CONTENTS

1	Pre	1	
	1.1	A crisis of liquid fuels	1
	1.2	Solar energy	8
	1.3	Direct uses of solar energy	14
2	The	18	
	2.1	Basic energy considerations	19
	2.2	Relevant aspects of the mechanism of photosynthesis	26
	2.3	The carbon cycles of photosynthesis	29
	2.4	Actual efficiencies of photosynthesis	35
	2.5	The nature of biomass materials	38
	2.6	Principles of energy accounting for biomass fuels	41
3	Нус	46	
	3.1	The photosynthesis of hydrocarbons	46
	3.2	Seed oils	53
	3.3	Energy accounting for oil-producing crops	56
4	Eth	63	
	4.1	Pretreatment and saccharification	65
	4.2	Fermentation of sugars to ethanol	73
	4.3	Distillation and Separation	75
	4.4	Energy accounting analyses	80
	4.5	Concluding remarks	89
5	The	91	
	5.1	Synthesis gas production	91
	5.2	Methane production from biomass	98
	5.3	Conversion of methane into synthesis gas	102
	5.4	Concluding remarks	103
6	Prir	105	
	6.1	The Functionalities of types of catalyst materials	106
	6.2	Kinetic features of catalytic reactions on solid surfaces	121

7	The Route to Methanol		126
	7.1	The Water-gas shift reaction	126
	7.2	Methanol synthesis	130
8	Liq	uid Hydrocarbon Fuels and their Synthesis	140
	8.1	Gasoline and diesel fuels	140
	8.2	Catalytic reforming of hydrocarbons	142
	8.3	The M-gasoline process	146
	8.4	Fischer-Tropsch synthesis	155
	8.5	Concluding remarks	161
Ref	erence	es	163
Index			166