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# Simplistic predictions of looming oil drought are wide of the mark

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ANALYSIS

The price of oil has been topping $130 a barrel, fuelled in part by fears that it is running out. But that isn't going to happen for a very long time

A gas burn-off in the oil fields north of Surgut in Russia: a rise of one dollar a barrel instantly augments global reserves by making economic a slew of prospects from which the oil was previously uneconomic to extract. Photograph: Scott Warren/Aurora/Getty Images

According to published sources, the world has something like one trillion barrels of oil reserves and consumes about 87 million barrels a day. Divide a trillion by 87 million and you get 11,494 days or 31½ years of oil left – that is, it will run out in 2040 or thereabouts.

That's within the lifetime of many of us, so panic about a coming oil drought is entirely appropriate. Right?

# Opinion

**“The limitless human mind will always ensure there is sufficient oil to meet humankind’s needs until well after our grandchildren have died of old age.**

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Wrong. For the equation assumes stasis, but its two key components, reserves and consumption, are wildly dynamic and uncertain.

Take consumption. It is dictated by demand, but this in turn is driven by energy mix (oil, gas, coal, nuclear, hydrogen, renewables such as hydro, solar, wind, wave, tides, bio – more of one means less of another); by technology (machines that are either more fuel-efficient or less so); and by business organisation (arranging things more cleverly, such as by eliminating process duplication within or between companies, or eliminating processes altogether – eg replacing travel with video-conferencing, or reaping economies of scale, or a multiplicity of simple things like car-sharing).

Consumption is also driven by oil price (higher prices lead to less consumption), which is itself driven by demand (more consumption leads to higher prices); by free-market competition forcing businesses to drive down their costs in order to survive; and by overall world economic circumstances that can foster either tighter or looser financial control, and lower or higher demand.

So if there is one thing you can be certain of between now and 2040, it is that consumption is not going to remain at 87 million barrels a day or any simple multiplicator of this.

Then there’s the reserves question, which is even trickier.

The reserves of a given oilfield are someone’s best estimate of how much oil can be economically produced at today’s prices and using today’s technology.

But reserves can’t be measured like liquid in a swimming pool, because oil sits in countless tiny voids (eg the space between adjacent grains of sand) within rock several kilometres downstairs and typically between a million and a billion cubic metres in size.

So you have to estimate the volume of the oil-bearing rock you’ve got; how much of this comprises voids able to contain fluids (porosity); how well the voids are connected together for easy tapping (permeability); the percentage to which the voids are filled with oil rather than water (saturation); how easily the oil itself can flow from one void to another till it gets to a well bore (viscosity); what help you may need to provide to push the oil along (eg external pressure); and the proportion, based on all the above, of the oil actually present that you will be able to economically extract – the so-called recovery factor.

On the last point, recovery factors for given oilfields range typically from 15 per cent to 60 per cent, with a global average of about 40 per cent, meaning the other 60 per cent doesn’t appear in reserves estimates.

The above is what you need to know, but all you can measure is a few metrics that will yield seismic data that vaguely maps the shape of the rocks; good raw data about rocks and fluids from individual wells drilled – but wells are expensive, so they are few and far between; and reliable data about past production, though this largely just tells you how wrong your previous estimates were.

So with this limited, spaced-out information, covering only a very small percentage of the rock, you nevertheless have to interpolate and extrapolate what it means for all of the rock.

It is not hard to see, therefore, that if two engineers get together to agree on a reserves estimate, they come up with at least three different answers.

And that’s not even to talk about human factors, such as the bonuses they might earn for themselves and their colleagues if they can increase reserves for their company and hence its share price, or the interest many Opec countries have in inflating their reserves to qualify for bigger production quotas, while simultaneously obscuring from their colleagues the basis of their calculations.

**“So when you see a figure like one trillion barrels of reserves, know that it is no more than a best estimate**

But even all this is only part of the story.

Technology is changing all the time in a manner that in effect continuously increases reserves, as new ways emerge to use ever-better seismic techniques to locate oil-bearing rocks – smaller, deeper, tougher – that would otherwise remain hidden; to drill wells in ever-deeper, rougher waters and in more demanding land locations (from frozen wastes to thick jungle) that go ever deeper underground, that snake in three dimensions through multiple oil-bearing zones like a fighter jet stalking its prey, that are multi-tentacled, able to reach out several kilometres – perhaps up to 15km - in all directions like the spokes of a bicycle wheel; and to drill wells ever more cheaply, and to re-use old wells, thus yielding a profit from what would otherwise be uneconomic oil.

Increasingly sophisticated engineering provides solutions that improve the recovery factor, ie by untrapping more of the 60 per cent of oil (over a trillion barrels) currently not economically producible. These enhanced recovery techniques include cracking the rock open by pumping in water at high pressure; dissolving the rock and/or solid impurities by soaking with acid or other solvents; flushing the reservoir with water, or steam, or gas, or thinning chemicals, or viscous fluids down one set of (injection) wells, in order to drive more oil into the bores of other (producing) wells; or combining such methods.

Modern applied science allows us to convert gas to liquid fuel using the latest so-called gas-to-liquid (GTL) technology, or indeed coal to liquid, so adding to liquid fuel reserves; to double present reserves by economically developing vast oil deposits hitherto locked within, for example, Canadian tar sands (over 0.3 trillion barrels), Venezuelan bitumen (over 0.1 trillion barrels) and US oil-shales (an astonishing two trillion barrels); and to transport and process oil in ways that relentlessly drive down costs on a never-ending basis.

And we must not forget the direct effect of oil price. Firstly, price rises encourage further exploration and investment, which ultimately add to reserves. Contrary to conventional wisdom, the days of finding super-giant oilfields are not yet over. Not long ago, Petrobras announced the discovery of no fewer than three of them off Brazil – Cariocas-Sugar Loaf, Tupi and Jupiter – which between them hold an astonishing 46 billion barrels of recoverable oil, plus unquantified gas and condensates.

But also, a rise of one dollar a barrel, instantly, with no effort by anyone whatsoever, augments global reserves by making economic a slew of prospects from which the oil was previously uneconomic to extract.

Thus, for example, rising demand pushes up prices that in turn cause reserves to rise. And vice versa of course. Moreover, as the oil price rises, so alternative energies become economic, which, of course, reduces oil demand and hence spins out oil reserves for longer.

Published reserves of the world’s oil represent the sum of millions of estimates that take into account all the above factors. They are performed every day all over the globe by hundreds of thousands of engineers and geologists, competent and incompetent, honest and flaky, checked and not checked.

So when you see a figure like one trillion barrels of reserves, know that it is no more than a best estimate as of a certain moment in time, and certainly wrong, and that it’s changing all the time.

Bear in mind also that less conventional energy alternatives – geothermal, wind, solar, hydrogen, tidal – are developing fast, their costs are dropping and before long they will be able to displace significant oil volumes (in the process making oil reserves last longer).

Above all, know and trust that there is no limit to human ingenuity. Indeed it is said that oil is found not in the ground but in that unfathomable, inexhaustible resource that is the human brain, prompted it must be said by the driving force of benign human greed that so fascinated the Scottish economist Adam Smith, spiritual father of capitalism.

The limitless human mind will always ensure there is sufficient oil to meet humankind’s needs until well after our grandchildren have died of old age.

And then there’s politics and oil. Ah, but that’s a story for another day.

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