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Alternatives for Growth: The Engineering and Economics of Natural Resources Development

NATIONAL BUREAU OF ECONOMIC RESEARCH

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Alternatives for Growth: The Engineering and Economics of Natural Resources Development

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Relation of the National Bureau Directors to Publications Reporting Conference Proceedings

Since the present volume is a record of conference proceedings, it has been exempted from the rules governing submission of manuscripts to, and critical review by, the Board of Directors of the national Bureau.

(Resolution adopted July 6, 1948, as revised November 21, 1949, and April 20, 1968)

Contents

Preface

No event can be beyond expectations,
Fear contradiction, or compel surprise, for Zeus,
Father of Olympians, has made night at full noon,
Darkness mid the brilliance of the sun—
And pale fear has seized men.
Henceforth nothing for them is certain:
One may expect everything,
And none among you should be astonished to see,
One day, the deer, preferring the sonorous tides
Of the sea to the land,
Borrow from the dolphins their sea pasture,
While the latter plunge into the mountains.

—Archilochus, 700 B.C.

Future historians will probably describe this time in our enlightenment as the age of conscious social change—a time when we take into account what we as humans have done and are doing to our planet earth and what we must do if we are to continue to improve our conditions and not return to a less abundant existence. The Charles Carter Newman Symposium on Natural Resources Engineering provided the opportunity to convene a group of concerned and interested scholars, scientists, educators, and policymakers to review and discuss a set of original and useful papers in the areas of natural resource use, development, and shortage. It was the feeling among those of us responsible for the planning and organization of this meeting that too much has been written about the limits of the world's future and the troubles that lie ahead for all mankind, and that not enough consideration has

been given to the more positive aspects of alternatives, which surely must exist.

During the last quarter of the twentieth century all peoples have been told over and over again that we face an uncertain future because of unanswered fundamental questions such as: How do we control human population? Can we permit increasing consumption of energy and natural resources? Should we allow technology to continue its exponential growth? How do we produce an ever-increasing supply of food and fiber? Can the leadership of the world continue to plan for the improvement of the quality of human life, or must it be content to regress because of finite supplies of essential natural resources? What is the one predominant factor underlying any possibility for answering these questions in a satisfactory way? It is surely the assessment of where we are, where we want to go, and the focusing of the advancement of our technology in a more meaningful way. Will mankind continue to improve the quality of human life and make technological progress? Or will we regress because of misuse of our current essential natural resources?

This debate was, in a way, initiated by the "limits of growth" controversy. Along with carefully documented studies of the topic came an assault of emotionally charged reports and discussions. On the one side were advocates of a total moratorium on economic growth; on the other, proponents of unlimited industrial and technological advancement. On both sides there has been a proliferation of experts eager to tell us in the most explicit detail just what the impact of shortages in natural resources, or a slowdown in exploiting all resources, will be, and as a rule, predicting the demise of Western technological civilization because they are not being taken seriously. There is nothing wrong with a prediction in itself, provided it is arrived at rationally and founded upon accurate information. This is quite different, as one writer put it, "from the torrent of soothsaying that pours over us, predominantly emotional, frequently verging on the hysterical, and displaying ignorance of technology, science, economics, or history."

Out of all this heat has come some light with the dedication to obtain better data, develop plans, and move toward a reasonable synthesis of positions on the "growth" issue. Other economic alternatives have been added to those of "no growth" and "unlimited growth." Some scholars have raised questions about the very concept of natural resources: What is a resource? Aren't people a natural resource? Are resources truly limited? Isn't it *time* that we're really short of? Will our present thoughts about the true constraints on growth used in 1977 be the same as those used in 1997? Others offer resource-use alternatives that emphasize individual action and creativity, the role

of economic incentives, market forces, and property rights. Still others suggest studying the interrelationships between natural resources, technological change, and the social system, using systems analysis to formulate action plans.

The future is, of course, uncertain, but it is the natural creativity and genius of the people of all the world that makes it almost certain that there are solutions to all problems. Natural-resources engineering, economic analysis, planning, and management applied to the utilization and conservation of land, natural resources, air, water, and human resources are the crucial aspects of any rational strategy for solving the resource utilization-conservation dilemma, and for determining alternatives for continued growth. An intricate web of fact-finding, education, information and decisionmaking links engineers, scientists, agriculturalists, economists, financiers, government officials, legal experts, representatives of the media, and all people into a fellowship of concerned action.

The power of our technology makes it possible for us to do more than dream. Technology has allowed us to substitute plastics for metals, create a synthetic energy called electricity, communicate by satellite, calculate by computers, program machines to do much of our manufacturing, develop space vehicles and nuclear weapons, and do a host of other "impossible" things. There is widespread public recognition of technology's influences—good and bad—upon every facet of our way of life. It has raised fears and concerns that make us wonder if it has gone too far. Without question, however, it is our hope for the future. To forget what we know is not possible even if it were desirable. All of us who have been a part of technology's science, its management, or its support know that it is not always predictable, nor does it always achieve what we had hoped. But, when treated with respect, concern, and common sense, technology does deliver a fair share of its promise.

It was to this end that the Charles Carter Newman Symposium took place, bringing together specialists of international reputation to generate new thoughts on natural resource development among concerned scientists in agriculture, engineering, and economics. We hope that the papers and comments printed in this conference volume will serve as a series of philosophical and practical points of departure for researchers and policymakers involved in natural-resources management, economics, and engineering, that as a result the problems facing the nation and the world will be in better focus, and that programs will be developed and carried out to ensure that growth and economic well-being can continue. The discussions in these papers deal with the larger issues, the social and economic as well as technological aspects

of resources utilization and conservation, and aim at producing the kind of thought and research required to develop alternative plans to cope with these real issues. Above all, these papers embrace a view that humanity is a steward of the future, and that we should plan and act wisely in the use of all resources. Bertrand Russell once said, "If rational men cooperated and used their scientific knowledge to the full, they could now secure the economic welfare of all." This is our hope.

Harvey McMains, National Bureau of Economic Research
Lyle Wilcox, Clemson University

Acknowledgments

We gratefully acknowledge participation by H. Guyford Stever as our program moderator, and John J. McKetta, Jr. and Paul W. MacAvoy as banquet speakers. All are experts in fields covered at the Symposium and all contributed greatly to its success.

In addition, we acknowledge with appreciation the family and J. Wilson Newman, whose gift to honor his father created the Symposium Series.

Part I

Technology