Population Review

Volume 44, Number 1, 2005

Type: Viewpoint pp. 75-76

Fossil Fuel Depletion Will Reverse the Population Explosion

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Empires and civilizations emerge, peak and collapse, over time scales usually measured in centuries. The rise of Western civilization as we know it began with the Industrial Revolution in the mid-18th century. It is characterized by material prosperity based on the ready availability of cheap energy, mostly in the form of fossil fuels. It may now be peaking, with Westerners consuming lavish amounts of the most convenient fossil fuel, oil. Britons get through 10 barrels of oil per person per year, and North Americans use up more than twice that figure. For most Third Worlders, by contrast, individual consumption is normally a tiny fraction of one barrel.

The benefits of Western civilization have spread around the world, allowing the human population to explode. It had risen slowly and painfully to about 0.6 billion in 1750, only to shoot up to 6 billion by 2000. Mechanized agriculture with artificial fertilizers, disease control by modern medicines, and the imposition of peace on warring tribal societies by colonizers, are responsible. There is usually enough food to eat, and life expectancies have risen steadily (until the advent of HIV/Aids in Africa).

Why then is Western civilization peaking? Populations tend to explode when a critical resource becomes available, and collapse when it is used up. Saint Matthew Island in the Bering Sea was overgrown with reindeer moss when 29 reindeer were released there in 1944. With no predators, the herd grew to around 6000 animals in 1963, and then collapsed. They had eaten all the moss. A few Polynesians reached Easter Island in the South Pacific about 900 AD. They found it densely forested, with good timber for all purposes, especially deep-sea fishing canoes. When the last trees were felled in the 1600s the population had risen to around 15,000. It then collapsed amid clan warfare, squalor and cannibalism.

Western civilization's critical resource is fossil fuel in the form of coal, natural gas, and especially oil. In this year of 2005 the global demand for oil appears to be exceeding the ability of depleting oilfields to supply it. Despite feverish drilling activity, for every new barrel of oil discovered, 3 or 4 barrels are consumed. The price of crude is rising, and will rise faster as scarcity becomes obvious. Personal transport will become a luxury item. Any population that is unable to afford agricultural machinery, fertilizers and medication will start a painful decline.

Westerners assume, in ignorance, that science and technology will provide all the energy necessary to replace fossil fuels, from renewable sources. They will not, for one simple reason. Essential materials like steel, concrete and plastics are plentiful and cheap today because we produce them using plentiful and cheap fossil fuel energy. But when renewable electricity is the only energy we have, they will be seriously scarce and expensive.

Suppose that in 2150 you want to construct a wind turbine requiring 100 tonnes of steel. The iron ore must be dug from a mine, concentrated, transported to a blast furnace, smelted with limestone and charcoal, transported to a mill where it is fabricated into

components, transported to the site and erected, all without the benefit of energy from fossil fuels. Only electricity and biofuels are available. Certain alloy metals such as nickel, chromium and tungsten are rare and more expensive to produce. The same high costs apply to the concrete and plastic used in the turbine.

During its lifetime, will the turbine generate as much energy as went into procuring and fabricating its components, and carrying out regular maintenance? The answer may well be no, unless the turbine is favorably located in relation to industrial centres and the sources of raw materials. Electricity is not a convenient form of energy as regards road transport. According to Walter Youngquist (The Post-Petroleum Paradigm --and Population, 1999) "A gallon of gasoline has the same energy content as one ton of conventional electric storage batteries". Such a massive energy imbalance is not susceptible to a simple technological solution, at least at present.

Before the Industrial Revolution, humankind had a few windmills, watermills and sailing ships, but biomass in various forms supplied most human needs. Plants and animals provided food, clothing, constructional materials (timber) and energy for heating, agriculture and small-scale industry. High-grade metal ores were still to be found here and there at the earth's surface. Most of the world's half-billion people were poverty-stricken by our standards, scratching a living by their own muscle power and that of their domestic animals.

If, in the post-fossil-fuel era, one or two centuries into the future, technology is of limited value because of the high material cost of capturing renewable energy, we may once again have to rely on biomass. This will be mainly wood, because forests will grow without the annual energy input (sloughing, sowing, fertilizing, weeding etc.) that specialized biofuel crops require. Given that the human standard of living depends on the availability of energy, the ratio of forests to cropland will have to be very high, perhaps as high as ten to one.

I have calculated an optimum population for the United Kingdom, based on energy from biomass, mainly coppice woodland. To live fairly comfortably (better than 'scratching a living') the population should not exceed about 2 million. This compares with 60 million today. On the same basis, world population would need to decline from 6.5 billion to around 0.2 billion.

During the one or two centuries of adjustment to a lower population, as fossil fuels are used up, hard and politically incorrect decisions will have to be taken. The years ahead will be, in the terms of the old Chinese curse, "interesting times".