runs the still, but he could gear-up if necessary. As backup, he has six horses and two fields of hay to fuel them.

I refer to Diego's place as a bastion for good reason. It makes no sense to prepare for the Dark Ages if you're unable to fend off marauders scavenging for food and fuel. He has an intruder-detection system that covers a half-mile perimeter, and hidden surveillance cameras scan the only access road, which he has mined with remote-controlled IEDs. It was strongly hinted that Diego also has a serious arsenal in the bunker. As for handling horses, his whole family is well trained. For families like Diego's, home schooling encompasses a lot.

As an energy analyst, I occasionally read about people like Diego, who act on their conviction that we should prepare for the day when civilization collapses, perhaps because the oil runs out.[1] These people are rare. But not so rare are those who believe that an energy day of reckoning is imminent and that we should worry about our rapid oil depletion. For many older Americans, this concern dates back to the 1970s, especially the 'oil crisis' of 1973.

In October 1973, the United States provided military supplies to Israel during its month-long Yom Kippur war with Egypt and Syria. In a show of solidarity, Arab oil-exporting states embargoed supplies to the US and some European countries, causing gasoline shortages unseen since World War II. President Nixon appointed an energy czar, William Simon, to control prices. He prohibited gasoline sales on Sundays, and rationed sales on alternating days between even- and odd-numbered license plates. The situation remained tense for months. Truckers went on strike to protest the size of their fuel allocations, leading to violence between strikers and strike-breakers. Queues snaked out from gas stations, sometimes up to 100 cars long. Nixon urged drivers not to exceed 80 kilometers per hour (55 mph) and households to limit thermostat settings to 20 degrees Celsius (68 degrees F).

Some states contributed with their own energy-saving ordinances, with Oregon gaining notoriety for its Grinch-like ban on Christmas lights. Newspapers reported fistfights in gas station queues. Almost overnight, the price of crude oil had jumped from $3 per barrel to $12. While $12 might seem paltry today, it's $75 when adjusted for 45 years of inflation. Thanks to gasoline price controls in the US, the domestic price only doubled, but this was still a huge shock for a gas-guzzling, auto-dependent nation. And because oil generated a fifth of US electricity back then, electricity prices also jumped.

The year 1973 was full of dramatic news. There was the Arab-Israeli war. The US was in the final stages of its painful withdrawal from Vietnam. The Chilean military overthrew the government of Salvador Allende. And the Watergate scandal mesmerized Americans, culminating in the resignation of President Richard Nixon. While the 1973 oil crisis was just one of many dramatic events, for some it symbolized the beginning of the end for humanity's resource profligacy, exposing the impossibility of exponential growth on a finite planet.

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Google the term 'peak oil' and get ready for a tsunami of the frightening scenarios envisioned by Diego and fellow preppers – deserted suburbs, empty skyscrapers, armed battles over food, water, and other resources, mass migrations in a chaotic world. Websites offer instructions on gardening and food preservation, living off-grid on solar, wind, and wood, and defending yourself and family from desperate intruders.

It is misleading, however, to conclude that all the people concerned with peak oil are dystopians awaiting global chaos. From time to time the peak oil concern is widely shared by people whose views are otherwise far from those of people like Diego. This mainstream interest goes in cycles. After a peak in interest during the oil shocks of the 1970s, the concern diminished in the late 1980s and early 1990s, as development of new oil sources kept oil prices low. But the high oil prices from 2004 to 2014 sparked a new wave of peak oil concern. The recent flourishing in the US of plentiful light tight oil (also called shale oil) has reduced media interest in peak oil since 2010. But the concern has not disappeared.

The premise of peak oil is simple. Oil is the critical energy input of the global economy. The annual global consumption of oil is massive, while its quantity is essentially finite. (Although oil is continuously being produced by the decomposition of tiny dead animals and plants, this annual rate of production is minute compared to our annual consumption.) As oil scarcity becomes acute, its price will rise to high levels, creating a crisis for our oil-dependent economies and lifestyles.

To assess the peak oil claim, it seems obvious to ask people who know something about the earth's crust. Colin Campbell, a British geologist who helped found the *Association for the Study of Peak Oil*, offers the following, "It's quite a simple theory, and one that any beer-drinker understands. The glass starts full and ends empty, and the faster you drink it, the quicker it's gone."[2] Campbell and other geologists have studied the oil-endowed regions of the planet to produce an estimate of what's left. They expect a peak in the rate of discovery, followed by the inevitable decline as humans scour the earth's crust for remaining oil deposits in increasingly dispersed and difficult locations.

The global oil assessment by these modern researchers is based on the pioneering analysis in the 1950s of an American geoscientist, Marion King Hubbert. Originally from Texas, Hubbert earned a PhD from the University of Chicago in 1937 and then worked as a petroleum geologist for Shell Oil from 1943 to 1964. At a 1956 meeting of the *American*

Petroleum Institute, he presented his theory that discoveries of oil in a given oil-bearing region would trace a bell-shaped curve over time, with initially a rising rate of discovery, then eventually a declining rate.[3] The peak would be reached when half of the total reserves had been discovered, hence the symmetrical shape. Oil production would have the same bell-shaped curve, but it would lag the discovery curve depending on the time required to bring new reserves into production.

The bell-shape of peak oil is depicted in Figure 7.1. At that 1956 meeting, Hubbert predicted that annual additions in the lower-48 US states would peak about 1970, with production peaking soon after. His prediction went counter to prevailing industry wisdom and was disregarded.

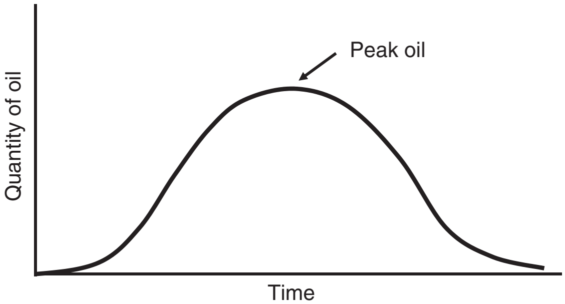

Figure 7.1 Peak oil

But 15 years later, right on cue, US oil supply additions peaked in the continental US (excluding Alaska), which prompted oil analysts to revisit Hubbert's views. His stature within the industry started to climb. Then, the oil crisis of 1973 spread his reputation to the general public, as suddenly everyone was concerned with oil scarcity, especially given the growing US oil dependence and the impacts of the surprise Arab oil embargo.

The media enjoyed the story about this maverick geoscientist who 15 years earlier had predicted the US peak with amazing accuracy. In 1975, the National Academy of Sciences accepted Hubbert's US analysis and publicly acknowledged its earlier mistakes in critiquing it. Today, the Association for the Study of Peak Oil annually bestows the King Hubbert Award on leading contributors, and the terms peak oil and 'Hubbert's peak' are synonymous.

The study of peak oil increasingly shifted from the US to global estimates of oil supply and production, with peak oil alarmists suggesting that that the global peak will be globally catastrophic. Robert Hirsch, who produced a report on peak oil for the US government, said in 2005, "Previous energy transitions were gradual and evolutionary; oil peaking will be abrupt and revolutionary."[4]

Alarm about peak oil was expressed by high-profile personalities with no particular expertise in global energy. In 2006, Kurt Vonnegut said, "What's going to happen is, very soon, we're going to run out of petroleum, and everything depends on petroleum. And there go the school buses. There go the fire engines. The food trucks will come to a halt. This is the end of the world."[5] Visit peak oil websites and you will find similar warnings about the downward slope of Hubbert's curve.

As someone whose career has been devoted to resource and environment sustainability, I sympathize with this view. The modern economy gobbles up the planet's resources at a tremendous rate and spews a massive flow of wastes into the environment. Figure 7.2 visualizes this conundrum: the human economy is like a machine that extracts resources from the environment and converts these into goods and services, expelling a polluting stream of wastes. The two prime threats to sustainability are exhaustion of critical resource inputs and pollution that disrupts the environment's ability to provide clean water, fertile soil, breathable air, and a stable climate. As the economy grows, it swallows more resources and spews more waste. Even if it doesn't grow, current flows are unsustainable, certainly when it comes to GHG emissions.

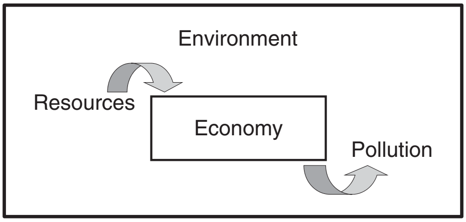

Figure 7.2 Sustainability challenge of resources and wastes

This situation provides lots to worry about. On the resource side, we can fret about exhausting non-renewable resources, like fossil fuels, zinc, copper, and phosphorus. Even if a resource is potentially renewable, we might harvest a fish species to extinction, grow crops in ways that deplete soil fertility, or drain an aquifer faster than natural percolation replenishes it.

On the waste side, the by-products of human settlements and industrial activities have pollution impacts that range from local to global. Over the past half-century, wealthier societies have reduced some local impacts, like effluents despoiling rivers and emissions causing smog, in part thanks to the power of NIMBY – 'not-in-my-back-yard.' Global threats are more challenging. Still, there have been some successes, such as the quick international agreement in 1989 to phase out chlorofluorocarbon gases that were creating a hole in the ozone layer.

It is perhaps no coincidence that the oil scarcity fears of the 1970s coincided with a rising general alarm over the twin threats of resource scarcity and environmental degradation. In 1972, a think tank called The Club of Rome published *The Limits to Growth*, a book which illustrated how exponential growth of resource use and pollution on a finite planet could not endure.[6] The book triggered a vigorous debate. On one side are people concerned with impending resource scarcity. On the other are optimists who believe that human ingenuity, in concert with market forces of supply and demand, will respond to these sustainability challenges by switching away from scarce resources and controlling pollution before it reaches truly harmful levels.

Who is right? Difficult to say. Bjorn Lomborg argued in *The Skeptical Environmentalist* that environmental conditions are not as dire as claimed by environmentalists, and Matt Ridley argued in *The Rational Optimist* that the exponential growth of human ingenuity will keep us dodging the twin swords of resource depletion and environmental destruction.[7] Less optimistic books are Clive Hamilton's *Requiem for a Species*, David Wallace-Wells' *The Uninhabitable Earth*, and Nathaniel Rich's *Losing Earth*, who lament our environmental predicament, especially the role of powerful corporations and individuals in preventing humanity from acting on the threat of climate change.[8]

As these books attest, assessing if and how humans will overcome a wide array of threats to sustainability is a difficult endeavor. While I agree that we often underestimate human ingenuity, I also agree that humans are ill equipped to deal with a threat like climate change, which requires a coordinated, global effort to address the pollution output side of Figure 7.2. Over two decades of failure suggest the odds are not in our favor.

The concern for peak oil, however, is not about the wastes we produce, like GHGs, but rather about the threat of exhausting key resources, the left input side of Figure 7.2. But how urgent is this threat compared to climate change? And since oil is involved in both cases, are these two sustainability concerns – resource depletion and pollution accumulation – connected in some way?

* * *

The bell-curve of Hubbert and his followers depicts the annual supply additions of a specific resource – oil. This sounds simple, but it's not. The definition of oil has changed continuously in the past, and will continue to change in future. And each time it changes, the estimated oil supply increases, and Hubbert's bell-curve gets tossed aside and replaced by a taller and wider version. Yet this seems to go unnoticed by those concerned with peak oil.

When Hubbert's career started, the definition of oil did not include oil under the deep ocean, as in the North Sea and off the coast of Brazil. Nor did it include the additional oil that could be extracted by injecting gas or water into depleted oil reservoirs to force more oil from wells that would otherwise stop producing – called 'enhanced oil recovery.' Nor did it include oil-impregnated sand, as in western Canada's oil sands. Nor did it include molasses-like heavy oil, as in Venezuela. Nor did it include oil trapped in shale rock, as in North Dakota. Technologies to exploit these substances either did not exist or were too costly, so these 'unconventional oil resources' were excluded from oil supply estimates even though geologists knew about them.

The petroleum industry progresses in fits and starts from the easier to the more difficult, incorporating these unconventional resources along the way. Yes, we are *always* running out of the easier stuff, such as conventional oil which flows freely from a well under its own pressure. But as this happens, we develop technologies that reduce the cost of exploiting the more difficult stuff, such as the various forms of unconventional oil. This transition forces industry to broaden its definition of oil to progressively incorporate more of these unconventional supplies, especially as their costs of production fall with technological innovation.

Every year British Petroleum issues a highly regarded energy statistical update that includes estimates of global oil supplies.[9] Just 20 years ago, Canadian oil sands were not considered economic and so were excluded from the BP global estimate. But cost-reducing technological innovations and rising oil prices led BP to change its oil supply estimate for Canada from 40 billion barrels in 1990 to 180 billion in 2000, on par with the oil supplies of Saudi Arabia. This process was repeated for the heavy oil of Venezuela. In 2000, BP's oil supply estimate for Venezuela was 75 billion barrels, but by 2010 it had ballooned to 300 billion barrels.

Since 2010, BP has also been revising upward its estimates of light tight oil, as found in North Dakota, Texas, and elsewhere. The earth's sedimentary rocks are full of carbon from the remains of dead animals and plants accumulated over billions of years. We find conventional supplies of oil and gas because some of these carbon-rich remains, after high pressure transformed them into liquids, migrated through porous rock until they accumulated under an impervious layer, such as limestone. But much of the earth's carbon was unable to migrate and accumulate, remaining trapped in layers of mud and clay that eventually compressed into shale rock.

Thanks to recent technological innovations, we now combine the fracturing of carbon-rich shale rock, a process called 'fracking,' with horizontal drilling that can find small, isolated oil deposits in shale and associated rocks. This technology also enables the extraction of a lot more natural gas. Thus, the development of fracking and horizontal drilling has dramatically increased the estimated supplies of oil and natural gas in North America, and a similar development is gradually occurring on other continents. This unconventional source of oil and gas is enormous.

If, instead of living in the mountains of New Mexico, Diego was tucked away in the backcountry of North Dakota, he would probably know about shale oil. In 1953, just as Hubbert was developing his peak oil theory, geologists identified a major subsurface shale deposit on the land of Henry Bakken, a farmer near Williston, North Dakota. Eventually, they determined that the Bakken formation underlies 200,000 square miles of North Dakota and Montana. This is a huge source of oil. Yet, for the next 50 years the petroleum industry ignored it. There was no incentive to exploit the more difficult oil sources while the easier stuff was plentiful, and lower cost to produce.

But once oil prices started climbing in 2003, some oil companies scaled up their fracking efforts and cost-reducing innovations soon followed. Oil output at Bakken, which was close to zero in 2003, grew exponentially to 200,000 barrels per day in 2009, 600,000 in 2012, and over 1 million in 2015. With the development of light tight oil in North Dakota, Texas, and other states, total US oil production increased from 5 million barrels per day in 2008 to 10 million in 2018. The US is now virtually self-sufficient – producing as much oil as it consumes.

In trying to make sense of this rising output from a resource that is supposed to be in decline, Diego might take a break from peak oil websites and briefly turn to an independent assessment by some of the world's leading energy experts called the *Global Energy Assessment*.[10] Released in 2012, after five years of collaborative research, this report presents multiple dimensions of the global energy system. It shows that humans have consumed about one trillion barrels of conventional oil, but the earth's crust still has over two trillion barrels. Enhanced oil recovery adds another trillion, oil sands and heavy oil another trillion, and light tight oil yet another trillion. This makes five trillion barrels available. In other words, we have only burned about one sixth of the oil and oil-like substances that we currently know are available.

Peak oil analysts claim that the peak occurs when about half of the resource is consumed. They further claim that peak oil is imminent. But, if we have consumed only one sixth of the resource, then a peak oil crisis is hardly imminent. And the amount of oil remaining might not matter anyway once we acknowledge the fact that oil is but one fossil fuel option for making products like gasoline and diesel. Germany produced synthetic transport fuel from coal during World War II when British ships and Soviet armies blocked its access to oil supplies. Today, South Africa produces much of its gasoline and diesel from coal, having adopted the same German technology in the 1970s to circumvent the oil embargo imposed to discourage its racist apartheid system. Meanwhile Qatar exports diesel that it produces from its plentiful natural gas supplies and there are similar facilities elsewhere in the world.

These 'coal-to-liquids' and 'gas-to-liquids' processes can expand dramatically if oil scarcity provided a market opportunity. In such a scenario, the authors of the *Global Energy Assessment* estimate that natural gas supply could equal six trillion barrels of oil and coal 10 trillion. This means that we have used but 1/20th of the fossil fuels available to economically produce gasoline and diesel, a devastating ratio for the peak oil paradigm. There are now analysts arguing that the oil price will stay low for a long time.[11]

How can the peak oil analysis be this wrong? One problem for people concerned about oil scarcity is the tendency to overlook the response to higher oil prices, as Daniel Yergin explained in his book *The Quest*.[12] Economic history abounds with instances when the rising price of a scarce commodity triggered exploration and innovation in the development of alternatives. Some of the best evidence comes, ironically, from the very 1970s oil crisis that is so symbolic for peak oil catastrophists.

The 1973 oil price increase was followed by a second jump to $40 per barrel during the Iranian revolution in 1979. The price stayed at that level for six years. But, in 1986 it collapsed to below $20 and, except for a brief spike during the 1991 first Iraq war to expel Saddam Hussain's army from Kuwait, it remained low for the next 15 years.

Why didn't oil prices keep rising through the 1980s and 90s as many had expected? The answer is the predictable supply-demand response to the 1970s price increases. On the demand side, industrialized countries stopped generating electricity from oil by switching to coal, natural gas, nuclear, and renewables. Oil use in industrial boilers and residential furnaces plummeted, mostly replaced by natural gas, while vehicle efficiency regulations reduced consumption of gasoline and diesel.

On the supply side, increased exploration led to supplies from new conventional sources, such as the north slope of Alaska. Technological improvement increased the take from enhanced oil recovery and enabled offshore development, as in the North Sea. With government help, investment also flowed to unconventional sources like oil sands, shale oil, light tight oil, and coal-to-liquids. But most of these developments stagnated once the oil price collapsed in 1986, when what was an oil seller's market became a buyer's market.

This rapid response explains why historical graphs of global and US oil production show a different pattern from the singular pinnacle predicted by Hubbert and his followers. Figure 7.3, constructed from data of the US Energy Information Administration, shows the 1970 production peak, as predicted by Hubbert. But since 2003, US production is rising again.

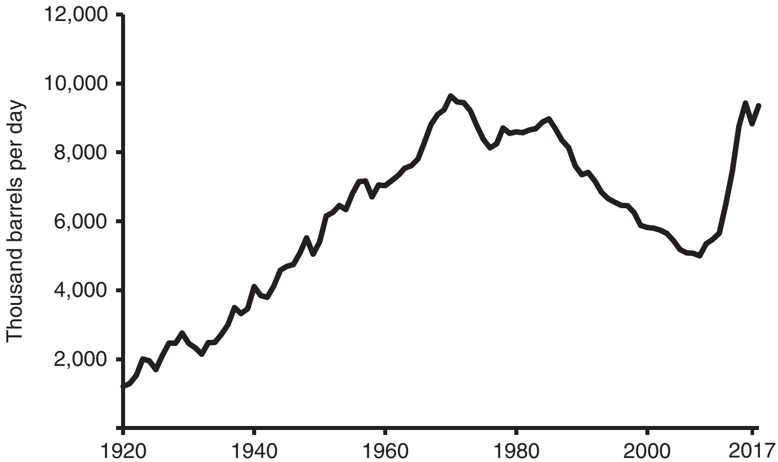

Figure 7.3 US oil production

This development undermines the beer-drinker metaphor for oil depletion. A more accurate version has an industrious bartender who responds to depleting stocks of ale by rummaging through the inner recesses of his pub's cellar to find more kegs. Yes, supplies are finite. But the huge cellar has many uncharted nooks and crannies. Although some of the pub's stored ale is more difficult to retrieve, it far exceeds the amount in the kegs currently on tap. It is incorrect to assume the pub's beer will be exhausted when these are drained.

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Many people misinterpreted the oil crisis of the 1970s as signaling the end of oil. In fact, the price rose because a geopolitical crisis caused a temporary shortage. When the crisis abated, supply increases from market competition caused the price to fall in 1986 back down to oil's cost of production. It stayed there until 2003, when growing demand, especially in China and India, outstripped the discovery rate for new supplies, and speculators in a tight market drove the price higher. But this higher price triggered a market response that increased supply and moderated demand, so prices settled far from the lofty heights predicted by peak oil catastrophists.

When asked why prices are today not at $200, some peak oil believers credit oil supply shortages with causing the economic recession of 2008–2010. They claim that high oil prices in 2008 caused the economic crisis, which in turn reduced oil demand, causing its price to fall. It doesn't matter that leading authorities on the economic crisis, such as Paul Krugman in *The Return of Depression Economics and the Crisis of 2008*[13] and Joseph Stiglitz in *Freefall*,[14] do not finger oil prices as causing the crisis. Instead, they explain how a lethal combination of lax financial regulation and simple greed wreaked economic havoc.

The price of oil, like that of any commodity, rises and falls in response to short-term market changes, which can be triggered by war, geopolitical tension, facility failures, major new discoveries, and rapid demand increases and decreases. Those who believe that peak oil is imminent tend to interpret each significant price increase as the start of a unidirectional ascent brought on by the peaking of oil supply. This leads to claims that oil prices will reach $200 or $300 per barrel and stay there. The likely market response to such high prices is ignored.

When pressed with all of this contrary evidence showing a huge supply of alternatives to conventional oil, some peak oilers offer one last argument – the declining rate of 'energy-return-on-energy-invested' (referred to as 'EROEI'). They claim that although there is a huge supply potential from the alternatives to conventional oil, the conversion of these into gasoline and diesel requires a lot of energy, forcing the economy to "run faster just to stand still." They note that in the 1930s the US oil industry consumed one barrel of oil for every 100 barrels it produced, while today that ratio is down to one to 15, and even lower in the case of shale oil and oil sands. This declining rate of EROEI will cause, so they say, rising energy prices and a peak oil crisis. In other words, the peak in the discovery and production of conventional oil is still critical, despite a plethora of high-cost unconventional alternatives, because exploitation of the latter requires too much energy.

But while this ratio indicates a greater input of energy to produce each unit of oil used in the economy, it is not true that a rising EROEI automatically leads to rising oil prices. Before such a conclusion, we must first determine the effect of ongoing innovations that improve the productivity of the industrial plant, equipment, buildings, infrastructure (called 'physical capital') used to produce the oil. If the cost of these investments per unit of oil declines fast enough, this offsets rising costs due to consuming more energy inputs per barrel produced, especially when those energy inputs are cheap.

As an example, assume that it costs $100 to produce a barrel of oil, and that this is comprised of $10 for energy inputs, $75 for physical capital, and $15 for all non-energy operating costs, including labor. (The relative costs in this example are close to reality, and I picked an oil cost of $100 for simplicity.) Now, assume that a declining EROEI over the next two decades necessitates a three-fold increase in energy input for each barrel of oil. If nothing else changes, this increases the production cost to $120 per barrel, with total energy inputs now costing $30 instead of $10.

This suggests a rising cost of oil, and therefore higher energy prices because of a declining EROEI. But before concluding this we need to know what happens over this period to the cost of the physical capital per barrel, especially since we know that innovations are continuously improving the productivity of plant and equipment in any industry. What if this rate of improvement was a conservative 1% per year over the next 20 years? If so, the cost of physical capital per barrel would fall from $75 to about $58. The net effect of these two processes – a dramatic decline in EROEI and a gradually falling physical capital cost – would together result in an increase in the production cost of oil by $3 over 20 years. It would rise from $100 to $103 ($30 + $58 + $15). This is hardly the frightening jump in production costs that people fear. Yet it closely reflects what actually happened over the past half-century as we depleted the easy oil.

Returning to the big picture, we've burned one trillion barrels of oil and we still have over five trillion barrels of oil and oil-like substitutes, and over 16 trillion barrels of oil-equivalent coal and natural gas substitutes. That's a lot of fossil fuels, and potentially a lot of carbon pollution. No wonder that we experts who worry about climate change see the world so differently than people worried about peak oil. Our worry is that we *won't* run out of oil fast enough.

Most people concerned with peak oil acknowledge that global warming is also a threat to sustainability. So maybe it's harmless if they continue to worry about peak oil. But maybe it's not harmless, especially when it inadvertently helps the fossil fuel industry convince politicians and the public of the urgency of increasing oil production. Whenever oil prices rise because of some short-term crisis, industry echoes the peak oil argument to convince governments to approve and even assist new fossil fuel projects. Since we already have enormous capital resources and technical know-how in this industry, the quickest response to an apparent energy supply shortage is to stay on the fossil fuel path, which is also the GHG-increasing path.

Thus, focusing on the peak oil concern can have the unintended consequence of helping the fossil fuel industry increase carbon pollution. It also can justify complacency on the climate-energy threat. Why enact policies to phase out gasoline use if we'll soon run out of oil anyway?

But it doesn't have to be this way. By tackling the climate change threat we also address the peak oil threat. Hitting a peak in emissions requires us to shift the transportation system from reliance on oil-derived gasoline and diesel to a rapidly growing use of electricity, ethanol, biodiesel, and hydrogen. As this shift happens, the consumption of gasoline and diesel will peak and then fall. On the surface, the peak in oil consumption would appear to vindicate Hubbert. But in this case, the peak would occur not because of a decline in oil discoveries and reserves, as he predicted, but because of a decline in oil demand, while supplies remained plentiful. Just as the Stone Age did not end for lack of stones, the Oil Age would not end for lack of oil.

I share many of the concerns of peak oilers. Like them, I cannot ignore how the growing global economy gobbles up resources and spits out wastes. For long-run sustainability, humans need to find a way to transform our economies so that they mimic biological systems, recycling wastes and resources in a closed loop. But now we must focus on rapidly cutting GHG emissions. We can't let the myth of peak oil help the fossil fuel industry keep us on this disastrous path.