UK Energy Review 2001

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By Gilbert Valentine, interested UK citizen.

1.0 **Introduction**

This short note presents some initial ideas for the PIU Review of UK Energy Policy for years 2000-2050.

2.0 **Finite Fossil Fuels**

Oil Depletion – global peak.

The world has been using oil faster that it has been finding it for the past 20 years and a peak in the supply and production of oil is imminent in the first or second decade of the 21st Century (1). There is reason to suspect that the data commonly used to predict the global reserves of oil is suspect and overstates the probable position (2). An early oil shock within 10 years remains a possibility, although the probability is more difficult to determine.

The World Resource Institute report (3) by James Mackenzie states:

"Over the past fifty years, many oil companies, geologists, governments and private corporations have performed scores of studies of Estimated Ultimately Recoverable (EUR) global oil. (EUR is the total amount of the oil that will eventually be pumped from the earth). Taken together the great majority of these studies reflect a concensus among oil experts that EUR oil reserves lie within the range of 1,800 to 2,200 billion barrels. As of the end of 1995, the world had consumed about 765 billion barrels of these ultimately recoverable reserves.

Given these estimates of recoverable oil, and plausible assumptions about moderate growth in demand (about 2 per cent per year), we can use a simple model to calculate when world oil production might begin to decline driven by resource constraints. At the low end, for EUR oil equal to 1,800 billion barrels, peaking could occur as early as 2007; at the high end (2,300 billion barrels), peaking could occur around 2014. (An

implausibly high 2,600 billion barrels for EUR would postpone peaking only another five years – to 2019)."

The risk of interruptions to supply and oil price escalation within the first 2 decades of the 5 decades of this Review period remains a significant one and requires contingency plans.

The UK as an exporter of oil is in decline and will be reliant on foreign oil supplies within a decade. The dependence of UK society upon oil for transportation is a critical item to be addressed.

Global gas peak.

A global peak in gas production will be many years after the oil peak. However, given the substitution potential of gas for oil and the intimate relationship in some countries between oil and gas means that when oil peaks the gas market will accelerate towards peaking. Again, like oil the UK gas reserves will soon be in decline and dependence on mainland Europe and beyond for gas is the prospect in the first 2 decades of the 50 years of the Review period.

Coal Reserves.

The relative abundance of coal compared to oil and gas makes it a deceptively attractive substitute fossil fuel. Coal gasification, liquefaction, and sequestration of carbon will no doubt be considered. Whilst some such technologies are commercially proven, e.g. liquefaction in South Africa, others such as coal-fired electrical generation with environmentally clean carbon sequestration require to be commercially demonstrated.
These technologies will need to consider carefully the Net Energy balance arising.

Coal based technology cannot be considered a "sustainable" energy technology for all future generations, but it may have to assist in the transition towards sustainability, during the limited coming 50 years of the next 2 generations.

3.0 **Rates of Growth**

Governments continue to judge their performance as satisfactory in crude terms if there is an increase in the annual rate of growth in Gross Domestic Product or Gross National Product of circa over 2%. There is a highly significant correlation between Energy consumption growth and economic growth. What is rarely expressed is the longer term cumulative effect of compounded annual growth rates, e.g. over 25 years (only half the Review period).

1%	annual	growth	adds	28%	to load in 25 years
2%	"	"	64%	"	"
3%	"	"	109%	"	"
4%	"	"	167%	"	"
5%	"	"	239%	"	"

It can be seen that a 3% growth rate results in a doubling of the consumption within 25 years. Is that really a sensible goal ?

The planet is a sphere, and by definition has a finite amount of matter distributed around the crust. The distribution of these resources is only relevant where they are concentrated in energetically valuable concentrations. There is no point in digging for a single bucket of coal, if it takes 2 buckets of coal to power the machines that extract the coal. The physical and spatial concentration of resources further limits the available fossil energy, or other natural resource.

We should not ignore the concept of "Limits to Growth" first proposed over 30 years ago. Just because the 1970 Limit to Growth theorem, has been temporarily refuted by finding oil and gas on the UKCS and elsewhere and some technology improvements have improved resource utilisation, does not mean that the theorem is false. It is a self-evident truth that a spherical planet has finite resources. There is also a limit to some kinds of technological advance, although that may be much more uncertain, and difficult to define.

4.0 **Net Energy**

The topic of Net Energy is crucial to Energy Policy Review and sustainability. It takes energy to get energy (4). The Gross energy of a fuel is the total amount of energy contained in the resource, but this has to be reduced by the energy used to explore, extract, process, transport, convert etc. before using the energy. Net energy can be considered as the residual useful energy. In equation form one can express it thus:

Net Energy = Gross Energy minus Energy Subsidy

Several authors have drawn attention to the reducing net energy of fossil fuel resources (5). It is estimated that the decline in Energy Return on Energy Investment (EROEI) for fossil fuels in some areas of the world over the past 50 years is somewhere in the region of from 50:1 towards 5:1 (6). It is of concern that the first half of the global oil consumption peak has used up the high quality fuels, and the remaining second half of the available resource production curve will contain fuels with reduced Net Energy. The question of the quality of remaining resources in terms of Net Energy is more important than a resources mere existence.

There is a prevailing myth that oil shale and like resources will save us when conventional oil is depleted. However, several authors (6, 7) have drawn attention to the fact that much of the vast resources may be energetically valueless to develop because it will take more energy to use them than they produce. To invest in such technology would be folly, and to rely on their existence in the marketplace, and not promote other means of addressing oil depletion would be criminal.

5.0 **Nuclear**

If there is to be a nuclear renaissance in the UK a number of issues require to be resolved
Waste disposal remains an obstacle for which no amount of huffing and puffing and wishful thinking can remove.

Safety in design, safety in operation and management, and safety from terrorrist attack remain difficult to quantify risks that need be considered. Without upgrading the national electricity distribution system to transmit power from remote areas, means providing nuclear power at point-of-use. There is a fundamental problem of locating high-risk activities adjacent to highly populated areas, or within 50 miles of population centres.

There is also a significant terrorist threat from having numerous nuclear power outlets throughout the country. A simple conventional land-delivered explosive to a nuclear power station would be a very effective way for a foreign agent to incapacitate a centre of population. The world, and the UK included, has a sufficiently large number of unstable terrorists that the increased probability of such risks has to be considered. There is also the difficulty of increasing the quantity of bomb-grade material in the world and the enlargement of security provision necessary to deal with the increased risk.

There is considerable difficulty in performing risk assessments and quantifying the external costs of a nuclear incident, arising from faulty design, operation or terrorism. However this needs to be addressed rather than ignored by virtue of the complexity of the cost/benefit analysis.

Uranium supplies.

The World Resources Institute estimates that there are 41 years supply of uranium at known reserves and production ratio. If a significant part of the developed world were to adopt nuclear power to solve their energy crises the supply may decrease significantly. How the US deals with an emerging energy crisis remains to be seen. Although uranium is available in many different countries, at what concentrations can it be mined economically and with sufficient net energy promise ? The supply of uranium is no more attractive than gas in terms of sustainablity. It may do nothing more than provide a temporary stop-gap measure before the inevitable move towards a more sustainable resource.

6.0 **Renewables**

There can be little doubt that the development of the range of Renewable power generation means is urgently required, given the finiteness and depletion of oil and gas over the period of the study.
The reform of the planning process should be immediately undertaken as a matter of national security to ensure that wind power is no longer stymied. The development of off-shore and onshore wind should be hastened.

Care needs to be exercised with innovative technologies to ensure that they provide Net Energy. All emerging unproven renewable technology should be subject to Net Energy analysis to ensure that there is no unforeseen fossil fuel subsidy. Crops for ethanol and photovoltaics should be critically appraised with respect to net energy. Net energy payback figures should be produced by independent reputable methods. Current claims for Photovoltaics energy payback period provided by the PV industry do not include all the energy embodied in the production. There is a belief that

economies of scale will reduce costs of PV. That may prove to be correct but a more critical question arises as to whether this will provide a net return of energy when ALL energy used in production and decommissioning is included.

7.0 **Demand Reduction**

Massive Public Education Exercise.

It is clear from the November 2000 public support for the UK farmers and hauliers Fuel protest that the UK public has no conception of the impending fuel crisis that lurks ahead. A massive programme of public education to advise of the folly of unlimited growth, depletion of oil and gas, and substitution needs to be considered. Furthermore when it becomes apparent that there are only limited solutions, the role of massive demand reductions will be an unpalatable message for some unfortunate government to deliver. The longer this responsibility is shirked the more difficult it will be to recover from the inevitable energy shock.

Politicians need to investigate how to deliver the bad news, and still do it in a way that gets them re-elected. Evidence that is widely held as valid is required to avoid excessive debate and delay. There is no reason why people should not feel good about a move towards sustainability. Its like telling a bad driver to put on the brakes before he crashes. He gets a shock, you save his life, but he is grateful and feels good.

Domestic demand reduction policies should be promoted. Motorway taxes, large vehicle taxes, subsidised bus transport need to be promoted. Campaigns such as “Are you Doing your bit?” need more funding and promotion. Power shutoff hours (aka California and Brazil) should be timetabled for all regions of the UK to promote energy efficiency, and to prepare for the day when it might be needed by necessity.

The central and unifying role of energy as the power of industry needs to be recognised. A coherent joined-up policy that addresses road and rail transport and security and diversity of power generation techniques is required.

The difficulty of predicting up to 50 years hence should not dissuade us from the task. A bad plan is better than no plan at all. If it is difficult to see where the energy resources will come from then we should make provision for frugality of energy consumption. Demand reduction is a suitable policy alternative to supply expansion.

8.0 **Environmental Issues**

Climate Change.

The environmental concerns of climate change help to support the need for action to reduce fossil fuel consumption. The IPCC report makes clear the increasing risk from fossil fuel burning. The reduction of carbon emissions is consistent with the need to address the finiteness and unsustainability of fossil based energy resource utilisation.

9.0 **Short-term versus Long-term conflicts**

The government needs to put as much effort into looking at long-term interests as it does the short term. The limitations of the market place are insufficiently recognised. We have too many Consumer groups with a tunnel vision constitution concerned with lowest cost. The person who considers price only is a fool. How do you "value" the energy supplier who charges you an extra 5% in order to invest in future infrastructure.
You don't do it by only looking at the price of energy.

The UK psyche is obsessed with a lottery mentality which says - be unrealistic and focus on the single millionaire winner and ignore the 999,999 essential co-existent losers. Reversing the lottery mentality and relearning deferred gratification is required.

We are governed by bean counters and watchdogs that are unable to recognise long-term sustainable value. In our haste to address the problems of public ownership we have thrown out the baby with the bathwater. Decisions that are left to the market place and are reliant on the lowest cost mentality are by definition doomed to avoid the long-term strategic infrastructure issues.

The essential question is about getting the balance right between short-term cost and long-term interests, and we have rollercoasted too far to the short-term bean-counting rationale.

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