TABLE OF CONTENTS

PREFACE	xi
ACKNOWLEDGEMENTS	xiii
1 INTRODUCTION	
 1.1 Impacts of Climate Change 1.2 Tracing the History of Greenhouse Gas Emissions 1.3 Global Efforts to Stabilize Climate Change 1.4 Climate Change Mitigation and Developing Countries 1.5 Outline of the Book 	2 4 5 7 9
2 GREENHOUSE GAS EMISSIONS	
 2.1 Introduction 2.2 Greenhouse Gases, Aerosols and Radiative Forcing 2.3 Growth in Concentration of Greenhouse Gases 2.4 Carbon Dioxide Emissions 2.4.1 Global annual CO₂ budget 2.4.2 Projection of CO₂ emissions according to SRES scenarios 2.4.3 Projection of carbon dioxide concentrations in the atmosphere 2.5 Share of Developing Countries in Global Carbon Dioxide Emissions 2.5.1 Share of developing countries in annual carbon budget 2.5.2 Contribution of industrialized and developing countries to cumulative CO₂ emissions during the twentieth century 2.5.3 Projections of share of developing countries in fossil fuel related carbon dioxide emissions 2.5.4 Carbon dioxide emissions and GDP in selected developing and industrialized countries 	11 11 12 14 15 15 21 22 22 22 22
2.5.5 CO ₂ emissions per unit of GDP 2.5.6 Growth in aggregate GDP and CO ₂ emissions in China 2.6 Methane Emissions Projections	25 26 26
2.7 Carbon Dioxide Equivalent Greenhouse Gas Emissions2.8 Greenhouse Gas Inventory; Case Studies of Argentina, Indonesia and	27
Zimbabwe 2.9 Emissions Inventory and Developing Countries 2.9.1 Factors contributing to quality of greenhouse gas inventory 2.9.2 Measures to improve greenhouse gas inventory 2.10 Implications of Reliable Estimates of Greenhouse Gas Emissions Inventory 2.11 Conclusions	28 33 33 33 34 35

3 CARBON EMISSIONS – HISTORICAL TRENDS AND FUTURE SCENARIOS

 3.1 Introduction 3.2 Regional and Country-Specific CO₂ Emissions 3.3 Methodology 3.3.1 Historical trends in CO₂ emissions 3.3.2 Future scenarios of CO₂ emissions 3.3.3 Sources of data and methods of analysis 3.4 Decomposition Analysis of CO₂ Emissions – World 3.5 Decomposition Analysis of CO₂ Emissions – Asia 3.6 Decomposition Analysis of CO₂ Emissions - Latin America 3.7 Decomposition Analysis of CO₂ Emissions – Africa 3.8 Inter-Country Comparison of Economic Growth and CO₂ Emissions 3.8.1 Past trends of CO₂ emissions 3.8.2 Projections of CO₂ emissions 3.0 Conclusions 	37 38 39 40 41 41 43 46 51 55 57 57 59 62
3.9 Conclusions 4. CLIMATE CHANCE, WILLNEDADILITY IMPACTS AND ADAPTATE	
4 CLIMATE CHANGE: VULNERABILITY, IMPACTS AND ADAPTAT	ION
4.1 Introduction	63
4.2 Projected Patterns of Climate Change	64
4.2.1 Predicting climate change	64
4.2.2 Observed changes in climate system	66
4.2.3 Projections of climate change	66
4.3 Assessment of Vulnerability to and Impacts of Climate Change	69
4.4 Observed Impacts of Recent Regional Climate Change	70
4.5 Projected Impact of Climate Change on Food Production and Security4.5.1 Impact of climate change on agriculture and food	71
security; Second Assessment Report of the IPCC	72
4.5.2 Impact of climate change on food production - regional impacts 4.5.3 Impact of climate change on agriculture and food	73
security; Third Assessment Report of the IPCC	73
4.5.4 Future food production and climate change according to other studies	75
4.5.5 Uncertainty of projections of climate change on agriculture	76
4.6 Impact of Climate Change on Forest Ecosystems	77
4.7 Impact of Climate Change on Water Resources, Health, and Sea Level Rise 4.7.1 Water resources and stress	80 80
4.7.2 Human health	81
4.7.3 Sea level rise	82
4.7.4 Human infrastructure and habitats	83
4.8 Greenhouse Damage Assessment	84
4.9 Adaptation to Climate Change	85
4.9.1 Types of adaptation	86
4.9.2 Why is adaptation necessary?	87
4.9.3 Generic adaptation strategies	88

4.9.4 Sector-specific adaptation strategies	89
4.10 Barriers and Approaches to Promotion of Adaptation Strategies	91
4.11 Adaptation at Global, National and Local Levels	92
4.12 Mitigation Versus Adaptation	93
4.13 Conclusions	94
5 CLIMATE CHANGE MITIGATION	
5.1 The Approach to Mitigation	97
5.1.1 Climate change mitigation studies: Background	98
5.1.2 Methodology for mitigation studies	99
5.1.3 The structure of a mitigation assessment	100
5.1.4 Time horizon of a mitigation assessment	102
5.2 Mitigation Opportunities in the Energy Sector	104
5.2.1 Primary mitigation options	104
5.2.2 Results from greenhouse gas mitigation studies: Bottom-up approach	105
5.2.3 Results from greenhouse gas mitigation studies: Multicriteria approach	113
5.2.4 Results from greenhouse gas mitigation studies: Top-down approach	114
5.2.5 Energy sector mitigation; Third Assessment Report of the IPCC	118
5.2.6 Summary of key findings from energy sector mitigation studies	119
5.3 Forest Sector Mitigation in Developing Countries	120
5.3.1 Status of forests in developing countries	121
5.3.2 Implications of forest loss, degradation and low afforestation rates	122
5.3.3 Mitigation opportunities in the forestry sector	123
5.3.4 Methodology for assessment of forestry sector activities	126
5.3.5 Land availability for mitigation activities	129
5.3.6 Mitigation potential of land use, land-use change and forestry sector	131
5.3.7 Mitigation potential assessment for seven developing countries	137
5.3.8 Cost-effectiveness of mitigation	138
5.3.9 Investment for realizing mitigation potential in the forestry sector	143
5.3.10 Comparison of energy and forestry sector mitigation potential 5.4 Agriculture	144 144
e	
5.4.1 Features of the agriculture sector activities 5.4.2 Mitigation opportunities for CO ₂ in the agriculture sector	145 146
5.4.3 Methane emissions reduction from agriculture sector	149
5.4.4 Mitigation of nitrous oxide	153
5.4.5 Methane and nitrous oxide emissions and mitigation potential	153
5.4.6 Methane mitigation potential and cost-effectiveness	155
5.4.7 Mitigation potential in agriculture sector; Third Assessment	133
Report of the IPCC	156
5.4.8 Conclusions on mitigation activities in the agricultural sector	157
5.5 Conclusions	158
6 POLICIES, PROGRAMS, AND MEASURES	
6.1 Barriers to Mitigation Options in Developing Countries	162
6.1.1 Generic barriers	162
6.1.2 Technology-specific barriers	165
o.i.2 reciniology specific bufflets	103

6.2 Policies Programs and Massures to Overcome Rarriers	166
6.2 Policies, Programs and Measures to Overcome Barriers	166
6.2.1 Macro policies, programs and measures	167
6.2.2 Sectoral policies, programs and measures 6.3 Regulatory Instruments	168 172
6.3.1 Energy and environmental performance standards	172
6.3.2 Procurement policies	173
6.3.3 Environmental legislation	173
6.4 Demand-side Management Programs	173
6.5 Renewable Energy Programs	174
6.6 Land Use Land-Use Change and Forestry Sector	175
6.7 Agriculture Sector	176
6.8 Policies and Measures to Promote Adaptation Strategies	176
6.9 Information Programs	176
6.10 Summary	177
7 GLOBAL MECHANISMS FOR ADDRESSING CLIMATE CHANGE	
7.1 GLOBAL ENVIRONMENT FACILITY	179
7.1.1 Genesis	179
7.1.2 Pilot phase of GEF	180
7.1.3 Restructured phase	181
7.1.4 Eligibility criteria and operational principles	182
7.1.5 Operational programs under climate change portfolio	183
7.1.6 Project cycle	183
7.1.7 GEF funding of climate change focal area	185
7.1.8 Performance and impact of GEF programs	188
7.1.9 GEF: Problems and challenges	189
7.1.10 Potential measures to overcome project cycle hurdle	192
7.1.11 Future of GEF	193
7.2 CLEAN DEVELOPMENT MECHANISM	197
7.2.1 Background	197
7.2.2 How might CDM work?	199
7.2.3 CDM institutions	202
7.2.4 Concepts, definitions and terminology	203
7.2.5 Project boundary and monitoring domain	205
7.2.6 Baselines and additionality	206
7.2.7 Meeting criteria for sustainable development	211
7.2.8 Monitoring, evaluation, reporting, verification and certification	
of CDM projects	212
7.2.9 CDM: Implications for LULUCF sector	215
7.2.10 CDM and adaptation	217
7.2.11 CDM: Contentious issues	217
7.2.12 Project developer's perspective	221
7.2.13 NGOs' perspective	221
7.2.14 Perspective of the developing country governments	222
7.2.15 Developing country preparedness for CDM	222
7.2.16 CDM and developing countries	223

8 CLIMATE CHANGE: DEVELOPMENT, EQUITY AND SUSTAINABILITY

8.1. Introduction	225
8.2 Linkage Between Climate Change, Development, Equity and Sustainability	227
8.2.1 Development	227
8.2.2 Equity	228
8.2.3 Sustainable development	231
8.3 Differential Contribution and Impacts	232
8.3.1 Past and cumulative emissions	233
8.3.2 Projected CO ₂ emissions from developing countries	233
8.3.3 Differential impacts of climate change	234
8.4 Costs of Adaptation, Mitigation and Burden Sharing	235
8.4.1 Mitigation and adaptation	235
8.4.2 Estimating the cost of adaptation and mitigation	236
8.4.3 Co-benefits of mitigation actions	237
8.4.4 Implications of Kyoto mechanisms on economic development	
in developing countries	238
8.5 Global Climate Change Stabilization; Participation of Developing Countries	239
8.5.1 Burden sharing of mitigation and adaptation costs	239
8.5.2 Options for burden sharing	240
8.5.3 Burden sharing mechanisms under the Kyoto Protocol	242
8.6 Cost-Effectiveness, Equity and Sustainability	244
9 CLIMATE CHANGE AND DEVELOPING COUNTRIES	
9.1 Climate Change and the Stake for Developing Countries	247
9.2 Stabilization of Greenhouse Gases in Atmosphere to Mitigate	
Climate Change	249
9.3 The Roles of UNFCCC and Kyoto Protocol in Addressing Climate Change	251
9.4 GEF and Developing Countries	252
9.5 Climate Change; Technology Transfer, Capital Flows and Capacity Building	253
9.5.1 Barriers to transfer of ESTs, capital and institutional capacity	253
9.5.2 Strategies for transfer of ESTs, capital and institutional capacity	254
	255
9.6 Clean Development Mechanism	255
	256
•	256
9.7.2 Supplementarity	257
	258
	258
*	259
7	260
9.9 Climate Change Negotiations and Developing Countries; Future Directions	262
REFERENCES	267
INDEX	283