

**ONLY ONE
WORLD**

ONLY ONE WORLD

OUR OWN TO MAKE
AND TO KEEP

GERARD PIEL

For the René Dubos Center



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For

Sarah Harfield and Katherine Harfield

Chase Benjamin, Joshua Gerard, and Samuel Harriss

May their century

start a happier millennium

FOREWORD

In this splendid book, Gerard Piel examines how natural and social systems have interacted to shape the course of human development. Across the broad sweep of history, he unravels some of the complex threads of cause and effect that link human behavior and its environmental consequences, documenting the essentially integrated nature of environment and development. He illustrates his arguments with a profusion of vivid and persuasive detail.

Conclusively, this book demonstrates that business as usual is simply not an option that we can entertain. The quality of future life on Earth will depend to a high degree on the size of the stable world population that is likely to be reached some time in the next century, and on the speed of the demographic transition in the preindustrial world. Key to this transition are the survival of infants and the consequent decline of birth rates. For this as well as for humanitarian reasons, the priority must be the eradication of poverty and the meeting of basic needs of the world's poorest people.

The description of how life has evolved on this Earth, the miracle of human existence, and the impact that the human species has had on the planet in its geologically momentary dominion are all described with a literary ease and elegance that almost disguises the wealth of scientific information that is imparted. Recognizing human development as the prerequisite of sustainable development, Mr. Piel examines basic human needs for food and energy and the capacity of the Earth's systems to provide for those needs.

Free from either environmental doom-mongering or techno-optimism, this book provides a balanced prescription for our sustainable future: a new partnership between the developing and the industrialized worlds. The people of the industrialized world will lead lives that are less resource-consumptive and polluting, and the people of developing countries will receive greater support in their attempts to achieve livelihoods that do not undermine or destroy the environment and the resource base on which their future livelihoods depend. This must entail considerably greater technological and financial assistance to enable the preindustrial countries to overcome their burdens of debt, poverty, and underdevelopment and to make the transition from dependence to interdependence. The key to success here is a quantum leap in the crucial investment in human development: education, training, and the capacity to manage the collective enterprises of industrialization. The special roles and advantages of regional organizations and cooperation are highlighted.

This book is a tour de force. As the founding father of the *Scientific American* we have known since May 1948, its author is the doyen of science writing. But his profound understanding of social systems—the paramount importance of democracy and a judicious balance between the workings of the free market and governmental intervention—and his superb handling of detail and of historical perspective make this much more than a scientific volume, and they add the insight and enlightenment of a truly wise and universal man.

This book will make a timely and invaluable contribution in illuminating the issues to be addressed by the Earth Summit in Rio de Janeiro in June 1992, and it will point the way to the new and more hopeful future that should emerge from Rio as we move toward the twenty-first century.

MAURICE F. STRONG
Secretary-General,

United Nations Conference on Environment and Development

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Eleanor Jackson Piel has thought out loud with me and has read every edition of the manuscript; the perfections are hers and the imperfections mine.

25 December 1991
New York City

GERARD PIEL

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1

BIOLOGY AND HUMANITY

The present half century has recast the human predicament. Toil and want are no longer necessary conditions of our existence. The industrial revolution that began only four centuries ago has lifted these afflictions from the lives of more than 1 billion of the world population of 5 billion.

These fortunate people are assured the survival of their first infants. Never before has such a large minority of the population had this assurance. It has brought them to demonstrate a capacity unique to human biology: procreation of the species is subject to control by the cerebral cortex. For love of their children and by the simple arithmetic that shows "the fewer, the more for each," these people have brought their fertility under rational restraint. The populations of the industrial countries are universally approaching zero growth.

The possibility that the same future may be within the reach of the rest of humankind who dwell in the preindustrial world—in the "poor," "underdeveloped," or "developing" countries—must now be considered. These people live in the age-old condition of want, not much relieved by their toil. Against high death rates, besetting especially their children under five years of age, they maintain high birth rates. The much bruited explosion of their population accounts for most of the doubling of the world population that has occurred in the present half century.

This population explosion may soon be seen, however, to have been a benign event. It is the consequence not of the fertility of these people but of the lengthening of their life expectancy. This is the consequence, in turn, of the beginning of their industrial revolution. With production of the means of subsistence increasing faster than their population growth, they have begun to experience improvement in their material circumstances. If that improvement can be continued and hastened, if the transformation of their existence by industrial revolution can be secured earlier rather than later, then humankind may bring its increase to a halt at a number that the planetary environment can sustain.

In fact, the rate of world population growth has been declining since 1970. The prospect that the world population may stabilize at some finite number—perhaps double the present number—by the end of the next century is real. That prospect must command the interest of everyone who rejoices in posterity.

People equipped with industrial technology use energy from sources external to their bodies to increase, apparently without limit, the yield that they secure from their resources. Thus, in the present half century, by the input of technology and of electrical energy incorporated in nitrogen fertilizer, they have more than doubled the world output of food. People have doubled the food supply before, of course, to meet earlier doublings of their numbers; they did so by extending the land under cultivation. This time, they multiplied the yield from the land. The principal increases were secured in the industrial countries, but the “green revolution” is spreading the technology worldwide.

With other industrial technologies, the people of the preindustrial countries can bring about the same catalytic reaction between energy and their abundant resources of other kinds. Industrial revolution can ensure, therefore, not only food sufficient to sustain their still growing populations but the rest of what is necessary to secure to them the survival of their first children. Among the necessities taken for granted by people fortunate enough to have their industrial revolutions behind them are potable water, sanitary disposal of their excrement, and a dwelling secure against the weather. The same lucky people know still other necessities: electric light to lengthen the day, retinues of large and small household appliances, personal mobility and the public services of communication and transportation, safety, medical care, and education. All of this comes from the

value that these people add by technology to their resources, the same resources that are available in one combination or another in preindustrial countries.

Presently, for lack of industrial technology, the human and physical resources of those countries go underemployed and underutilized. The plain remedy is transfer of the technology to them from the industrial countries. In fact, the transfer has begun, reaching the people most widely in public-health measures and education. Technology of more substantial kind has been installed in the building of railroads, highways, and port facilities to expedite the export to the industrial world of resources that people in the preindustrial world have not learned to use. Those resources have supplied and fueled the recent enormous expansion of the industrial economies. The technologies for the production of goods to meet the needs of the increasing population of the preindustrial countries and the necessary improvement in their material circumstances have moved more slowly. The early installation of these technologies, in time to secure stabilization of the world population at a smaller size in a nearer future, calls for massive transfer of economic assistance in the form, primarily, of the books, the tools, and the machines that embody the technologies.

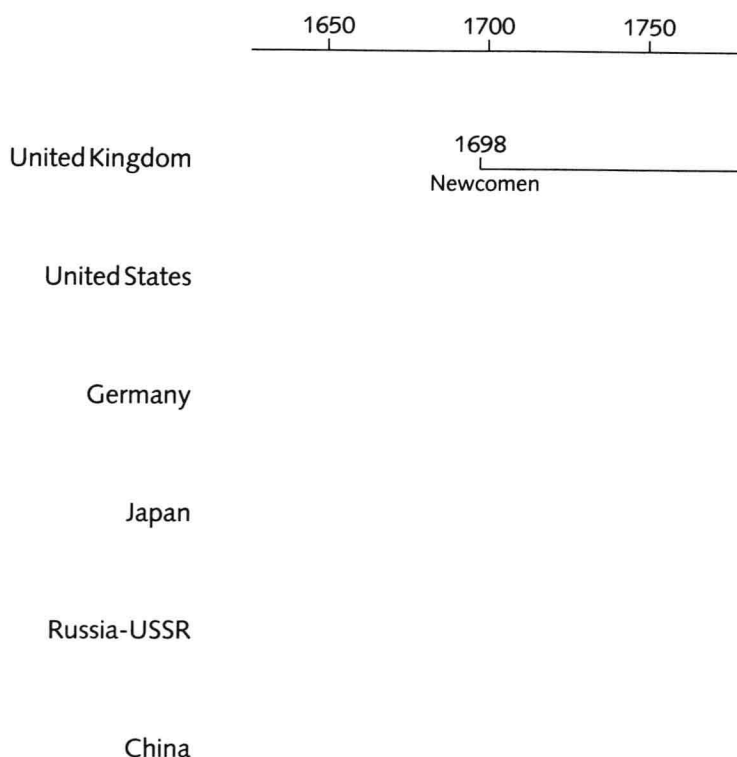
The prospects for the transfer of such assistance are strongly conditioned by the long-standing relation between the rich and the poor. Ever since the beginning of civilization, people have organized their social institutions to secure the inequitable distribution of goods that were always, until recent times, in short supply. Now the inequity that divides humankind is international; people are inhabitants of rich nations or of poor nations. And the rich go on living at the expense of the poor.

From historic habit, nations make policy and people continue to root their morality in the assumption that there can never be enough to go around. The industrial revolution has confuted that assumption. If people will use industrial technology equitably and wisely, they may at last, in the words of Indira Gandhi, "make this only Earth a fit home for man."

INDUSTRIAL REVOLUTION

The people of Japan have shown best how a poor nation can become rich by industrial revolution. Their island arc has no resources but the

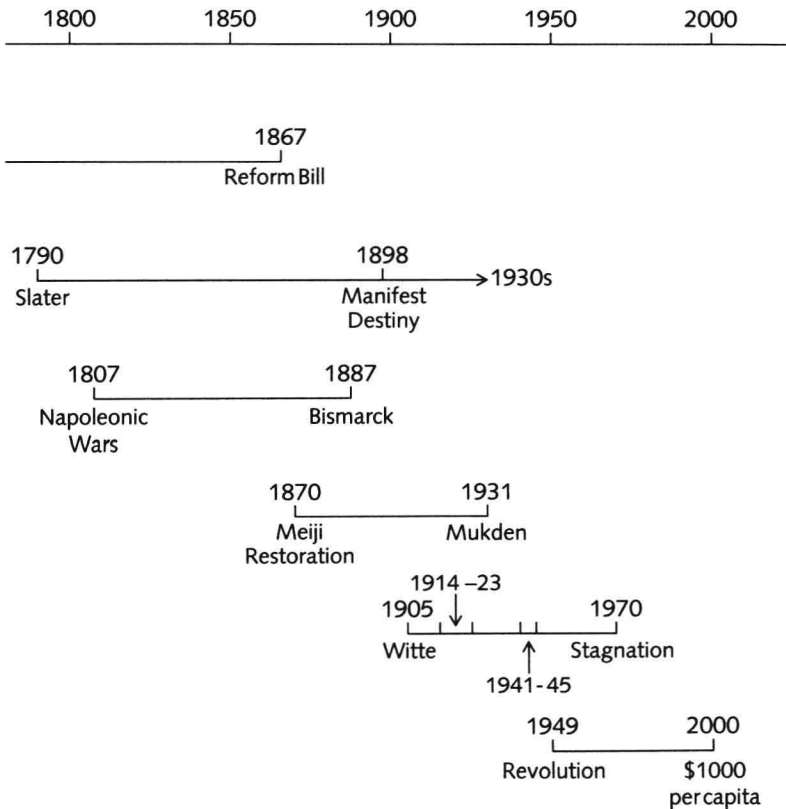
people themselves, rainfall, and some arable land. All the rest, energy and raw materials, they must import. With mastery of industrial technology, also imported but now incorporating their own innovation, the Japanese in 1987 transformed their imports to \$16,000 of product per capita. After all the value they added by technology—value added by manufacture, in the language of economics—the cost of the imports came to a mere 6 percent of their gross national



COURSE OF INDUSTRIAL REVOLUTION *run by six nations is plotted from starting to completion dates of at least symbolic kind. British revolution begins in 1700 with Newcomen steam engine and culminates in 1857 electoral reform laws. Bismarck creates the German welfare state in 1887. The U.S. revolution culminates*

product (GNP) of \$2400 billion. They more than paid this cost with exports worth 10 percent of their GNP, a dividend from their value-added.

The industrial revolution has happened often enough in different countries under sufficiently different circumstances to suggest that people have begun to learn how to manage it. The prolonged agony of the first industrial revolution has not had to be endured



in Spanish-American war in 1898; its welfare state waits for creation by New Deal in 1930s. Japan asserts its industrialization by conquest of Manchuria in 1931. Political revolution and war interrupts the Russia-USSR industrial revolution. China projects \$1000-per-capita income in A.D. 2000.

again. The British industrial revolution required no less than 150 years, if it may be dated somewhat arbitrarily from the demonstration of the first practical steam engine by Thomas Newcomen around 1700 to the founding of the welfare state by Benjamin Disraeli around the middle of the nineteenth century. The latter event signified the political arrival of the urban industrial working class and the moral recognition that there was beginning to be enough to go around. Along the way, industrial revolution had to wait on the invention of the first industrial technologies, proceeding as it proceeded.

The second revolution could borrow technology from the first. Samuel Slater, in truth, stole the design of Richard Arkwright's spinning machine to set up the first textile mill in the United States in 1793 at Providence, Rhode Island. From that symbolic event, the second industrial revolution ran its course through the nineteenth century. Considerable investment came in from Britain at midcentury to finance railroad building and to develop the continent's mineral resources. The wealth of the continent, chattel slavery, and the continuous supply of steerage immigrants (35 million from 1865 to 1915) permitted the installation of the U.S. welfare state to be postponed until 1936.

Succeeding revolutions, taking off from an ever enlarging technological base, ran the course in shorter times. Germany, awakened to nationhood by the Napoleonic humiliation of its petty kingdoms, arrived at its welfare state under Bismarck in the 1880s. Japan, from the Meiji restoration in 1870, took 50 years to emerge as a world power in the 1920s. Ridiculed as "imitators," the Japanese set their brightest young men to getting the educations necessary to ransack the accumulated stock of technology in the West. With its feudal order intact, Japan was a welfare state from the start. A mission from the Harvard Medical School in the 1870s found a lower infant-death rate in Tokyo than in Boston.

If due allowance is made for the years of war and social revolution that intervened, the Russian industrial revolution ran about 50 years, from the laying of Count Witte's trans-Siberian railroad at the turn of the century to the economic stagnation of the 1970s that started the collapse of the Soviet regime. The gigantic industrial plant was in full-blast operation, with no market to take away its product. If the Chinese make their deadline of 2000 A.D., they too will have accomplished their industrial revolution in 50 years. By rigorously enforced equality in the distribution of the rising product of their

economy, they have already secured many human welfare objectives—including a rapidly declining birth rate—that other nations reached only at much higher incomes.

History attests, therefore, that a 50-year schedule for the industrial revolution of the preindustrial countries is not unreasonable. On that schedule, the revolution will increase individual well-being to a level that assures the survival of their first infants to all people in a world population increasing to 10 billion or less, or not much more. Multiplication of the present world product by four times would meet that objective. By the same multiple, in the present half century, the industrial nations increased their output to bring the first quarter of the world population to stabilize its numbers.

The satisfaction of this logistical requirement does not hang on some breakthrough in fundamental research. The technology is in hand. It is there, on the shelf; it is highly portable and becoming more so every day. Even steelmaking, the most heavy of industries, has acquired mobility. Direct, continuous casting of the solid product from the molten metal, made possible by electronic feedback control, has abolished the economies of gigantism. Ocean transport negates the comparative advantage of the possession of iron ore. Japanese steelmakers have lower raw-material costs than the U.S. steel industry. Any country with a deep harbor can make steel.

The resources are there. Industrial technology defines resources. The Chippewa had no use for the iron ore in the Mesabi Range when they hunted deer over that territory. The Chatanooga shale underlying the Appalachian states holds uranium with more potential energy available to present nuclear fuel cycles than the original supply of coal in that region.

It is now nearly 50 years since the urgency of the worldwide industrial revolution was proclaimed and written into the charter of the United Nations. The industrial nations then undertook to supply technical and economic assistance to the "underdeveloped countries." That promise, renewed on the initiative of the United States in the 1960s, remains unfulfilled. In this same half century, the world population doubled.

Industrial expansion as conducted during these years in the rich nations and rising desperation in the poor nations have now put in doubt the Earth's capacity to yield to the genius of industrial technology and the demands of the rising world population. The fires

that generate the soaring output of industrial energy have suddenly begun to perturb the modulation of the Sun's radiation by the global atmosphere, threatening change in climate and sea level with prospectively calamitous consequences to both rich and poor. Fires set by ranchers and planters and by landless people to clear forests in the poor countries amplify this perturbation and lay the further threat of desertification to the existing pattern of world climate. In both the preindustrial and the industrial nations, unloving cultivation of the soil erodes its capacity, and the effluent of both poverty and abundance pollute the water in their different ways. Reduction of the diversity of life on the planet at last compels recognition of the dependence of human life on that diversity.

The human predicament is now defined, therefore, by two questions. It is whether common humanity will heal in time the mutual estrangement in which, for so long, some people have lived rich and most have died poor. At the same time, it is whether the understanding possessed by some few people will bring the rest soon enough to cherish the Earth as the only planet known to harbor life. The two perplexities are one: the Earth cannot long sustain the folly of affluence and the desperation of poverty it knows today.

THE ACCELERATION OF HISTORY

It cannot be said that people have been slow to comprehend the change, four centuries in the making, of their circumstances and prospects. The rate of change has proved, suddenly, to be exponential.

Not only did the doubling of the world population since 1950 bring the largest absolute increase in population, it came also in the shortest doubling time in history. As the doubling population more than doubled the production of food, it also doubled the tonnage of iron above ground and smelted more iron and steel than in all the centuries since the Bronze Age. For this and countless other purposes, people consumed two-thirds of all the coal, oil, and gas they have so far extracted from the Earth and nine-tenths of all the electrical energy they have generated in the 150 years since they mastered the electromagnetic force. Much of the primary fossil-fuel energy went to increase human mobility. More people are traveling farther and faster in all directions over the planet. The average annual