Contents

Foreword		xiii
by Qingtai	Chen	
Foreword		xv
by David I	Dollar	
Foreword	·	xvii
by Christia	an Delvoie	
Preface		xix
About the Au	thors	xxiii
Acknowledgments		
Acronyms and Abbreviations		
Executive Summary		
The Problems China Faces		
Sustainability: A Challenging but Feasible Goal		
The Path t	o Sustainability	xxxix
Sequencing the Steps to Sustainability		
Chapter 1	Introduction	1
	An Impressive Foundation of Past Achievements	1
	Growing Concerns about China's Energy Future	2
	The Four Pillars of Energy Sustainability	5
	The Closing Window of Opportunity	6
	Structure of the Report	7
		•

Chapter 2	China's Energy Future:		Chapter 7	Shaping the Future toward Sustainability	149
	The Challenge of Recent Trends	. 11	-	At the Threshold of Change toward	
	Sustained Consumption Growth, 1980-2000	13		Sustainability in Energy Structure and Policy	151
	High Growth Forecast for 2000 to 2020	19		Characteristics of a Comprehensive Policy	
	Recent Signs of an Unsustainable			for Energy Sustainability	154
	Energy Growth Path	22		Four Guiding Pillars for Sustainability Policy	156
	The Urgency for Policy Action	30		Building Blocks to Put the Energy Sector	
			4.0	on a Sustainable Path	157
Chapter 3	Reining in Future Energy Consumption	35	•	The Sequence of Steps to Sustainability	170
	Achievements in Energy Efficiency	37		-	
	Concerns about Energy Consumption Trends		Appendix A	Gross Domestic Product and Energy	
	of the 10th Five-Year Plan	41	· • •	Consumption in China, 1980–2005	181
	Bold New Directions of the 11th Five-Year Plan	41			
•	The Closing Window of Opportunity		Appendix B	Biomass Energy Use in China	187
	for Reducing Long-Term Energy Intensity	43		Summary	187
	The Missing Link: An Improved Policy	-		Biomass Resources	187
	and Institutional Framework	63		Current Status of Development	188
				Prospects for Biomass in China's Energy Balance	188
Chapter 4	Greening the Energy Sector	67	•	Adverse Effects on the Natural Environment	
•	Pollution Levels Still a Major Concern	69		and on Human Health from Biomass Use	189
	Environmental Impacts of the Energy Scenarios	72		Policies Designed to Encourage the Use	
	The Energy Path to Greener Development	74		of Modern Biomass Technologies	190
Chapter 5	Securing Energy Supply	87	Appendix C	The Chinese System for Energy Statistics:	
	China's Growing Sense of Insecurity	89		History, Current Situation, and Ways	
	Options for Securing Oil and Gas Supply	96		to Improve the System	19
	Options for Securing Electricity Supply	115		The Groundwork Established in the 1980s	. 19
	Choosing the Right Mix and Amount			Retrenchment in the 1990s	19.
	of Energy Supply Security Measures	119		The Current Situation and Its Weaknesses	19
			•	Conclusions and Recommendations	19
Chapter 6	Getting the Fundamentals Right	127			
	Furthering the Reform Agenda		Appendix D	Energy Costs as a Proportion of Gross	
	and Developing a Sound Pricing Framework	129		Domestic Product: Estimates for China,	
	Energy Pricing in Competitive Markets	131		Japan, and the United States	19
	Setting Sound Regulated Tariffs	133	•		
	Taxing Energy Commodities	136	Appendix E	Feedback from the Dissemination Workshop	20
	Measures to Mitigate the Environmental			Feedback 1: China's Energy Economy Presents	
	Effects of Energy Use	138		Many Challenges	20
	Energy Commodity Price Policy:			Feedback 2: The Energy Statistical System	
	Status and Necessary Changes	141		Needs Revision	20

 ∞

0

()

80

	reedback 3: The Target 20 Percent Energy-Intensis	ty
	Reduction during the 11th Five-Year Plan Will	•
	Be Difficult to Achieve	203
	Feedback 4: Economic Well-Being, Energy	
-	Consumption, and Environmental Concerns	
	Should Be Addressed	204
	Feedback 5: Energy Technology Leapfrogging	
*	Requires Clarification	205
	Feedback 6: International Cooperation	205
	and Technology Transfer Are Needed	206
Appendix F	Life-Cycle Costs of Electricity Generation	
	Alternatives with Environmental Costs	
	Factored In	208
		200
Appendix G	International Experience of Insecurity	
	of Energy Supply	212
	Concerns about Oil Imports	212
	Gas Supply Concerns	219
	Concerns about Electricity Supply Failures	224
	Coal Supply, Competitiveness,	
	and Environmental Concerns	226
Appendix H	Strategic Oil Reserves for China	228
	International Practice	228
	Commercial Stocks	229
	Rationale for Stockpiling	229
	Rationale for a Particular Level of Stocks	230
	Decisions to Draw Down Stocks	230
	Costs	230
	A Strategic Oil Reserve for China?	231
	Quality of Estimates	232
		0
Appendix I	Predominant Approaches for Setting	
	Regulated Tariffs for Gas and Electricity	
	Transmission and Distribution	233
	Period between Full Tariff Cases	234
	Three Simple Rules Necessary	40 T
	for Determining Tariffs	234
	Revenue Requirements	235
	• • • • • • • • • • • • • • • • • • • •	233

3.3	Energy Efficiency in Buildings	60	3.3	China's Energy Intensity and Major Development	
4.1	Key Elements for Environmental Improvement		0.5	Periods, 1954–2005	46
	in the Green Growth Scenario	73	3.4	Tunneling a Less Intensive Energy Path to Higher	
4.2	China's Clean Development Fund:	· ·	5	Per Capita Income	47
	Leveraging Carbon Finance for Technology Transfer	82	3.5	Energy-Intensive Industries to Double Output by 2020	53
5.1	Bank Involvement in China's Coal Subsector	94	3.6	Projected Truck Fleet by 2020	55
5.2	Examples of Domestic Energy Development		3.7	Increase in Vehicle Population	56
	Incentives in Other Industrial Countries	98	4.1	Expected Growth in Global Carbon Dioxide	
5.3	Repatriating Equity Oil:			Emissions through 2020	72
	Is There a Better Way to Provide Security?	102	4.2	Funding the Technological Leapfrogging	84
5.4	The IEA's Approach to Short-Term Oil Emergencies	111	5.1	Energy Insecurity: Generic Causes, Effects,	
5.5	The Shell Group's Latest Energy Security Scenarios	113		and China's Special Concerns	90
5.6	Strengthening China's Energy Security:		7.1	Designing and Implementing a Coordinated Energy Policy	158
	China's Special Concern	120	F.1	Levelized Cost Comparison of IGCC and Subcritical	
7.1	Effective Energy Institutions Involve Significant			600-Megawatt with FGD Units: Capital Cost Ratio	210
	Staffing and Budgets	152	F.2	Levelized Cost Comparison of IGCC and Subcritical	
7.2	The U.S. Energy Policy Act of 2005	160		600-Megawatt with FGD Units: Change of Capital	-
7.3	Key Elements of a Program for a 20 Percent			Cost of IGCC	211
	Improvement in Energy Efficiency	162	I.1	Three Simple Rules for Determination of Tariffs	235
7.4	Creation of a Strong Energy Ministry Reflects		K.1	The Gas Supply Chain: Structure, Contracting, and	
	International Practice	164		Pricing Prior to Introduction of Wholesale Competition	250
7.5	China and the International Energy Agency	167	K.2	The Gas Supply Chain: Structure, Contracting, and	
G.1	The 2003–06 Oil Price Spike—How Significant Is It			Pricing after the Introduction of Wholesale Competition	255
	in the Security Debate?	216		·	
G.2	Causes of the First 21st Century Oil Shock	217	-		
G.3	Regional and Liquefied Natural Gas Supply Issues	220	Tabi		
G.4	Canadian Views on the Security of Gas Supply	223	2.1	Primary Energy Production and Consumption,	14
J. 1	Impacts of Selected Failed Policies	242		1980–2000	1-
J.2	The Present Gas Supply-and-Demand Situation		2.2	Final Energy Consumption by Economic Sector	18
	in North America	245	2.2	and Fuel, 1980–2000	10
			2.3	Key Policy Elements Affecting the Projections of the DRC and ERI's Scenarios for 2020	20
Figu			2.4		۷.
2.1	Energy Intensity and Energy/GDP Elasticity, 1980-2005	16	2.4	Projections of China's Primary Energy Consumption, 2000–20	2
2.2	Net Oil Imports, 1990–2005	27	2.5	Final Energy Consumption by Sector and Fuel, 2000–20	2
2.3	GDP per Kilogram of Oil Equivalent of Energy Use	31			۷.
3.1	China's Per Capita Energy Consumption and GDP		2.6	China's Primary Energy Production	24
	Compared with Selected Countries and the World Average	44	27	and Consumption, 2000–05	2
3.2	China's Projected Growth Path of Energy Demand.		2.7 3.1	China's Oil Consumption and Trade, 1990–2005	. 21
	1980-2020, Compared with That of Other Countries	45	3.1	Change in China's Energy Intensity by End-Use Sector, 1980–2000	38
				Sector, 1960–2000	30

3.2	Improvements in the Efficiency of Key Energy-Using	
	Equipment and Comparison with International	
	Standards, 1980-2000	39
3.3	Sectoral Composition of China's GDP, 1980-2000	40
3.4	Energy Demand/GDP Elasticities of Major Industrial	• •
	Countries, 1961–2002	47
3.5	Household Appliances per 100 Households, 1995–2002	62
4.1	Projections of Key Air Pollutants in the Energy Scenarios	
	for 2000-20 and Government Caps	74
5.1	Oil and Gas Reserves in the Middle East	Ť
	and Russian Federation	99
5.2	Assessment of Relative Difficulty, Cost, and Degree	
	of Control of Key Measures for Short-Term Oil	
	Supply Security	104
6.1	Fuel Taxation in Selected Countries	137
6.2	A Classification of Market-Based and	
	Regulatory Instruments	140
7.1	Shaping the Future: The Issues, Guiding Pillars,	
	Building Blocks, and Sequencing Steps to Sustainability	176
B.1	Development of Biomass Energy in China	189
C.1	Final Energy Consumption by Sector, 1980-2000	195
C.2	Final Energy Consumption by Fuel Type, 1980–2000	196
C.3	Conversion Factors for Tables C.1 and C.2	196
D.1	Total Primary Energy Consumption and Fuel Shares	
	in China, 2005	199
D.2	Total Primary Energy Consumption and Fuel Shares	
	in Japan, 2005	199
D.3	Total Primary Energy Consumption and Fuel Shares	
	in the United States, 2005	200
F.1	Main Technical Indices of IGCC and Subcritical	
~ 1	600-Megawatt with FGD Units	209
G.1	Major Global and Regional Oil Supply Crises since 1950	213
G.2	Some Major Electricity Failures of the Past 40 Years	225
K.1	A Phased Approach to the Introduction	
	of Wholesale Competition	251
L.1	New Tariff Requirements	259