The link between energy use and population growth potential

by Uwe Parpart, Contributing Editor

Uwe Parpart, EIR *Contributing Editor and research director of the Fusion Energy Foundation, was the keynote speaker of the panel on "The LaRouche-Riemann Model: A Study of World Population and Energy" at the July 4 afternoon session of the International Caucus of Labor Committees semi-annual conference in New York City. We print here edited excerpts from Mr. Parpart's keynote.*

In the aftermath of the 1973-74 oil crisis, many people suggested that in order for the economies of the advanced sector to deal with the situation it would be necessary to shift from a relatively advanced, energy-intensive economy, to relatively less energy-intensive economies. Specifically, proposals were made to substitute labor for energy, to reverse what were at that time almost 200 years of movement of the advanced sector economies in the opposite direction.

To a significant extent, this has actually occurred in the economy of the United States and also in several other advanced sector nations. And not in small part, the present difficulties and dangers inherent in our immediate economic situation are due to that particular fact.

In this same period people like the Joint Economic Committee of the Congress, under the leadership of Ted Kennedy, proposed the possibility of reducing energy consumption in the United States by up to 40 percent, while at the same time maintaining economic growth rates which they regarded as sustainable at a level of 2 to 3 percent per annum in GNP terms.

Initially this sounds like a crazy proposal, but it becomes clearer what is intended when the internal composition of the economy is studied. It is quite possible to realize economic growth in GNP terms, specifically in the service sector and the so-called tertiary sector of the economy. This service-sector growth gives the appearance that the economy is growing, while in fact the production side of the overall economy is falling apart. There is no question that apparent economic growth in the service sector can be realized with great energy savings if there is a shift, for example, from steel production into putting up gambling tables in Atlantic City. Undoubtedly, the gambling tables, for unit of dollar output, take a lot less energy input, and therefore "energy savings" are realized.

The U.S. economy has been doing this now for at least five to six years, and we are facing the results right now. There is a longer-term process, which started in the mid-1950s, of the internal shift from the manufacturing and agricultural sector into the service sector, and this longer wave of development interacts with the shorter-term substitution of labor for energy.

The critical point to keep in mind is that we have at this moment a situation about which short-term accounting parameters no longer tell the story. It is precisely because of this that all the traditional econometric models—the Wharton School, Data Resources, Chase Econometrics—have failed miserably, while our own model, which has taken into account these critical boundary conditions of the evolution of the economy, has been capable of making very accurate and very precise predictions. Under normal circumstances where, for example, this labor-energy substitution did not occur, one could have expected other models to perform reasonably well by simply predicting existing trends linearly. But normal conditions are no longer the case.

The economy has, in fact, undergone a phase change and continues on a downward spiral, which is extremely dangerous. The very people—and I think this is the most frightening element of this whole situation—such as Paul Volcker and others who have thrown us into the depression that we are facing, have little or no understanding of what determines the long-term behavior of the economy. The people who are evil are simultaneously so stupid that they cannot actually find a way of evaluating the consequences of their evil deeds.

A new world population model

We have begun the process of putting together a world economic model on the basis of the concept of potential population density, which Lyndon LaRouche has proposed specifically in his writings for several years. We are now in the process of trying to quantify the relationship between population growth and energy use in the economy.

The basic idea is quite clear and straightforward. The idea is to treat the notion of population potential as a potential function, and to look at the time-evolution of a potential population, very much like temperature or other functions in physics.

What we see is actually an ordered sequence of connected potential surfaces, which represent given population densities and given points in time. They are connected in their upward ordering of population density potential by major changes in technology. The major changes in technology can in turn be described quite efficiently in terms of the concept of energy-flux-density. We are trying to develop an ordered sequence of potential surfaces of increasing complexity connected by increasing energy-flux-density, defining the actual potential at any given level.

Energy use and population growth

How is this population potential defined and what are the principal figures involved in this? This has to be measured, as I said, mainly in terms of energy-flux-density. In the year 1800, we know roughly the total amount of energy that was actually used by mankind. And between the year 1800 and the year 1975, for which we have measured these figures, there has been a 350-fold increase in actual energy production on a world scale. In this same period of time, there has only been a roughly fourfold increase of the total world population.

In the last 100 years or so, as late as 1850, the energy-flux-densities associated with this large multiplication of total energy production were very, very limited. For example, as late as 1815, nine-tenths of all energy produced and consumed in the U.S. was firewood, which, in fact, represents the lowest energy-flux-density that we could have conceivably come up with at that time. When the United States was operating in 1850 on solar biomass, this was at an energy-flux-density of about 10^{-6} megawatts per square meter. We are, by and large, meeting our energy needs now in energy-flux-densities of between 10 and 50 megawatts per square meter in the United States and in the entirety of the advanced sector. The gain of the efficiency associated with that is precisely what defines the possibilities for increasing the population potential.

In agriculture as well this principle applies. In considering the energy used per hectare for rice production, we see that the higher the energy-flux-density on the input side, the more energy in effect is saved because the energy needed to produce a ton of rice varies inversely with the amount of energy input.

In industry various types of engines, mainly steam-powered, that have been developed since the late 17th century, have raised energy-flux-density. The steam engine in its original form, had by 1796 achieved a conversion efficiency of about 5 percent, which is extremely low. The converse of this proposition is that the fuel consumption in kilograms per kilowatt hour of these kinds of engines was very, very large indeed. The utilization of these engines did not significantly extend the actual power of man over nature in those circumstances. In the second half of the 19th century, however, the major technological innovations of the Industrial Revolution were realized. The modern, latest-developed turbines give us a 40 percent efficiency and a simultaneous decline in fuel consumption in kilograms per kilowatt hour. Here is demonstrated a very close correlation between the energy-flux-density and efficiency on one hand, and the actual relative—but not absolute—savings in fuel consumption.

The same thing can be measured indirectly by looking at the composition of industrial production. Percentages of what you might think of as total economic activity expended in the actual production in these categories (averaged figures over Western Europe and the United States) show that in the year 1900, 27 percent was expended on food production. By 1955, this percentage had dropped to 12 percent. Textiles had dropped from 20 percent down to 8 percent, basic metals rose from 7 percent up to 9 percent, with a slightly higher period which covers the war years. The most interesting categories are the last two: metal products such as machine tools, which more than doubled from 16 percent to 34 percent; and chemicals, which almost tripled from 5 percent to 14 percent.

It is the last three categories which represent the high energy-flux-densities in industry, and the previous ones which represent much lower energy-flux-densities. There is a wholesale shift in internal composition of industrial manufacturing from lower to higher energy-flux-densities and that, in turn, has a lot to do with the increase of the population potential.

The best figures we have representing energy-flux-density are figures that were assembled by a West German utility company (REW) of the Ruhr region, the largest supplier of energy in West Germany. If you take the total world land area, you can see the figure of .054 watts per square meter. This represents energy consumption for all purposes, household as well as industrial uses. If you look at the continental United States, you have 0.26. West Germany has about four times the energy-flux-density of the U.S. at 0.96. The Ruhr region is the most industrialized region in the world, at 16.6.

These figures, if our general outlook is correct, should translate more or less directly to production efficiencies, and that's precisely the way it shapes up. If you look at production in normalized dollar terms (1978), and look at the amount of tangible goods in agriculture and industry produced per square kilometer in the world as a whole, the figures are $50,000 per square kilometer for the world as a whole; for the continental United States it is $200,000, about four times as high, which corresponds quite nicely to the multiplier in terms of energy-flux-density. In West Germany, the figure is about 10 times as high again. The productive output of a square kilometer of surface in West Germany is actually $2 million; so basically that indicates 10 times the productivity of the average German worker compared to the average American worker.

If one now compares population, dollar GNP and per-capita kilograms-of-coal-equivalent (that is to say, energy contained in a kilogram of coal per capita), you will see that in the United States, the GNP per capita at this point is $8,800 while the kilograms-of-coal equivalent consumed per capita is 11,500 kilograms. When you look at the last figure, in the case of West Germany, the average income in GNP terms is $9,500 per capita now. However, the energy consumption is only about 6,000 kilograms coal equivalent per capita; that is, roughly half of what it is in the United States. This is due to distortions largely as a result of population density—because the larger population density in West Germany actually brings down the transportation costs, and transportation, in fact, accounts for close to 20 percent of total energy consumption in any advanced-sector country. In the case of the Soviet Union, the GNP per capita is $3,500, and the energy consumption per capita is 5,500 kilograms-coal-equivalent per capita, so a similar distortion is present there.

The U.S. demographic collapse

The United States at this point in time, much as all other advanced-sector countries, is actually losing people, and losing them at an increasing rate. The figures that were recently published in the *New York Times* in February of this year for New York City and for the United States are extremely telling and very important. The youth population in New York City, that is to say, people under 18 years of age, declined between 1970 and 1980 by 21 percent. This translates into a net loss of about a million and a half young people. Now someone might suggest perhaps they left New York City and went elsewhere, went South, went to Houston, Texas, or what have you. This is not the case; the figures for the United States are also down, though not by the same percentage. The total decline in actual youth population in the United States in the last decade is close to 6 million; and this translates into a percentage decline of 8.5 percent.

The additional population pressure we're looking at in negative terms actually comes from a direct medical connection between the unemployment rate and deaths per year. There was congressional testimony on this several months ago to the effect that every 1 percent increase in unemployment translates roughly into 50,000 deaths per year. That is to say, every time there is a 1 percent increase in the unemployment rate in the United States, at the end of the year in which that increase occurs there will be 50,000 fewer people alive than there would otherwise be. If you look at the increases in the unemployment rate over the last several years, it is obvious that the death count directly due to Paul Volcker's high-interest-rate policy probably is no less than several million people. We are talking about a situation in which we can directly lay the deaths of those people at the doorsteps of the United States Congress, of Paul Volcker, of the U.S. government, each of whom has found it impossible to reverse this situation.

It is not so much the so-called crude birth rate that, in the relative short term, determines actual population size and development, but actually the death rate. For example, the crude birth rate in Europe in 1750 was about 35 to 40 people per thousand; the crude birth rate in the developing sector at this point is roughly the same. That is to say, the industrial development that occurred in the 19th and 20th centuries in the advanced sector, while it changed the birth rates in the advanced sector to some extent, did not change them in the Third World. What led to the major population explosion in Europe from about 1800 on was not a change in the birth rates, but a very rapid decline in the death rate.

The major population explosion, as people called it, which occurred in the post-World War II period in the developing-sector nations, is due to the same phenomenon. While the crude birth rate essentially stayed the same, the death rate decreased quite dramatically, though not nearly as far and to the low level realized in Europe. The decline was to a level of about 15 to 20 deaths per thousand live births (rather than to 10 to 15) in the Third World sector nations at this point in time. This largely accounts for the apparent rapid population growth in the developing nations.

In a certain sense, Malthus was right—that actually the only way in which you can find ways of reducing the population growth rate is through increase of the death rate, and hardly anything else will work. Anybody who talks today about population growth reduction knows precisely that.

We are saying, therefore, that the people who write reports like *Global 2000*, like *The Limits to Growth*, and so forth, are not simply making predictions, but, in fact, are making policy proposals that are fully intended to be acted on. The population potential on the Earth right now is 30-50 billion people. We are nowhere *near* that. So if anybody wants to cut down population growth, the only way to do that, being that we are so far removed from that total potential, is by deliberately increasing the death rate.

How world population potential has grown

During his presentation of the progress on the LaRouche-Riemann world energy and population model, Uwe Parpart identified three major periods of human development, which he distinguished in terms of energy flux density and population potential.

Repeated leaps in human society's energy flux density and population potential, Parpart demonstrated, refute the neo-Malthusians' claims that there is a fixed point at which the earth becomes overpopulated.

The first major period of human population growth reached up to about 10,000 B.C. The most accurate scientific information at this time indicates that 10,000 B.C. marks the transition in the most advanced regions of the world economy from a hunting-and-gathering society to an agriculturally based society—the Agricultural Revolution. Total world population at that period was no larger than 10 million people, but was probably approaching 10 million, a figure which can be considered the actual population potential for the human species at the hunting-and-gathering stage of economic reproduction.

One way that this population potential figure can be tested is by reference to contemporary hunting-and-gathering tribes in the Kalahari desert, which use about 15 square kilometers per person to sustain their existence in the hunting-and-gathering mode. The total habitable land surface of the earth is about 135 million square kilometers: if this is divided by 10 million, the result will be about 12-15 square kilometers.

A major increase in population growth occurred following the Agricultural Revolution. From the year 7,000 B.C. on, extremely rapid growth of the human population was taking place, and by 3-4,000 years before Christ there were several hundred million people on the earth. We know that in the year 2,000 B.C. and later there lived close to 150 million on the Indian subcontinent alone.

However, the population potential of the human species in the entire period from 10,000 B.C. to the turn of the 18th century, probably could not and would not have exceeded 1 billion people. In the year 1750, it is estimated that there lived about 650-800 million human beings. There exist fairly accurate population figures for the second half of the 18th century, and they indicate strongly that population potential at that time and for that mode of economic reproduction could not exceed 1 billion. Another indication that a potential population density of about 1 billion was not to be exceeded is the fact that even though there were no major wars of depopulation like the Thirty Years War (1618-48) during the 18th century, the population growth rate during the second half of the century fell to about .3 percent on a world scale by 1800.

Then followed the Industrial Revolution. This change in mankind's mode of reproduction ushered in the most rapid population growth in human history. A look at the second half of the 19th century, the period during which there was economic realization of the technological advances of the first half of the century, shows enormous population growth rates. For example, in the territory which is now East and West Germany combined, there were 17 to 18 million people in the year 1800. By the year 1900, this population had grown to 70 million, that is, a fivefold increase in about a century's time. In that same period of time, at least 10 million native born Germans migrated the the United States.

How was this growth rate sustained? What are the actual parameters of economic development that correlate to such a growth rate, and what kind of conclusions can we draw from the kind of economic and population growth that occurred during this period?

The population potential defined by the Industrial Revolution was specifically defined by two breakthroughs in technology: the steam engine particularly as it was perfected in the form of the internal combustion engine, and electricity. With the rise in energy flux density brought about by these new technologies, the population potential of the human species rose by approximately two orders of magnitude over what it was in 1800.

If we consider only two-thirds of this figure to be optimum, and project worldwide population figures in terms of a population density roughly that of India—200 people per square kilometer—at least 30 billion people could live on the earth's habitable 135 million square kilometers.