1. Population trends

Slide 2 shows the trend in global population over the past 2,000 years. Numbers were increasing gently mainly thanks to improved agriculture techniques until the beginning of the industrial revolution and the dawn of the fossil fuel age.

The relationship between fossil fuel consumption and population growth is clearly demonstrated in **slide 3**. It is tempting to think of population growth as driving energy consumption. The reality is the exact opposite as it is only by accessing the vast quantities of energy stored within the earth that population has been able to rise in an exponential fashion.

In particular, food production is now heavily dependent on fossil fuel. Before industrialisation, to increase food production, you had to increase the acreage under cultivation, and displace your competitors. There was no other way to increase the amount of energy available for food production. Human population grew by displacing everything else and appropriating more and more of the available solar energy.

The mechanisation of agriculture allowed more land to be cultivated using less labour while land to feed draft animals was no longer required. Subsequently, oil-based pesticides and natural gas based fertilizers have allowed food production to soar way beyond the organic capacity of soils. In pre-industrialised times the energy input (from human and animal labour) into food production was close to the energy produced. Today the equivalent ratio for the average US citizen is 10:1 thanks to fossil fuels. It is no exaggeration to say that we eat huge quantities of fossil fuels (**Slide 4**).

As a result of this our food production is hugely dependent on fossil fuels. Any reduction in fossil fuel production would have major implications for global population, which is optimistically assessed at around 2 billion based on totally organic food production. Indeed fossil fuels have allowed parts of the world to support huge populations where previously virtually nobody lived e.g. Saudi Arabia (**slide 5**), Las Vegas.

In the UK, our population has increased six-fold within 200 years (**slide 6**). We are now one of the biggest importers of food in Europe.

One other important point to note is that additional food production has not just fed a growing population but also people, on average, are eating more as shown in **slide 7**. Food waste is also a growing phenomenon with 30% of food purchased in the UK thrown away. Clearly there is scope for per capita food consumption to fall back to previous levels. Unfortunately, the people who are eating more are also the wealthiest people who are least likely to cut back voluntarily.

As population expands and consumption patterns grow we are putting more and more strain on natural resources. One of the most important manifestations of this is climate change.

2. Climate change

The logic behind global warming is relatively straightforward. Greenhouse gasses such as carbon dioxide allow heat to reach the surface of the earth but some of that heat is then trapped. The higher the concentration of greenhouse gasses in the atmosphere the more heat is trapped and the more the earth warms up.

So what are the latest scientific projections as to the status and implications of climate change.

The latest measures of carbon dioxide concentration show that levels are way above their historic norms at 382 parts per million compared with the pre-industrial level of 280 ppm (**slide 9**). Scientists say that this explains the rise in average global temperatures of 0.8 degrees over that period. However, there is a significant time lag before greenhouse gasses begin to affect the climate. Best estimates put that at 25-30 years (**slide 10**). Based on emissions over the last 30 years the average global temperature is therefore expected to rise by 1.5 degrees above pre-industrial levels.

Furthermore, the scientific consensus holds that an increase of 2 degrees marks a watershed and threatens unstoppable climate change. At this stage "positive feedback" loops are set to kick-in such as:

- Irreversible melting of the Greenland ice sheets
- Collapse of the Amazon rainforest
- Widespread melting of the Siberian permafrost

Under this scenario, human reaction to climate change becomes irrelevant and temperatures soar way above pre-industrial levels.

The following figures indicate the average probability of reaching an increase of 2 degrees. These figures are broadly supported by the intergovernmental panel on climate change (IPCC) which itself uses a slightly different method of measurement:

400 ppm = 28%
475 ppm = 64%
550 ppm = 82%

Remember the current level is around 382 ppm and is rising by 1.5-2 ppm per annum.

So the science is telling us that to stand a reasonable chance of avoiding catastrophic climate change we need to stabilise greenhouse gas concentrations at just over current levels.

To date, the most stringent targets adopted (by the EU and the Swedish government) is 550 ppm. This represents a near certainty of breeching the 2 degrees threshold.

In other words, even the most stringent targets that have been set (for which no serious policy solutions have been established) are woefully inadequate based on the latest scientific projections.

Governments are fully aware of this contradiction as evidenced by the following:

"with an atmospheric CO2 stabilisation concentration of 550ppm, temperatures are expected to rise by between 2°C and 5°C"
DEFRA, 2003. The Scientific Case for Setting a Long-Term Emission Reduction Target.

"a limit closer to 450ppm or even lower, might be more appropriate to meet a 2°C stabilisation limit."
HM Government, March 2006. Climate Change: The UK Programme 2006.

"to have a reasonable chance to limit global warming to no more than 2°C, stabilisation of concentrations well below 550 ppm CO2 equivalent may be needed."
Council of the European Union, 11th March 2005. Information note 7242/05.
http://register.consilium.europa.eu/pdf/en/05/st07/st07242.en05.pdf

It should be noted that all countries signing up to the IPCC have committed themselves to preventing "dangerous climate change".

To make matters worse, the very latest scientific papers suggest that even the IPCC calculations are on the optimistic side. **Slide 13**.

3. Resource Issues – Peak oil and the threat to economic security

Clearly the earth is finite and as population expands and consumption patterns increase resources become increasingly strained. People are familiar with concerns over fish stocks (**Slide 15**) and water resources (**Slide 16**). According to the United Nations, around 1.2 billion people live in areas of physical water scarcity, and 500 million more are approaching this situation, partly due to increasing drought brought on by climate change.

As we have seen, energy and especially oil has been fundamental to the explosive growth in human population. It is also essential to modern economic processes. Oil accounts for 43% of the world's total fuel consumption Over 90% of global transportation depends on oil. Aviation and shipping are totally oil dependent and, without oil, the global economy would literally implode. Our way of life is quite literally lubricated by millions of years of condensed sunlight.

Up until recently we have been accustomed to a cheap and expanding supply of oil. However, things are starting to change and this change will have dramatic consequences for all of us. This change is known as "peak oil" and this is a term you will hear a lot more about in the coming decade.

Peak oil refers to the maximum amount of oil that is ever produced (**Slide 17**) after which output goes into terminal decline (**Slide 18**). This is not a controversial theory. Indeed most of the world's oil producing countries have passed the peak in oil production. This includes the USA (**Slide 19**) where output peaked in 1970 and the UK where output peaked in 1999 **(Slide 20**) and Britain is now a net importer of oil. This puts us in a very vulnerable position should any disruption emerge to global oil supplies. It also raises questions as to how wisely we have managed our natural resources. World-wide, two-thirds of the oil producing nations are past peak (**Slide 21**).

A key question is when will the world as a whole hit the peak in oil production. **Slide 22** shows the scale of the emerging problem. Oil discoveries peaked in 1964 and have been on a downward trend ever since. At the same time, oil consumption has been trending ever higher. We now consume up to 5 barrels of oil for every barrel we discover. Clearly this is unsustainable especially as China, with 20% of the world's population is rapidly expanding its consumption of oil.

The range of estimates among most analysts is 2005-2018. The reason for the confusion is that nobody knows how much oil there really is. OPEC reserves are widely believed to be inflated as output quotas are determined by the amount of each country's reserves. When this system was introduced in the 1980s OPEC's published reserves doubled virtually overnight and have remained virtually unchanged since despite the vast quantities of oil produced in the meantime.

Unfortunately, just about the only organisation that accepts these figures is the International Energy Agency on which most government's including our own depend on for estimates of future energy supply. According to the IEA global oil production will rise by 70% by 2030. Most other observers believe we will peak long before then. Furthermore, the rate of consumption in oil rich countries is rising rapidly which means less is available to export. Consequently, peak oil is probably a reality today for oil importing nations.

So why does this matter?

Few countries are more vulnerable to declining oil supplies than the USA. In 2005, the US government commissioned a report entitled "Peaking of World Oil Production, Impacts, Mitigation and Risk Management" The summary of the report warns that "as peaking is approached, liquid fuel prices and price volatility will increase dramatically, and, without timely mitigation, the economic, social, and political costs will be *unprecedented*. Viable mitigation options exist on both the supply and demand sides, but to have substantial impact, they must be initiated *more than a decade* in advance of peaking." [Emphasis added.].

Given the recent trend in oil prices it may already be too late (**Slide 24**).

In Britain, public investment is still heavily geared to high-carbon, energy intensive activities. It isn't just the doubling in air capacity by 2030 or the 400km of new roads planned over the next decade. Retail investment is heavily skewed towards energy hungry supermarkets with their associated food mils and car-dependency. Housing developments have hopelessly inadequate energy efficiency standards that aren't even enforced.

The UK government does not accept that future oil supply poses a serious threat and is making little effort to reduce our oil dependency. Compare this with Sweden where it is national policy to achieve zero oil dependency by 2020 or Denmark where the last oil crisis in 1979 prompted a massive investment in renewable technology and in oil free transportation.

To date, the impact of peak oil in Britain has been modest. Within reason, wealthy countries can afford to pay increased costs for energy with relatively little hardship.

As usual it is the poorest who suffer most. Take this recent example from Senegal:

> "Senegal has increased the price of electricity by 15 percent, infuriating consumers already angry with the government after months of chronic power cuts. Regular blackouts, lasting days in some areas, have disrupted the economy and fueled public anger. **The power cuts are largely due to problems purchasing increasingly expensive fuel to run oil-fired generating plants**. Residents deprived of fans and refrigerators during the hottest part of the year, when daily temperatures rise above 90 degrees, were shocked by an unannounced price increase on their latest electricity bills. "

New York Times, October 2006

Thingsa made from oil **(Slide 26**)

4. Our response

Given the gloomy prognosis surrounding climate change and the lack of preparation for peak oil, how should we as individuals, as communities respond?

I'd like to give 2 examples from recent history of countries that have suffered a sharp reduction in oil supply.

When the USSR collapsed both Cuba and North Korea lost access to over half of their regular supply of oil. In Cuba, the government instigated a crash programme to reduce the country's oil dependency. Despite the initial disruption and hardship a decade later:

80% of food grown in Cuba is organic
60% of Havana's food is grown within the city
Rates of diabetes, obesity and heart disease have fallen significantly, largely due to increased walking, cycling and a more healthy diet
Cuba is now Latin America's biggest exporter of organic pesticides and fertilisers.

North Korea's closed society makes it hard to know exactly what happened but a collapse in food production and general economic activity lead to widespread famine in which it is estimated that between 1-3 million people died.

Cuba embraced it's own version of peak oil and built a stronger, healthier community. North Korea shrank.

Slide 28

In Britain there is a growing network referred to as "Transition Towns" which seek to bring about a positive local response to the challenges of climate change and the end of cheap oil.

Slide 29

In essence the transition network aims to rebuild communities. The first step on this journey is to recognise the challenges and threats posed by climate change and peak oil. We need to make the mental adjustment that accepts that we will have less energy available to us in the future and we need to rearrange our world accordingly. All attempts to perpetrate the myth that our lives will continue to develop in the future as they have done in the past will simply make the inevitable adjustment to a low carbon lifestyle all the more painful.

In other words we need to deal with reality or reality will deal with us.

Slide 30