CONTENTS

Preface					
Acl	knowl	edgments	xv		
1	Histo	orical Development	1		
2	Tidal Phenomenon		7		
	2.1	Introduction	7		
	2.2	Ocean Tides	8		
	2.3	Types of Tides	9		
	2.4	Propagation of Tides in Estuaries	12		
	2.5	Coriolis Effect	13		
	2.6	Barrage Effects	13		
3	Tidal Power Potential and Site Selection		15		
	3.1	Hydroelectric Versus Tidal-Electric Developments	15		
	3.2	Site Potential Estimation	17		
	3.3	Coefficient of the Tide	19		
	3.4	Major Factors Influencing Project Economics	20		
	3.5	Site Selection	20		
			vii		

4	Mana	agement and Organization of Investigations	25
	4.1	Management	25
	4.2	Organization	28
	4.3	Feasibility Studies	29
5	Tidal	Power Schemes and Modes of Operation	35
	5.1	Single-Basin Development, Single-Effect Mode of Operation	35
	5.2	Single-Basin Development, Double-Effect Mode of Operation	38
	5.3	Pumping to Augment Tidal-Effect	40
	5.4	Linked-Basin Developments	42
	5.5	Paired-Basin Developments	45
	5.6	Retiming of Tidal Energy	45
6	Basi	c Data	47
	6.1	Introduction	47
	6.2	General Physiography of the Estuary	48
	6.3	Geology	49
	6.4	Tides	50
	6.5	Waves	54
	6.6	Tidal Currents	54
	6.7	Suspended and Mobile Sediments	55
	6.8	Ecosystem Characteristics	58
7	Hydraulic and Numerical Models in		50
	reas	ibility Investigations	59
	7.1	Introduction	59
	7.2	Hydraulic Models	60
	7.3	Numerical Models for Estuaries	62
	7.4	Hybrid Models	67
	7.5	Modeling of Barrier Effects	67
	7.6	Mathematical Model for Closure Activities	69
	7.7	Utility System Planning and Simulation	69
8	Civil	Works for Tidal Power Development	71
	8.1	Introduction	71
	8.2	Dry Versus Wet Construction	72
	8.3	Design Parameters	77

	8.4	Caisson Design	80
	8.5	Dikes	87
	8.6	Construction Schedules	95
9	Electromechanical Equipment for a Tidal Plant		
	9.1	Introduction	97
	9.2	Specific Requirements for Tidal Generating Equipment	98
	9.3	Types of Turbines	99
	9.4	Generators	113
	9.5	Electrical Equipment	114
	9.6	Transmission	115
10	Optimization of Plant Output		117
	10.1	Principal Variables	117
	10.2	Energy Production and Optimization	118
	10.3	Simulation of Operation	120
	10.4	Development of Models	121
	10.5	Plant Optimization	124
11	Integration of Output with Electric Utility Systems		129
	11.1	Introduction	129
	11.2	Absorption of Raw Tidal Energy	132
	11.3	Enhancing Raw Tidal Energy Output	137
	11.4	System Considerations	141
12	Economic Evaluation		149
	12.1	Introduction	149
	12.2	Economic Cost Parameters	152
	12.3	Economic Analysis	153
	12.4	Sensitivity Analysis	155
	12.5	Risk Assessment	157
13	Socia	al and Regional Impacts	159
14	Environmental Aspects		165
	14.1	Unique Effects	167
	14.2	Agricultural Aspects	174
	14.3	Floods and Drainage	175
	14.4	Birds	176

	14.5	Fish and Fisheries	177
	14.6	Recreation and Tourism	178
	14.7	Transportation	179
	14.8	Summary	179
15	Existi	ng Tidal-Electric Developments	183
	15.1	La Rance Tidal-Electric Plant	184
	15.2	Jiangxia Tidal-Electric Plant	194
	15.3	Kislaya Guba Experimental Plant	195
	15.4	Annapolis Tidal-Electric Plant	198
16	Potential Developments		207
	16.1	Argentina	208
	16.2	Australia	211
	16.3	Brazil	214
	16.4	Canada	215
	16.5	Canada-United States	224
	16.6	China	226
	16.7	France	226
	16.8	India	228
	16.9	Korea	230
	16.10	Mexico	233
	16.11	Russian Federation	234
	16.12	United Kingdom	238
	16.13	United States	242
Арр	245		
Glo	255		
Ref	263		
Bib	275		
Inde	277		