Reading : Resource Depletion – Oil and Phosphate

Course : Green Economy – Start-up Series

Generating Ideas

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Peak Oil

Our oil reserves were formed in two periods, 90 million and 150 million years ago. Yet we have consumed more than half of these reserves in around 150 years. The world consumes around 85 million barrels of oil each day (about 40,000 gallons per second) and demand continues to grow. Oil (and natural gas, which was formed at the same time as oil and in a similar way) is a finite natural resource, subject to depletion. This means that production begins in any country or region after reserves are discovered and ends when the reserves are exhausted. The peak of production is passed when approximately half the total has been taken.

The peak of oil discovery was in the mid 1960s and in 1981, the rate of use passed the rate of discovery of new reserves with the gap between discovery and production widening ever since. Despite many uncertainties in relation to the reporting of oil reserves, it is evident that the world is now entering a period when this resource begins to decline due to depletion. The exact date of peak oil production is difficult to ascertain but it is probably irrelevant when the real issue is how the human race comes to terms with the transition to a period of declining oil production.

Access to potential oil reserves in the high arctic has, ironically, been made possible by sea ice melting due to climate change!

One consequence of man's addiction to oil and the imminent decline in production has been the rush to find oil reserves in ever more difficult and dangerous places. There is currently pressure to find and exploit reserves in the high arctic, which has, ironically, been made possible by melting sea ice due to climate change caused by burning fossil fuels.

Other sources are coming under exploitation pressure

The same pressures are leading to the exploitation of 'unconventional' sources of oil and other fossil fuels such as the 'tar sands' in Northern Canada and shale gas in other parts of North America and Europe. These resources are much more difficult and expensive to exploit and can lead to other serious environmental and social issues.

Forecasters predict oil prices will continue to rise

Perhaps the major consequence of peak oil is the increase in the price of oil as it becomes more difficult to recover oil from existing reserves, as new reserves become scarcer and as the quality of oil found declines. The price rises we have seen since the global financial crisis in 2008 are not likely to be reversed. There may be short-term fluctuations but the trend is likely to remain upwards which will have major implications for the global economy as this is based on access to (relatively) cheap oil.

Peak Phosphate

Worldwide, 158 million tonnes of phosphate rock are mined each year, mainly for use in the production of agricultural fertilisers but, like oil, the supply is finite. Recent analysis suggests we may reach 'peak phosphate' production in 2033 after which, supplies will decline and the resource will become increasingly scarce and expensive. Phosphorous is an essential nutrient for all plants and animals.

Phosphorous is essential to plants and is second only to nitrogen as the most limiting element for plant growth

An adequate supply of phosphorous is essential to plants for seed formation, root development and plant maturity. It is second only to nitrogen as the most limiting element for plant growth and it cannot be substituted in food production. Under natural conditions, the phosphorous taken up by growing plants is returned to soils in plant residues and from the urine, excrement and carcasses of the animals that have grazed the vegetation.

We need to guard against removing phosphorous

In cultivated agricultural systems, some of the phosphorous taken

from the agricultural cycle

up by the crop is removed at harvest and then eaten directly by humans or fed to livestock. Therefore it is necessary to return the phosphorous to the soil in a form that is immediately available to plants, or to be stored for later release. Historically, phosphorous was returned to agricultural land through the application of animal manure and human excreta. More recently, especially in industrialised agricultural systems, phosphorous is provided by artificial fertiliser produced from phosphate rock. Without this, it is estimated that the production of wheat from conventional agricultural systems may decline from current levels of around 9 tonnes per hectare to less than 4 tonnes per hectare.

The availability and cost of phosphorous is one of the key factors that will limit crop production

Crops grown in conventional, non-organic agricultural systems have been bred to rely on high levels of artificial fertiliser to give high yields. So, the availability and cost of phosphorous is one of the key factors that will limit crop production in the future.

Phosphate fertilisers have a strategic importance

In 2009, China was the world's largest producer of phosphate rock, producing around 35 per cent of the total. The country holds one of the biggest known reserves. The Chinese government recognises the strategic importance of phosphate fertilisers and since 2008 has imposed a tariff on exports. This will affect the price and availability to other countries.

Significant reserves of phosphate rock have recently been discovered beneath the North York Moors National Park in the UK. When planning permission is sought for exploiting this resource (as it inevitably will be) it will be interesting to see how the tension between economic growth and protecting the natural environment will develop.

Mining phosphate rock has a significant environmental impact

Mining phosphate rock also has significant environmental impacts. The fertiliser is produced by dissolving the rock in sulphuric acid to produce phosphoric acid. For each tonne of phosphoric acid produced, 5 tonnes of phosphogypsum, an unwanted by-product is generated and due to naturally occurring uranium and radium in the ore, this is toxic and radioactive.

In addition, the mining, production and trade in artificial fertilisers is dependent on cheap oil supplies. The process is very energy intensive and the emissions of carbon dioxide and contribution to climate change are significant.