

THE GREAT OIL DENIAL

Submission to the UK Energy Review by David Fleming

For the last thirty years there has been abundant good information that oil production would peak and start to go into decline around the turn of the century. The failure to listen to these warnings has left the UK (and all other nations) totally unprepared for the consequences of the oil shock which will take place in the first decade of the century, with the result that the shock, when it comes, will be catastrophic. Even at this late hour it would be worthwhile to give a renewables / conservation programme the highest government priority, but government remains paralysed by scepticism and denial. The Energy Review could be an opportunity to wake up, at last, to the reality of the coming energy famine.

Beneath the seabed off the coast of Saudi Arabia, there is an oil field called Manifa. It is a giant, and its riches are almost untapped.¹ There is, however, a snag. Its oil is heavy with vanadium and hydrogen sulphide, making it virtually unusable. One day, the technology may be in place to extract and dispose of these contaminants, but it will not be for some time and when, or if, it does happen, it will do no more than slightly reduce the rate at which world oil supplies slip away towards depletion. However, even this field has advantages relative to the massive reserves of oil which Middle East suppliers are said to hold ready to keep oil prices low and secure the future of civilisation. Unlike those fantasy fields, Manifa actually exists.

For the last twenty five years, there has been a tacit consensus that oil depletion has almost no place on the environment agenda. This is partly a reaction to the criticism of the Club of Rome's (1972) Study, *The Limits to Growth*, which drew attention to the existence of limits to the oil resource.² The study was revisited and ably defended,³ but the weight of criticism was crushing, and environment policy turned instead to sustainable development. The question of resources - oil included - came to be regarded as an embarrassing phase in the environment movement's early days.⁴

But now, it is back with a vengeance. In region after region, the story is of ageing oilfields, of the wrong sort of oil, of nitrogen being pumped into wells to keep up the flow, of exploration turning to unpromising areas such as West-of-Greenland. The UK's North Sea oil is past its peak, as are the giant fields in Alaska, the former Soviet Union, Mexico, Venezuela and Norway. The United States' own oil production has been declining since 1970 and now accounts for less than half its needs. The only producers who still possess an oil resource which may be capable of keeping oil flowing into the world market at a roughly constant level in the first decade of the century are the Middle East OPEC Five - Saudi Arabia, Iran, Iraq, Kuwait and the United Arab Emirates. And even with these countries, it seems, the closer you look at the detail, the less they have to offer.

Much of Saudi Arabia's reserves of oil are held in one huge field, the Ghawar. It has been pumped

continually since 1948 and not surprisingly, it is showing signs of exhaustion, with its southern end now flooding with water. Saudi Arabia can keep its production roughly constant for between seven and ten years before it, too, has used up half its total oil resource and rolls over towards depletion. Then it will turn to smaller fields, producing smaller amounts, followed by poor-quality fields with real problems like Manifa. Saudi Arabia's legendary oil wealth is now coming up hard against the geology.

Reality intervenes in the case of the other Gulf states, too. Iran, which in the past was one of the young giants of the world oil business, could not now sustain a higher output for long, and there are suspicions that some of the production credited to Iran in recent years has actually consisted of oil piped over the border from Iraq. Kuwait and one of the Emirates, Abu Dhabi, could increase production and may well do so, but development would take several years, and their reserves are small relative to the world's demand for oil. There is, however, one country with potential for a serious increase in output, on a scale that could make a difference. The snag in this case is that the country is Iraq.

Unlike every other region with major oil potential, Iraq's oil geology is not fully explored, but there are some well-informed guesses. One estimate is that there are 110 billion barrels there, equal to more than three UK North Seas, or more than one third of the total resource once possessed by Saudi Arabia - enough to keep world oil production rising for a few more years. It lies, however, in a country which is armed to the teeth, consumed by loathing of the West, and just waiting for the threat of armed intervention from America to make its day. Iraq was prevented from selling off its oil during the 1990s, when prices were lower than they will ever be again; it will soon be well placed to apply its own sanctions to the rest of the world by fine-tuning its oil production and naming its price.

The most shocking quality of this story is that it is not new. The essential problem has been known for a very long time. It is a well established fact, written up exhaustively in the literature, that the period around the turn of the millennium would mark the end of growth in the world production of oil, and the start of its long decline towards depletion. Consistent forecasts of the "peak" - the moment when oil production turns down - have been routine for half a century.⁵ In 1956, the geologist King Hubbert correctly forecast that America's oil production would peak around 1970.⁶ In 1970, Esso forecast that global production would peak around 2000.⁷ In 1976, the UK's Department of Energy warned that the North Sea production would peak around the end of the century - about the same time as the peak in world oil production; it would therefore be a good idea, its report concluded, to be ready with alternative supplies of energy.⁸ The *Global Report to the President*, commissioned by President Carter and published in 1982, noted that if there were no constraint in demand, the peak would occur in the 1990s, but this would be slightly postponed if (as happened) there were to be any attempt to enforce higher prices: "Convenient, easily transported, relatively clean-burning petroleum and natural gas resources are being depleted." It recommended action:

As these resources become increasingly scarce, a transition to other forms of energy must be made.⁹

The procession of unheeded warnings has continued. Individual energy analysts, notably Colin

Campbell, Buzz Ivanhoe, Jean Laherrère and, more recently, Roger Bentley, have produced a series of detailed empirical studies showing that the turning point for oil would occur around the turn of the century.¹⁰ In November 1998, the International Energy Agency (IEA) showed (although it required a little deduction to decode the message) that growth in world oil output could not be expected to continue beyond about 2001.¹¹ And, in mid 2000, a member of the conservative United States Geological Survey (USGS), published on the Internet with his master-class on "the Big Rollover - when the demand for oil outstrips the capacity to produce it". It concludes, "Hang on tight. If we don't recognise the problem soon and deal with it, it's going to be quite a ride!"¹²

The reputable forecasts, then, have consistently indicated that an oil-price shock is likely in the opening years of the twenty first century, and that its impact will get worse over time. Why, then, have they been ignored? If the problem were really serious, surely - in this society rich with economists and experts - we would have been told? Not necessarily. The principles of economic thought which are so confidently used as an aid to understanding what is going on in the market economy break down when they are applied to natural resources such as oil.

There are four ways in which the unquestioned principles of market economics do not apply in this case. The first arises from the fact that the price of oil has virtually no influence on the rate at which it is discovered. In market economics, the rules of supply and demand hold good: if, owing to increased demand, the price of something goes up, then this gives a signal to supply more of it; new suppliers will pile into the market until the price settles down again. In the oil market, price does not have this effect. In the early days, the best and biggest fields of conventional (i.e. liquid and accessible) oil were quick to be found, and very cheap to pump. In fact, a new well did not have to be pumped at all; it just gushed. This cheap-to-produce and very useful fuel was immensely profitable, so the world's resources were prospected rapidly and, with the help of digital seismic technology, the discovery of oil grew to a peak in the mid 1960s. Since 1965, however, the rate of discovery has declined by approximately 70% and is falling fast.¹³

This means that we are using oil now which was discovered over forty years ago, in the period when it was being found in huge quantities. That period of discovery is over. There is no conceivable increase in prices, nor any prospective technological advance,¹⁴ which will bring it back. As we use up more of the oil fields which were found in the past, it is becoming harder and harder to sustain the growth of production. Soon production will decline. The famous "price signal" which is supposed to kick in at that point will have absolutely no effect. It is an *impasse* to which the well-behaved theories of prices, supply and demand are irrelevant.

The second breakdown in the well-behaved thinking of market economics occurs with a failure to grasp the significance of the "peak" in the supply of oil. There is still a large quantity of oil in the ground; we are probably not yet even half way through the total quantity of recoverable conventional oil, and there will always be some left to trickle up, if it is pumped hard enough, as proved by the oil donkeys in Pennsylvania which are still nodding away after more than a hundred years. What matters is not the quantity of oil that remains, but the turning point at which the flow of oil hits its peak - when producers are forced to turn to the smaller wells from which it is impossible to sustain the massive

flows of former years. It is here that we come to the parting of the ways between what the market needs and what the oil industry can produce.

The third way in which oil insults the received rules of economics is that it cannot usefully be discussed in abstract terms such as "reduced dependency" and "falling percentages." The press and the government has persistently argued that the world's dependency on oil has declined during the last three decades, and this, it is claimed, means that the market is much less vulnerable to prices and disruptions affecting oil than it was in 1973. Certainly, this was the UK government's position at the time of the first ominous price rises of 1999-2000: "In effect, people have substituted away from oil and oil product consumption", wrote John Battle, the Energy Minister, and his successor, Helen Liddell, agreed: "The declining reliance of the world economy on oil" is one of several factors which "counterbalance fears regarding the peak in oil production".¹⁵ The *Financial Times* admiringly quoted calculations of the effect of high oil prices on corporate profits. \$40 a barrel? - that would merely reduce corporate profit growth from 13% to 12%. No problem. It summarised: "These projections reflect the fact that the corporate sector - and western economies as a whole - have become far less dependent on oil. As a proportion of output, OECD oil and gas imports were three and a half times higher in 1978 than they are now."¹⁶

Less dependent? Even if oil accounted for no more than one percent of the total quantity of energy used, and that one percent provided the fuel for transport, then disruptions to the supply of oil could close the economy down within days. Arcane calculations about the impact of oil prices on growth rates are irrelevant. While it is true that oil declined from 45 percent to 33 percent of all energy used in the UK between 1973 and 2000, the volume of transport, which depends entirely on oil, doubled. We are twice as dependent on transport as we were in 1973. The economists' arguments about "reduced dependency" would be entirely correct were it not for one little snag: we do not fill up our cars with percentages.

The "reduced dependency" argument, then, is absurd. The world uses 30% more oil now than it did in 1970, and the fact that its consumption of gas has doubled does not mean that it is less dependent on oil; it simply means that it has become more dependent on gas, too. In the case of the UK, the contribution of gas and oil combined grew from 50% to 70% of energy consumption between 1973 and 2000. Secure supplies of gas itself cannot be expected to last significantly beyond 2020;¹⁷ this date would be brought forward substantially if there were any large-scale switch from oil to gas for transport, and the switch itself would require a transition period of 5-10 years in order to become a serious solution. There is therefore not a shred of justification for arguing that we are less dependent on oil. Our reliance on a secure flow of oil to underpin our economic and social order is, at present, total.

The fourth way in which well-behaved economic analysis throws us off the scent of the oil shock is that it prefers to ignore time-lags. Specifically, it makes simple assumptions that other sources of energy, from renewable sources - such as solar and wind power - will come on stream as soon as the "price signal" of high oil prices kicks in; when it does so, renewables will flood into our homes and cars and solve our problems. The belief is persistent that ingenuity will come to the rescue - to take the

case of transport alone - with shared, gas-powered and much smaller cars (goods vehicles too, maybe), opening up a smooth and speedy path to post-oil economy. What is really worrying the Opec countries, according to Anatole Kaletsky in *The Times*, is the danger of alternative energy sources bringing the demand for oil to a premature end: "The Saudis, in particular, realise that oil demand could collapse well before their kingdom has the chance to sell off its oil reserves."¹⁸

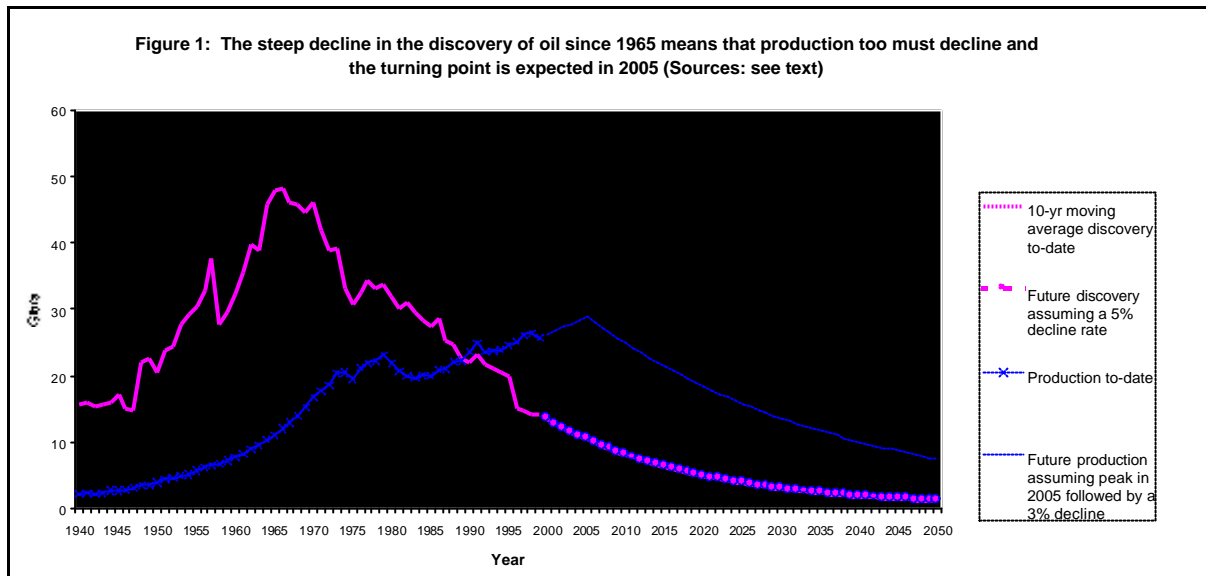
The problem is, however, that the development of those alternative energy sources will take a long time. Look at the scale of the task, to take just the transport case again: build solar / wind / biomass facilities to generate electricity; use the electricity to produce hydrogen; distribute this hydrogen at an ultra-low temperature to "petrol-stations" fitted with the robots that are needed to deliver it into cars and trucks fitted with fuel-cells, cut dependency on road transport by some 75% ... Natural gas clearly has a useful contribution to make here but, given the time it would take to switch to natural gas and the coming peak in the flow of gas itself, this contribution will be quite limited. For energy as a whole, the UK government's own target in 2000 was that renewable sources should, by 2010, account for the equivalent of some 2% of total current final energy demand. A detailed study, published by the LTI-Research Group in Mannheim in 1998, found that, if the development of renewable energy systems were supported as an urgent priority by decisive, well-coordinated action by governments, then it would be possible to provide energy from them equal to as much as 35% of the energy used at present - but it would take fifty years to do so.¹⁹

If more efficient ways of using energy (e.g. conservation methods and super-efficient technologies) were both developed at the same time as a reduction in the need for energy services (e.g. more compact ways of using land), this 35% might conceivably give us all the energy we needed in fifty years, and if it were given the highest possible urgency, then, perhaps, it could be done in twenty-five years. It follows that, if we wait in the approved manner for the market to give the "price signal" that renewable forms of energy should now be developed, we shall ensure that the job starts twenty five years too late. It also follows that, even if the shock were not imminent after all and, instead, were postponed for ten years, while an intensive programme to develop renewables started straight away, it would still have started fifteen years too late to avoid a destabilising "energy gap" before the alternatives are functioning properly.

In fact, our twenty-five year estimate of the time needed for a shift from dependency on oil is doubly optimistic, because the LTI-research group's own estimate of fifty years is based on the assumption of the comfortable background of a fully functioning economy with no disruptions to transport or industry or to any of the other conditions of normality. In reality, the building of the renewables-based economy will have to take place against a background of the oil shock, with all its consequences, which will make it difficult to put into effect a decisive coordinated programme on anything at all.

It is evident therefore, that one of the reasons for this surreal situation, with imminent and devastating change unrecognised by the experts and discounted by government, is that the problem falls outside the mind-set of market economics. Expertise, it seems, wipes the mind clean of commonsense. Maybe, for a moment, we should stop thinking, and just feel the reality of energy famine. It starts in the poorer countries, when the cost of paraffin which they use for cooking places it beyond their reach; after the

peak, consumers all over the world are in trouble, not because oil is expensive, but because it is not there.



(Source: industry sources)

The economics of oil is now dominated by its close proximity to the peak, and the graph (figure 1) shows the peak that could be expected in 2005. In fact, the global peak will not take the usual form of a simple turning-point; instead, as production begins to slow down, price increases will begin to speed up, suppressing demand and slowing the rate of growth in production even more. The market will go into "contango". Buyers will want to *buy more oil today* - i.e. for delivery straight away, since it will be cheaper than oil in the future, while sellers will have an incentive to *hold back the supply of oil today*, since the oil that is still in the ground is appreciating in value. This increase in demand for today's oil, combined with limited supply, will tend to raise its price while the expectation that oil in the future will be still more expensive will tend to increase the price of future oil too, though not quite so fast. Eventually, the price of today's oil will catch up with that of future oil, returning the market to order and equilibrium, but at a much higher price. Oil production will flatten off towards a plateau for a period, followed by a relatively abrupt downturn onto the path towards exhaustion.

The three main purposes for which oil is used worldwide are food, transport and heating. Agriculture is almost entirely dependent on reliable supplies of oil for cultivation and for pumping water, and on gas for its fertilisers; in addition, for every calorie of energy used by agriculture itself, five more (mainly from oil and gas) are used for processing, storage, and distribution.²⁰ Since farming and the food industry is not famous for spending money unnecessarily, there must be a presumption that there is very little short term "slack" which would allow its demand for energy to be reduced at short notice without disruptions in food supplies. In the case of transport and heating fuel, there is more scope for saving energy at short notice; cutting leisure journeys, for instance, wearing extra pullovers and, in the slightly longer term, driving smaller cars have a role to play while, in the longer term, there is totally different low-energy paradigm waiting to be developed, as the Lean Economy shows. But it is the

short term that has to be survived first, and in that short term, the competition for oil for food, transport and heating will be real and raw.

One hitherto cuddly competitor which will abruptly reveal another side to its character will be the United States. America will fight hard and dirty. Its economy is organised irrevocably around the assumption of cheap transport, and any failure to keep its automobile economy moving would be even more damaging there than it would in other developed economies. It has, at the moment, a lot of money, and it can afford to bid high. And, America has the additional problem that it is facing not just a shortfall in the supply of oil but, at the same time, a progressive reduction in the supply of gas; it already relies on gas imports from Canada, whose own reserves are now depleting rapidly.²¹ The timing is vicious: just at the moment when the world's supply of oil starts to decline, the United States will have a new and pressing incentive to *increase* its consumption of oil. American households will have the choice of freezing in unheated homes or - for only as long as the purchasing power of the dollar lasts - paying very high prices for oil.

The world market as a whole will strain to cope with the prices, but the scarcities themselves will intensify. There will be serious economic contraction and destabilisation. Unless the installation of alternatives to replace both oil and gas moves ahead at an extraordinary speed, the deconstruction will get rapidly worse as the supplies of oil, and then gas, go into decline. The market economy in its present form will not survive this sudden loss of cheap and abundant energy.

Government is now in a dilemma. Is this analysis, with its appalling implications, to be taken seriously? Can it really be true that the institution-based spokesmen and advisers on energy are united in error, and that for good information the government must rely on the academic literature, on cautiously worded statements from official bodies, but above all on independent geologists and energy analysts with workaholic tendencies, mainly working outside the institutional mainstream? That is, in fact, as good an attribution of "sources" as we are going to get for figure 1; can it, therefore, really be taken seriously? Doubts will linger. There is therefore a real race on. Will the government, or indeed the opposition, be willing to recognise what the true situation is before the first explosive consequences of a deficit in oil supplies hit the economy? Probably not: the barrier between rational thinking and institutional complacency is holding well and, after proving robust to attack for many years, there is no reason to believe that it is about to be breached.

When the government does eventually acknowledge the problem, its immediate task will be to understand it. A completely new generation of independent thinkers - perhaps a task force, briefed to work at unprecedented speed - should be asked to make good estimates of the timescale on which events can be expected to unfold, and to write a programme for action.

The first thing to do is to establish a proper dialogue with the public. The public needs to be told what the situation is, what the government is proposing to do about it, and why the effectiveness of any response depends primarily on the public's cooperation. The public, which is now alert to the fear that something strange is happening, will want a political leader who manifestly knows what he or she is

doing.

Secondly, we need to find out quickly how vulnerable the nation's food supplies are, and how food security will be affected by declining oil supplies. Agriculture's dependency on oil could be eased by organic agriculture and shorter transport distances; the UK's farms could be, once again, by far the most important source of the UK's food - but only if action is taken to ensure that many unemployed people living within the destabilised economy can afford to buy it.

Thirdly, the government must lead a national programme to establish alternative energy sources and conservation technologies, and to reform the present inefficient ways in which we use land. The solar and wind technologies (which could produce the hydrogen needed by fuel cells) have been developed over several decades, and they are now ready to move ahead with production, installation and training, although a renewables-based energy system is unlikely ever to provide the energy needed for transport on the present scale.

The coming clamour for nuclear power will need to be rejected; its very high capital costs would bleed funds out of the far more cost-efficient renewable energy and energy-conservation technologies; its construction-times are long, its waste problem has still not been solved and, in a destabilised economy with the prospect of social unrest and terrorist action, it would be unintelligent to fill the landscape with nuclear power stations and uranium stores.

There may be a case, despite the climate change implications, for opening the way to a return to coal mining. The problem is that we shall need a functioning energy system, along with industry and transport, in order to be able to develop the energy alternatives of the future. The use of coal can help us to buy time. Within a relatively short time-scale of a few years, part of the transport system can be switched over to gas, and part of the electricity grid can be switched to coal. Coal's impact on climate is a good reason for not using it, but it could be the lesser evil for a limited period, and the increased emissions of carbon dioxide will be partly compensated by a decline in emissions from oil.

Fourthly, there can be no doubt that fuel rationing will need to be put in place. A design for electronic rationing - "domestic tradable quotas" - which allows citizens to trade their electronic rations, buying additional rations or selling their surplus, already exists in outline and is ready for development. (www.dtqs.org)

The fifth area for government action is international. Here, too, there is a case for some form of tradable rationing system and the essential structure of a system of this kind has already been developed with international action to reduce emissions of the gases that cause global warming. The "Kyoto" model for international rationing of emissions could be a useful instrument around which to organise an international response to the scarcity of oil.

When citizens are motivated and organised, they can get results. But we have to be ready for the economic consequences of what lies ahead. The extraordinary prosperity of the twentieth century was built on cheap oil and gas. When they are no longer either cheap nor reliably available, the

economic consequences will be far greater than can easily be imagined, conditioned as we are by the security and regularity of the oil-rich market economy. It is not a short-term problem of high oil prices. It is energy famine. The implications of that must now, at this late hour, be recognised.

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super giant fields are now very old with high water cuts and steep decline curves. Most of these giant fields are now mere pygmies through rising decline rates".

14. Confidence in "technological improvements relating to discovery and recovery rates" is expressed by, for instance, by the UK's Energy Minister, Helen Liddell, in her reply to a recent letter from Tim Yeo, Shadow Agriculture Minister, 10 May 2000.
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Bentley writes, "Going by the North American experience (which is mor-or-less at peak on gas), [the] proportion for the gas peak is around three-quarters. However, unlike oil which declines gently when the peak is reached, gas production past peak falls off a cliff." (p 3).