

Contents

Preface vii

1	Future, M. A. Styrikovich	1
	1 Oil 4 2 Natural Gas 5 3 Coal 6 4 Nuclear Fuel 8 5 Solar Energy 10 6 Hydraulic Resources 11 7 Geothermal Resources 11 8 Other Power Resources 12 9 Growth in Demand and Prospect of Supply 12 References 17	
2	The Case for Alternative Energy Sources, James P. Hartnett	19
	1 World Energy Consumption Patterns 19 2 Fuels Used for Energy 1950-1970 22 3 Distribution of Energy Resources 25 4 Postembargo Energy Projections 30 5 Energy Program in the United States 33 References 37	
3	Energy Development and Related UNESCO Activities, B. M. Berkovsky 1. General Pattern of Energy Consumption since 1850	39
	1 General Pattern of Energy Consumption since 1850 39 2 Prospects of Energy Consumption Growth 42	iii

		Prospective Methods of Energy Production and Some Related				
		Scientific and Technological Problems 51				
	5	Current Methods of Energy Production and Some Related Scientific and Technological Problems 54				
	6	UNESCO's Activities in the Field of Energy Development 55				
4	App	plications of Fluidized Beds in Coal Technology, Arthur M. Squires	59			
	1	Particulate and Aggregative Fluidization 60				
	2	Introduction to Species of Fluidization: The Contrast between Behavior of Fine and Coarse Powders 61				
	3	Analogies with Aerated Pools of a Liquid 65				
		Co-current Upflow of Air and Water 68				
	5	Turbulent and Fast Fluidization of a Group A Powder 70				
	6	Lurgi's Fast Fluidized Bed Calciner 72				
	7	City College Studies of Fast Fluidization 74				
	8	Lanneau's Data and Consideration of Contact Efficiency 78				
	9	Distinction from "Dilute-Phase" Conveying 82				
	10	Distinction from Riser Reactor Used in Modern Crackers 83				
	11	Heat Transfer in a Fast Fluidized Bed 83				
	12	Kinetics of Gasification of Coal in a Fluidized Bed 84				
	13	Species of Fluidization 87				
	14	Fluidized Bed Combustion: The Mainstream of Current Activity 88				
	15	Combustion of Coal in the Fast Fluidized Bed 92				
	16	Combustion in Extremely Shallow Fluidized Beds: The				
		Fluidfire 95				
	17	Bead-Accreting Fluidized Beds: Fluidizing Sticky Solids 100				
	18	The Ignifluid Boiler and the Godel Phenomenon 106				
		knowledgments 107				
	Ref	ferences 107				
5	; C	oal Gasification, Kurt Hedden	111			
J						
	1	The Gasification Reactions 111				
2 Types of Gasification Processes and Yield Calculations 121						
	_	Conventional Gas Producers 132				
		New Developments in Gasification 140				
		omenclature 147				
	K	eferences 148				

6	Solar-Thermal Energy Systems, Ephraim M. Sparrow and Rachel B. Sparrow	
	1 Introduction 149 2 Insolation 152 3 Thermal Analysis of Flat-Plate Collectors 153 4 Flat-Plate Collector Performance Results 167 5 Thermal Storage 175 6 Space Conditioning Systems 178 7 Conclusion 180 Acknowledgment 181 References 181	
7	The French CNRS 1000 kW Solar Furnace: Description, Performance Characteristics, Present Utilization, and Perspectives, F. Trombe, A. Le Phat Vinh, and C. Royere	183
	 Background 183 Description of the Facility 185 Energetic Performance Characteristics of the Odeillo Furnace 189 Utilization of the Solar Furnace for Thermal Shock Studies 198 Utilizations for Processing Refractory Materials 204 Conclusions and Perspectives on Utilizations 215 References 216 Other Sources 217 	
8	Solar-Thermal Power Systems, Jesse C. Denton	219
	1 Introduction 219 2 Solar Energy Source 220 3 Solar-Energy Collection 225 4 Energy Storage 234 5 Electric Power Utility Considerations 236 References 242 Other Sources 243	
9	Heat and Mass Transfer in the Earth, Gene Simmons	245
	1 The Problem 245 2 Materials Properties 250 3 Heat Transfer by Conduction 261 4 Heat and Mass Transfer by Convection in Permeable Media 263	

vi CONTENTS

5 Some Geologic Considerations 271	
6 A Dynamic Model for Geothermal Systems	274
References 275	

10 Geothermal Power Utilization, Present and Future, Valdimar K. Jónsson 279

1 Multipurpose Use of Geothermal Energy 279

2 Geothermal Power Generation 290

3 The District Heating System in Iceland 304 References 323

Index 325

