Peak Oil: High Tide for an Oil Addicted World

What is this book going to look at?

The purpose of this book is to provide a simple but comprehensive overview of the phenomenon known as ‘peak oil’. There are many books and other resources we recommend [add/link to further reading section] that cover peak oil and all its associated topics in detail, but we wanted to create an introduction for those who are new to the topic. We hope that what follows succeeds in being an overview, giving sufficient detail of most aspects of peak oil to be a firm grounding in the topic while encouraging deeper reading, but given in basic, layman's terms so that everyone can understand the situation at the high-tide of the hydrocarbon age.

What this means is that we will look at:

```
   * what oil is, where it comes from, and what we do with it;
   * what peak oil is;
   * why people are confident that we are at, or nearly at the Peak;
   * what the consequences of peak oil are likely to be for you, your
family, society, and the world;
   * what solutions there might be, including possible alternatives to
oil; and
   * what actions need to be taken now to mitigate the likely problems
peak oil.
```

During the years we have been looking at this topic we have come across many questions that people ask, often in the hope that what peak oil entails isn’t actually true, so we have modelled this book on a gigantic FAQ, posing questions and answering each in turn.

A quick note about the people behind this book. We come from a variety of backgrounds united with one concern – the peak and decline of oil is the most imminent challenge modern society faces with the most incredibly serious potential consequences. To tackle this problem we need full awareness, debate and immediate action. No part of our society is immune from the decline of oil. This book is part of that awareness raising process.

CONTENTS

[Hyperlinked table of contents to be added to the final version]

A Summary of the Fundamentals

Why is oil important?

Because our modern economy is lubricated by oil - and not just literally! In fact the world around us would be unimaginably different if it wasn’t for oil.

The most obvious use of oil is transportation: 95% of all transport is powered by oil - virtually every car, lorry, ship and aircraft in the world runs on it. But did you also know that oil is vital for making plastics? Look around, and try to imagine a world without plastic. It is used in pretty much every industrial process you can imagine, including modern methods of food production. We use it for heating, and electricity generation. Oil is the

most versatile and, very importantly, the cheapest form of energy known to man. We are so dependent on oil that to truly understand how anything works in our current society we need to grasp the vital role played by oil in our technologies. Reduce or take away oil from a modern society, and it will very quickly grind to a halt. [Pie chart of oil useage?]

Are we about to run out of oil?

No, we are not about to run out of oil! We are roughly half way through all the conventional oil we know to exist in the world. Oil production will carry on for many more years. The key issue today is not running out of oil, but whether we can produce it quickly enough to satisfy our economy's demand. And that is where peak oil comes in.

What is peak oil?

This is the phrase that has been adopted to refer to the point in time when worldwide oil production reaches a peak. After the peak, the amount of oil produced year on year will decline.

If you look at the pattern of oil production for a single oil field you find that, in general, production from that field increases in the early years and reaches a peak when roughly half of the recoverable oil has been extracted. There after little can be done to stop production rates falling. For an individual oil field the actual pattern can be jagged. When you combine the data for many fields, a smoother pattern emerges. [Graphs to show individual field and averaged pattern]

The same principle applies to a basin, a country and the world. When we have used half the world's recoverable oil then production will start to decline. That point is call 'peak oil'. Many predictions have been made as to when this will occur however dates are increasingly converging on the period 2005 to 2015. Unfortunately the data for any given year takes time to come out, so it will be at least 1-2 years after peak oil has happened before we can be sure we are on the downward trend.

Who came up with this idea of peak oil? Is it really credible?

The theory was developed by M King Hubbert in the 1950s. In 1956 he predicted that US oil production would peak in the late 60s or early 70s. At the time he was derided, but in 1970 US oil production did indeed peak, and has declined ever since. Oil production in many countries around the world [list and dates] has peaked, in line with Hubbert's theory.

Hubbert was an American geophysicist, who for much of his career worked for the Shell Oil Company. When he left Shell in 1964 he became the senior research geophysicist for the United States Geological Survey, and held professorships at both Stanford and Berkeley. We find his experience and theory credible - but then if we didn't we wouldn't have written this!

Fortunately, we're not the only ones who are taking notice of peak oil. Over the last year some journalists in the mainstream media organisations have woken up to the issue, and have written articles or presented programmes warning of the danger. For example [list 4 or 5 best examples, preferably with hyperlinks].

Ultimately, though, whether you think peak oil is credible is up to you. At the very least, we hope this book will encourage everyone who reads it to think seriously about the issue. oil started to be found in 1907.

Is peak oil the end of the world as we know it?

The end of the world? That's a bit apocalyptic! But that said, it's important not to underestimate the effects of peak oil. Once oil production is over the peak and in decline it will become increasingly difficult to continue with our current lifestyles, and change will be forced upon us. As will be addressed in more detail later in this book the world economy is based on economic and financial systems that are reliant on overall growth - which in itself relies on increasing use of resources. Energy is, arguably, the primary resource. With enough energy virtually any other objective can be achieved.

Oil counts for about 40% of total energy use in a Western economy and over 90% [Why not 95%? - see paragraph 2 of "Why is oil important?" above] of transportation. The critical need is (ultimately) to produce enough alternative primary energy. Whilst there are potential alternatives, for the reasons set out below these are not likely to fill the gap left by declining oil supplies. A totally novel energy source may be developed (and there are candidates), however these are unproven and will require many years to bring from laboratory and to turn into viable energy sources. We are thus facing, at best, chronic economic recession lasting 10s of years. This is very likely to be accompanied by political, financial and economic turmoil, armed conflicts leading to fundamental shifts in the balance of power between nations. The Western consumerist way of life will no longer be viable. It won't be a smooth ride.

Oil in Detail - source, production, & usage

What is oil’s place in the history of energy?

Oil was not the energy source that enabled the industrial revolution to begin; water, wood, and coal powered machines were working long before the first commercial oil well was drilled in north western Pennsylvania in 1869 [1]. The next thirty years after that first drilling saw oil wells spring up all over the United States and then the rest of the world as companies such as Standard Oil, Shell and Royal Dutch battled to explore and drill.

The influx of this new form of energy acted as an accelerant to industrial growth in the latter part of the industrial revolution. Initially oil replaced whale oil used for illumination, but soon it was refined and used for lubricating faster, more efficient machinery, and by the start of the 20th century for fuel and roads. Oil as a cheap energy source created massive economic growth in the late 19th and early 20th centuries and soon became central to industrial society.

Oil crucially also enabled other forms of energy to become viable. The infrastructure supporting natural gas, nuclear and even renewable energy is dependent on oil as an energy resource. The changes oil has made to the way we live means that contemporary, modern society views cheap and plentiful energy as a natural part of human existence. Not having this energy on tap is incomprhesensible to most people in the modern world, despite the fact that mankind's tenure on this planet stretches back over hundreds of thousands, if not a couple of million years. Agriculture emerged 10,000 years ago fundamentally altering the way humans lived, and the discovery of oil has arguably had an even bigger impact.

[1] James Howard Kuntsler,'The Long Emergency', Atlantic Books, 2005

Why is oil so useful?

Energy Density

Energy density is the measure of how much energy you get out of a given amount of a fuel. Approximate energy densities of combustible fuels include coal at 17-30 MJ/kg, and wood at 10-20 MJ/kg. The energy density for petroleum products is 30-460% greater, at typically 40-46 MJ/Kg. [Source?]

In terms of energy density only uranium, when it is used for fission [find figure MJ/Kg] does better than oil.

Transportability

Because it is a relatively stable liquid at normal temperatures, oil is easy to transport. It used to be poured into barrels and transported around on trains. Nowadays it is more common for it to be transported through pipelines, seaborne tankers or, once refined, by road tanker. This also means it is easy to use - imagine the days of steam ships, and having first to load thousands of tons of coal, and then shovel it into the furnaces. Now compare that with how easy it is to power an engine with oil - think of filling a car with petrol and driving away!

Storage and stability

At normal temperatures oil is relatively stable and does not degrade quickly. This means that oil is relatively easy to store, especially in its crude (unrefined) form. Most countries hold large strategic reserves in case of supply disruption - the US holds these in vast underground caverns [capacity?].

Price of extraction and processing

For many oil reserves, once the well has been drilled, the oil flows out freely due to the natural high pressures. As this pressure starts to decrease, secondary recovery techniques are often used. For both primary and secondary recovery the energy inputs required to get the oil out of the ground are far less than for other fuels (natural gas excluded). As the easy to extract oil is used up then these figures will increase, for example deep sea oil takes much more energy to get to a refinery than does some of the onshore reserves in Saudi Arabia.

Abundance

Crude oil and natural gas have been relatively abundant over the last fifty years. Indeed at some periods so much has been extracted from the earth that the price has dropped so low as to seriously effect the income of some oil producing nations. This in essence led to the formation of the OPEC countries and their self imposition of production quotas. Its ready availability and cheap price has helped increase our dependency.

Versatility

The vast number of uses of oil, both in energy, heating, transport and products mean that today's society is highly dependent on its availability. More details on its uses are outlined in the next section.

What do we use it for?

Plastics

Look around you. There is a phenomenal amount of plastic all about us in the modern world. Think about your computer - the tower, monitor, keyboard, mouse, webcam, speakers, printer, scanner; all substantially plastic.

What about the chair you are sitting on? The pens around your desk? Your CD and DVD or video collections, encased in or made from plastic. From disposable cups to car dashboards to PVC window frames to radios and televisions, not to mention your mobile phone, every electrical cable or plug, and the shrink-wrap on almost everything you buy. Creating plastics from oil has transformed our world.

Heating

In the UK most of our space heating comes from natural gas. In more rural areas, and other countries, heating oil plays a greater role.

Petrol and diesel

Over 500,000,000 vehicles [source?] around the world aren't much use with empty tanks. And how would your lifestyle change if those vehicles were to be out of action?

Aviation fuel - both for light aircraft and jets There are roughly 20,000 commercial aircraft [source?] carrying people and goods around the world at the moment.

Electricity

Whilst natural gas, coal and nuclear make up the bulk of our electricity generation in the UK, oil fired power plants still play an important role in electricity generation around the world.

Lubrication

Without lubrication much of our society would literally grind to a halt.

Man-made fibres

Many man made fibres [examples?] used in carpets, curtains, clothes and other materials are made from petroleum products.

Fertilizers and Pesticides

Current intensive farming techniques rely on huge quantities of oil and natural gas derived fertilizers and pesticides. [Source and number for quantities?]

Pharmaceuticals

Many of our manufactured drugs are petroleum derived. [Examples and source?]

Hydrogen

Another important petroleum derived product is hydrogen from natural gas. Elemental hydrogen does not naturally exist in large quantities and must be generated using either electrolysis or from natural gas, with natural gas being the major source at present.

Examples of other petroleum derived products include food additives, non-soap detergents, ink dyes, photographic film, wax, rubber, backup generators, insulation, packaging, paint and the list goes on and on.

It is also important to realise that our society relies on oil and its products to an even greater secondary degree. For example, although our vegetables aren't made out of oil, it is used in fertilizers, pesticides, powering farm vehicles, preserving, packaging, transporting. Another example is the manufacture and transportation of goods to market, from plasma

screens to ping pong balls.

In essence, oil underpins most facets of our lives, in terms of keeping people employed, keeping things going and keeping things alive.

What doesn’t depend on oil?

Look around you and identify anything that is not made from oil. If it isn’t made from oil did it get where it is due to oil-based transportation? Was oil used in its production or manufacturing process? Did the people who were involved in that process use oil to get to work? When you look at it this way you see just how dependent on oil we are.

How much of our energy mix is oil?

Electricity (2004) [Are more recent figures now available?] Gas 40%, nuclear 19%, Coal 33%, Hydro 1% Imports 2%, Other Fuels 4%, Oil 1%

Inland Energy Consumption: Gas 41%, Oil 24% and Coal 17% out of a total of 234.9 million barrels of oil equivalent.

Oil and Gas have the following percentage inputs to each of these parts of society:

Industry Domestic Transport Services

Oil 24% 6% 99% 46%

Gas 37% 70% 0% 8%

Combines 61% 76% 99% 53%

[Data taken from the dti publication: UK Energy In Brief July 2005 http://www.dti.gov.uk/energy/inform/energy_in_brief/energyinbrief2005.pdf]

[Speak to Paul Mobbs and get Fig 11. A Flow Diagram of Energy Use in the UK 2003 from page 29 of Energy Beyond Oil]

How does oil compare with other sources of energy?

Oil presents many advantages when compared to other sources of energy such as coal, nuclear power, hydroelectric generation or other renewables. These advantages fall into the six catagories mentioned above: energy density, transportability, storage and stability, price of extraction, abundance, and versatility.

Coal, for example, fails to surpass oil in nearly all of the catagories: First, it has a about half the energy density of oil, (17-30 MJ/kg compared with the 40-46 MJ/Kg of oil). As coal is a solid, it is much more difficult to transport—simply compare the effort it takes to fill-up at the petrol station with images of men stoking the coal furnace on old steam trains! This solid state means it's also more difficult to extract, as it must be mined from seams in the earth rather than pumped out of underground reservoirs. The main advantages of coal are that it's much more abundant than oil, with significant quantities being found in most countries.

The nuclear energy generated from uranium ore compares nearly as poorly. The uranium must not only be mined like coal, but also separated from the surrounding ore and "enriched" by isolating the correct type of uranium. Even this enriched uranium cannot be used directly, but must be safely transported to the nuclear reactor before any of its energy can be obtained. This all means that the high energy density of the uranium itself is less important, as so much energy is required before that energy is available. The energy is

finally produced as electricity, which although convenient for transport along power lines and usable in any household applicance, is unsuitable as a portable fuel in cars and planes, and cannot be used to make plastics or other chemicals.

Energy from renewable sources suffers mainly from the last point as well. Wind, solar, and all forms of hydroelectric generation produce only electricity. While electric cars are in use today, their electric batteries have a much lower energy density than oil: they either force the car to travel shorter distances before recharging, or take up far more space than a conventional fuel-tank. The abundance of renewable sources, however, is a promising advantage: whether it's strong sunlight, large rivers or frequent winds, nearly every region on Earth has access to local renewable energy.

Historically, oil has also been the cheapest form of energy, and readily available. Both the cost and availablity of energy are crucial to our modern society, as economic growth is predicated by energy growth.

What do you mean that economic growth is predicated by energy growth?

If there was not cheap, plentiful energy, and more of it every year, the world’s economy would not grow. Because oil has all the advantages and uses outlined above, the oil price is extremely influential on the rate of world economic growth. If there is not more oil every year the laws of supply and demand push the price up until the economy will not bear the price rise and we experience economic depression.

The economy is a system like any other, it needs inputs to create outputs, you put energy in and you get all the products and services our modern society uses out. Of course this seems obvious, to grow something you need more of what makes it grow: more fertilizer, more plant. Modern economics requires constant growth, its logic assumes that there is no limit to energy consumption, forgetting that constant growth will eventually use up all resources in a finite environment.

To understand economic growth and energy you must understand how money is created, and how money and the banking system work together. This is covered in Section Five - Oil & The Economy.

How was oil created?

Around 360 to 286 million years ago, climatic conditions on Earth favoured a huge proliferation in plants such as trees and ferns. Over millions of years, the remains of plants and animals were washed into the world's oceans, along with large quantities of sediment carried by rivers. The organic matter sank to the bottom of the oceans and was buried under layers of sediment, where it decayed. As more and more layers of sediment buried the organic matter, the pressure and temperature increased. Certain bacteria that thrive in anaerobic (oxygen starved) conditions began the process of transforming the rotting matter into crude oil, gas and coal.

The high pressures compacted the sediments into rocks (sandstones and limestones). The oil and gas slowly migrated into the pores of these rocks, which are referred to as "source rocks" by petroleum geologists. In many cases, the oil and gas seeped through cracks in the overlying rock strata and leaked away to the surface. However, in some cases the oil and gas deposits were prevented from reaching the surface by an impermeable rock layer (often a thick layer of salt). This caused a build-up of pressure behind the impermeable layer,

pushing the overlying strata upwards. The distinctive salt "dome" is regarded as being indicative of potential oil and gas deposits.

Further information:

http://www.energyquest.ca.gov/story/chapter08.html

Where is the remaining oil?

http://www.hubbertpeak.com/campbell/images/com17.gif

This graph demonstrates where [declared?] oil reserves are located. You can see by a long way, it is concentrated in the Middle East. Western Europe has a small endowment, rapidly declining.

Who uses all that oil?

http://www.cia.gov/cia/publications/factbook/rankorder/2174rank.html

The USA is by far the largest consumer, followed by the European Union, China and Japan. It is largely the countries with decreasing native supplies that are using more and more. As countries such as China, India and Japan increase their economy and living standards increase, their demand for oil will continue to grow at a fast rate. [Graph to show rate of increase of consumption?]

How much do we use a day?

```
The Chevron website (http://www.willyoujoinus.com/) has an
automated ticker that shows how many barrels of oil the world uses as
time progresses. At present this is roughly 85 [update] million barrels
 a day. In 1986 that figure was 60 million barrels a day. In 1966 it
was 33 million barrels a day.
```

85 million barrels is:

3,570,000,000 US gallons

or 2,972,450,000 imperial gallons

or 13,515,000,000 litres

or 637,500,000 tonnes

or 485,350,000 giga joules

or 5406 Olympic size swimming pools - (1,973,190 swimming pools a year)

Its always difficult to work out the average oil use per country due to the different energy mixes, the different uses of oil and problems such as production in one country and consumption in another. However as a rough comparision the world average per capita consumption (excluding UK and US) is 1.6 litres a day, the UK average is 4.9 litres a day and the US average is 11 litres a day.

How much oil is left?

This is quite a controversial subject. For example, do we include unconventional oil? Can we know the ultimate recoverable reserves figure? If we include unconventional oil we can reach figures of 3 trillion barrels, but if we stick to conventional oil, it is about 1 trillion.

So how long will it take us to use that much oil?

If we go with the assumption touted by many that we have 1 trillion barrels of oil left (CIA, Chevron etc), that would give us about 35 years of usage at current rates of consumption before we ran out. But this also assumes oil production can be kept at a steady pace for 30 years. However, due to the nature of oil production, the 'Hubbert Curve', geological factors mean we will be forced to use less, earlier, meaning we will have oil for longer, but at an increasingly lower level.

Isn’t it true that oil reserves have just been growing and growing?

http://www.geologie.tu-clausthal.de/Campbell/img/20.gif

If you look at this first graph, of oil discoveries as reported, you would think that is true.

So aren’t we discovering more?

http://wolf.readinglitho.co.uk/chartpages/d/d1oildiscavproj.html

This second graph shows all you need to know. Colin Campbell of ASPO went back and charted all the real discovery data, not the reported discovery data. What this shows is that oil discovery peaked in the mid 1960s, and from around 1980 we started consuming more than we discovered. The reason why oil discovery has peaked is that oil companies know where oil will be, so it is easy to find the largest reserves first. Despite increased investment in finding new oil fields, there really is little of any significance being found.

Why aren’t reserves the important thing?

Quite simply, it is the supply rates that are the most important thing. If you've got a house on fire by a lake but can only use one bucket of water at a time to put the fire out, it is clear to see that it is flow rates that is the important thing.

Didn't I read that oil is renewable?

You might have done, but it's not a generally accepted view.

The conventional scientific explanation for the origin of oil is that organic matter, buried under sediments millions of years ago, gradually became "pressure cooked" into crude oil by high temperatures and pressures (see "How was oil created?" above). This is why oil is referred to as as "fossil fuel". This theory is backed by the collected evidence from a century of oil drilling and scientific analysis, and is the basis for all modern oil prospecting methods.

An alternative theory, originally proposed by Russian scientists, is that oil has a non-biological (abiotic) origin. The abiotic theory proposes that oil originates from methane and carbon dioxide deep within the Earth's mantle, which is converted to heavier hydrocarbons by high temperatures. This implies that oil reservoirs will be continuously refilled after oil extraction has taken place. However, as author Richard Heinberg notes:

"If there are in fact vast untapped deep pools of hydrocarbons refilling the reservoirs that oil producers drill into, it appears to make little difference to actual production, as tens of thousands of oil and gas fields around the world are observed to deplete, and refilling (which is indeed very rarely observed) is not occurring at a commercially significant scale or rate except in one minor and controversial instance[...]" [1]

The abiotic theory of petroleum origin is not taken seriously by the majority of scientists in the field. Even if it were found to be true, we are consuming oil at a far higher rate than could be sustained (as is shown by the graph of the US peak - after all, if it was being replenished at a sustainable rate, there would be no decline!), and there will still be a peak and decline in global oil production.

[1] http://www.museletter.com/archive/150b.html

Can’t we just spend more money on discovering it?

The major oil companies such as ExxonMobil, Chevron, Shell, BP etc have been doing just that. However, they are increasingly finding that the record amounts of money they've been spending on exploration are not being covered by the value of new oil discoveries. [1]

[1] http://www.energybulletin.net/2470.html

Can’t we use technology to improve extraction?

We have been. From water injection to superstraw drilling, technology has been implemented to improve the extraction rates from oil fields. That is why newer oil provinces tend to peak earlier after discovery than older fields There hasn’t really been any improvement in technology in recent years though that will not make much of a difference. If you look at Prudhoe Bay in America, where they have the access to the technology, you can see it has made little difference.

“Of course it is possible to go back to an old field developed long ago with poor technology and extract a little more oil from it by a range of well known methods, such as steam injection. But this is a phenomenon of the dying days of old onshore fields of the United States, Soviet Union and Venezuela. Most modern fields are developed efficiently from the beginning. In any event the addition contributes little in global terms and has no impact on peak. Technology serves mainly to hold production rate as high as possible for as long as possible. That obviously makes the most profit. But it adds little to the reserves themselves and clearly accelerates the rate of depletion. The high depletion rate of Norway shows how efficient they have been at extending plateau production. The decline slope now becomes a cliff.”

http://www.hubbertpeak.com/campbell/images/com15.gif

http://www.hubbertpeak.com/campbell/commons.htm

Another problem is that technology may actually be counter-productive. For example, Matt Simmons talks of the Saudi oil fields being damaged by inappropriate water injection.

“Pumping large amounts of oil at the maximum rate can damage the geological structure of the field, usually referred to as "rate sensitivity". Basically the hole falls in on itself, making large amounts of oil within it un-extractable.”

http:/ / english. aljazeera. net/ NR/ exeres/ 08B97BCF-7BE6-4F1D-A846-7ACB9B0F8894. htm

What is the official view on when we will peak?

[We need to build in the July 2007 IEA Medium Term Report]

According to the UK Government's Energy white paper 2003, "Our Energy Future - Creating a Low Carbon Economy" [1] "Globally conventional oil reserves are sufficient to meet projected demand for around 30 years, although new discoveries will be needed to renew reserves. Together with non-conventional reserves such as oil shales and improvements in technology, there is potential for oil reserves to last twice as long".

This is consistent with the assessment made in the International Energy Agency's 2004 World Energy Outlook, which concludes that "...global production of conventional oil will not peak before 2030 if the necessary investments are made". However, this assessment rests on the assumption that oil discoveries have been declining purely as a result of reduced explortion activity, and that greater investment in exploration will yield massive new reserves.

[1] http://www.dti.gov.uk/energy/whitepaper/index.shtml

This date is premised on the USGS Mean estimate of 2626 Gb (billion barrels) for remaining conventional oil. It goes on to state that if this estimate should prove too high, the peak of production would come by 2015 or before. This means that the IEA accepts the notion of peak oil, that the date ranges from 2015 to 2033, but even sooner if all assumptions are not fulfilled. “ It follows that Governments are now on notice that they must make energy plans for the future that accept peak oil as a reality.” Kjell Aleklett

http://www.peakoil.net/uhdsg/weo2004/TheUppsalaCode.html

When do others think we will peak?

There are a range of predictions being advanced by independent experts, starting as early as 2005 to around 2020. Here is a summary taken from the Hirsch Report [1]:

2006-2007 Bakhitari, A.M.S. Iranian Oil Executive

2007-2009 Simmons, M.R. Investment banker

After 2007 Skrebowski, C. Petroleum journal Editor

Before 2009 Deffeyes, K.S. Oil company geologist (ret.)

Before 2010 Goodstein, D. Vice Provost, Cal Tech

Around 2010 Campbell, C.J. Oil company geologist (ret.)

After 2010 World Energy Council World Non-Government Org.

2010-2020 Laherrere, J. Oil company geologist (ret.)

2016 EIA nominal case DOE analysis/ information

After 2020 CERA Energy consultants

2025 or later Shell Major oil company

No visible peak Lynch, M.C. Energy economist

NB: Deffeyes has since revised his prediction and believes we passed peak oil in late 2005.

[1] http://www.netl.doe.gov/publications/others/pdf/Oil_Peaking_NETL.pdf

Why do people think we will peak now?

There are several key indicators for this.

The main approach, using Hubbert's model for oil production, points to a Peak in the first decade of the 21st century. This is championed by the likes of Colin Campbell at the Association for the Study of peak oil and Gas. A refined version of Hubbert's model has been created by Prof. Kenneth Deffeyes and he believes the Peak occurred at the end of 2005. Because this model relies a lot on the ultimately recoverable reserves it can be refuted by some by pointing to things such as unconventional oils from, for example, tar sands in Canada. If unconventional oil is included reserves can be pushed up to 3 or 4 trillion.

Much more useful, now that we are near the Peak, is the work by Chris Skrebowski, editor of Petroleum Review. He conducts a yearly review of all the oil fields in the world, looking at the data for oil fields coming online over the next few years, and looking at the decline rates of current oil fields. It is the only field by field analysis conducted. This is a very useful approach as it is the flow rates that are the important thing. It presents a clear view of how future production flows are going to work. He notes that "90% of known reserves are in production," and that "as much as 70% of the world's producing oil fields are now in decline" with decline rates averaging between four and six percent per year. When you get to the point where you can no longer offset the decline of current oil fields with the increase in production at current oil fields or bringing on new oil fields, then you have global oil decline. That is why it is so important to understand depletion, not just increases in production – you have to take into account the full sum. Chris Skrebowski's work strongly suggests a Peak occurring by 2011 [update?].

http://www.energybulletin.net/5395.html

http://www.energybulletin.net/5266.html

Other points to take into consideration:

Global rates of discovery have been falling since the mid 1960s as has been confirmed by ExxonMobil [source?]. This is a well established trend.

We are consuming much more than we discover – In 2005, according to IHS Energy Inc., a total of 4.5 billion barrels of oil were discovered in new fields, while 30 billion barrels of oil were extracted and used worldwide. Thus, currently only about one barrel of oil is being discovered for every six extracted.

http://www.energybulletin.net/14102.html

The 100 or so giant and super-giant fields that are collectively responsible for about half of current world production were all discovered in the 1940s, '50s, '60s, and '70s and most are now going into decline. These days, exploration turns up only much smaller fields that deplete relatively quickly.

Have people made wrong predictions about peak oil before?

Absolutely. People have been talking about the end of oil almost as long as the oil industry has been around. People have made pessimistic predictions, but there have also been optimistic predictions made too.

“In 1968 the USGS released predictions of US oil production showing continuing production growth far into the future. This report was discredited in 1974 but not after it had done serious economic damage due to errors in economic planning. History appears to be repeating itself. Recently on Channel 4 news the retired head of exploration at the Saudi state owned oil company Aramco, Sadad Al-Husseini, had this to say about the USGS estimates. ‘They’re not only overestimating the Middle East, but they overestimate non-Opec, they overestimate Russia, they overestimate the whole global resource base. And I think this is a rather dangerous situation for the US government policy to be based on.’”

http://www.oilcrash.com/articles/oil_wrng.htm

However, there is much more knowledge about the nature of oil production now, about discovery & decline trends, and what is likely to happen. This is one of the reasons why many analysts see a Peak very likely the first decade of the 21st century.

Have we passed any peaks?

In terms of energy, world oil production per capita [also peaked in 1979??] and his since fallen faster than world energy production per capita.

http://en.wikipedia.org/wiki/Olduvai_theory

Oil production has also peaked in 33 of 48 major oil-producing countries

1955 – Austria

1966 – Germany

1970 – Venezuela, Libya, Ukraine, Bahrain

1971 – US48

1973 – Canada, Turkmenistan

1974 – Iran

1976 – Romania

1977 – Indonesia

1978 – Algeria, Trinidad, Brunei

1981 – Tunisia

1982 – Chile

1983 – Peru, Albania

1986 – Brazil, Cameroon

1987 – Russia, Netherlands, Hungary

1988 - Croatia, France

1991 – UAE, Turkey

1992 – Pakistan

1993 – Papua

1995 – Egypt

1996 – Gabon

1998 – Argentina, Angola, Uzbekistan, Sharjah

1999 – UK, Colmbia, Yemen

2000 – Australia

2001 – Norway, Oman, Congo

2004 – Mexico, Nigeria, Qatar, India, Malaysia, Ecuador, Denmark, Italy

2005 – Vietnam, Sudan, Thailand

2009 - Chad?

2010 - Azerbaijan?

2013 – Saudi Arabia?

2015 – Kuwait?

What do the oil companies think?

On November 19th 2007 the Wall St Journal's front page was headlined "Oil Officials See Limit Looming on Production [1]". The article goes on to say 'A growing number of oil-industry chieftains are endorsing an idea long deemed fringe: The world is approaching a practical limit to the number of barrels of crude oil that can be pumped every day. Some predict that, despite the world's fast-growing thirst for oil, producers could hit that ceiling as soon as 2012. This rough limit -- which two senior industry officials recently pegged at about 100 million barrels a day -- is well short of global demand projections over the next few decades.'

Other oil industry executives have also expressed a view.

'My view is that "easy" oil has probably passed its peak.' Jeroen van der Veer, Chief Executive, Royal Dutch Shell [2]

Chevron [3] states:

"Energy will be one of the defining issues of this century, and one thing is clear: the era of easy oil is over. What we all do next will determine how well we meet the energy needs of the entire world in this century and beyond."

A senior BP executive has said:

"Discovered hydrocarbon volumes have been declining since the end of the '60s. The deepwater theme of the '90s and a renewed search for gas has helped to reverse this trend but the last few years have been poor for exploration. The number of supergiantfields and the number of giant provinces have fallen off markedly in recent decades. Field sizes are declining..."

http://www.aspo-usa.com/exxonmobil.cfm

Exxon on the other hand says:

"Contrary to the theory, oil shows no sign of a peak"

http://www.exxonmobil.com/Corporate/Files/Corporate/OpEd_peakoil.pdf

Jeremy Gilbert is the recently retired Chief Petroleum Engineer of BP with a lifetime of experience in the oil industry. Although he does not represent the official BP position, the fact that he has now come out and http://www.scag.ca.gov/rcp/pdf/summit/Gilbert.pdf agreed that peak oil is soon is important to note.

What happened to all the spare capacity?

Rapid growth demand in emerging economies such as China and India, combined with increases in production failing to offset the rate of decline fast enough has meant there is now no spare capacity. Saudi Arabia used to be the swing producer, able to turn on the taps as and when needed, but now it cannot provide as much of the cheap, easy oil. The spare capacity remaining is dirty heavy oil , about 1 million barrels, with no refining capacity to deal with it.

Wasn’t all this predicted in the 1970s? Didn’t it turn out to be wrong?

‘The Limits to Growth’ by The Club of Rome was published in 1972. Using sophisticated computer models from MIT, it said the world would ultimately run out of many key resources. Over the following few decades it was mocked by economists as the supply of resources just kept on increasing and prices dropped. People now refer to it as having predicted that we’d have run out of oil by 2000, and then use this to discount all other warnings about oil supplies.

“Nowhere in the book was there any mention about running out of anything by 2000. Instead, the book's concern was entirely focused on what the world might look like 100 years later. There was not one sentence or even a single word written about an oil shortage, or limit to any specific resource, by the year 2000.

The members of the "Club or Rome" were also not a mysterious, sinister, anonymous group of doomsayers. Rather, they were a group of 30 thoughtful, public spirited-intellects from ten different countries. The group included scientists, economists, educators, and industrialists. The book then postulated that if a continuation of the exponential growth of the seventies began in the world's population, its industrial output, agricultural and natural resource consumption and the pollution produced by all of the above, would result in severe constraints on all known global resources by 2050 to 2070. The most amazing aspect of the book is how accurate many of the basic trend extrapolation worries which ultimately give raise to the limits this book expresses still are, some 30 years later. In fact, for a work that has been derisively attacked by so many energy economists, a group whose own forecasting record has not stood the test of time very well, there was nothing that I could find in the book which has so far been even vaguely invalidated. To the contrary, the chilling warnings of how powerful exponential growth rate can be are right on track. The thesis that it is easy to misjudge this type of growth has also been proven by the volumes of misguided criticism that the report engendered.”

Matt Simmons went back, looked at everything the Club of Rome said and found they were far more right than wrong.

http://www.greatchange.org/ov-simmons,club_of_rome_revisted.html

What influence has oil had on agriculture? What effects have oil and gas had on agriculture & food distibution

It is approximately fifty years since horses finally disappeared completely from commercial agriculture. In that time crop yields have increased phenomenally. Wheat for example increased from 1 to 1.5 tonnes to the acre to 3 to 3.5 tonnes to the acre, with the better farms achieving nearer 4.5 tonnes. This increase duplicated across many crops throughout the world is what has enabled the growth in population [discussed earlier - need to amend

or build in earlier section].

Yet the United Kingdom has become less self sufficient in food down to 64% for all food in 2004 (John Nix, Farm Management Pocketbook 36th edition) meaning that our food supply is much more reliant on other countries. When oil is plentiful and cheap, this isn't a problem - and indeed, that's exactly why our self-sufficiency has declined.

The supermarkets themselves didn't exist as a significant force until the 1950s and they have grown their reach and perfected their centralised distribution systems on the back of cheap oil and gas. Next time you go into a supermarket just think about how much energy is being used keeping those open decked chillers running and the freezers and the lighting 24/7, let alone the amount of energy used to shift lorry load after lorry load around the country.

Lifestyles have also changed. People lead more rushed lifestyles and food often takes a back seat, squeezed into the day, with many people picking food up on the run and grabbing an energy intensive chilled or frozen ready meal from the supermarket on the way home from work. Processed foods have become the norm with only a minority of the younger generation with the desire, time or skills to cook an indigenous food meal from scratch from fresh and basic ingredients. Cars have enabled people to do a big shop once a week and with the use of the refrigerator and the freezer in some cases once a fortnight or once a month. Diet has become more varied with exotics such as pineapples and mangos widely available and fine green beans from places like Kenya and Thailand available year round by the use of exceptionally energy intensive air freight.

The average spend on food as a percentage of average income has also dropped significantly in this time meaning that people have more to spend on other things such as cars (consume energy), central heating systems (consume energy), entertainments (consume energy). Cheap food has come about for various reasons; commonly attributed to the cheap food policies followed by governments and the increasing competition of the supermarkets, the effect on food prices of cheap oil and gas for production and distribution is frequently overlooked. The reality is that cheap food would never have existed without cheap energy, nor would the supermarkets or the cars or the refrigerators in every home.

During the twentieth century for the first time in the history the total of energy use from seed to plate has vastly exceeded the energy consumed. [source?]

Production

Originally farms produced all their own energy. Cultivation was carried out by horses which were fed on grass and grain produced on the farm. Horses usually required 20% to 25% of the land in both grass and grain to provide their food requirements. Fertilisers were non existent other than via manure from livestock kept on the farm. All farms were mixed farms, right across the UK. Now the eastern counties are predominantly arable or crop farming and the western counties predominantly livestock, meaning that livestock products such as meat and milk have to be transported east and south to their markets and crop products such as feed wheat have to be transported west to their markets. The only exception to this is industrial poultry and pig farming where the animals are largely kept indoors and these farms tend to be predominantly in the eastern grain producing regions. Vegetables are mainly grown in and around the Wash in Lincolnshire, Cambridgeshire and Norfolk where the soil is supremely suited to their production. These then have to be distributed accordingly around the country. Much of this area owes its existence to drainage systems pumped and dug and maintained first by coal and steam pumps and now by oil. Irrigation is

used extensively in this area on some crops although overall the U.K's reliance on irrigation is much lower than that of many other countries, irrigation relies mostly upon diesel powered pumps to move and pump water to where it is needed.

The mechanisation that was enabled on the back of oil through tractors, combine harvesters and all the tasks that they can accomplish has significantly reduced the labour required on British farms, meaning that more people were "free" to go off and seek their living in other industries. The mechanisation meant that timeliness was increased, and therefore only two or three different crop species were a possibility on a big farm. Even a small tractor can plough more in an hour than a team of horses and work for more hours a day.

Originally everything was organic because there was no other way to be. Then early in the twentieth century guano, a deposit of bird faeces rich in Nitrogen with some Potash and Phosphate content, was found in abundance on cliffs in places such as Peru and Africa. This was mined and transported to other countries where its value as a fertiliser was soon realised. As with all natural substances used on a large scale this commodity soon could not keep up with the demand and other substitutes were found. Nitrogen fertiliser based on the Haber-Bosch process was soon in use on a wide scale. This process uses large quantities of natural gas.

Soon after the Second World War a lot of effort was put into finding chemicals to control weeds, pests and diseases. These chemicals are also reliant on oil for feedstock and for the energy to manufacture, distribute and apply them. Seed breeding and development has been thanked for a great deal of the increases in yields and is probably the least energy intensive part of the new style of agriculture. However a lot of the varieties that have been bred have been very successful when supplied with copious quantities of fertiliser and pesticides and it remains to be seen how many of them are viable without these inputs.

What influence has oil had on population?

http://altbuzz.org/public/peak_oil/world_population.jpg

This graph says it all. Oil has been incredible for the human population. It has improved healthcare, agriculture, trade, water supplies and shelter, and for these reasons people have been living longer and mortality rates have decreased. It has created an artificial carrying capacity for the world. Oil increased the quantity of people we were able to sustain, but when oil goes into decline, it is not hard to consider that population will go into a decline too. Whether this is sudden or gradual will vary around the world.

Can’t Saudi Arabia pump more?

The true answer here is that outside of Aramco (the Saudi Arabian public oil company) nobody really knows. Some argue (most prominantly Matt Simmons in "Twighlight in the Desert") that there is evidence that Saudi is nearing its peak of production and has in all probablility passed its peak of light sweet crude (low sulphur and shorter carbon chains - far easier to refine). Others, including Aramco officials argue that Saudi production can be raised over a period of time to greater than 15 million barrels per day (it is currently around 9.5 million barrels a day).

We do know that most of the big Saudi fields were found over 40 years ago and that they have been producing for tens of years. Very little significant reserves have been found in the past few decades.

We also know that Saudi is the world's last swing producer. A swing producer is a country that can increase itsproduction to cover for short term supply disruptions elsewhere. The rest of the world is pretty much pumping as fast as they can. If Saudi does peak then the world will have almost certainly reached a global peak but even before that time, Saudi needs to increase its production at a rate higher than the global decline to stave off the global peak - something that gets progressively harder as more fields and countries start to decline, while demand continues to grow.

Until we have publicly available field by field data from the Saudi oil wells, the only way to know how much Saudi can produce is to wait and watch.

The markets will sort it out.

A number of factors come into play discussing the role of the markets and solutions to the coming energy crisis - 1) are theoretical free market principles reflected in our current society 2) to what extent are energy costs factored into the markets 3) to what extent do we commit the cardinal sin of using past performance to predict the future 4) how will supply and demand work in the energy crisis 5) what are the limits to market capitalism 6) how will our reliance on debt and growth be effected.

1) for markets to function properly there needs to be transparency of information and an absence of coercion or undue influence.

2) considering virtually all of the raw materials used in energy production, space heating and transport are finite, and for the vast majority, their cost of production does not factor in the millions of years of sunlight, heat and pressure required to make them, their true value is not reflected in their market price. In essence the last hundred years have been the equivalent of the ground giving people $100 a barrel and us having to pay back $10 for it. Our current market model has not been subjected to a situation where a fair price is paid for fuel inputs, it can then be argued that our current model is theoretically if not practically flawed. Perhaps it will work when energy costs reflect their true price of production but our testing of its robustness have historically not included these pressures.

3) the technological and medical advances that have been possible over the last few hundred years through the availability of cheap fossil fuels have lead the human race to fall into the trap of predicting the future to be a continuation of the status quo. Humans have become arrogant in the belief that we can overcome any obstables placed in our path. Our belief is that our ability to invent technologies for any eventuality is unlimited. A key to financial theory is not to see past performance as an indication of future performance.

4) supply will always match demand (in a market with an unregulated price) but the emphasis needs to be placed on the supply being the determining factor rather than the demand. Due to a few hundred years of the ability to increase supplies (of most things) to meet demand, the usual focus on the supply and deman equilibrium is on the demand side. Peak oil will cause a supply constraint. The only possible outcome is demand destruction - i.e. the price of oil, as it becomes more scarce, will rise so that more and more people simply can't afford to buy any.

5) our current guise of the free market, i.e. capitalism, has the ability of infinite growth as one of its fundamentals. If you are of the belief the land and resources are finite then you will understand that when these are no longer freely available then the model begins to crumble. It takes a true hard headed capitalist to believe that the earth and the beings on it have an infinite potential to expand.

6) Our debt based (mortgages, loans, bonds) society's continued viability is predicated on growth - between 2 and 3 percent a year on average, and that growth it can be argued is dependent on cheap fuel sources. The energy crisis therefore has the potential to destroy our capital markets; now whilst this does not necessarily mean that the theoretical market will not continue, it may mean that our global market as we know it now may cease to exist or be radically changed.

We'll find something better, won't we? We always find a better fuel!

Not always. For example, in the case of Easter Island, wood was their major fuel source. They used it all up and there was nothing to replace it. Until the industrial extraction of coal, Britain experienced plenty of wood shortages, and there were decades where use of wood was limited. We went from wood to coal, and then oil and gas. Nuclear also emerged making a small overall contribution. But there is nothing we know of that is better than oil or as flexible as oil.

Does the market have a role to play?

The market can be considered to be reactionary not proactive. In that sense solutions tend to be found when problems arise and someone comes up with an idea that they feel they can make a profit on. As such the market tends to be short sighted. It could then be argued that declining oil production is a problem that needs longer term thinking and planing and therefore, a reactionary system such as the free market will not be suitable mechanism for change by itself. However, as part of an overall effort to a more sustainable, post peak society it is possible that the free market might have a role to play if it is integrated in with other measures. Although, there are some people who would argue that it should not be part of a solution as it will allow those with more spending power to force a solution for themselves rather than opting for an overall strategy that benefits society as a whole.

Necessity is the mother of invention. Technology will save us. Somebody will think of something.

The magical technology fairy saves the day. Seems like a good plan to me, let's not do anything because someone else with think of something. We will invent the technology to save us all! OK, sarcasm aside, the obvious problem there is basing our hopes on something yet to be invented. That's putting our faith in something that doesn't exist. Maybe it will work, maybe it won't but a wise course of action would be to assume that it doesn't and plan accordingly. Then you will be covered both ways. It doesn't take much of a look at history to find that there are plenty of examples where new technology doesn't actual do much more than make the situation worse. For example, new machinery introduced into a factory that then breaks down or requires more effort to maintain than the old machinery. It could suffer from a bit of teething trouble. There is also the problem of time. We can make a good guess as to what is coming our way and we know that we need to act now and there is no time to wait. There is not much activity at the moment in research to find alternative technologies for a post carbon world. Most research is aimed at developing technology to maximise company's profits or in some way or other to keep going as we are. When it is realised that we can't it may be far too late to develop new technologies even if such things could be developed.

Now, lets go back to the beginning. The problem we are dealing with is not so much a technology problem but an energy problem. Anything and everything we do requires energy and post peak there is a good possibility that we will be running short of energy. Technology does not make energy it can only use it. We already know what energy we have available and how to use it. We also have the technology to use it more efficiently. Therefore, it can be argued that we do not need any new technology to tackle this problem. It can then be argued that we need to look at the way we are doing things and change or socio-economic system rather than trying to invent new things to keep partying a little longer.

Another thing to consider is that we wouldn't be in the position of an oil dependent world if the invention of the mass produced automobile hadn't occurred – the invention of the car led to it becoming a necessity, and now we find ourselves in the position we are in!

ENERGY OPTIONS

After oil, what next?

That's what we all would like to know! We can't predict the future but we can make some educated guesses. One of which is to say that whatever the future has in store for us it may well be very different to the world we live in today. We can get some clues form what is happening today. We have alternative energy sources such as wind and solar but they are intermittent and will not meet our current needs but perhaps they could be combined with energy farms. There is nuclear but that leaves a lot of nasty waste to handle and is in itself just another finite resource and will also peak exactly as oil will. There are bio fuels but they, like, wind and solar, will not be able to meet our current needs. So, what ever next maybe it will probably be a world with a mixture of energy sources combined with ways to reduce our energy needs. Maybe that will mean more reliance on local communities maybe it will be more like a "Mad Max" world. We don't know but its up to us how we shape the future. We are now going to look at a whole range of potential energy sources for the future, but a couple of things will remain clear. The first is that finding a direct replacement for oil is not easy and that most of our options only produce electricity. The second is that the laws of thermodynamics are very important to consider.

What are the laws of thermodynamics?

Law 1. You don't get something for nothing. Or more technically, the energy you put into a system is equal to the energy you get out plus the energy you lose in the system. This means that energy is conserved, that there is no energy magical appearing out of nowhere.

Law 2. If you want to keep something running you got to put energy into it. That is, a closed system will run down and come to a halt unless you keep adding energy to it (then it won't be closed!). Another way of saying this is to say that the entropy of the system increases. The result of this law is all around us when you see things degrading and needing maintenance.

Law 3. The colder things are the less energy they lose. So, if you could freeze a system down to the coldest you can get then the entropy of that system would be constant.

What about non-conventional oil?

Fossil fuels come in a range of forms from coal to natural gas. 'Conventional Oil' generally refers to easily flowing oils - and some definitions restrict the term to on-shore or shallow-water oil. Conventional oil is the easiest to extract and the easiest to use. Non-conventional oils range from heavy oil (thick and more difficult to both extract and refine) to tar sands. Another form of non-conventional 'oil' is 'oil shale' - in fact not a form of oil at all but nearer to the form that organic materials take before heat and pressure creates oil from them.

There are very large amounts of both tar sands and oil shales in the USA and Russia. However extraction of these and conversion into useable oil is not easy. Using current methods (in development for over 25 years) both require a large input of energy - and in the case oil sands - large quantities of water. Whilst there is an overall gain in energy - it is neither quick nor easy to produce oil from either of these sources. Furthermore, especially in the case of oil-sands, there is a substantial environmental impact.

Whilst production from heavy oils and oil-sands is increasing current projections are that these will not make up the shortfall as conventional oil production starts to fall. Oil shale has yet to be produced on commercial scale.

What about renewables such as solar and wind?

The current forms of solar and wind energy produce electricity. This, of course, could be used either to produce hydrogen (or some other form of energy carrier) or to charge batteries in electric cars.

The current focus on these renewables is to try to replace conventional (fossil fueled) generation to reduce CO2 emissions. At present, however, demand for electricity is increasing [insert figure or graphic] - and the rapidly increasing implementation of new solar and wind generation systems isn't even covering new demand, let alone replacing conventional generation. The point is that irrespective of peak oil we also have an issue on conventional power generation. So to tackle both this issue and peak oil would require immensely larger programmes. By way of example roughly 4% of the UK's land area and 50,000 3MW wind turbines would be require to replace current electricity generation (Energy Beyond Oil, Paul Mobbs). To replace oil energy requires roughly the same amount [compare to current govt targets].

If electricity is used to generate hydrogen, and that hydrogen is then used to propel a vehicle, roughly 75% of the energy is wasted through conversion losses. The same applies to oil as cars are only 25% efficient - the rest of the energy ends up as heat. Use of the electricity to charge electric cars is more efficient, and also avoids the complexities of producing, transporting and storing hydrogen (although other chemical forms of energy storage are being developed).

Technology has been developed that will produce hydrogen directly from sunlight and attempts are being made to increase the efficiency of this. At present it isn't commercially viable.

So renewables could help - but would require a massive increase in implementation, for which there may simply not be enough sites. It would also require changes in vehicles and infrastructure to move the energy around.

What about renewables such as tidal or wave?

These are potentially major sources of energy in some parts of the world. The UK is fortunate in having both in large quantities on tap. However these are not easy to convert into electricity and many of the arguments that apply to wind also apply to tidal and wave energy.

Water is not a forgiving medium and equipment that is designed to operate in rough seas has to be very robust and is also difficult and expensive to maintain. There are, however, a number of methods being developed to extract energy from both tide and wave. The tidal barrage is well established approach but has substantial environmental consequences. Tidal lagoons have also been mooted. Tidal stream devices (a propeller connected to a generator) are in development. Wave solutions also are being developed and there are now implementations going ahead.

However the total amount of energy we can extract in this way using currently perceived developments is still small compared to the energy we get from oil. By way of example The Royal Commission on Environmental Polution estimated that 4GW of power could be delivered by tidal stream in the UK (which is well endowed with potential sites). This is only about 10% of current electricity use in the UK...and a much smaller proportion of our oil usage (let alone gas).

What about bio-fuels?

Biofuels are going to be an important source of fuel for the future. Until the onset of fossil fuels bio-mass in the shape of wood, dung, straw and much more was, along with the sun and

"In 2003, the biologist Jeffrey Dukes calculated that the fossil fuels we burn in one year were made from organic matter “containing 44×10 to the 18 grams of carbon, which is more than 400 times the net primary productivity of the planet’s current biota.”(1) In plain English, this means that every year we use four centuries’ worth of plants and animals."

http://www.monbiot.com/archives/2005/12/06/worse-than-fossil-fuel/

One calculation suggests we would need to use all of Britain’s current agricultural land to meet its current energy needs by using biomass.

A report from the E.U simply stated “You can feed either cars or people, but not both.” [source?]

What about gas and Liquid Natural Gas?

Gas is expected to peak 10 years after oil, so it is not any long term solution. It is also prone to sharper decline rates and is much more difficult to transport, hence the push for Liquefied Natural Gas as the choice for countries around the world with an increasing appetite for gas from far away countries. Transporting LNG by tanker is arguably cheaper than building pipe lines but there are many infrastructure problems such as building LNG ships and terminals. Gas is an incredibly important feedstock for fertiliser and many believe it is the decline of gas that we have to worry more about.

What about the hydrogen economy?

Stories in the media will often crop up about cars running on water. There is no car that runs on water, but what these stories are referring to is ‘The Hydrogen Economy’ – a future where the world is powered by emission-free Hydrogen. The key thing though is that unlike fossil fuels, Hydrogen isn’t an energy source – it is an energy carrier. It is a battery. You have to use energy both to getting it, and getting power into it. Despite Hydrogen being the most abundant element in the universe, it is incredibly hard to get in any usable form.

The laws of physics mean the hydrogen economy will always be an energy sink. Hydrogen’s properties require you to spend more energy to do the following than you get out of it later: overcome waters’ hydrogen-oxygen bond, to move heavy cars, to prevent leaks and brittle metals, to transport hydrogen to the destination. It doesn’t matter if all of the problems are solved, or how much money is spent. You will use more energy to create, store, and transport hydrogen than you will ever get out of it.

http:/ / www. powerswitch. org. uk/ portal/ index. php?option=content& task=view& id=483&Itemid=2

Any diversion of declining fossil fuels to a hydrogen economy subtracts that energy from other possible uses, such as planting, harvesting, delivering, and cooking food, heating homes, and other essential activities. According to Joseph Romm “The energy and environmental problems facing the nation and the world, especially global warming, are far too serious to risk making major policy mistakes that misallocate scarce resources.

Optimistic studies on the use of hydrogen as a fuel usually fail, for example, to take into account the storage costs associated with a highly compressed gaseous fuel. Hydrogen has such a low fuel value per unit volume that it is difficult to ship or pump meaningful quantities of energy from point to point.

http://www.powerswitch.org.uk/portal/index.php?option=com_content&task=view& id=834&Itemid=2

There is a joke about Hydrogen. "Hydrogen is the fuel of the future, and it always will be."

What about nuclear fission?

Nuclear fission is a highly emotive energy source. Statistically it is one of the safest forms of energy in terms of deaths per energy unit produced. However we are facing an immense backlog of nuclear waste to deal with, huge decommissioning costs for old power stations and leaving a radioactive legacy that spans 1000s of years into the future. There are also risks of nuclear proliferation.

There are also concerns over the availability of Uranium as current high-density reserves will run out in the next 30 years.

New designs and approaches massively reduce waste and decommisioning costs, however these are not eliminated. There are also ways of re-processing uranium, or using Thorium, or implementing breeder-reactors that massively increase the amount of energy (50 times or more) that can be derived from the same amount of input fuel. These would all require considerable development and come with new waste and safety issues.

In principle, if these issues could be overcome, nuclear power could produce a large amount of energy. Even so the scale the need should not be under-estimated. To replace, say, 25% of the UK's current oil consumption would require electricity from about 20 nuclear power stations.

What about fusion?

Whereas current Nuclear Power is based on Nuclear Fission – splitting the atom – Nuclear Fusion is based on fusing atoms together. More specifically, two light atomic nuclei fuse together to form a heavier nucleus and release energy.

(http:/ / en. wikipedia. org/ wiki/ Fusion_power March 2006) This is the same kind of reaction that sustains the Sun. It is also the basis of the Hydrogen Bomb. It could be used to generate tremendous amounts of electricity and little high level radioactive waste. The idea is not new, but unlike Nuclear Fission, the breakthroughs in creating a self-sustaining Nuclear Fusion Power Plant have not happened despite $20billion spent over 40 years on research. Even Nuclear Fusion's staunchest advocates say it is many decades away at best. There are tremendous technological challenges to overcome. For example, the temperature in the reactors would be about 100-200 million Kelvin, and there is no known material that can withstand that level of heat for a fraction of a second. There has been no nuclear fusion reactor that has produced more energy than it consumes. It will not be until 2016 – possibly later – that the big hope, the ITER (International Thermonuclear Experimental Reactor;) experimental fusion reactor will be operational. It will then be many years until we will even get close to anything commercially viable. And even then it only produces electricity, not oil, so we will have to have transport in place that can run on an electric grid. Assuming that all the breakthroughs necessary do happen, it will not be until mid-21st century that Nuclear Fusion could be in place, and by then the world will be a very different place. We would hope that we would be well on our way to creating a truly sustainable world by then. Some also that if Nuclear Fusion, or some other miracle power comes along, all it will do is enable humanity to carry on exploiting the world's resources.

What about coal, especially 'clean coal'?

Coal will undoubtably become a major part of the energy mix, regardless of the decline of oil. For example, in China they are building a new coal power station every week. Coal is cheap and for many countries such as China and America is in large abundance. However, there is no doubt that this threatens our intentions to mitigate climate change. Coal itself is subject to peaks - for example, coal is expected to peak in the U.S.A by 2032.

What about geothermal energy?

Geothermal energy is a useful source of heat and energy for the countries that possess it. It has been used commercially for many years is several countries, including Iceland, Italy, New Zealand, Phillipenes and the USA. However, it has been limited to locations close to volcanic activity and so has not been a major source of energy. The future lies with hot dry rock or enhanced geothermal systems (EGS). Deep holes are drilled, water pumped down and then extracted after heating by the hot rocks below. The energy theorectically available is enormous.Geothermal at Wikipedia [4]

What about free energy?

There are people who claim that there are ways of creating power that bypasses the first law of thermodynamics - that energy cannot magically appear out of nowhere, or even from background ambient energy. The simple fact is there is no demonstrable, scientifically proven example of such a device working that produces more energy than it consumes. Free energy makes up precisely 0% of the world's energy contribution. Some say that free

energy devices have been hushed up and hidden by the U.S government. This doesn't make sense. Economies grow based on energy growth. The more energy there is, the more economies can grow. If there was a way of producing free energy, there is no rational reason for with-holding such a breakthrough. If economic problems are one of the main reasons for governments to lose elections, then it would make sense to make use of every energy source possible. It also assumes that free-energy inventions can only occur in America! There are many energy-poor countries in the world that would not hesitate to make use of free energy inventions. Cheap, clean, free energy is the holy grail for energy research and it hasn't been found.

What about methane hydrates?

Methane Hydrates, otherwise known as Methane Ice or Methane Clathrate is ice that contains a lot of methane within its structure. There are very large deposits of methane hydrates on the ocean floor. Methane is a natural gas so exploiting this resource is very attractive to the oil and gas industry. However, there is no commercially operating methane hydrate extraction process. Methane, of course, is a greenhouse gas, ten times more effective than carbon dioxide. It is thought that changes in sea-level during previous ice-ages ld to methane being released from the hydrates causing global warming. Drilling for methane hydrates is a hazardous process with "many floating drilling platforms having been lost in shallow waters when a gas pocket was penetrated before the blow out preventer was installed… Being a solid, methane in oceanic hydrates cannot migrate and accumulate in deposits sufficiently large to be commercially exploited. The published estimates of the size of the resource are highly unreliable and give flawed comparisons with conventional fossil fuels. There are other non-conventional sources of gas which are infinitely more reliably known and accessible than hydrates, yet remain uneconomic for the time being. The prospects for the commercial production of oceanic hydrates in foreseeable future are negligible. In short, they are a chimera.

" (http://www.dieoff.org/page192.htm)

What about turning waste into oil?

There is a process called Thermal Depolymerization which mimics the natural geological processes that produces fossil fuels. By using biomass waste and putting it under intense pressure and heat, the process creates light crude oil. After a long period of development the process now produces more energy than it consumes. A working plant in Missouri is thought to turn 200 tons of turkey waste each day into 500 barrels of oil. The USA creates 12 billion tonnes of waste each year. Obviously the amounts of oil produced by different types of waste varies, but assume that it was 12 billion tonnes of turkey waste, it would still only produce 30 million barrels of oil a year. America consumes more than that amount of oil in 2 days at the moment. Triple it and you still only get a week's worth of oil for the most wasteful country in the world. And that is the point – it depends entirely on a society that produces waste. If we assume the world of the future will be in a harsher economic climate, then we can assume it will produce less waste. It may be that turkey guts are better served as a feedstock to other animals such as dogs and cats! Equally it relies on energy inputs, and the cost of gas involved in the heating process is going to go up, as will the cost of transporting the waste to the TDP plant and then transporting the oil from the TDP plant. Thermal Depolymerization is a useful process but it will contribute very little.

Are all these alternatives useless then?

They will all be part of an increasingly diverse energy mix, but even combined, they will not be able to replace the decline of oil.

What about increasing efficiency?

What may seem a common sense solution is to make everything dependent on energy more efficient. Jevon's Paradox states that as the efficiency of something such as fuel is increased, total consumption of the resource actually increases rather than decreases because it makes more available, at a cheaper price.

Source: http://en.wikipedia.org/wiki/Jevons_paradox (March 1996)

So, if you made a car's petrol usage twice as efficient and the cost of the fuel remained the same, you'd be getting the twice the amount of fuel for your money, in effect. However, this decreases demand so the cost of fuel drops, making it more accessible to others, thus increasing consumption. You get better usage from the fuel but it doesn't mean that less is used. Jevons noticed this in his 1865 book "The Coal Question". Consumption of coal soared when James Watt's coal-fired steam engine was introduced. It was more efficient that Thomas Newcomen's earlier design so it was more cost-effective, therefore more people could afford it, and it could be more widely adopted by industry. As a result, overall coal consumption rose even though less coal was required than before to do the same work.

Some say that Jevons Paradox ceases to apply once we past the oil peak As the price of oil continues to rise, to maintain the same standards of living for the same cost, efficiency must increase.

How is oil linked to economic growth?

http://www.peakoil.net/uhdsg/weo2004/OilDemandAndGDP.jpg

This graph from the World Energy Outlook 2004 shows clearly the link between Oil Demand and GDP growth.

Is this more of an economic crisis than an energy crisis?

The two are inextricably linked. Just as a crisis which is solely economic will reduce energy consumption, so a crisis that is solely based on a lack of energy will cause economic recession. Whilst peak oil will create both an economic and an energy crisis, it is the basic flaw in the conventional wisdom of modern economics which has created it: the belief in year on year economic growth in a finite world. A lack of understanding of the power of the exponential function (the increase of anything by a percentage amount) has led to business, academics and policy makers becoming disconnected from the effects of economic growth.

It is also important to understand that an oil crisis does not just affect energy prices, oil is important for almost every part of the economy.

[1] Evar D. Nering 'The Mirage of a Growing Fuel Supply', New York Times 2001

[2] Dr. Albert Bartlett: A Lecture on Arithmetic, Population and Energy, 2005

http://www.globalpublicmedia.com/lectures/461

Hasn’t economic growth been decoupled from energy growth?

No. Economic growth cannot be decoupled from energy growth, there is, and always will be a correlated relationship between what an economy produces and how much energy it uses. This relationship is of course different for different industries and different countries, some are more energy intensive and so the relationship may be equal, and others biased towards less energy intensive industries like the service industry will use less energy for every percentage increase in energy use. Currently world economic growth is around 3-4%, whilst world primary energy demand is projected to expand by more than half between now and 2030, an average annual growth rate of 1.6%[1]. Some point to the oil shocks of the 1970s and to current high oil prices and ask why there has not been a recent economic recession, what this fails to take into account is the fact that oil prices were much higher in the 1970s if inflation adjusted.

[1] International Energy Agency Report, ‘World Energy Middle East and North Africa Insights 2005’, 2005.

How is money created?

Banks loan money into existence, when you or I put £100 into a bank £10 of it is kept by the bank, the rest is loaned to businesses and people. So now you have £100 in your bank account, and someone else has a £90 loan, and the bank has kept £10 to cover withdrawals, so in effect there is now £190 in existence where only £100 existed before you went to the bank. This cycle of deposit and loan continues until the original deposit has created about six times its original amount in money terms. Banks expect interest to be paid on the amount they loan out, more than they pay you or deposits. But interest can only be paid if the loans banks make are successful themselves in making money.

What will happen to the financial system once everyone realises we’ve peaked?

Money is an expression of energy, an exchange medium for work and products and financial system enables the transfer of that energy around the economy. Lets say you take out a loan to buy computers to sell in your computer shop. It takes ten times the weight in fossil fuels to make a computer, so each of the 5kg computers is 50kg of fuel. Lets say the price of oil rises, and your computers are now a third more expensive to buy, which you pass on in the sale price. Now not all of your computers sell because people have less disposable income after an oil price hike, and you cannot pay back the loan plus interest. You default on the loan. You don’t pay your suppliers and they default on their loans. Banks realize that much of the money they leant out will not be returned, they stop loaning anyone else money, and decide their existing loans must be recalled, sending more companies and individuals into bankruptcy. People begin to lose faith in the banking system and demand their money from their accounts. But remember, banks loan out 90% of the money they take in, so if everyone wants their money the bank cannot hope to pay. Riots break out as the banks are besieged by people who want their cash before the bank’s reserves are drained, to see an example of this look at Argentina’s bank run of 2001. [1]

[1] http://en.wikipedia.org/wiki/Argentine_economic_crisis_(1999-2002)#The_crisis

CONSEQUENCES

Can we see what is going to happen by what has gone before?

There are some recent historical precedence that can be used to gain some idea what might happen. The situation in Cuba is probably the most important. When the former Soviet Union collapsed Cuba found itself with out a regular supply of oil. They were dependent on oil from the Soviet Union for things such as electric power production and food. The situation there deteriorated and they found themselves with regular power cuts and food shortages. The energy intake from food for the average Cuban was reported to have declined by about a third when compared to before the collapse of the Soviet Union.

To get through the crises Cuba turned to the community solution of cooperation coupled with organic growing techniques. They introduced organic hydroponics called organoponics, which uses only organic fertilisers fermented from urine and worm farms. They also introduced other methods such as permaculture to produce food. They developed bio-pesticides and grew food wherever they could, even converting old car parks into growing areas in the towns. For transportation they reverted to cycling and walking as well as aiming for more energy efficient public transport system. A new revelation swept through Cuba and it worked. Cuba successfully survived the transition and has become a model of what can be achieved by working together and Cuba can be seen as an example of a post carbon state.

Ref: http://www.globalpublicmedia.com/articles/657

http://www.globalpublicmedia.com/interviews/649

http://www.energybulletin.net/13171.html

Have we ever experienced anything like this before?

No. We have never in human history had a civilisation that ran on oil. We have never been so dependent on such a single source of energy and we have never had such an abundance of cheap energy before. This civilisation in it's current form has been built on a mineral slime like no other civilisation before it. Civilisations have come and gone before and we have had dependencies on various types of minerals and land usage before but not on oil. We have never faced a situation where we have put all our eggs into one basket and than faced a situation where it started to run out!

However, there are some historical precedence that, although they are not the same situation, do have aspects that can give us an indication of what might lie ahead. On of which is what happen in Cuba after they lost their oil supply due to the collapse of the Soviet Union. The collapse of the Soviet Union, itself, is another situation that we can draw lessons from. So is the population collapse on Easter Island. We could also draw some ideas what we might be in store form the oil shock of the early 1970s and maybe even from the famines in eastern Europe during the 1930s as well as the depression before the Second World War.

So, although this situation is unique in human history there are past events that we can look at. They may not be exactly what we are up against now but they do have element that maybe found in our current and future situation.

Ref: Collapse : how societies choose to fail or succeed by Jared M. Diamond. Viking, cop. 2005. ISBN: 0-670-03337-5.

Will it be anything like the fuel protests of 2000?

Maybe. As the price of oil increases we could expect to see some sort of fuel protests. However, even though the bulk of the fuel price at the pumps is tax the underlining reasons for a price rise due to peak oil is physical not political. As such there is only so far that any government can go to alleviate any rise in prices. Those countries with a high rate of tax have the ability to soften the rising cost for a limited time and those countries with low tax will notice the rise in price first. So, in the end, no matter how much fuel protests there are the price of oil will most likely rise in the long term and the fuel protests of 2000 may well end up looking like minor irritation but nothing significant in comparison!

Will oil and other energy prices just keep on going up?

With demand increasing but supply decreasing, what we will see is oil and other energy prices rising and rising until an economic recession is induced, creating ‘demand destruction’ through the closure of businesses and increasing unemployment. This downward spiral of decreasing economic activity will lower prices because usage will be lowered. However, at a certain point there will be a recovery with the whole process being repeated. Even in the absence of recovery as the decreasing supply crosses the depressed demand line, price will rise, creating deeper depression. It will be an ongoing process of prices going up and down, but when they go down it is not because of increased supply but because the economy is in decline. It is maybe for this reason that it is wise to invest early in having microgeneration installed for your property.

Does peak oil increase the potential for conflict?

With the arrival of the peak of oil and gas production, we can expect to see a series of deepening global recessions, culminating in depression due to our dependence on fossil fuels. Throughout this time there will be large pressures placed on our current ways of life, pressures that will either dictate a voluntary change in the way our society works, or, should we chose to reject that course, a series of conflicts and wars over the lessening scraps around the world. This later route, at its best, will be a more painful means of reaching the same low energy society, at worst...depends how far things escalate, but we may not get there at all.

From time immemorial wars have been fought over resources. Actually, virtually all of them: from the expansion of the Roman Empire, to French, Spanish, Portuguese and British Imperialism, to the Japanese conquest of Manchuria, to Soviet expansionism, to the Iraq invasion of Kuwait, and the British and US invasion of Iraq.

With virtually every aspect of the world's people and lives reliant on oil and gas, the stakes are raised. The arguments will be more subtle ("Our way of life is not negotiable"), the bogey men more terrifying ("The Hitler of our time"), the consequences of military inaction more disastrous ("40 minutes").

The last great depressions in the 1920s and 1930s were firmly felt in Germany and the United States. The Nazis played the scapegoat card to support their expansionist policies. The resultant war dragged the United States out of its depression. Everyone would have preferred a different way out to the estimated 55 000 000 deaths.

Is peak oil related to the ‘War on Terror’?

Lets look at the facts. Fact one, world oil production will peak, for definite in the next 30 years, and very likely much sooner. Fact two, the US depends on control of the world’s energy supplies to ensure economic growth and consolidate its position as the only superpower. Fact three, Europe and the US have been meddling in Middle Eastern politics since days of empire. Fact four, the US’s government is controlled by people who have a lot to gain by increased military spending.

There can be very little doubt that peak oil and the War on Terror are related, just how related is open for debate. There are two levels of theory about the relationship between the War on Terror and peak oil. The first is that Al-Queada’s attacks are a useful and co-incidental part of a plan to gain more control over the world’s energy resources, the second is that Al-Quaeda’s actions were known about and possibly encouraged in the run up to 9/11 by elements of the Bush administration in order to bring about conditions for the use of force. There are many unanswered questions about what happened on 9/11, such as the destruction of building number 7 at the World Trade Center and the failure to scramble intercept aircraft, amongst others. To do this subject justice would require another book, so I won’t write anymore.

What effect will this have on the economy?

That can be difficult to say but there are various scenarios that are possible. Peak oil could actually be a good thing in the short term. As oil prices rise it may well become cheaper to produce goods locally which could be a boost to local economies, as more jobs become available. Governments could also invest in new ways of doing things and implement effective. Individuals and private groups could form an important part of new initiatives. Society could move over easily to a more sustainable way of living and we may hardly notice a difference. Other scenarios could be a recession or a depression, which may result from a slow response by governments and other agencies. However, even after a slow start our economies could be transformed into a more sustainable economic system. Another scenario is an economic collapse and civil unrest.

Whatever happens, it is unlikely that our current economic system will survive as it is. Oil is so fundamental to our economy, and we have no simple solution, that it is hard to imagine that our current system will continue as it is, as the oil prices rise. Even without peak oil it is unsustainable and will need to radically alter the way we do things.

Why haven't the recent dramatic increases in oil price had an effect on the economy like the 70's oil shocks?

There has long been a strange assumption (or so it seems to me and my recent interest in economics) that the world is governed by rules of economy. Economists seem to forget that their 'rules' are simply observiations of what has happened over a prolonged period of growth, therefore they ignore limits to growth, and tend to underplay the importance of the 'inputs' to our economy, such as fossil fuels etc.

There is an interesting section of Strahan's Last Oil Shock that explains that up until the mid 1950's most economists thought that growth of the economy was caused by increases in either labour or capital. This causal link was formulated into the Cobb Douglas function. In the mid fifties Solow applied this function to the US economy as a whole and showed that growth could NOT be attributed to just labour or capital. The economy had grown more

than either of those two alone could have achieved. There must be something else at work.

It would seem that at this point, rather than wondering why there was such a huge miss-match in the figures the difference became known as the 'Solow residual' and was assumed that the gap represented 'technical advance'. They left it at that.

Check out this definition of the Solow residual (from the London School of Economics); http:/ / lse. co. uk/ FinanceGlossary. asp?searchTerm=& iArticleID=2308& definition=solow_residual

Imagine that!!! They are quite happy to have a huge amount of the economy unexplained! To me as a scientist that is just bloody weird.

Anyway finally some scientists got involved after the 70's oil shocks and showed that oil was far more important to the growth of the economy. Solow's model represented energy only in terms of the money spent on it. The Solow model predicted that if energy inputs increased by 1% the economy would grow by only 0.05%!!!!! The oil shocks of the 70's proved that was ridiculous.

The team of scientists used the old inputs (capital and labour) but also included a physical measure of the energy put into the system (oil, gas etc measured in Joules). This model they resulted in is called the Linex function. It is a fairly sophisticated function, but models the US economy really well. No more 'Solow Residual'. Kummel's Linex function showed that for 1% increase in energy the economy would grow by roughtly 0.5%. i.e. Kummel's model showed that oil was 10x more important to the economy that Solow predicted.

The interesting thing is this. That the Solow model shows that if oil costs go up by 1% then the effect on the economy is a shrinking of 0.05%, whereas the Kummel model shows that if the amount of energy used by the economy drops by 1% then the economy shrinks by 0.5%. 10x more effect.

Ayers took the work further and suggested that what is important to the economy is not the energy contained in the sources of energy to the economy, but the amount of energy from those sources that is turned into useful energy. i.e. thermodynamic efficiency gains can cause increases in the economy, which can result in more money being invested in R+D which can in turn increase efficiency.

Ayers researched efficiency gains through the last century, and came up with figures for the amount of energy usefully converted to work by the economy. He fed these figures into the Kummel function and his resultant figures fit the US and Japanese curves almost identically. Amazing! So we end up with an indication that the AMOUNT of energy used by the system is far more important to the economy than the cost of the energy in the system.

As we are aware the cost of oil has gone up some 200% since 2001, which will affect the economy, but it will be nothing like the effects of removing oil from the system. That has over 10x more influence on the economy than the price!

A good examination of the Linex function and some clever modeling should show how much a rise in the price of oil will affect the economy. Remembering that oil is only a proportion of the energy we use, then maybe overall energy costs have gone up by 100% since 2001, and look at the advances in fuel efficiency of cars etc over that time. Maybe the effect on the economy would be a small shrinkage. However the models clearly show that actual energy received from fossil fuels is far more important than cost.

What else is interesting is that as oil prices have been rising strongly since 2001, and the economy has been growing then something must have been contributing to the economy. I

would speculate that two things have contributed to the growth of the economy in the face of rising oil prices. Increases in capital (money supply) caused by ever more irresponsible lending, and secondly increases in efficiency. If we all drove more economic cars and changed our lightbulbs we could probably even coax another couple of years of growth from the system.

Where will conflict be for oil in the future?

To look at where oil conflict will be in the future you need to look at where the oil will be in the future. Michael T Klare's book 'Resource Wars' identifies these points of tension. The Persian Gulf, The Caspian Sea Basin and The South China seas are the main ones. However, there is also the possibility for conflict in places such as Venezuela and Mexico. Of the Persian Gulf, Klare writes "Of all the world's oil producing areas, the Persian Gulf region is the one most likely to experience conflict…possessing nearly two-thirds of global petroleum supplies, the Gulf is certain to remain the focus of intense worldwide competition. In addition, the region is riven by a multitude of power rivalries, religious schisms and territorial disputes."

The Caspian Basin is believed to have the second or third largest reserves of petroleum along with a vast supply of natural gas. "Caspian sea energy is clouded by ethnic and political turmoil and the emergence of a new power struggle between the United States and Russia."

The conflict in the South China Seas could emerge from the competition for the Spratly Archipelago that stretches for hundreds of miles. Possession of these islands would enable claims to ownership of the surrounding waters and sub-sea resources where large quantities of oil and gas are expected to be. China, Malaysia, Philippines, Taiwan and Vietnam have all established military bases while Japan is also exploring the area for energy resources.

Any conflicts in these regions will impair the supply of oil, causing price spikes and actual physical shortages.

What is fractional reserve banking?

This is the method that most, if not all, banks work today. Someone deposits a certain amount in the bank and then the bank loans out, say eight to ten times that amount. A fraction of the amount that was originally deposited in the bank is keep to pay any withdrawals that might occur. The money that is loaned out is generated, as if by magic, out of thin air and doesn't, as such, "really exist. The new money that was made up by the bank increases the amount of money in the system and is the primary cause of inflation. The system works so long as people believe that their deposits will be paid back when needed, which is normally the case. However, the system can fail if there is a run on the bank and more people wish to withdraw their deposits than the bank has reserves.

Will I lose my job?

Probably not immediately. However, there are some jobs in the long-term that maybe unsecured as a result of peak oil. One could imagine, for example, jobs like airline pilot or petrol station attendant being threatened by peak oil but other jobs may also be threatened. It is possible that the world economy could go into a down turn. We could see a recession or even a depression at least as worse as the one in the 1930. In which case it is quite possible

that most people may see their jobs under threat as we go down the down slop.

On the other hand we may also see new jobs being created. There could be, for example, more employment in local food production or indeed, any local industry as the increase in the price of oil makes it more economical to produce goods more locally. There may even be new industries of occupations formed as a result of peak oil depending on what new technologies may come about in response to a new need that is generated or how creative people are at finding solutions to problems that arise post peak.

Will I lose my house?

Possibly, if you have a mortgage. This is a real possibility. House prices can be considered to be very high at the moment in the UK. If peak oil was to cause a recession or even a depression, anyone in debt, not just house owners with a mortgage, could be hit first, and may well feel the effects of any future rise in oil prices the hardest. This is because any rise in oil will have knock on effects such as a rise in food costs, heating and electricity costs. This would mean less money for paying back the mortgage and, therefore, threatens people homes. Coupled with a possible rise in unemployment there is a real possibility that on the down slop you may see more people having their homes reposed due to failure to pay back the mortgage.

What will happen to my investments?

We could see major economic problems ahead and if things go really, badly we could even see an economic collapse. In such a scenario any long term financial investments could seriously be threatened. Even if things go well and we move over to a sustainable society, long-term financial investments may not be safe. If we were to head towards a society that is more sustainable it is arguable whether or not such a socio-economic system would have the ability to grow financially. There may not be any profit for industry nor interest for bank loans so future financial investments may just remain static. It can be hard to say.

There are, however, other investments that might be of more value. Investments in education, learning things that might be of use in a post peak world. Investments in activities, joining with other to start preparing for a post peak world. A world without oil is not all gloom and doom but to make it so could well depend on what we do today and what investments we make for the future.

Hold on…pensions are investments. Are you saying I’m going to lose my pension?

That is a very real possibility. There are many, probably some even within the pension industry, that think pensions are a waste of money. As they say in the investment industry, “past performance is no indicator of future performance”, yet on the bases of the past we predict the future. The situation with peak oil is something different to past situation so we really don’t know what will happen, but facing a recession or depression is a real possibility. If we were to have severe economic troubles one could imagine that pensions will be among the first casualties. If the economy was to collapse then it would be bye-bye to pensions anyway.

(NB: maybe something about Russia in here too?)

What will happen to my debts?

Debts are like loyal friends they will stick with you through think and thin! I could be argued that those who are owed money will do their best to ensure that it is paid back. Thus, your debts will most likely remain. They may even become more difficult to pay back. In the great depression of the 1930s people who owed money suffered more than those without debts did. A wise course of action, therefore, could be to minimise or remove debts as much as possible and avoid getting into new debt. However, on the other hand, we could see more and more debts being cleared by people becoming bankrupt but then would that really be a better situation to be in?

What will happen to transport?

Post peak with a probable higher cost for oil the price of petrol at the pumps would no doubt increase. We could see the era of private, personal transport coming to an end, or at least becoming the domain of the rich. It is unlikely that bio-fuels will ever replace the level of oil we currently use. Major consumers of oil such as the airline industry could even cease to exist. Transport of the future may be horses and bikes! Large scale public transport may be be high speed trains, however this would require a large investment from governments or from the private sector. Something we are not seeing much of at the moment.

What will happen to agriculture?

As we go post peak it is most likely that we will be able to use less oil based fertilisers and pesticides but that will bring in two foreseeable problems. Firstly, the cost of production might increase and food will become more and more expensive. This could be good for farmers as it might turn the industry into a profit making business again. However, the second problem is we may not be able to produce the food we need without oil based fertilisers and pesticides which has the potential to lead to starvation and famine in Europe.

To minimise the possibilities of food supply problems it maybe that we change our agricultural methods to more organic methods and we may see the introduction of systems such as permaculture. Work in this area has so far shown that there is more opportunity for work if such practices were used, and we could possibly maintain food production at adequate levels. Therefore, we could see a movement of people to the countryside. We could also see more “inner city farms” where people in the towns start producing their own food more locally. Either in their own gardens or as community projects.

What will happen to agriculture & food distribution?

This will depend on the speed of the transition but the first thing that consumers will notice is that they are spending an increasing amount on food as a percentage of income. This is likely to have a knock on effect into other areas of expenditure reducing discretionary spending on luxuries.

We will see reduced imports in particular things mange tout from Thailand and green beans from Kenya or other such products which are air freighted into the country and have a relatively short life after harvest. There are also implications for the availability as other countries start to struggle to reach their own food requirements they will be more likely to try and grow more of what their own people can eat rather than crops that can be traded for money with which they buy food from other countries. Food security will become an issue again for all nations and they will seek to de-globalise to achieve this.

Supermarkets will increasingly losing their competitive advantages such as breadth of range and the efficiencies of centralised distribution. Chilled and frozen foods will gradually become more expensive as people will consume less luxury foods and more necessities. Diets will change as meat becomes less affordable, we will be eating more whole cereals, root vegetables and beans, less fats and sugars and significantly les processed food. Overall the diet is likely to be healthier, though much less exciting.

Customer's habits & lifestyles will change as we have to start using more public transport again, the size of the shopping basket will decrease, but the frequency with which we shop will increase. We will be spending less time travelling to work as we will have to live nearer to our place of work. Consequently we will probably have more time in which to cook proper food at home, providing we don't have to work longer hours just to keep bread on the table.

The supermarkets will fight these new trends with all their might as they have a lot invested in the continuation of business as usual but they are unlikely to be able to maintain the massive facilities they currently have for a much reduced product base and as local food produced on local farms and sold in local shops becomes very competitive once again.

We will be more interested in keeping warm & keeping fed than we will anything else we will be seeking necessities over luxuries. Human expectations will be somewhat lower in terms of material wealth. Agriculture can be a source of food and of fuel for keeping warm and a new balance will have to be found between these priorities.

Crop production

The use of fertiliser is going to get very expensive because of the cost of the energy involved in producing and distributing it. Nitrogen fertiliser in particular is produced using natural gas and is already hitting record prices due to the increase in gas prices. If farmers stop using or reduce the amount of fertiliser that they use, crops will not yield as they do at the moment, this in itself has the potential to increase food prices due to the supply and demand effects driving food prices up.

Crop protection products

Pesticides are used to control weeds, pests & diseases, all of which can reduce crop yields. Again the price for these products is linked to the price of oil, both as energy for manufacture and distribution but also as a feedstock in the manufacturing process.

Many people who study peak oil claim that after the peak in oil production, organic farming using no pesticides and no chemical fertilisers farming will become more normal, but early on the oil production down slope, there may be an increase in chemical and fertiliser use as prices of food go up therefore stimulating production and also as governments realise the potential impact of the food security threat, there is a possibility that they may subsidise pesticides and fertilisers to encourage them to be used, thereby keeping yields up and stopping the market from finding a natural balance.

Mechanisation

Fossil fuel is used extensively across the world for cultivation, crop protection, fertilising and harvesting using a combination of various diesel powered machines such as Tractors and Combine Harvesters. Renewable energy in the form of wind and solar simply cannot replace the power of a diesel engine with existing technology. So farmers will have to decide between doing it the old way with horses or trying to maintain the status quo with tractors using bio-fuels such as oilseed rape oil produced on the farm where they are used

or nearby. There are advantages to both ways, but it will depend on how much industrial infrastructure can be maintained, for example tractors go wrong and need spare parts, whereas horses are able to replicate themselves. Both routes are likely to see 20 to 25% of the land being used for energy production for the purposes of farming to produce food.

We are likely to see a return to more mixed farms as crops and livestock work very well together. We will need to see the materials loop closed with all bio-degradable waste being kept in the nutrient cycle either in people own gardens or on the farms. The days of sewage going out to sea or vegetable peelings going to land fill will be gone.

If there is a return to using horses for draught work then there will be a need for significantly more people working in agriculture. Even if the bio fuels route is taken this is still likely to be the case as crops which are more labour intensive make a return to the U.K.

Livestock products

The livestock industry will also change as a lot of energy goes into all livestock products although most of it is indirectly. Dairy farming will alter because much of the increase in yield from a cow has been due to concentrate feedstuffs largely based on crops grown with fossil fuels. Cows can of course manage on diet consisting mainly of grass or stored grass in the form of hay and silage; however their milk yield is likely to be much lower. The productivity of the grassland that feeds them is also likely to drop if fertiliser input is reduced due to increased natural gas prices. The same applies to beef and sheep farming, all ruminants are likely to be farmed much more extensively leading to lower yields, higher prices to the consumer, and potential food shortages, in milk and meat.

Poultry & pig farming for eggs and meat will suffer higher input prices due to increased prices for grain. It is possible for pigs and poultry to live on scraps of waste from the house and forage around the farmyard, but they would not grow very well and it would not work commercially. Overall it may come down to can we afford meat today or will bread and butter suffice.

What will happen to food distribution?

It is quite conceivable that food distribution is likely to go back to the way it was done before oil really started to drive the economy. That is local production for local consumption using very short distribution chains, market gardening becoming more competitive and people growing more of their own food. The supermarkets are likely to disappear altogether, within 50 years of peak and gradually pull back from their least efficient sites a lot sooner. Food distribution systems will change moving more by rail and sea transport.

Trade in some high value goods with a long life such as herbs, spices teas & coffees will continue as it always did prior to oil; they will just become more expensive.

The end of cheap food!

What will happen to water supplies?

Water supplies are very oil dependent – for chemical treatment and also because water supplies are energy intensive. Pumping, cleaning and storing water requires tremendous amounts of energy, so the more energy prices go up because of oil prices going up, this will affect the cost of supplying clear water. Water is considered by many to be the main resource constraint of the 21st century, world-wide. We might be able tp live without oil but we can’t live without water. Water, like all commodities, will become more expensive.

What will happen to healthcare?

There are several things to think about as far as healthcare goes. First, a lot of medicines and products are reliant on oil and gas in their production. These will become more expensive and harder to obtain. Secondly, if we experience an economic crisis as expected, the reduction in tax collected means that there will be less available for national healthcare. The NHS is already under a lot of financial stress, and this will only be exacerbated further. It could be that there will be a rolling back of exactly what the NHS will deal with, while private hospitals and healthcare may gain more ground. The emphasis will be placed much more on prevention rather than cure, with health education becoming much more prevalent. Preventative healthcare can be a very low energy intensive scheme, and could be a source of wider, although lower-paid employment for the future. Such a system exists in Cuba, which is almost a perfect case study for a Post peak oil world, where “Health care for every citizen has been a top priority, second only to education. Clinics and health care providers are located throughout the country even in rural areas, and care is free. The system emphasizes prevention, health education, and community medicine… Cuba's life expectancy rates and other such indications are equal to those in developed countries: Life expectancy among men is 74 years, among women 77 years; infant mortality rates are about 12 per 1,000 births.”

http://www.culturalorientation.net/cubans/health.htm (march 18th 2006)

What will happen to religion?

Religion has been with us since the Stone Age. It has developed as the human race has developed since the dawn of humanity. It has survived the rise and fall of civilisations and continues today. Religion is a very human activity. It builds on our human nature, our desires and wishes, our need for control and to be controlled and our need for security. Therefore, come what may, so long as there are people around there will most likely always be religion. It may adapt, it may change, it may be reinterpreted as it has been in the past (today’s religion is not the same as it was 100 years ago) but it will most likely still go on and still be there post peak. It could even be argued that it might become a stronger influence in a post peak world. If times become harder people may turn to religion for comfort and for emotional strength so it could even be possible that we see a reverse of secularisation. When material wealth becomes harder to obtain, people may begin to look to achieve spritual wealth, with religion as the conduit to achieve that.

What will happen to the environment?

It could actually get better! Imagine, less pesticides around more balanced farming less plastic waste and less mono-cultures as we adopt systems like permaculture, we may see a better a cleaner environment. However, we may see more destruction to out world then we have ever done so before! Imagine society doing what ever it can to pro-long its current way of life. Imagine a society that is quite happy to destroy what we have in the way of wood land and forests, not just in the UK but world wide in an attempt to grow bio-fuels. Imagine a society that is willing to destroy the ant-arctic to get at what may be the lasts deposits of oil.

There is potential to go either way. We could have a world with a better environment or one that we spend our remaining energies destroying so we can party a little bit longer.

What will happen to education?

This can depend on what happens to society as a whole. Education is a long-term investment. It costs a great deal of money to educate a person and the longer a person is in education the more it will cost. The returns on that investment comes over the life time of the individual, often with those of a higher education level generating more wealth for society. However, if finances become strained due to economic problems that may result as we go down the down slope of peak oil it could well be the case that long-term investments will be one of the first areas to suffer as reactionary policies will more likely be aimed at short term survival efforts rather than securing the long term future. This could mean that education, especially higher education could suffer post peak.

What will happen to democracy?

It could be argued that we are already seeing the signs of the decline of democracy as a result of the “war of terror”. It could then be seen as a possibility that if the situation was to deteriorate with a break down in social order rioting and an increase in civil disobedience post peak that we could see governments resorting to more and more dictatorial powers post peak in a desperate attempt to control the situations. However, it is not necessarily the way things might go. For example, another scenario could be that the people become more involved in the way society is governed and the direction society takes as peck oil forces more focus on local communities and local solutions. In that respect society could become more democratic with more people involvement.

What will happen to freedom?

This can depend on how things go. The down slope and any resulting increase of oil prices may result in civil unrest. In such a situation you could imagine a government being more reactionary and attempting to maintain order by introducing more draconian measures and suspension of freedoms. However, this is by no means a certainty. A more enlightened government would be preparing for the down slope and action would have been taken before any civil unrest problems were to develop. Also individuals and groups would be acting independently to eleviate any future problems as best they could and that would lessen the probability of civil disturbance and any resulting attempt to restrict freedoms.

However, there still may be practical restrictions to freedoms such as losing the freedom to travel by car when ever you want due possible high prices of oil.

Will trade decline?

People have been trading since the beginning of the human race. Stone Age people maintained trade routs that stretched long distances and we have had world-wide trade long before we discovered a use for oil. It is possible that we may see a decline in world-wide trade as the cost of oil goes up. It may become more cost effective to produce goods more locally. As a result we may see more local trade even if there is a decline in world trade. That could actually mean there will be more trade on the down slop than before! However, if things go badly we could see less trade as economies go into recession or depression or even collapse but even in such scenarios some form of trading will continue even if its just barter.

Will plastic production decline?

Maybe, we could see a general decline in manufacturing if we were to go into a depression and plastic production might decline as a result of that. However, plastic production only takes a small amount of oil when compared to other usage. If we were to become a bit more sensible with the way we do things it is possible that we could use the remaining oil more for plastics than for other usage and, therefore, plastic production would not decline. Also, we don't actually need oil to make plastics, we can make it from other sources so we could continue with plastic production.

However, do we really want to maintain our current level of plastic production. If we were to more to a society that is more in balance with nature, one that reduced its consumption, reused what it made and recycled the rest we could reduce plastic production and the resulting waste and still maintain a good standard of living.

What do you mean by interdependencies?

Like a cobweb, everything is connected to everything else! To produce the food we need we need oil to produce the oil we need people and to feed the people we need food. Stop the food we stop the oil or stop the oil and we stop the food. Now, that was an example of interdependencies and it was very simple. For such a simple example it is easy to find solutions or alternatives to keep things going. However, our society has many interdependencies and most of them are far more complex then the simplistic example given. Consequently, solutions to any break down to the interdependencies is not so easy to find!

Another way to think of the interdependencies is to think of a woven mat. It all hangs together nicely but tug at one of the lose threads and the whole thing can come undone. In some ways out society is like that. One of the lose threads that could cause society to fall apart is oil. As oil is at the root of so much of our interdependencies losing oil can mean the thread that society is woven of can come undone.

What will happen to the law?

It is too simplistic to say that poverty or unemployment breeds crime. There are many important factors that play a role at the same time such as perceived social inequality, previous experience of steady employment, perception of future prospects, cultural influences etc.

http://www.uefap.com/vocab/exercise/awl/crime.htm (march 18th 2006)

However, there is no doubt that a sudden drop in living standards that an economic recession can bring on increases in crime rates. A study by the Crime and Society Foundation in 2005 indicated that "The recession of the early 1980s triggered the rising murder rates of the past 25 years…People in the poorest areas were six times more likely to be murdered than those in the richest. This is because poverty is the "key component to what makes one place more dangerous to live in as compared to another ""http://news.bbc.co.uk/1/hi/uk/4348238.stm

Equally, economic recession can bring stresses on families that can lead to more broken homes which again is something said to contribute to increasing crime rates.

Argentina is a good example to look at. "There days Argentines not only have to cope with their economic malaise but also what they see as its most worrying by-product: a violent

crime wave that has swept the country and encouraged some to take the law into their own hands."

http://www.findarticles.com/p/articles/mi_m2242/is_1668_286/ai_n14709975

This does not mean that everyone is going to become a criminal but it will create an environment where criminal acts are likely to be more common. This will take place in a context of declining taxes and decreased funding for the police, which could increase the problem. In response to this there may be harsher punishments for criminals as deterrents, with maybe a push for the reintroduction of the death penalty. Communities may take it upon themselves to self police their own areas. There is also the option for an increase in police numbers but at a lower salary (for example you could have two policeman on half the salary of a current policeman, thus getting better value for money). The danger with this is that police would possibly be face increased exposure to opportunities for corruption.

How will this affect politics?

Politics is all about manipulating opinions and politicians have been doing that for centuries and it is highly likely that they will continue to do so for as long as their are people around. It was noted in the ancient world that politicians often maintained contradictory opinions and nothing has changed that in the intervening centuries. Perhaps the main way that peak oil will affect politics is to give politicians another subject with which to manipulate people's opinions on.

Will there be civil unrest?

This is a very real possibility. In a scenario where oil production was to decline and prices were to rise we could see the cost of, for example, the price of petrol at the pumps rising considerably. The full protest of 2000 could then bee seen as a small taste of what might come. It would not take much of an imagination to see that in such a situation things may indeed become ugly if there has not been sufficient preparation in society to handle the crises to the world economy that may result as oil prices rise. There is a possibility that we could see food prices and unemployment rising and when such things have happened in the past they have often been followed by some form of civil unrest. Civil unrest may well be the norm for the future if adequate preparations and planing are not taken today!

Will we experience blackouts?

Britain has an ageing fleet of power stations, and analysis suggests that perhaps the only way to avoid blackouts would be to build over 50 new coal powerstations.

What will happen to population levels?

Thomas Malthus predicted a population crash as a result of unbounded population growth and the failure of agriculture to keep up. His predictions did not come true. There are a number of reasons for that but the main one is that food production increased at greater rates than he anticipated. One of the reasons why we wear able to maintain high food production and feed an expositional growing population is because of pesticides and fertilisers, which are based on oil. If oil production was to decline and there was a shortage of oil or its price was to increase it does give the possibility of a population crash. Even before that there could be scenes of malnutrition before starvation is seen in the UK, Europe and even America. Such a possibility is a scenario developed by the Club of Rome.

However, it is not a certainty. The application of our scientific understanding of nature could help us to produce sufficient food using methods such as organic farming and permacuture, although there may be some doubts as to whether or not that is achievable.

Even with oil, fertilisers and pesticides there will be a maximum population that this planet can support. We can not grow forever. Peak oil may just bring a population crash earlier than would otherwise be expected unless there is some immediate limitation on the population growth.

Ref: Limits to Growth : the 30-year update by onella Meadows, Jorgen Randers, Dennis Meadows. Earthscan. 2005. ISBN 1-84407-144-8.

What is die-off?

“Die off” is a rapid population collapse due to the decline in oil production and the lack of possible replacements that will meet our energy needs. Basically our whole civilisation can be considered to run on oil, from the production of pesticides and fertilisers to the transpiration of food and other goods everything is in one way or another depended on oil. This abundance of energy has allowed us to go into a population “overshoot”. An overshoot is where we have more people than we can really sustain. In other words, without oil our current population levels are unsustainable. It’s like borrowing more money form a loan shark than we can pay back; sooner or later it will catch up with us and the “pay back” isn’t going to be pleasant! As the oil production declines we may well be unable to supply food for most people on this planet which would lead to starvation and a population collapse.

ref: http://www.dieoff.com/

Wasn’t Malthus wrong?

Yes and no. Basically his thesis was that the production capacity of the earth is far less than the potential for population growth. He considered that the food production increases at a liner rate and that the population increased exponentially. The result of which would mean that at some point in time there would be more people than we could supply food for if the population was not kept in check by such things as floods, war and diseases. This would lead to a “Malthusian catastrophe” where populations would collapse and society would revert to a subsistence level of existence.

Yes he was wrong in the sense that his predictions of population collapse did not come true, certainly not within the following centuries. However, he was right in the sense that population growth, if unchecked, will out strip our capacity to produce food. To some extent the reason why there was not a population collapse during the nineteenth and twentieth centuries could be considered to be because of the improvement in farming methods. One of the main improvements was, of course, the use of pesticides and artificial fertilisers that have been produced from oil. Therefore, if there was to be a decline in production of oil and /or an increase in the cost of oil there is a very real possibility of Malthus being proved correct in the twenty-first century.

ref: An Essay on the Principle of Population by Thomas Malthus. 1798. http://www.ac.wwu.edu/~stephan/malthus/malthus.0.html

Die-off sounds dramatic? Will it be?

It depends what you mean by ”dramatic”. Its unlikely that if there is a population crash that it would happen overnight. The population could decline rapidly over a few years or even a few decades. Even so, on the long term scale of things a decline that took decade would still be seen as dramatic. It could also be seen as dramatic on the scale of the individuals who will go through any such population decline. An uncontrolled population collapse would entail a large amount of human suffering and hardship. To the people who would be there at the time that would be a very dramatic change in their lives!

Can we stop die-off?

Some would argue no. Essentially we have known that our current system is unsustainable for at least the last 70 years, possibly even longer. In the 1950 the decline in oil production was predicted to occur about the year 2000. The world was given a sharp remainder of the unsustainability of our current socio-economic system and the importance of oil by the Club of Rome and the oil shock in the 1970s. Even through we have known about the unsustainability of our current system we have done very little to correct the problem. Consequently we have just been running faster and faster to the cliff edge so that now it would take such a radical change to the way that we do things that society would just not be able to stop and change direction before we all fall off the cliff edge! So, no matter what we do now we would not be able to stop a population collapse, only minimise the suffering for our children and grand children who may have to go through it.

However, that may not be the case. It could be argued that die off is not inevitable. It could be the case that if we act now to point society in the direction of sustainability for a post carbon world we could avoid a population collapse. In one scenario of the Club of Rome, for example, a world population of eight thousand million, more than we have today, was sustainable.

There have been efforts by individuals and groups to form sustainable communities and these may be indicators of how we may live in the future. There have been advances in science that may help us produce the food we need without oil, for example, applied ecology in the form of permaculture. Combine that with a society that implements a zero population growth policy then there is every possibility, even at this later stage, of avoiding die off. However, the longer we leave it the harder it will be! The correct answer depends on what we do today!

Does peak oil increase the chances of Nuclear War?

Yes. Due to increased international tension and possibly limited resources for fighting wars, combined with increasing nuclear proliferation, the risk of Nuclear War is certainly increased.

Since the industrialised world is so much more dependent on oil than the developing world, will the industrialised world suffer first?

The oil crisis has begun for many poorer or developing countries where oil is now simply too expensive to use as they did before. These countries will be like 'canaries in the mine shaft'. Equally, people within countries will be affected differently, depending on their level of wealth. It will be like a rising tide.

Is this oil crash going to be slow and gradual or hard and fast?

It could be either and we need to be prepared for both.

Why isn't anyone dealing with this? Why isn't it a number 1 national issue?

A very good question! There actually people dealing with this but its is more on an individual or group bases rather than at local or national government level. What response there is from governments can be considered to be minimal and more in the form of words than action. The lack of any major response from the government can be seen as puzzling and there maybe a number of reasons for it.

It maybe that governments do not take the potential fall in oil production seriously, which could be because they are not convinced about peak oil or because it is not seen as a subject that will attract large number of votes. It could also be argued that the government's job is to maintain the status quo and provide and environment that is profitable for business, stable and of a high standard of living for its citizens. As any attempt to move to a post peak, sustainable society would be counter to that objective governments are reluctant to implement any policies until dwindling oil supplies becomes a more serious threat to the economy. It could also be argued that peak oil and its effects are a long-term issue and that governments, businesses as well as individuals plan and act for the short term. As a result the lack of action may be a "we will cross that bridge when we come to it" attitude. Also, it can be considered that governments are there to serve the people and that the elected representatives are there to represent the opinions and interests of their constituents. As a result the government follows the people rather than leads from the front. So if the people are not interested nor wish to act then governments will follow suit. After all, governments get elected by promising a bright and sunny future and manipulating peoples opinions rather than campaigning on issues that deal with physical reality. Those parties that do deal with physical issues tend not to gain much voter support.

It could also be the case that the lack of government action is only a perception and that the government is doing something about it but it is not made public.

Can't I just buy a farm and be alright?

Probably not!

Farming is currently only marginally profitable in the UK and across Europe. This would be insufficient to fund significant borrowings. If you have access to the funds to purchase a farm then it becomes a much more secure proposition. With shortages of food created by the peak in oil, farming is likely to become profitable once again.

Agriculture is currently heavily supported; will governments be able to continue this after oil has peaked? It is probably likely that they will have to, as food security will become once again the biggest issue which governments have to tackle.

Farmers have become very good at adapting to changing priorities. The Common Agricultural Policy and other government interventions frequently changes the direction in which farmers businesses need to go for the best profits. peak oil will alter the rules again, but will farmers respond, will they realise before it is too late that the change in the rules is permanent. Some will survive and prosper under the new rules others will go to the wall.

The average age for UK farmers is currently 60 which suggest that there will be a lot of people retiring from the industry over the next 10 to 15 years. Many currently have no sons or daughters wishing to enter the business, so there may be a glut of land on the market which may exert a downward pressure on the value of land.

Owning a farm does not guarantee that you will be able to sell whatever you produce. Farmers tend to have a broad range of skills, such as production, finance, marketing, mending, driving tractors.

If your primary concern is just to secure your own and your families food supply then buying a smallholding might be a good idea. However you would need to bear in mind whether you have or can obtain the skills of a smallholder and whether you are prepared to put up with the downsides, such as having to go outdoors every day whatever the weather.

You could just get an allotment and be in a good position from the point of view of your own food, however you may need to be prepared to defend and secure your crops if law & order breaks down.

Farms nearest to centres of population, with easily accessed markets and shops will be best positioned to profit from the coming turmoil.

MITIGATION & TRANSITION

What are our options for dealing with peak oil?

Once we accept that oil production cannot continue to grow, we are faced with the choice of how to proceed. The easiest option is to do nothing, carry on as we are and hope that a new technology will provide a solution or that the problem will not be a big as predicted. If we are to act there are a number of options open to us but we must decide whose interests we are acting in.

Firstly, we could just act in our own selfish interests and then we can ask do we move to a farm in the countryside, stock up on provisions and the weapons to protect them and so attempt to save ourselves and our family? This is our first option and can be summarised as “The bunker mentality”.

Alternatively we can think of the nation as a whole and about trying to preserve what we have. Then we can ask do we act as a nation, using our present wealth to secure the resources we will need it the future? Or do we choose the most difficult path, and attempt to scale-down our resource use responsibly, and thereby benefit the entire planet? That gives us our second option of heading towards a more sustainable society.

We could even take the interests of the plant a bit further and ask do we choose to change our social and economic structure so that we have a system that is in balance with nature. Perhaps this option is the most radical but could be argued to be the one that will enable us to have a good standard of living in a post peak world.

Why is it important to act now? If we act now, we may damage the economy.

Of course any action we take now will affect the economy, likely for the worse. But this affect must be weighed against the economic effects of the peak itself.

Whichever actions we choose to take, we must act soon. Even the big petroleum companies are predicting a global peak in oil production by 2020, while most independant geologist place it much sooner. We have no why of knowing when the wider effects of the peak will become evident in society, but once they become prominent, we will have missed our chance to prevent them.

Can we afford to be wrong about peak oil?

Any adequate preparation for peak oil will be difficult. On a national level, it will require strict regulatory measures to gradually lower our dependance on oil and gas, reducing our economy and rendering us less competetive globally. Personal sacrifices would also be necessary as car and plane travel was restricted and electricy use cutback. If the predictions are wrong and peak oil does not occur, these sacrifices will have been unecessary.

But the conquesences of wrongly assuming peak oil is "no big deal" are just as costly: once we've passed the peak, it is those countries which prepared beforehand which will be the best-off economically. If are economy is still reliant on today's levels of oil and gas consumption when global production begins to decline, we'll be forced to either pay exorbitant prices for whatever oil is availible or face the economic blow of losing the oil and gas we depend on almost overnight.

Either way, we cannot afford to be wrong about peak oil.

What is the government doing about this?

Far too little. While Sweden is planning to have a 'oil-free' society by 2020, the UK finds it hard enough to begin to put plans into place to mitigate climate change. It may simply be a case of the government's faith in the markets to sort it out, through demand destruction - i.e. job loss, decreasing power usage. Some say that the government is dealing with peak oil through climate change. However, the government won't even really recognise the problem so officially it is not doing anything about it. There is a small but growing number of MPs concerned about it though.

ref: http://www.sweden.gov.se/sb/d/5992/a/51058'

http://www.thelocal.se/article.php?ID=2200&date=20051002

What can businesses do about this?

Businesses provide products and services to consumers with a view to usually making a profit. Whatever business you look at it takes a resource from one source or another and adds value to it some way before moving it on to customers who are the prepared to pay for it.

There will be winners and losers in business. Many businesses will go to the wall not realising that the rules have changed permanently. Others will survive, and others will positively thrive. There will be new businesses that our generation had not previously dreamed of and old established businesses and industries which currently appear to be exceedingly strong will disappear completely. Broadly those that produce or sell necessities for their local communities will thrive and prosper. Businesses that produce or sell luxury items will suffer and probably go out of business altogether.

The general economic trends that we are likely to be looking at are high interest rates, periods of high inflation and periods of low inflation. It is also likely that some things will become un-saleable at any price, so provoking deflation in some areas whilst other items are going up in value. Different parts of the economy will be affected differently. Wages will probably not rise as quickly as the cost of living, and this will lead to unrest in the workforce and a growing number of strikes.

Rising energy costs are currently very much on businesses minds already. Businesses are going to have to accept that higher prices are here to stay and the costs will get even higher. Businesses will have to look at every way possible to reduce their energy costs. The methods for doing this will be via conservation of energy. Hedging against rising energy costs would be beneficial and this could involve signing long term contracts with suppliers or buying energy futures (this will probably be beyond most businesses).

Investing in & controlling renewable sources of energy is another option as if you can generate enough power for your business, you are fixing the price for the long term. The problem with most forms of renewables available to businesses will be their intermittency and businesses need a reliable supply. There is of course some doubt as to whether the grid will be able to provide reliability in the future and this should be factored into business plans.

Some businesses will be tempted to ask the question “can I handle the rising costs of energy in my business?” And answer yes, but without taking into account what is going to happen to their suppliers and their customers and how it will affect their behaviour, the answers given will not necessarily be the right ones.

Customers are going to be spending an increasing proportion of their income on necessities such as fuel and food; this will change what they are able to buy. Customers that are reliant on their cars to get to a business will change where they buy things. They will do other things for entertainment; they may have less time to be entertained.

Businesses may have to find alternative routes to market as their existing distribution systems become to expensive.

Suppliers are businesses in their own right. Suppliers are critical to any business, whether it be raw materials or energy suppliers or computers. If suppliers cannot keep pace with change they may not be around to supply what businesses need for their processes. Security of supply could become a major business issue.

Businesses will need to look at what is happening to their competitors. It is possible that some will be in a better position to cope with the changes than others.

A key question that business should be asking is “can my business survive the coming changes”?

Many businesses will be able to, providing they are in the right business to start with and can manage themselves according to the new rules. They may have to change what they sell, how it is made, where it is made and many other things. It will be essential to plan the business with peak oil in mind.

If businesses can meet this challenge it will be easier for everyone. If businesses fail in a big way it will spell disaster for society as a whole as businesses are currently part of the fundamental fabric of society, and have been since long before the industrial revolution.

Survival will need to be the primary aim for businesses in the future.

What are Tradable Energy Quotas?

It modern society, how much energy an individual or business has access to is limited only by how much they can afford. The most fundamental difference as we pass the peak is that there will be a definite limit on the total amount of energy available—and more importantly there won't be enough for people to use as much as they might be able to purchase. With our present system, this would lead to such a huge increase in energy price that most people would no longer be able to afford any electricity or petrol at all.

One scheme for how we might prevent this involves what are called Tradable Energy Quotas (or TEQs) [5]. The key idea is that every individual and business would be awarded a certain energy "quota" once a month. The quota isn't the energy itself—it must still be purchased normally—but merely an allowance to consume that energy. So each time you fill-up at the pump or pay an electric bill, you'd spend some cash and use up some of your quota.

These energy quotas are called "tradable" because they'd be exactly that. If you didn't require all of your energy quota, you would be able to sell as much as you like to anyone else. Business which require a large amount of energy would need to purchase the addition consumption quotas from people or other businesses which use less.

The advantage of TEQ is that the price of petrol and electricy can be control, as the total amount of quotas awardment would be set to match the amount of energy available. And even if the price of the traded quotas were to escalate due to limited energy supply, this would only affect people and business who consume so much energy that their monthly allotment is insufficient; the majority of people would be able to live without purchasing any extra.

What is the Rimini Protocol?

Similar to the Kyoto Protocol for carbon emissions, the Rimini Protocol lays out a system whereby nations can mutually agree to reduce their oil and gas consumption. It was proposed by Dr. Colin Campbell and the Association for the Study of peak oil & Gas, and signatories must agree to restrict their imports and consumption of oil. Unlike the Kyoto Protocol, the Rimini Protocol is in the very initial stages of refinement and has yet to get widespread attention of governments or the media.

What is the Simultaneous Policy?

The Simulataneous Policy is a way of getting governments around the world to implement hard choices all at the same time. Many governments won't implement a policy because it will harm them if they do it unilaterally but it everyone agreed to do it at the same time, then they would be okay. It is a way for governments to cooperate in solving global problems.

What should government be doing about this?

There are many different things that the Government could do to ease the transition to a post-peak world. To begin with, it needs to recognise the scale of the problem. At present, the Government denies that peak oil is imminent, because it relies on information provided by the flawed studies conducted by the International Energy Agency (IEA).

Once the Government acknowledges the problem, it should begin a process of educating the public as quickly as possible. This would include information about the possible ramifications for the UK and for the rest of the world, and the steps we need to take as a society to minimise the pain. The public must become much more aware of the energy they use, and how they can reduce their overall consumption.

Beyond this, the Government could produce a roadmap explaining how they intend to manage the energy descent, and a set of policy measures for implementing it. These might include:

- Introducing a fixed carbon allowance for each adult, which can be traded between individuals.

- Beginning the process of decentralising power generation, e.g. by funding local grids and micro-generation.

- Legislating very high energy efficiency requirements for new housing, consumer goods, electric lighting.

- Establishing local food production centres, and discourage shipments of food across the country and imports from abroad.

- Declaring a date by which most of the UK's energy will be independent of fossil fuels.

Do we have to change our expectations?

Yes. Things can't continue as they are and we need to have a bit rethink about what we want from the world.

What is the optimum population levels for UK and the World?

That depends on what we want to do as a society. If we try and maintain our current way of doing things then it can be argued that we have already exceeded our optimal population level and we could be heading for a population crash this century. If we were to head towards a more sustainable society, one that is in balance with nature but still a technological society we could still maintain our current levels of population and even have a higher level of population. The Club of Rome, for example, has a world-wide sustainable population level of 8 thousand million people in one of their scenarios.

Although it may be difficult to say what the optimal populatio0n level it would seam wise that we should be heading for a stable population level and zero population growth now. That way we have the possibility of avoiding the worst of any possible population crash or

even avoiding it all together.

Ref: Limits to Growth : the 30-year update by onella Meadows, Jorgen Randers, Dennis Meadows. Earthscan. 2005. ISBN 1-84407-144-8.

Can we change the economic system?

Yes we can. Not only can we but it can be argued that we must or a change will be forced upon us by nature. There are plans for other types of economic systems that have been around for many decades or more. There is, for example, well know systems such as socialism and communism. However, those system have had mixed success. The communist system in the former Soviet Union collapsed and even in communist China elements of a free market has been introduced suggesting that the centralised-planed economy does not work. However, it can be argued that the socialism practised in Sweden in the 1970s and 1980s is an example of a socialist system that did work. However, such systems also suffer form having a sigma attached to them in the West.

There are also other plans for money-less system. These systems such as energy credits of the Technocracy movement in the US and Europe or the cosmic accounting system proposed by Buckminster Fuller use energy as a regulator of the production system (like for example, the money-less society of “Star Trek”). The problem with these systems is they have not been fully evaluated in experimentation or simulation and need more research before we can be sure they can work.

ref: http://www.cjfearnley.com/fuller-faq-3.html#ss3.2

http://www.technocracy.ca/pdfs/Brief29.pdf

A lot of this sounds like things the green movement has been saying.

And others as well. You may well find similarities between the Greens and other organisations who take a more “reality based” view of things. You could say that the greens work from the environment and its physicals limits and then sees how people can bets fit into that. Other parties and organisation are more money centric and the “value of money” is subjective, therefore, it could be argued that such policies, ideologies or plans are based on subjective judgements rather than physical reality.

Nature does not care what race, region or ideology you may have. Nature has her own rules, you either play by her rules or you take what comes!

Can’t we survive without oil?

We have managed to survive with out before and in all likelihood we will managed to survive with out oil in the future. That is we as in the human race, now if “we” was to mean this civilisation then it will probably not survive, certainly not in its current form without oil. However, this society is not the only way we can have a high standard of living not is it the only way we can maintain a technological society. Surviving is one option but we can actually go beyond just surviving and work towards something worth while.

Do we need to change the definition of success?

Yes. If we continue with success being defined by increasing economic wealth, then with this clearly not being possible, will only lead to greater unhappiness. It may be that we want to start thinking about social success - i.e. Gross National Happiness rather than Gross Domestic Product.

Do we need to have an end-game plan?

No, there is nothing that says we must have a plan at all. It could be argued that there was no plan for forming this current civilisation in the first place. It could be argued that this civilisation was formed because of individuals and groups following rules (such as law of the state) and interacting with one another rather than following any sort of plan. However, where would we be if we had followed a plan? What could we achive if we had worked towards a goal? Perhaps we would not be in this situation of facing the possibility of lives ruined and populations crashing? Perhaps if we worked towards a goal and had a plan maybe we could actually build a better society post peak than we built pre-peak?

PERSONAL ACTION

This sounds bad, but why should I worry about it?

Isn't it your world? Your friends? Your family? Your children? Your grandchildren? Isn't it in some way going to effect you? Your standard of living? You don't want to worry about that? Well, maybe you shouldn't worry about it, worry does not get you anywhere. Worry does not help. Besides, it's not all bad. OK, oil will one day be too expensive to use. One day we will be living in a post carbon world, but that world is not necessarily a dystropia. It is not by all means certain that we will end up living in a "Mad Max" nightmare. Think of peak oil from a more positive side. Think of a world that is more locally organised, one that is in balance with nature. We can still have technology base society. One with a good standard of living. Peak oil gives us an opportunity. One where we can start to think about what kind of world we want for our children and our grand children. One we can start building. It is not beyond our abilities to do and the earlier we start the easier it will be. Don't worry, act!

How am I supposed to prepare for this when I have so much else to deal with?

Lack of time for you own survival? Lack of time for your own future? One might wonder about priorities! However, preparing for peak oil and a post carbon world is probably not something that you should be doing by yourself. If at all possible then you should be working with others. Family or those living close to you for example. Sharing the work is one way of giving yourself more time.

If I start giving stuff up, it'll just make things cheaper for others and they'll be able to enjoy it instead. Why should I give things up?

Greed and selfishness will always be with us and it is the nature of cooperation that when the majority benefit there will always be more to gain in the short term by acting selfishly. However, in the long term all will lose. Hopefully, most people will realise that their long term best option is to work together with others. To reduce, reuse and recycle so even though some people will gain by acting selfish most people will still gain overall. Greed and

selflessness are part of human nature and they will never go away. But so is generosity, a cooperative sprit and a willingness to do things for others. Those characteristics will, most like, be the characteristics that will see us though and hopefully enough people will realise that so that we can benefit from working together, despite the minority that will be working against everyone else for their own selfish reasons.

Do I have to go and live in a cave or in a forest?

Most likely, no. It will be very unlikely that that will be the sate we will end up in. The human race has spent most of its existence with out oil. Civilisations have come and civilisations have gone but even when things have been at their lowest people have survived with out haven't to go back to caves or the forest. It is quite clear that we can not continue as we are but that does not mean things will go backwards. Already there are people working on local solutions to a post carbon world, people are forming communities and looking at growing their own food. You could see those as seeds of a future society. Perhaps one that is more in balance with nature? They can be seen as a sign that people will not have to go back to caves but there is a way to live post carbon with a good standard of living.

Should I get a gun or learn self-defence?

Learning self-defence is a wise thing to do regardless of peak oil and there are many good self-defence systems such as ju-jitsu that a person can learn. As for a gun, it is not clear what the situation will be like post peak but it is probably unlikely to deteriorate to that degree. On one hand, as time and finances are limited it would be wise to allocate such resources to more important activities such helping with local solutions. However, on the other hand a gun could be an option if you wish to plan for the worse case scenario. It can also be seen as an unwise activity as more and more people obtain guns it becomes more of a necessity to have one, which then contributes to a deteriorating situation. Not opting for a gun could help keep the situation at a more civilised level.

One compromise position is to obtain a gun for hunting rather than self-defence which can also be used on a farm for activities such as shooting vermin. The gun could then be available if things do go really bad.

ref: http://www.bsdgb.co.uk/

Will people wake up in time?

On the basis of the past we predict the future. Everything was fine yesterday and it is fine today so it will be fine tomorrow. Won't it? There has been plenty of doomsayer in the past predicting the end of the world and they were all wrong so anyone today predicting bad time ahead will also be wrong. Won't they? People like to think things are going well. They don't want to know about problems. They vote for politicians that promise them a better future. Even if there are problems, we will cross that bridge when we come to it. So even if you have all the facts in the world stacked in your favour. Even if the evidence supports your case people won't listen. They are too busy with their own lives to think about something that is depressing. Not until thing start to hurt will people wake up and then they will want to know why was anything done sooner?

Even so, there are people who wake up early. There are people who listen and there are people who act. A world with out oil is not all doom and glom. Peak oil gives us an

opportunity to think about what we are doing and what kind of world we want to live in and people are being to wake up to that. The question should really be are enough people waking up or is apathy going to bring about our doom?

Where can I learn more?

There are many resources available both online and in hard copy form. There are also a number of good organisations that work within areas that are of interests such organic farming, permaculture or seed for planting.

On line resources:

PowerSwitch [6]

http://www.downsizer.net/

http://www.lifeaftertheoilcrash.net/

http://www.communitysolution.org/

http://communitiesofthefuture.org//

http://www.geocities.com/holonicfuture/

Books:

Hubbert's Peak: The Impending World Oil Shortage

Kenneth S. Deffeyes

The Earth Care Manual: A Permaculture Handbook for Britain and Other Temperate Countries

Patrick Whitefield

Beyond Oil: The View from Hubbert's Peak

Kenneth S. Deffeyes

Oil, Jihad And Destiny: Will Declining Oil Production Plunge Our Planet Into A Depression?

Ronald R. Cooke

Oil As a Finite Resource: When Is Global Production Likely to Peak

James J. MacKenzie

Where should I live?

Where you live is, of course, up to you. But factors you might like to consider when deciding where to live are things like:

Distance to work – with ever increasing oil prices the car might become too expensive to use on a daily bases. You might like to move closer to work or somewhere where you could telecommute.

Growing space – food prices might also go up. It might be economical, or even necessary, to grow your own food. That could mean you might want a house with a garden or a place near an allotment.

Other people – some people are already acting. You might want to consider moving to where there are already people preparing for a post carbon world.

Should I have children?

This is essentially and hopefully will remain a personal choice. If you don’t care about the future of the human race then you probably wouldn’t be interested in the consequences of peak oil and are best to go out and party. If you do care, then at the societal level sensible reproduction is not only not at odds with mitigating the worst consequences of peak oil, but is essential for the future of the human race. In fact just a small drop in the overall birthrate, i.e. sensible reproduction, would reduce our population naturally over a reasonably short period. Reducing our population is seen by many as important in order to share out the reduced resources and pull ourselves back from overshoot (please see The Limits to Growth: The 30-Year Update (Meadows, Randers, Meadows ISBN 193149858X June 2004 for more info). However stopping all reproduction would lead to self imposed die-off , which unless all you are interested in is a human free world for all the fluffy bunnies is not the solution.

In short, have children if you like, but not too many.

How should I change my life?

The keywords here are: reduce, reuse and recycle. Something you could do is to try and look at what you use and see if you could reduce you consumption and your eco-foot print. Look at what waste you produce, look at insulating you home or look at just turning down the heating a bit. When you go shopping plan your waste in the shop and think about what goods you buy. Then look at reusing things. If you reuse something it will save you having to buy it again and saves having to throw it away. Many things can be reused such as margarine tubs which can be used for storage, so can glass bottles and jars. Clothes can be passed on to other kids etc. Recycle what you can't reuse. It only takes a small amount of additional effort to throw waste away in a container marked “glass” or “paper” rather than all in one bin. Then those, already sorted, containers can be taken to the local recycling station.

Another thing that you might want to consider is where you buy your goods from. Local produced goods have less of an impact on the environment than goods produced halfway across the world and are then transported to you local shop. The same can be said for buying things that are organic. If you can buy locally, think about doing so (even if it's a little bit more expensive). See if there is a local farmers' market or box scheme in your local area. Support your local shop and even see if you can work in cooperation with your local shop.

What is permaculture?

In essence permaculture is using modern know how along with nature to introduce design into growing and as such achieve sustainable high-yielding ecosystems. The name comes from permanent agriculture.

Permaculture therefore seeks to reduce the overall impact on the environment and not externalise costs. Concepts include the forest garden, renewable energies, natural building materials and energy efficient design, companion planting, diversity of ecosystems, natural fertilizers and natural pest control methods.

The permaculture movement has long been behind reducing dependencies on fossil fuels both because of their environmental impact as well as their lack of sustainability.

If I tell people about this, will they take me seriously?

Probably not. After all, why should they? Everything is fine isn't it? Besides, if things were to go wrong then the government would fix it, wont they? And what do you know about it anyway? If there was a real problem won't the experts be telling us? We don't need to hear it from doomsayers such as you! Now, I will go stick my head back in the sand!

However, that is not a good reason not to inform other people. You can never change people's minds, they will do that to themselves. You can't tell other people what to think but you can inform yourself and then inform others. It is then up to them what they do with the information and most people probably wont take it seriously until things start to hurt them personally. However, sooner or later you will find someone who will take it seriously and then another and then another. There are already a small groups of people becoming informed and informing others who are taking it seriously. Hopefully the number will continue to grow by small actions of individuals who inform others despite most people they meet not taking it seriously.

Where can I learn more about preparing myself?

You could start by learning how to become more self-sufficient in all aspects of your life. Teach yourself some essential skills that will useful to yourself and others. Here are some resources to get your started.

Books

- Save Cash and Save the Planet (ISBN: 000719420X)

- The New Complete Book of Self-sufficiency (ISBN: 0751364428)

- The Earth Care Manual: A Permaculture Handbook for Britain and Other Temperate Countries (ISBN: 185623021X)

Organisations

Centre for Alternative Technology:

http://www.cat.org.uk/

Green Energy Centre:

http://www.greenenergycentre.org.uk/

General self-sufficiency

http://www.downsizer.net/

http://www.inthewake.org/

Case studies

http://www.theyellowhouse.org.uk/

CONCLUSIONS

Can we adapt? Can we survive?

Yes we can, and that is yes to both questions. We have done so in the past and we, no doubt will be able to do so in the future. It may not be easy and it may not be a pleasant experience but we can adapt and we can survive. Lets take the worse case scenario and say that there is a decline in world oil production and that lead to a Total Economic Collapse (TEC). What then? Would that mean that the human race will be extinct? That we would fail

to survive? The human race is intelligent and, although we may not behave rationally all the time, we can analyse and solve problems when we put our minds to it. We may be short sighted and only think of our short-term selfish goals but there are other aspects of human nature. We may live in a socio-economic system that encourages selfishness and greed, but people are also capable of cooperation and self-sacrifice. It is well within our potential to rebuild and adapt to a drastic change in the way we live. People are already doing it. Individuals are working on their own personnel solutions. Groups have been formed to work together for a post carbon world. There is every possibility that we could be seeing the beginnings of a new socio-economic system. One that moves away from placing importance on material wealth, and is instead in balance with nature, focussed on securing our long-term interests.

Maybe in the near future, immediately post peak, there will be suffering due to our lack of foresight and willingness to face up to the challenges that face us but beyond that there is room for great hope. We can actually build a better future but its up to us. The future is built on what we do today. What kind of future do we want for our children and grand children? Let's start building a better future today!

==Useful Things To Know== [Turn into a Glossary?]

What is The Association for the Study of peak oil & Gas?

ASPO is a network of scientists, affiliated with European institutions and universities, having an interest in determining the date and impact of the peak and decline of the world's production of oil and gas, due to resource constraints.

Its mission is to:

1. Define and evaluate the world's endowment of oil and gas;

2. Model depletion, taking due account of demand, economics, technology and politics;

3. Raise awareness of the serious consequences for Mankind.”

ASPO presently has 26 branches around the world.

What is EROEI?

EROEI, or Energy Returned on Energy Invested, is the proportion of energy produced by a resource (such as oil, gas or wind power), relative to the energy required to exploit that resource. It is sometimes referred to as the net energy return.

EROEI provides a simple numeric value for measuring how economical it is to produce a particular fuel source. An EROEI of 1 means that the energy produced by the resource is the same as the energy used in its production. As EROEI increases, progressively more energy can be produced as a proportion to the energy input.

The energy used to exploit a resource is largely dependent on its accessibility and can be highly variable over time. Prospecting, mining, fuel transportation, infrastructure, waste disposal and decommissioning are factors that may affect EROEI calculations.

In the early days of oil exploration production costs were low, because oil was discovered in shallow basins that did not require the drilling of deep wells. This meant that the EROEI was often more than 50. EROEI has steadily decreased since that time, and will eventually reach the point where it is no longer economical to extract it, at least for use as simple energy.

A 1984 study found that nuclear energy from light-water reactors had an EROEI of about 4 [1]. By comparison, the Danish Wind Energy Association claims that during its life time a wind turbine delivers 80 times more energy than is used in its production, maintenance and scrapping [2].

Note: EROEI is occasionally quoted as the difference between the energy returned and the energy invested, rather than the ratio of these two figures. In this case, negative EROEI values correspond to a net loss of energy and positive values correspond to a net gain.

[1] Energy and the U.S. Economy: A Biophysical Perspective. Cutler J. Cleveland; Robert Costanza; Charles A. S. Hall; Robert Kaufmann. Science, New Series, Vol. 225, No. 4665 (Aug. 31, 1984), 890-897.

http:/ / www. ker. co. nz/ pdf/ Energy%20and%20the%20U. S. %20Economy-%20A%20Biophysical%20Perspective.pdf

[2] http://www.windpower.org/en/didyouknow.htm

What are the laws of thermodynamics?

[Check accurate, and link to internet resource? Incorporate slide on p.7 of 1st chapter?]

Thermodynamics is a branch of science that studies heat and its movement through systems. Heat is energy on the move so it’s an important area of study for anything that involves energy. Thermodynamics can be summed up in three laws.

The first law basically says that the increase in the amount of energy in a system is the same as the energy added to the system plus the losses. As no system is perfect you will lose some energy when you add energy to a system so you will need to add a bit more to cover the losses. Another way of saying that is to say the energy is conserved.

The second law says that you can’t get energy from nothing. So if you take the energy output from a system and feed it into a system the system will run down and come to a stop. This is because what you take out is a bit less than what you put in because the system is not perfect and you lose some energy in the system.

The third law states that as the temperature of a system approaches absolute zero (-273°C), the available energy of that system approaches zero.

What is entropy?

Entropy is a term used to describe the energy in a system which is not available to use. If we take the example of a wind-turbine, the turning propellers generate rotational kinetic energy—which is use to power a generator and produce electricity—but they also generate heat due to friction. This heat energy cannot be used, and is therefore included in the entropy of the windmill.

The second law of thermodynamics (above) is a result of this kind of entropy. It says that in any process, a certain amount of useable energy must be converted to entropy and lost. If the system is to continue to function for a indefinite period of time, sources of fresh energy must be found to make up for that lost due to entropy.

What is emergy?

Emergy is a contraction of the term embedded energy. “It evaluates the work previously done to make a product or service. Emergy is a measure of energy used in the past and thus is different from a measure of energy now.”

http://www.mnforsustain.org/emergy_odum_howard_t_emergy_evaluation.htm

It brings into account the true energy and environmental cost of a product or process. It is very useful for, among other things, evaluating alternatives to primary energy sources. For example, when assessing a solar power, you don’t just look at how much energy it produces and how much it cost, you look at the total amount of energy used in the process of constructing and installing that solar panel, and also the environmental impacts which are often not included.

What is fractional reserve banking?

“Fractional-reserve banking is the near-universal practice of banks retaining only a fraction of their clients' deposits and notes as reserves to satisfy demands for withdrawals, investing the remainder in loans to generate income. Clients would normally receive a proportion of this income via interest on their deposit. Inflation, partly caused by fractional-reserve banking increasing money supply, would reduce a client's capital growth in real terms.” This creates the risk of a ‘bank run’ when demand depositors and note holders attempt to collectively withdraw more money than the bank has in reserves, causing the bank to collapse.

http://en.wikipedia.org/wiki/Fractional_reserve_banking

This is important to understand because during the first half of the age of oil banks created money by lending more money than they had on deposit due to confidence that tomorrow’s expansion would pay for today’s debt. Because oil is the principal driver of economic growth, the decline of oil undermines that belief. This in turn erodes the value of most organizations quotes on the stock market.

http://www.energybulletin.net/5944.html

Evidence is emerging that progress can no longer be taken for granted. Growth may be coming to an end. Since our entire financial order — interest rates, pension funds, insurance, stock markets — is predicated on growth, the social and economic consequences would be severe and widespread.

http://www.timesonline.co.uk/article/0,,2099-1813695_1,00.html

Will banks be so willing to lend money without the confidence they will be repaid? Will interest rates shoot up causing people to default on their loans and mortgages, increasing the problem?

This book was developed by the members of the PowerSwitch UK Peak Oil Action and Awareness Community. http://www.powerswitch.org.uk

References

[1] http://online.wsj.com/article/SB119543677899797558.html?mod=hpp_us_whats_news
[2] http://news.ft.com/cms/s/fb775ee8-8d0e-11da-9daf-0000779e2340.html
[3] http://www.willyoujoinus.com/
[4] http://en.wikipedia.org/wiki/Geothermal_power
[5] http://www.teqs.net/
[6] http://www.powerswitch.org.uk/

Article Sources and Contributors

Peak Oil: High Tide for an Oil Addicted World *Source*: http://en.wikibooks.org/windex.php?oldid=1501821 *Contributors*: Biffvernon, Dallas1278, Mike.lifeguard, PSJ, SunnyJim, Swift, Whiteknight, 22 anonymous edits

License