



Bruno Fritsch · Stephan Schmidheiny
Walter Seifritz

Towards an Ecologically Sustainable Growth Society

Physical Foundations, Economic
Transitions, and Political Constraints

With 28 Figures

Springer-Verlag

Berlin Heidelberg New York

London Paris Tokyo

Hong Kong Barcelona

Budapest

Prof. Dr. Bruno Fritsch
Aussichtsstr. 13
CH-8704 Herrliberg

Dr. Stephan Schmidheiny
Postfach 1474
CH-8640 Hurden

Prof. Dr. Walter Seifritz
Chapfstr. 4
CH-5200 Windisch

ISBN-13 : 978-3-642-78744-7 e-ISBN-13 : 978-3-642-78742-3
DOI: 10.1007/978-3-642-78742-3

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in other ways, and storage in data banks. Duplication of this publication or parts thereof is only permitted under the provisions of the German Copyright Law of September 9, 1965, in its version of June 24, 1985, and a copyright fee must always be paid. Violations fall under the prosecution act of the German Copyright Law.

© Springer-Verlag Berlin · Heidelberg 1994
Softcover reprint of the hardcover 1st edition 1994

The use of registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

43/7130-5 4 3 2 1 0-Printed on acid-free paper

PREFACE

This book is the work of three specialists from the field of Economics (B.F), Business (S.S.) and the Natural Sciences (W.S.). While each chapter concentrates more or less on one or other of these areas, with varying degrees of complexity, it is hoped that the readers whatever their background will find something of value in each section, in particular those outside their own disciplines. The authors believe that such cross fertilization of ideas will become increasingly needed in the coming development of a sustainable growth society and it is therefore their hope that this book, as a first example of its kind, will thereby contribute in an interdisciplinary way to the general understanding of the issues of sustainable growth.

The authors divided their main contributions to the book as follows:

Bruno Fritsch	Chapters 1, 2, 3, 4, 5 and 8
Stephan Schmidheiny	Chapter 7
Walter Seifritz	Chapters 2, 3, 4 and 6

They would like to thank in particular Lloyd Timberlake for his editorial advice and his assistance on chapter 7. Special thanks are due to Irena Kusar for preparing the original figures and diagrams and to the Paul Scherrer Institute for permission to use the illustration, printing and copying facilities during preparation of the manuscript.

They would also like to thank Richard Stratton for assembling, typing and correcting the text, editing and final layout and for his helpful advice and contributions to organising the presentation of the material.

Two of us (B.F. and W.S.) and the editors would like to offer grateful thanks to Stephan Schmidheiny for his support and encouragement in the publication of this work.

Table of Contents

1	INTRODUCTION	1
1.1	Aims and Objectives	1
1.2	References to Chapter 1	10
2	HISTORICAL DEVELOPMENTS	11
2.1	Events of the last 25 Years	11
2.2	Between Past and Future: the Present State of Affairs	13
2.3	A Short History of Entropy	14
2.4	References to Chapter 2	35
3	EVOLUTION AND ENERGY	37
3.1	Entropy, Life and Evolution	37
3.2	Energy in Biological and Societal Systems	40
3.3	Evolution of Population and Energy Densities	44
3.4	Energy Use and the Increase of Entropy	47
3.5	References to Chapter 3	52
4	ECONOMIC GROWTH AND ECOLOGICAL SUSTAINABILITY	55
4.1	From Limits to Growth to Growth of Limits	55
4.2	Manufactured Capital vs "Natural" Capital	60
4.3	The Hypercycle of Energy, Time, Availability, Knowledge	70
4.4	References to Chapter 4	74
5	THE SPECIAL ROLE OF ELECTRICITY	77
5.1	Electricity and Society	77
5.2	The "Form Value" of Electricity	82
5.3	A Modelling Approach	87
5.4	References to Chapter 5	92
6	SOME TECHNICAL STEPS TOWARDS SUSTAINABILITY	95
6.1	Controlling the Flow of Energy and Wastes	95
6.2	Measures to Limit CO ₂ in the Atmosphere	108
6.3	A Mixed Nuclear/Fossil System	121
6.4	Nuclear Waste and Safety	127
6.5	Entropy Again	137
6.6	References to Chapter 6	146
6.7	Appendix to Chapter 6	148
7	ECOEFFICIENCY AND THE ENTREPRENEURIAL FACTOR	155
7.1	Sustainable Development	155
7.2	About Business	157
7.3	Reflecting Environmental Reality	161
7.4	The Concerns of the Developing World	165
7.5	Trade and Technology Cooperation	168
7.6	Farming and Forestry	172
7.7	Capital Markets	174
7.8	The Corporate Agenda	176
7.9	References to Chapter 7	180
8	SUMMARY AND CONCLUSIONS	183
8.1	Towards an Ecologically Sustainable Economic Growth	183
8.2	The Key Concept: Ecoefficiency	185
8.3	Conclusions	186
8.4	References to Chapter 8	191
	NAME INDEX	193
	SUBJECT INDEX	195