

Chapter 1

A New Outlook and New Resources

A Brief History of Mankind

I want you to read this so that you have a good idea of the problems that are facing human beings in modern technological society, and understand how urgent it is to solve them.

What aim or purpose do we have in mind as we live our daily lives? “To be comfortable and well off” might be one answer. This demands the follow-up question, “What do you mean by comfortable and well off?” To which many people would probably reply something like, “To have your own house, buy a car, eat well, and go on holidays abroad.”

This, at least would be a typical answer from someone in modern Japan, or any other country in the modern industrialized world. It is an answer that shows what many people live for these days, what they find important in their lives — in other words, their sense of values. Of course, the sense of values varies from individual to individual, but it would seem that there are not so many people in the modern world — the industrialized nations, that is — whose aims in life differ greatly from this.

The sense of values that rules the lives and actions of people throughout the industrial world, to be comfortable and well off, can be expressed in another term: material wealth, or materialism, which is the pursuit of material wealth. Materialism has one major characteristic. That is, the more each of us tries to acquire, the more materials and energy are required. This leads to an ever-increasing demand for materials and energy.

But we must remember that this sense, so common in the modern world, that places value on higher and higher consumption is actually not that old. In turbulent medieval times, for example, ordinary people must have wished for a life of peace and security rather than any material wealth. In this way, our sense of values changes over time and with developments in society.

It may be difficult to find out exactly how people’s senses of values have changed through history. But to some extent we can calculate how their material wealth has changed, and how much energy has been used for that purpose. For not only can we work out how much energy has been consumed as food, but we also know that as material wealth increases, increasing

amounts of energy will be needed to create that wealth.

About two million years ago, there appeared a primitive Man — an ape-man who could walk on two legs and use his hands, and had the intelligence to make simple tools (Figure 1). His energy consumption was no more than was needed for basic biological survival, and is believed to have been around 3,000 kilocalories a day (Figure 2). His energy needs, therefore, were no more than those of any other animal, and nothing could have been further from modern materialistic society than this totally natural existence of our early forerunner.

It has been about 500,000, or half a million, years since the appearance of a humanoid who walked upright, and 200,000 years since the appearance of what is considered to have been our direct ancestor. Our present species, *Homo sapiens*, did not come on the scene until 30,000 years ago. Then we survived by chipping stones to make tools and weapons, which we used for hunting animals and gathering vegetable foods. It was a period called the Old Stone Age, or Paleolithic Era, when the world was warm, blessed with sunlight and water and covered with forests. The human population grew to around three million, and it is estimated that daily per capita energy consumption rose to 5,000 kilocalories or so. Material wealth was already on the increase. It had taken almost two million years for that primitive ape-man

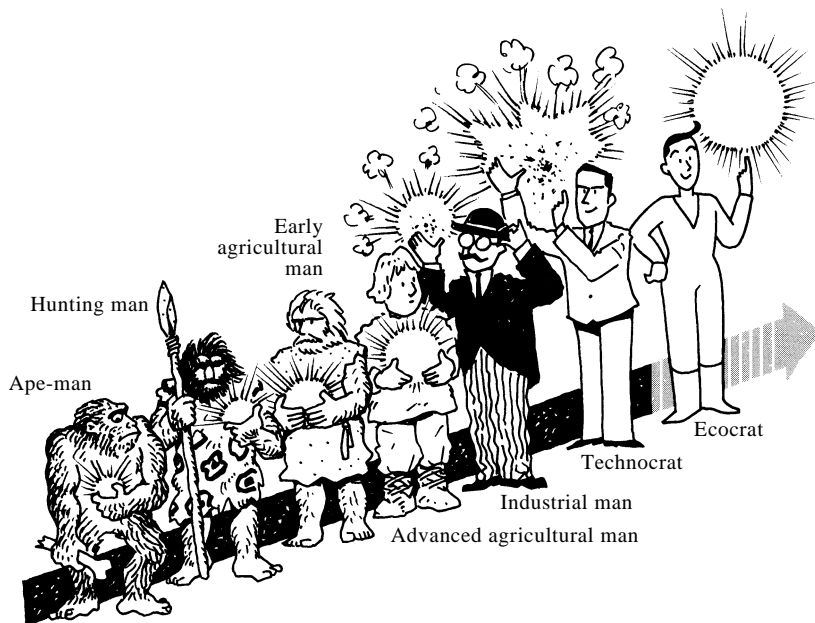


Figure 1. The cultural evolution of mankind

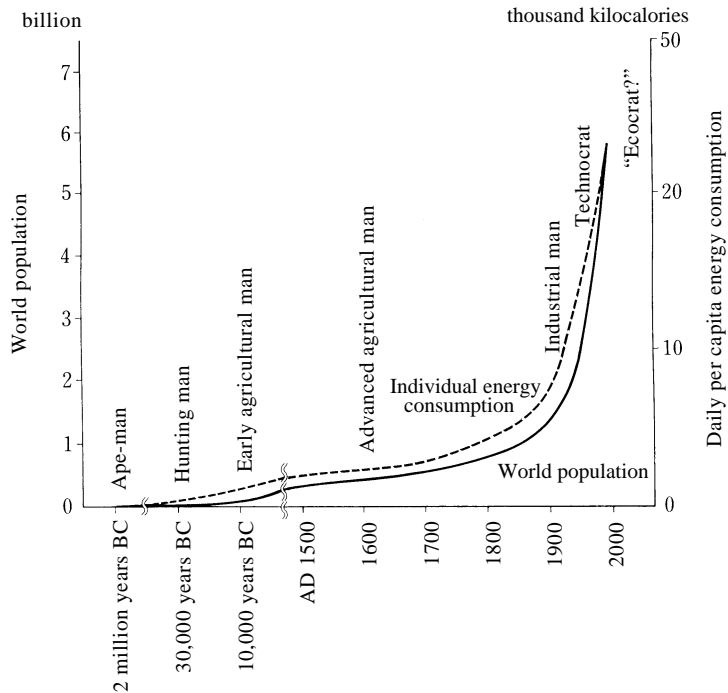


Figure 2. Changes in world population and daily per capita energy consumption

to evolve into Paleolithic Man, whom we might call Hunting Man.

Later, about 10,000 years ago, crop-growing and livestock-breeding began: at last a steady supply of food could be had. While up till then people had been constantly on the move in search of food, they now began to settle on the land. This in turn gave them more time to work on their stone implements, and produce gradually more sophisticated ones. This period is called the New Stone Age, or Neolithic Era, because it was an era of developing new tools, new skills, new methods. New resources, and new uses for them, were discovered, too.

Following these revolutionary changes in life and culture in places such as Mesopotamia and parts of Africa, world population rose again, to 30 million; daily per capita energy consumption reached 12,000 kilocalories. So the transition from Hunting Man to Early Agricultural Man, as we might call this next stage, was relatively rapid, compared with the previous pace of change. Even so, it still took around 20,000 years.

As agricultural production increased, technology and culture progressed; villages became towns, and towns, cities. As organizational structures to unite these groups of settlers were developed, city-states, or small independent

states based on the city as a unit, came into being. The Babylonian dynasty, which had started out from one of these city-states, is believed to have united all of the city-states of Mesopotamia into one nation under its control in 2169 BC. This was yet another step toward political sophistication.

By the time of the birth of Jesus Christ, constant improvements in agriculture and other skills had contributed to an increase in the world's human population to 250 million. This doubled to 500 million by about the year 1650, when daily per capita energy consumption had risen again to 26,000 kilocalories. It had taken 5,000 years for Early Agricultural Man to evolve into "Advanced Agricultural Man," the state of human civilization on the threshold of the Industrial Revolution.

In late 18th century England, coal was first used to provide the energy to make steam, which in its turn was used to drive engines. These early engines drove spinning machines for cotton, which meant that what had always been manual work was suddenly transformed into work that could be done by machine. The Industrial Revolution really did revolutionize industry. Large factories, capable of producing large quantities, sprang up. Society, which for so long had been based on agriculture, invested vast amounts in machines and factories as a new base for its production.

Society was further transformed as a result of the German Professor J. Liebig's discovery of how to enhance agricultural yield by using artificial fertilizer which can be produced artificially in a factory. Once this came to be used in agriculture and food production increased, then population could increase further, too. And even greater numbers could work in the factories. With the industrial production of fertilizers and the subsequent rapid rise in agricultural productivity, the first stage of the Industrial Revolution was complete.

As industrial activity expanded, society became more and more complex, and more and more materialistic. But while mankind had previously always existed in a kind of harmony with the natural environment, the danger arose that those natural bounds might be overstepped. World population soared: one billion (That's a thousand million, or a one followed by nine zeroes.) in 1850; one and a half billion in 1900. What's more, energy consumption soared, too, to 77,000 kilocalories per person per day. "Industrial Man" had taken only a few thousand years to replace Agricultural Man.

Expanding populations and growing materialism have led to clashes among nations, including the two World Wars of the twentieth century. These wars themselves have spawned yet more advances in science and technology, based on yet more inventions and discoveries. Greater and greater amounts of energy, from coal, then oil, and then nuclear power, have been consumed.

Thus mankind, armed with so much technical knowledge, numbered

two billion in 1930, or half a billion more than just 30 years before that. In 1981, there were 4.6 billion of us, or more than double the number 50 years previously. At 230,000 kilocalories, a modern person's daily consumption of energy had reached 100 times that of our primitive forebears. Industrial Man had been replaced by "Technological Man", or what I shall call the Technocrat.

Subtract the energy required for biological survival from the total consumed by the Technocrat, then compare that amount with that consumed by primeval Man, and you will see that the difference is almost infinite. Then remember that it took only a hundred years or so for the Technocrat to "evolve" from Industrial Man.

There are now about 6 billion of us, each requiring incomparably more energy than any other animal. Multiply the daily per capita consumption by the total population, and you have an incredibly huge amount, which is bound to rise yet further as we become more materialistic, and as the population continues to increase. The world is no longer big enough for us. The demands of individuals and nations are straining Spaceship Earth.

We need yet another new kind of human being to support this all-consuming society, to find and guarantee new resources and to use them effectively. This new type of person must be not only a Technocrat but must also have a determination to restore our harmony with the natural environment. I will call that kind of person an "Ecocrat", and I believe that we all, every single one of us, have to cast off our old skins and be reborn as Ecocrats.

The Search for New Resources

Any further human progress is going to require sufficient resources to support it; moreover, we shall need to consider very carefully how to use them. The earth is already like an overmanned spaceship, and what we have to consider is how those resources can be safely used inside Spaceship Earth. We must also remember that these new resources must exist in sufficient quantities to support such a large population.

When we hear the word "resource", we think of it as something bright and promising. In Webster's New World Dictionary, it is defined as "something that lies ready for use or that can be drawn upon for aid or to take care of a need," which seems to suggest that resources are things that we have used in the past, and can continue using in the future.

It is true that we have developed and used various things as resources — for example, coal and oil. But before their value as resources was recognized, they were despised — one as a smelly kind of rock when it burned, and the other as a goeey, worthless liquid. So for a long time coal-

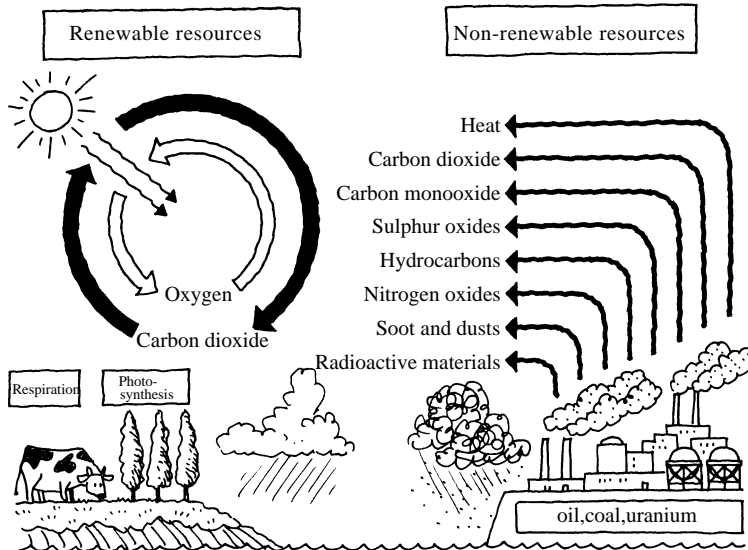


Figure 3. Renewable resources leave no waste, and are kind to the environment.

and oil-fields were left unused, and ignored.

In other words, unless we know how to use a resource, it is not a resource. Which leads us to imagine that all around us there might still be many new, exciting resources to be discovered. Or there might be resources whose value we recognize but which cannot yet be fully exploited because the technology for it is not advanced enough — solar energy, for example.

All sorts of things are covered by the word “resources,” but they can all be separated easily into two categories: whether they can be reproduced by nature, or not (Figure 3). Coal, oil and so on cannot: they ought not to be wasted. Agricultural crops, on the other hand, can be naturally reproduced: the seeds of corn and other annual grain crops return to the soil to repeat the process of growth. Unless we break that natural cycle, all natural products can be reproduced like that.

One other thing that we have to be careful of is that all non-reproducible resources create waste. Because the reproducible ones can be used over and over again, no waste is left behind. Until recently, surprisingly little attention had been paid to this important difference. But now that there is concern about the Earth warming up because of the carbon dioxide emitted from burning oil and so on, at last people have turned their attention to this problem of waste. From this point of view, too, Spaceship Earth must be very careful about using non-reproducible resources.

Indeed, the wisest thing to do would be to use them as little as possible.

Those non-renewable resources include not only coal and oil, but also the uranium used in nuclear fission, and the hydrogen and helium used in nuclear fusion. If we use them to generate energy, the heat they emit itself becomes a kind of waste. It is heat that did not previously exist on Earth, and so will lead to heat pollution, which in turn is bound to lead to a variety of problems. Furthermore, in the case of nuclear power, radioactive waste is produced as well.

On the other hand, most of Earth's reproducible resources, such as plants, animals and even rainwater, are brought forth by the Sun. The Earth receives energy in the form of sunlight, and returns energy into space in other forms; through this balance, there is no problem. The Deep Ocean Water, or DOW, that is the subject of this book is also such a renewable resource, due initially to energy from the Sun. What's more, it is there in such huge quantities that apart from considering whether or not it is reproducible, there is much, much more of it than there is coal or oil. Even so, it may at this stage be difficult for you to imagine how DOW can be used, or even what sort of a resource it is. Details will follow as you read on, but I would like to say one thing now. All renewable resources need a certain time to reproduce themselves. Thus, when we use them, we must bear in mind the time they need in which to be reproduced. If we do keep that in mind, then those resources can be used virtually infinitely.

