With the rise in public concern over the depletion of natural resources, the social role of the materials industry has come up for closer scrutiny. World models such as those being developed by Professor Forrester and his colleagues at M.I.T. leave little room for doubt that economic growth cannot continue far into the twenty-first century without enormous advances in the economical use and recycling of nonrenewable resources. Although studies of specific resource availability such as those carried out by Resources for the Future indicate no materials crisis before the year 2000, this optimistic picture is predicated on large and continuing advances in materials technology ranging all the way from geophysical exploration through the more economical use of materials in design. There is a serious question as to whether economic incentives to private industry will continue to be sufficient to call forth the necessary rate and direction of technological innovation in the materials field to insure the necessary husbanding of the world's resources. Wider governmental, and eventually multinational intervention in the allocation of scarce materials resources may become necessary to supplement the signals from the marketplace which may not act sufficiently far in advance. On the other hand, there is a growing realization in the underdeveloped world that they control the resources which the developed world needs to feed its industrial machine and can increasingly set their own prices. This may not be wholly bad in that it will tend to stimulate more innovation in the economical use of scarce materials and in the development of substitute materials. Furthermore in the long run it may provide a more acceptable way of transferring needed foreign exchange to the less-developed countries. The materials industry needs to face up more squarely to the future long-range challenge provided by the utilization of materials in a world in which material consumption simply cannot grow at anything like the rates of the recent past to which we have become accustomed.

With the last decade there has arisen a widespread recognition that the world is only a few generations from a sort of saturation. In the words of a recent report to the Secretary General of the Organization for Economic Cooperation and Development (OECD):1

1Many aspects of developed societies are approaching a condition that may be described as the precursor of saturation, in the sense that things cannot go on growing much longer in some lines without reaching fairly fundamental limits. Indications of saturation are present in total population, pollution of the environ-

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From this base he has played a leading role in the development of national policy relating to science and engineering, largely through the National Academy of Sciences and the National Academy of Engineering, but he has also served the U.S. Government in additional capacities such as the Advisory Committee on Reactor Safeguards of the Atomic Energy Commission and as a member of the U.S. President's Science Advisory Committee.
ment, in the size of urban conglomerations, in traffic, in information overload impinging on the individual, even in higher education and perhaps, in the view of some people, the production of new knowledge. This does not mean that growth will stop in the next decade, or even that the time limits for growth in the future can now be foreseen in every instance, but only that a declining rate of growth is foreseeable within the lifetime of people now alive. In a society now accustomed to growth in almost all its aspects during the last 300 years, this is something quite new, something that will require considerable adjustment. The general perception of saturation will appear only gradually."

At varying times the nature of the predicted saturation has changed. In the early part of this decade attention focused primarily on the balance between population growth and food supply in the underdeveloped countries. 2 With the recent growing evidence of success of the so-called "green revolution" in Asia, 3 however, attention has shifted towards other factors which may limit growth primarily in the developed parts of the world. These include depletion of natural resources, the growth of environmental pollution, and the psychosocial effects of overcrowding. It is the industrialized world which consumes most of the world’s resources and generates most of the pollution, particularly that of a large scale or even global nature. Economic growth in the industrialized and urbanized societies, rather than population growth in the poor countries, may thus produce a crisis of growth earliest, even though all the factors mentioned are interrelated and influence each other.

Were the less-developed countries to reach the present material living standards of the developed countries the resulting resource demands would be enormous, but at present rates of development this would take about 130 years, and during the same period continuation of present economic growth rates in the developed countries would probably have produced a resource crisis long before the underdeveloped countries accounted for a major share of the total world demand for resources, despite their greater and growing share of the world’s population. Only if there were substantial equalization of the world’s material wealth would the resource demands of the underdeveloped world be a predominant factor in the crisis of resources.

Although there may be disagreements as to which factors are more limiting than others and as to the exact timing of the crisis that may be coming for mankind, there is little argument that within at most two or three generations the world will have to find a quite different technological basis for equilibrium between man and nature. Eventually the world must approach some sort of steady state in which population is nearly stationary, nonrenewable resources are recycled, and economic growth, at least as measured by the utilization of materials and energy, is greatly slowed down or ceases altogether. Of course, this will not occur all at once, or for all economic factors simultaneously. Furthermore, man and the biosphere are not closed systems. They are continually using energy, and the continuation of any civilized society demands a continuing flow of energy. Whether this proves to be solar energy, breeder reactors, controlled fusion, or some combination of these, man’s energy supply seems assured virtually indefinitely, something we could not have said with such confidence a few decades ago. Given such a supply of energy a steady state seems feasible, but indefinite growth is not, if only because even recycling materials entails carrying a larger and larger inventory in process, and eventually even the necessary addition to the inventory would exceed the earth’s sources of supply.