

CONTENTS

PREFACE xiii

INTRODUCTION i

PART I ENERGY'S ORIGINS AND SOURCES

1 COSMIC ORIGINS 6

In which are described the guesses that scientists make about the universe, the galaxies, the stars, and stellar explosions. All known sources of energy are derived from these cosmic origins.

2 SUN, EARTH, AND LIFE 27

In which it is shown that our sun is a remarkably constant star. It has scarcely changed in billions of years; it is not likely to change in many more billions. Life has developed on earth during approximately three billion years. A time equal or even longer remains for our descendants.

3 BIOLOGICAL ORIGINS OF FUELS 37

In which life appears on earth, an event so surprising that it may well be called a miracle. Life's energy is derived from the sun. A very small portion of this energy is stored up as coal and petroleum, in a manner that experts debate but no one understands.

PART II USE FROM THE RECENT PAST TO THE NEAR FUTURE

4 CONVENTIONAL USES FROM PROMETHEUS TO THE OIL EMBARGO 52

In which a clever biped utilizes fire and turns into man. Energy is used to survive the ice ages in some degree of comfort; more energy is used to establish civilized communities. Finally, proliferation of energy in part of the globe is connected with the Industrial Revolution, coal, pollution, electricity, oil, and the oil shortage. The stage is set for asking many questions and receiving, perhaps, a few answers.

5 STOPPING THE WASTE 69

In which we discuss how to save what we lack. The author is reminded of a brief verse from the last century by Wilhelm Busch, originator of the comic strip:

Genügsamkeit ist das Vergnügen

An Dingen Welche wir nicht Kriegen.

An updated and unfaithfully translated version might read:

It is important that we make haste

To save and enjoy what we can't waste.

What must be done is hard to describe and even harder to do.

6 PETROLEUM AND ECONOMIC PUZZLES 96

In which we learn that there is not enough oil, although new oil deposits are found when one looks for them. We also discover that if we try to reduce the price of oil and gas the price will increase. It is clearly demonstrated that the author does not understand economics—perhaps, in this particular case, with good reason. But apart from economic worries caused by manmade laws, the outlook for more petroleum need not be without hope.

7 MINING COAL AND OTHER FOSSIL FUELS 113

In which we find that there is plenty of the old fuel left in known deposits, and there is probably much more yet to be found. But much of this energy source is hard to obtain and difficult to use without damage to those who obtain or use it. These difficulties may be just as great as those associated with attempts to get energy by some radically new approach.

PART III NUCLEAR ENERGY

8 THE BEGINNINGS OF ATOMIC ENERGY 136

In which the reader will learn many facts that today may seem irrelevant, but that remain interesting because the history of atomic power is the background for deciding whether and how to use the great forces of nature that have become accessible to us in the recent past.

9 THE REACTOR SAFEGUARD COMMITTEE 157

In which is described the situation of a distant, simpler past, when the difficult problems of reactor safety were reviewed by experts without interference from concerned but poorly informed scientists, environmentalists, and the daily press, and also before the urgency of an energy shortage or the investment of billions of dollars.

10 REACTOR SAFETY AND THE ANTINUCLEAR MOVEMENT 168

In which opponents of nuclear research appear in the role of that enormous rock Sisyphus tried to roll to the top of the mountain in the Underworld. At great effort, Sisyphus always succeeded; but the rock always rolled down the hill, so he had to start afresh. (Fortunately, the reader will have to read this chapter only once.)

PART IV PROSPECTS FOR THE MORE DISTANT FUTURE

11 CONTROLLED FUSION 200

In which the reader will find out how to tame and control the hydrogen bomb, either by making it slow or by making it small. Unfortunately, the work is not easy and the energy obtained may not be cheap.

12 NATURAL ENERGY SOURCES 220

In which uncertain predictions are made about an uncertain future. Solar energy will come, but how? The heat of the earth will be used, but where? There are other possibilities, but which?

PART V PLANS AND POLICIES

13 ENERGY POLICIES 264

In which the reader finds himself liberated from scientific and technical details only to be enmeshed in general problems that are no less controversial or complex. Besides demands for a clean environment

and the need to invigorate research, we face the impossible task of deciding what we do next. We may assume that if we disregard the energy problem it will go away; or we may decide that we have less and consequently we should use less; or we may try to create what we lack; or we may finally regard the problem as a worldwide crisis. In a desperate attempt at impartiality the author fabricates economic arguments that the cost will be approximately the same whichever course we choose.

14 A MODEL FOR THE FUTURE	288
<i>In which the reader will find that adolescence, the present stage of energy's development, is a time when advice and predictions are amply available, though not always requested or helpful. An attempt is made to see how promptly troubles can be resolved, and what might happen in the remainder of the century in the United States and in the rest of the world.</i>	
EPILOGUE	310
INDEX	313

