

List of Tables

Table 1.1	Gross Domestic Product (2015 US\$ Constant Prices) and Population in East Asia Summit 17 Countries (2019–2050)	8
Table 1.2	Imported Price Assumption of Real Oil, Natural Gas, and Coal	11
Table 1.3	Other Assumptions of Energy-saving Target Alignment with Nationally Determined Contributions in the Alternative Policy Scenario by East Asia Summit 17	12
Table 2.1	Australia – Energy Indicators, Business as Usual (1990–2050)	48
Table 3.1	Brunei Darussalam – Gross Domestic Product and Population Projection (2020–2050)	76
Table 3.2	Brunei Darussalam – Energy Supply and Consumption (2019)	78
Table 4.1	Cambodia – Updated Energy Information	101
Table 4.2	Cambodia – Installed Capacity, Business as Usual	101
Table 4.3	Cambodia – Installed Capacity, Alternative Policy Scenario 5	102
Table 4.4	Cambodia – Installed Capacity, Low-carbon Energy Transition	102
Table 4.5	Cambodia – Sectoral Share and Absolute Number of Greenhouse Gas Emissions, Business as Usual (2030)	113
Table 4.6	Cambodia – Summary of Business-as-Usual Emissions and Nationally Determined Contribution Emission Reduction	113
Table 5.1	China – Assumptions of Annual Growth Rates of Gross Domestic Product and Population	122
Table 8.1	Change in Final Energy Consumption by Sector, 2019 to 2050	184
Table 10.1	Assumption of Annual Average Growth of Gross Domestic Product and Population	218
Table 10.2	Potential Removals, Land Use Change & Forestry, Low Carbon Energy Transition Scenario, 2020–2050	231
Table 11.1	Assumptions, Gross Domestic Product Annual Growth Rate (%)	241
Table 11.2	Assumptions, Population Annual Growth Rates	241
Table 11.3	Energy Saving and Carbon Dioxide Reduction, Alternative Policy Scenario	246
Table 11.4	Potential Removals of LULUCF, Low Carbon Energy Transition Scenario, 1994–2050	253
Table 12.1	Installed Capacity and Power Generation by Fuel Type, 2019–2020	263

Table 12.2	Installed Capacity and Power Supply in Scenarios, 2030	264
Table 14.1	The Assumptions of GDP Annual Growth Rates, 2019–2050	306
Table 14.2	The assumptions of Population Annual Growth Rates, 2019–2020 and 2020–2050 (%)	306
Table 14.3	Alternative Policy Scenarios	312
Table 15.1	Assumptions of Annual Gross Domestic Product Growth Rates (%)	332
Table 17.1	Mitigation Targets and Related Legal Documents	359
Table 17.2	Potential Removals of Land Use, Land Use Change, And Forestry in Low Carbon Energy Transition Scenario, 2014–2050	374

List of Figures

Figure 1.1	Average Annual Growth Rates of Gross Domestic Product and Population in East Asia Summit 17 Countries	7
Figure 1.2	Average East Asia Summit 17's Thermal Efficiency in the Business-as-Usual Scenario	10
Figure 1.3	Average East Asia Summit 17's Thermal Efficiency in the Alternative Policy Scenario	10
Figure 1.4	Average East Asia Summit 17's Thermal Efficiency in the Low-Carbon Energy Transition Scenario	11
Figure 1.5	Final Energy Consumption by Sector, Business-as-Usual Scenario (1990–2050)	15
Figure 1.6	Final Energy Consumption Share by Sector (1990–2050)	15
Figure 1.7	Final Energy Consumption by Fuel (1990–2050)	16
Figure 1.8	Final Energy Consumption Share by Fuel (1990–2050)	16
Figure 1.9	Primary Energy Supply in East Asia Summit 17 (1990–2050)	17
Figure 1.10	Share of Primary Energy Mix by Source (1990–2050)	18
Figure 1.11	Energy Mix of the Power Generation in East Asia Summit 17 (1990–2050)	18
Figure 1.12	Share of Power Generation Mix in East Asia Summit 17 (1990–2050)	19
Figure 1.13	Final Energy Intensity – Final Energy Consumption per Unit of Gross Domestic Product (toe/million 2015 US\$)	20
Figure 1.14	Primary Energy Intensity – Final Energy Consumption per Unit of GDP (toe/million 2015 US\$)	21
Figure 1.15	Carbon Intensity of Gross Domestic Product (t-C/million 2015 US\$)	22
Figure 1.16	Carbon Intensity of Primary Energy Supply (t-C/toe)	23
Figure 1.17	Total Final Energy Consumption, Business-as-Usual Scenario vs Alternative Policy Scenario vs Low-carbon Energy Transition	24
Figure 1.18	Final Energy Consumption by Sector, Business-as-Usual Scenario vs Alternative Policy Scenario vs Low-carbon Energy Transition	25
Figure 1.19	Total Primary Energy Supply, Business-as-Usual Scenario vs Alternative Policy Scenario vs Low-carbon Energy Transition	26
Figure 1.20	Primary Energy Supply by All Energy Sources, Business-as-Usual Scenario vs Alternative Policy Scenario vs Low-carbon Energy Transition	27
Figure 1.21	Primary Energy Supply by Fossil Fuel Source, Business-as-Usual Scenario vs Alternative Policy Scenario vs Low-carbon Energy Transition	28

Figure 1.22	Primary Energy Supply by Clean Fuel and Renewable Sources, Business-as-Usual Scenario vs Alternative Policy Scenario vs Low-carbon Energy Transition	29
Figure 1.23	Power Generation, Business-as-Usual Scenario vs Alternative Policy Scenario vs Low-carbon Energy Transition (Terawatt-hours)	30
Figure 1.24	Power Generation, Business-as-Usual Scenario, Alternative Policy Scenario, and Low-carbon Energy Transition (%)	30
Figure 1.25	Total CO ₂ Emissions, Business-as-Usual Scenario, Alternative Policy Scenario, and Low-carbon Energy Transition	32
Figure 2.1	Australia – Gross Domestic Product and Population (1990–2050)	42
Figure 2.2	Australia – Final Energy Consumption by Sector, Business as Usual (1990–2050)	43
Figure 2.3	Australia – Final Energy Consumption by Fuel Type, Business as Usual (1990–2050)	44
Figure 2.4	Australia – Primary Energy Supply by Fuel Type, Business as Usual (1990–2050)	45
Figure 2.5	Australia – Power Generation, Business as Usual (1990–2050)	46
Figure 2.6	Australia – Share of Power Generation Mix, Business as Usual (1990–2050)	46
Figure 2.7	Australia – Thermal Efficiency of Power Generation, Business as Usual (1990–2050)	47
Figure 2.8.	Australia – Indices of Energy Indicators, Business as Usual (1990 = 100)	48
Figure 2.9	Australia – Final Energy Consumption by Sector, Alternative Policy Scenario (1990–2050)	49
Figure 2.10	Australia – Final Energy Consumption by Fuel Type, Alternative Policy Scenario (1990–2050)	50
Figure 2.11	Australia – Power Generation, Alternative Policy Scenario (1990–2050)	51
Figure 2.12	Australia – Share of Power Generation Mix, Alternative Policy Scenario (1990–2050)	51
Figure 2.13	Australia – Primary Energy Supply by Fuel Type, Alternative Policy Scenario (1990–2050)	52
Figure 2.14	Australia – Total Final Energy Consumption, Alternative Policy Scenario vs Business as Usual (2019–2050)	53
Figure 2.15	Australia – Final Energy Consumption by Sector, Alternative Policy Scenario vs. Business as Usual (2019 and 2050)	54
Figure 2.16	Australia – Total Primary Energy Consumption, Alternative Policy Scenario vs Business as Usual (2019–2050)	55
Figure 2.17	Australia – Total Primary Energy Supply, Business as Usual vs Alternative Policy Scenario (2019 and 2050)	56

Figure 2.18	Australia – Primary Energy Supply by Fuel, Alternative Policy Scenario vs Business as Usual (2019 and 2050)	56
Figure 2.19	Australia – Indices of Energy Indicators, Alternative Policy Scenario (1990 = 100)	57
Figure 2.20	Australia – CO ₂ Emissions Trends for Domestic Energy Use, Alternative Policy Scenario vs. Business as Usual	58
Figure 2.21	Australia – CO ₂ Emissions from Fuel Combustion, Alternative Policy Scenario vs. Business as Usual	58
Figure 2.22	Australia – CO ₂ Emissions Savings, Alternative Policy Scenario, 2050	59
Figure 2.23	Australia – Final Energy Consumptions by Sector, Low-Carbon Energy Transition (1990–2050)	60
Figure 2.24	Australia – Final Energy Consumptions by Fuel Type, Low-Carbon Energy Transition (1990–2050)	60
Figure 2.25	Australia – Final Energy Consumptions, Low-Carbon Energy Transition, Alternative Policy Scenario, and Business as Usual (1990–2050)	61
Figure 2.26	Australia – Primary Energy Supply by Fuel Type, Low-Carbon Energy Transition (1990–2050)	62
Figure 2.27	Australia – Primary Energy Consumptions, Low-Carbon Energy Transition, Alternative Policy Scenario, and Business as Usual (1990–2050)	62
Figure 2.28	Australia – Electricity Generation by Fuel Type, Low-Carbon Energy Transition (1990–2050)	63
Figure 2.29	Australia – Electricity Generation, Low-Carbon Energy Transition, Alternative Policy Scenario, and Business as Usual (1990–2050)	64
Figure 2.30	Australia – Indices of Energy Indicators, Low-Carbon Energy Transition (1990 = 100)	65
Figure 2.31	Australia – Saving of Fossil Fuel Consumption in 2050, Low-Carbon Energy Transition	66
Figure 2.32	Australia – Fossil Fuel Consumptions, Low-Carbon Energy Transition, Alternative Policy Scenario, and Business as Usual (1990–2050)	67
Figure 2.33.	Australia – CO ₂ Reduction in 2030 and 2050, Low-Carbon Energy Transition	68
Figure 2.34	Australia – CO ₂ Emissions, Low-Carbon Energy Transition, Alternative Policy Scenario, and Business as Usual (1990–2050)	69
Figure 2.35	Australia – CO ₂ Reduction in 2030 and 2050, Alternative Policy Scenario and Low-Carbon Energy Transition	69
Figure 3.1	Brunei Darussalam – Gross Domestic Product and Population Growth Rate, Business as Usual	77
Figure 3.2	Brunei Darussalam – Total Primary Energy Supply by Fuel, Business as Usual (1990–2050)	79

Figure 3.3	Brunei Darussalam – Final Energy Consumption by Sector, Business as Usual	80
Figure 3.4	Brunei Darussalam – Final Energy Consumption by Sector, Business as Usual	80
Figure 3.5	Brunei Darussalam – Final Energy Consumption by Fuel, Business as Usual	81
Figure 3.6	Brunei Darussalam – Electricity Generation by Fuel, Business as Usual	82
Figure 3.7	Brunei Darussalam – Carbon Dioxide Emission by Fuel, Business as Usual	82
Figure 3.8	Brunei Darussalam – Energy Indicators, Business as Usual	83
Figure 3.9	Brunei Darussalam – Reduction of Primary Energy Supply, Business as Usual and Alternative Policy Scenario	84
Figure 3.10	Brunei Darussalam – Final Energy Consumption Share by Sector, Alternative Policy Scenario	85
Figure 3.11	Brunei Darussalam – Final Energy Consumption by Sector, Business as Usual and Alternative Policy Scenario	85
Figure 3.12	Brunei Darussalam – Final Energy Consumption by Fuel Type, Business as Usual and Alternative Policy Scenario	86
Figure 3.13	Brunei Darussalam – Power Generation, Business as Usual and Alternative Policy Scenario	86
Figure 3.14	Brunei Darussalam – CO ₂ Emissions in Energy Consumption, Business as Usual and Alternative Policy Scenario	87
Figure 3.15	Brunei Darussalam – Energy Indicators, Alternative Policy Scenario	88
Figure 3.16	Brunei Darussalam – Total Primary Energy Supply, Business as Usual and Alternative Policy Scenario	88
Figure 3.17	Brunei Darussalam – Total Final Energy Consumption by Sectors, Business as Usual and Alternative Policy Scenario	89
Figure 3.18	Brunei Darussalam – Total Primary Energy Supply by Fuel Type, Business as Usual and Alternative Policy Scenario	90
Figure 3.19	Brunei Darussalam – CO ₂ Emissions, Business as Usual and Alternative Policy Scenario	90
Figure 3.20	Brunei Darussalam – Total Primary Energy Supply, Low-carbon Energy Transition	91
Figure 3.21	Brunei Darussalam – Total Final Energy Consumption by Sector, Low-carbon Energy Transition	92
Figure 3.22	Brunei Darussalam – Total Final Energy Consumption by Fuel Types, Low-carbon Energy Transition	92
Figure 3.23	Brunei Darussalam – Power Generation, Low-carbon Energy Transition	93
Figure 3.24	Brunei Darussalam – CO ₂ Emissions, Low-carbon Energy Transition	94
Figure 3.25	Brunei Darussalam – Saving of Fossil Fuel Consumption, Alternative Policy Scenario and Low-carbon Energy Transition	94

Figure 3.26	Brunei Darussalam – CO ₂ Emission Reduction, Alternative Policy Scenario and Low-carbon Energy Transition	95
Figure 4.1	Cambodia – Total Primary Energy Supply, Business as Usual	103
Figure 4.2	Cambodia – Total Final Energy Consumption by Sector, Business as Usual	104
Figure 4.3	Cambodia – Total Final Energy Consumption by Fuel, Business as Usual	104
Figure 4.4	Cambodia – Power Generation by Fuel, Business as Usual	105
Figure 4.5	Cambodia – CO ₂ Emissions from Energy Consumption, Business as Usual	106
Figure 4.6	Cambodia – Energy and CO ₂ Indicators, Business as Usual	106
Figure 4.7	Cambodia – Total Primary Energy Supply, Business as Usual, Alternative Policy Scenario, and Low-carbon Energy Transition (2050)	108
Figure 4.8	Cambodia – Electricity Generation, Business as Usual, Alternative Policy Scenario, and Low-carbon Energy Transition (2050)	108
Figure 4.9	Cambodia – CO ₂ Emissions, Business as Usual, Alternative Policy Scenario, and Low-carbon Energy Transition (2050)	109
Figure 4.10	Cambodia – Final Energy Demand by Sector, Business as Usual and Alternative Policy Scenario	110
Figure 4.11	Cambodia – Primary Energy Supply by Fuel, Business as Usual and Alternative Policy Scenario	111
Figure 4.12	Cambodia – Total Primary Energy Saving Potential by Fuel, Business as Usual vs. Alternative Policy Scenario	111
Figure 4.13	Cambodia – CO ₂ Emission by Fuel, Business as Usual and Alternative Policy Scenario	112
Figure 4.14	Cambodia – Total Final Energy Consumption by Sector, Low-carbon Energy Transition	114
Figure 4.15	Cambodia – Total Final Energy Consumption by Fuel, Low-carbon Energy Transition	115
Figure 4.16	Cambodia – Total Primary Energy Supply by Fuel, Low-carbon Energy Transition	115
Figure 4.17	Cambodia – Total Primary Energy Supply by Fuel, Low-carbon Energy Transition	116
Figure 4.18	Cambodia – CO ₂ Emission Reduction, Business as Usual, Alternative Policy Scenario 5, and Low-carbon Energy Transition	117
Figure 4.19	Cambodia – Energy Indicator, Low-carbon Energy Transition	117
Figure 5.1	China – Assumptions of the Average Annual Growth Rate of Gross Domestic Product and Population	123
Figure 5.2	China – Final Energy Consumption by Fuel, Alternative Policy Scenario, Business as Usual, and Low-carbon Energy Transition (2000–2050)	124

Figure 5.3	China – Final Energy Consumption by Sector, Alternative Policy Scenario, Business as Usual, and Low-carbon Energy Transition (2000–2050)	125
Figure 5.4	China – Total Primary Energy Supply in 1990, 2019, and 2050	126
Figure 5.5	China – Total Primary Energy Supply by Fuel, Business as Usual and Alternative Policy Scenario (2019–2050)	127
Figure 5.6	China – Primary Energy Supply by Source, Alternative Policy Scenario, Business as Usual, and Low-carbon Energy Transition (2000–2050)	128
Figure 5.7	China – Power Generation by Source, Alternative Policy Scenario, Business as Usual, and Low-carbon Energy Transition (2000–2050)	129
Figure 5.8	China – Thermal Efficiency of Fossil Fuel, Business as Usual (1990–2050)	129
Figure 5.9	China – Energy Indicators, Business as Usual (1990–2050)	130
Figure 5.10	China – Energy Indicators, Alternative Policy Scenario (1990–2050)	130
Figure 5.11	China – CO ₂ Emissions, Business as Usual (2000–2050)	131
Figure 5.12	China – CO ₂ Emissions by Fossil Fuel, Business as Usual Scenario (1990–2050)	132
Figure 6.1	India – Total Final Energy Consumption by Sector, Business as Usual (1990–2050)	138
Figure 6.2	India – Total Primary Energy Supply, Business as Usual (1990–2050)	139
Figure 6.3	India – Electricity Generation, Business as Usual (1990–2050)	140
Figure 6.4	India – Energy Indicators, Business as Usual (1990–2050)	141
Figure 6.5	India – Total Final Energy Consumption, Alternative Policy Scenario and Low-carbon Energy Transition (2000–2050)	142
Figure 6.6	India – Total Primary Energy Supply, Business as Usual, Alternative Policy Scenario, and Low-carbon Energy Transition (2000–2050)	143
Figure 6.7	India – Power Generation Output, Business as Usual, Alternative Policy Scenario, and Low-carbon Energy Transition (2000–2050)	144
Figure 6.8	India – Energy Indicators, Alternative Policy Scenario (1990–2050)	145
Figure 6.9	India – Energy Indicators, Low-carbon Energy Transition (1990–2050)	145
Figure 6.10	India – CO ₂ Emissions, Business as Usual, Alternative Policy Scenario, and Low-carbon Energy Transition (2000–2050)	146
Figure 7.1	Final Energy Consumption by Sector, 2019–2050 (Mtoe)	153
Figure 7.2	Final Energy Consumption by Fuel, 1990–2050 (Mtoe)	153
Figure 7.3	Primary Energy Supply, 1990–2050 (Mtoe)	154
Figure 7.4	Power Generation by Type of Fuel, 1990–2050 (TWh)	155
Figure 7.5	Thermal Efficiency, Business as Usual, 1990–2050 (%)	156

Figure 7.6	Energy Intensity and Other Energy Indicators, 1990–2050	157
Figure 7.7	Comparison of Scenarios' Total Primary Energy Supply by 2050 (Mtoe)	157
Figure 7.8	Comparison of Scenarios' Electricity Generation by 2050 (TWh)	158
Figure 7.9	Comparison of Scenarios' Carbon Dioxide Emissions by 2050 (Mt-C)	159
Figure 7.10	Final Energy Consumption by Sector, Business as Usual, and Alternative Policy Scenario (Mtoe)	159
Figure 7.11	Primary Energy Supply by Source, Business as Usual, and Alternative Policy Scenario, 2019–2050 (Mtoe)	160
Figure 7.12	Total Primary Energy Supply, BAU and APS, 1990–2050 (Mtoe)	161
Figure 7.13	Energy Intensity, 1990–2050	161
Figure 7.14	Carbon Dioxide Emissions from Energy Consumption, Business as Usual and Alternative Policy Scenarios, 1990, 2019, and 2050 (Mt-C)	162
Figure 7.15	Power Generation Mix, BAU and APS, 2019 and 2050 (%)	163
Figure 7.16	Final Energy Consumption by Sector, Low Carbon Energy Transition Scenario, 1990–2050 (Mtoe)	164
Figure 7.17	"Final Energy Consumption by Fuel, Low Carbon Energy Transition Scenario, 2019 – 2050 (Mtoe)"	165
Figure 7.18	Primary Energy Supply by Fuel, Low Carbon Energy Transition Scenario, 1990–2050 (Mtoe)	165
Figure 7.19	Electricity Generation by Fuel, Low Carbon Energy Transition Scenario, 1990–2050 (TWh)	166
Figure 7.20	Energy Indicator Index, Low Carbon Energy Transition Scenario, 1990–2050	167
Figure 7.21	Primary Energy Supply, BAU and Low Carbon Energy Transition Scenarios, 1990, 2019, and 2050 (Mtoe)	167
Figure 7.22	CO ₂ Emission Reduction, BAU and Low Carbon Energy Transition Scenarios, 1990, 2019, and 2050 (Mt-C)	168
Figure 8.1	Population and Gross Domestic Product Prospect	173
Figure 8.2	Final Energy Consumption by Sector, Business-as-Usual, 1990–2050 (Mtoe)	174
Figure 8.3	Final Energy Consumption by Source, Business-as-Usual, 1990–2050 (Mtoe)	175
Figure 8.4	Primary Energy Supply, Business-as-Usual, 1990–2050 (Mtoe)	175
Figure 8.5	Power Generation, Business-as-Usual, 1990–2050 (TWh)	176
Figure 8.6	Indices of Energy and Carbon Dioxide Intensities, Energy Per Capita, and Carbonisation Rate, Business-as-Usual, 1990–2050	177

Figure 8.7	Total Energy Consumption, Business-as-Usual and Alternative Policy Scenario, 2019 and 2050 (Mtoe)	178
Figure 8.8	Total Primary Energy Supply, Business-as-Usual and Alternative Policy Scenario, 1990, 2019, and 2050 (Mtoe)	179
Figure 8.9	Primary Energy Supply by Source, Business-as-Usual and Alternative Policy Scenario, 2019, and 2050 (Mtoe)	180
Figure 8.10	Indices of Energy and Carbon Dioxide Intensities, Energy Per Capita, and Carbonisation Rate, Business-as-Usual, 1990–2050	181
Figure 8.11	Carbon Dioxide Emissions from Fossil Fuel Combustion, Business-as-Usual and Alternative Policy, 1990, 2019, and 2050 (Mt-C)	182
Figure 8.12	Final Energy Consumption by Source, Business-as-Usual, Alternative Policy Scenario, and Low Carbon Energy Technology Scenarios, 2000–2050 (Mtoe)	183
Figure 8.13	Final Energy Consumption by Sector, Business-as-Usual, Alternative Policy Scenario, and Low Carbon Energy Technology Scenarios, 2000–2050 (Mtoe)	184
Figure 8.14	Primary Energy Supply, Business-as-Usual, Alternative Policy Scenario, and Low Carbon Energy Technology Scenarios, 2000–2050	185
Figure 8.15	Power Generation, Business-as-Usual, Alternative Policy Scenario, and Low Carbon Energy Technology Scenarios, 2000–2050	186
Figure 8.16	Indices of Energy and Carbon Dioxide Intensities, Energy Per Capita, and Carbonisation Rate, Low Carbon Energy Technology, 1990–2050	187
Figure 8.17	Fossil-Fuel Reduction in Primary Energy Supply, Business-as-Usual, Alternative Policy Scenario, and Low Carbon Energy Technology, 2019 and 2050 (Mtoe)	188
Figure 8.18	Carbon Dioxide Emissions from Fossil Fuel Combustion, Business-as-Usual, Alternative Policy Scenario, and Low Carbon Energy Technology, 2000–2050 (Mt-C)	188
Figure 9.1	Assumptions for GDP and Population, 1990–2050	195
Figure 9.2	Final Energy Consumption by Sector, Business-as-Usual, 1990–2050 (Mtoe)	197
Figure 9.3	Final Energy Consumption by Source, Business-as-Usual, 1990–2050 (Mtoe)	197
Figure 9.4	Shares in the Final Energy Consumption by Source, Business-as-Usual 1990–2050 (%)	198
Figure 9.5	Final Energy Consumption by Sector, Alternative Policy Scenario, 1990–2050 (Mtoe)	199
Figure 9.6	Final Energy Consumption by Energy, Alternative Policy Scenario, 1990–2050	199
Figure 9.7	Final Energy Consumption by Sector, Business-as-Usual vs Alternative Policy Scenario, 2019 and 2050 (Mtoe)	200
Figure 9.8	Primary Energy Supply by Energy, Business-as-Usual, 1990–2050	201
Figure 9.9	Total Primary Energy Supply, Alternative Policy Scenario, 2019–2050	202

Figure 9.10	Total Primary Energy Supply, Business-as-Usual and Alternative Policy Scenario, 2017 and 2050 (Mtoe)	203
Figure 9.11	Primary Energy Supply by Source, Business-as-Usual vs. Alternative Policy Scenario, 2019 and 2050 (Mtoe)	203
Figure 9.12	Carbon Dioxide Emission from Energy Consumption, Business-as-Usual vs. Alternative Policy Scenario, 2019 and 2050 (Mt-C)	204
Figure 9.13	Energy and Carbon Intensities, 1990–2050	205
Figure 9.14	Final Energy Consumption by Sector, Business-as-Usual, Alternative Policy Scenario, Low Carbon Energy Transition, 2000–2050 (Mtoe)	206
Figure 9.15	Final Energy Consumption by Source, Business-as-Usual, Alternative Policy Scenario, Low Carbon Energy Transition, 2000–2050 (Mtoe)	206
Figure 9.16	Primary Energy Supply by Source, Business-as-Usual, Alternative Policy Scenario, Low Carbon Energy Transition, 2000–2050 (Mtoe)	207
Figure 9.17	Power Generation, Business-as-Usual, Alternative Policy Scenario, Low Carbon Energy Transition, 2000–2050 (TWh)	208
Figure 9.18	Carbon Dioxide Reduction and Carbon Intensity, Business-as-Usual, Alternative Policy Scenario, Low Carbon Energy Transition, 2000–2050	209
Figure 10.1	Total Final Energy Consumption by Fuel Type (Ktoe)	215
Figure 10.2	Total Final Energy Consumption by Sector (Ktoe)	216
Figure 10.3	Final Energy Consumption by Sector, 2000–2050 (Mtoe)	219
Figure 10.4	Sectors' Share in Final Energy Consumption (%)	220
Figure 10.5	Fuels' Share of Total Final Energy Consumption (%)	220
Figure 10.6	Final Energy Consumption by Fuel Type (Mtoe)	221
Figure 10.7	Primary Energy Supply (Mtoe)	222
Figure 10.8	Electricity Generation 2050 (TWh)	223
Figure 10.9	Energy Intensity and Other Energy Indicators (2000 = 100)	224
Figure 10.10	Comparison of Scenarios, Total Primary Energy Supply, 2050 (Mtoe)	225
Figure 10.11	Comparison of Scenarios for Electricity Generation, 2050 (TWh)	225
Figure 10.12	Comparison of Scenarios, 2050 (Mt-C)	226
Figure 10.13	Final Energy Consumption by Sector, Business as Usual and Alternative Policy Scenario 5 (Mtoe)	227
Figure 10.14	Total Primary Energy Demand, Business as Usual and Alternative Policy Scenario 5 (Mtoe)	228
Figure 10.15	Energy Intensity, 2010–2019 (toe/million US\$)	229

Figure 10.16	Final Energy Intensity, Business as Usual and Alternative Policy Scenario 5 (toe/million US\$)	229
Figure 10.17	Primary Energy Intensity—Business as Usual and Alternative Policy Scenario 5 (toe/million US\$)	230
Figure 10.18	Carbon Dioxide Emissions from Energy Combustion, Business as Usual vs Alternative Policy Scenario 5 (Mt-C)	231
Figure 10.19	Final Energy Consumption by Sector, Low Carbon Energy Transition Scenario, 2000–2050 (Mtoe)	232
Figure 10.20	Final Energy Consumption by Fuel, Low Carbon Energy Transition Scenario, 2000–2050 (Mtoe)	233
Figure 10.21	"Primary Energy Supply by Fuel, Low Carbon Energy Transition Scenario, 2000–2050 (Mtoe)"	234
Figure 10.22	Electricity Generation by Fuel, Low Carbon Energy Transition Scenario, 2000–2050 (TWh)	234
Figure 10.23	Energy Indicators, Low Carbon Energy Transition Scenario, 2000–2050	235
Figure 10.24	Primary Energy Supply, Business-as-Usual and Low Carbon Energy Transition Scenarios, 2019 and 2050 (Mtoe)	236
Figure 10.25	Carbon Dioxide Emission Reduction, Business-as-Usual and Low Carbon Energy Transition Scenarios, 2000, 2019 and 2050 (Mt-C)	236
Figure 11.1	Final Energy Consumption by Sector, Business-as-Usual, 1990–2050 (Mtoe)	242
Figure 11.2	Final Energy Consumption by Fuel, Business-as-Usual, 1990–2050 (Mtoe)	243
Figure 11.3	Total Primary Energy Supply by Fuel, Business-as-Usual, 1990–2050 (Mtoe)	244
Figure 11.4	Electricity Generation by Fuel, Business-as-Usual, 1990–2050 (TWh)	245
Figure 11.5	Energy Indicators, Business-as-Usual, 1990–2050	245
Figure 11.6	Final Energy Consumption by Sector, Business-as-Usual and Alternative Policy Scenario, 2050 (Mtoe)	247
Figure 11.7	Final Energy Consumption by Fuels, Business-as-Usual and Alternative Policy Scenario, 2050	247
Figure 11.8	Primary Energy Supply by Fuels, Business-as-Usual and Alternative Policy Scenario, 2050	248
Figure 11.9	Final Energy Consumption by Sector, Business-as-Usual and Alternative Policy Scenario, 2019 and 2050 (Mtoe)	249
Figure 11.10	Primary Energy Supply by Source, Business-as-Usual and Alternative Policy Scenario, 1990 and 2050 (Mtoe)	250
Figure 11.11	Total Primary Energy Supply, Business-as-Usual and Alternative Policy Scenario, 1990 and 2050 (Mtoe)	251
Figure 11.12	Energy Indicators, Alternative Policy Scenario, 1990–2050	251

Figure 11.13	Carbon Dioxide Emissions Reduction by Fuel, Business-as-Usual and Alternative Policy Scenario, 1990 and 2050 (Mt-C)	252
Figure 11.14	Final Energy Consumption by Sector, Low Carbon Energy Transition Scenario 1990–2050 (Mtoe)	254
Figure 11.15	Final Energy Consumption by Fuel, Low Carbon Energy Transition Scenario 1990–2050 (Mtoe)	254
Figure 11.16	Primary Energy Supply by Fuel, Low Carbon Energy Transition Scenario 1990–2050 (Mtoe)	255
Figure 11.17	Electricity Generation by Fuel, Low Carbon Energy Transition Scenario 1990–2050 (TWh)	256
Figure 11.18	Energy Indicators, Low Carbon Energy Transition Scenario, 1990–2050	256
Figure 11.19	Primary Energy Supply, Business-as-Usual and Low Carbon Energy Transition Scenarios, 1990, 2019 and 2050 (Mtoe)	257
Figure 11.20	Carbon Dioxide Emission Reduction, Business-as-Usual and Low Carbon Energy Transition Scenarios, 1990, 2019, and 2050 (Mt-C)	258
Figure 12.1	Final Energy Consumption by Sector, Business-As-Usual, 2019–2050 (Mtoe)	267
Figure 12.2	Final Energy Consumption by Fuel, Business-As-Usual, 2019–2050 (Mtoe)	268
Figure 12.3	Final Energy Consumption by Source, Business-As-Usual, 2019–2050 (Mtoe)	269
Figure 12.4	Power Generation Mix, Business-As-Usual, 2019–2050 (TWh)	270
Figure 12.5	Energy Intensity, CO ₂ Intensity and Energy per Capita, 2019–2050	271
Figure 12.6	Comparison of Scenario to Total Primary Energy Supply (Mtoe)	271
Figure 12.7	Comparison of Scenario of Electricity Generation (TWh)	272
Figure 12.8	Comparison of Scenario of Carbon Dioxide Emission (Mt-C)	273
Figure 12.9	Final Energy Consumption by Sector, Business-as-Usual and Low Carbon Energy Transition (Mtoe)	273
Figure 12.10	Final Energy Consumption by Source, Business-As-Usual and Low Carbon Energy Transition, 2019 and 2050 (Mtoe)	274
Figure 12.11	Final Energy Consumption by Source, Business-As-Usual and Low Carbon Energy Transition, 2019 and 2050 (Mtoe)	275
Figure 12.12	Final Energy Consumption by Source, Business-As-Usual and Low and Low Carbon Energy Transition, 2019 and 2050 (Mt-C)	275
Figure 13.1	Gross Domestic Product and Population, 1990–2050 (Billion 2015 US\$ per Million Persons)	279
Figure 13.2	Final Energy Consumption by Sector, Business-As-Usual, 1990–2050 (Mtoe)	280
Figure 13.3	Final Energy Consumption by Source, Business-As-Usual, 1990–2050 (Mtoe)	281
Figure 13.4	Primary Energy Supply by Source, Business-as-Usual, 1990–2050 (Mtoe)	282

Figure 13.5	Power Generation by Source, Business-as-Usual (TWh)	283
Figure 13.6	Energy Indicators, Business-as-Usual, 1990–2050	284
Figure 13.7	Final Energy Consumption by Sector, Business-as-Usual and Alternative Policy Scenario, 2019 and 2050 (Mtoe)	285
Figure 13.8	Primary Energy Supply by Source, Business-as-Usual and Alternative Policy Scenario, 2019 and 2050 (Mtoe)	286
Figure 13.9	Total Primary Energy Supply, Comparison of 2050 Business-as-Usual and Alternative Policy Scenarios to 1990 and 2019 (Mtoe)	286
Figure 13.10	Energy Indicators, Alternative Policy Scenario, 1990–2050	287
Figure 13.11	Carbon Dioxide Emissions from Fossil Fuel Combustion, Comparison of 2050 Business-as-Usual and Alternative Policy Scenario to 1990 and 2019 (Mt-C)	288
Figure 13.12	Final Energy Consumption by Sector, Low Carbon Energy Transition Scenario, 2000–2050 (Mtoe)	289
Figure 13.13	Final Energy Consumption by Source, Low Carbon Energy Transition Scenario, 2000–2050 (Mtoe)	290
Figure 13.14	Primary Energy Supply by Source, Low Carbon Energy Transition Scenario, 2000–2050 (Mtoe)	291
Figure 13.15	Power Generation, Business-As-Usual, Alternative Policy Scenario and Low Carbon Energy Transition Scenarios, 2000–2050 (TWh)	292
Figure 13.16	Energy Indicators, Business-as-usual, Alternative Policy Scenario and Low Carbon Energy Transition Scenario, 2020–2050 (g-CO ₂ /\$US, 2015)	293
Figure 13.17	Savings of Fossil Fuel Consumption and Carbon Dioxide Reduction, 2050 (%)	294
Figure 13.18	Carbon Dioxide Reduction, 2020–2050 (Mt- C)	295
Figure 14.1	Total Final Energy Consumption, Fuel and Sector Shares, 2019 (%)	304
Figure 14.2	Total Primary Energy Supply Mix, Fuel Shares, 2019 (%)	304
Figure 14.3	Total Power Generation Mix, Fuel Shares, 2019 (%)	305
Figure 14.4	Total Final Energy Consumption, Sector, Business-as-Usual, 1990–2050 (Mtoe)	307
Figure 14.5	Total Final Energy Demand by Fuel, Business-as-Usual, 1990–2050	308
Figure 14.6	Total Primary Energy Supply by Energy, Business-as-Usual, 1990–2050	309
Figure 14.7	Power Generation, Business-as-Usual, 1990–2050 (TWh)	310
Figure 14.8	Thermal Efficiency, Business-as-Usual, 1990–2050 (%)	311
Figure 14.9	Energy Indicators, Business-as-Usual, 1990–2050	311
Figure 14.10	Comparison of Total Primary Energy Supply by Energy, 2050 (Mtoe)	314
Figure 14.11	Scenario Comparison, Electricity Generation, 2050 (TWh)	314

Figure 14.12	Scenario Comparison, Carbon Dioxide (Mt-C)	315
Figure 14.13	Final Energy Consumption, Business-as-Usual vs Alternative Policy Scenario, 2050 (Mtoe)	316
Figure 14.14	Total Primary Energy Supply Comparison, Fuel, Business-as-Usual vs Alternative Policy Scenario, 2050 (Mtoe)	317
Figure 14.15	Carbon Dioxide Emission Comparison, Business-as-Usual vs Alternative Policy Scenario, 2050 (Mtoe)	318
Figure 14.16	Final Energy Consumption by Sector, Low Carbon Energy Transition Scenario, 1990–2050 (Mtoe)	319
Figure 14.17	Final Energy Consumption by Fuel, Low Carbon Energy Transition Scenario, 1990–2050 (Mtoe)	320
Figure 14.18	Primary Energy Supply by Fuel, Low Carbon Energy Transition Scenario, 1990–2050 (Mtoe)	321
Figure 14.19	Electricity Generation by Fuel, Low Carbon Energy Transition Scenario, 1990–2050 (TWh)	322
Figure 14.20	Energy Indicators, Low Carbon Energy Transition Scenario, 1990–2050	322
Figure 14.21	Primary Energy Supply, Business-as-Usual and Low Carbon Energy Transition Scenarios, 1990, 2019, and 2050 (Mtoe)	323
Figure 14.22	Carbon Dioxide Emission Reduction, Business-as-Usual and Low Carbon Energy Transition Scenarios, 1990, 2019, and 2050 (Mtoe)	324
Figure 15.1	Comparison of Gross Domestic Product Growth Assumption, 2018–2050 (%)	331
Figure 15.2	Carbon Dioxide Emissions by Scenario, 2019–2050 (Mt-C)	334
Figure 15.3	Power Generation Mix by Scenario, 2050 (TWh)	335
Figure 15.4	Total Primary Energy Supply by Scenario, 2019–2050 (Mtoe)	336
Figure 15.5	Total Primary Energy Supply, Fuel by Scenario, 2050 (Mtoe)	337
Figure 15.6	Final Energy Demand, Fuel by Scenario, 2050 (Mtoe)	338
Figure 15.7	Final Energy Demand, Sector and Scenario, 2050 (Mtoe)	338
Figure 16.1	Final Energy Consumption by Fuel, Business-as-Usual (Mtoe)	344
Figure 16.2	Final Energy Consumption by Sector, Business-as-Usual (Mtoe)	345
Figure 16.3	Primary Energy Supply by Fuel, Business-as-Usual (Mtoe)	346
Figure 16.4	Power Generation by Fuel, Business-as-Usual (TWh)	347
Figure 16.5	Thermal Efficiency by Fuel, Business-As-Usual, 1990–2050 (%)	347
Figure 16.6	Energy Indicators, 1990–2050	348
Figure 16.7	Final Energy Consumption by Sector, Business-as-Usual and Alternative Policy Scenario, 2019–2050 (Mtoe)	349

Figure 16.8	Primary Energy Supply by Source, Business-as-Usual and Alternative Policy Scenario, 2019–2050 (Mtoe)	350
Figure 16.9	Total Primary Energy Supply, Business-as-Usual and Alternative Policy Scenario, 1990, 2019 and 2050 (Mtoe)	351
Figure 16.10	Carbon Dioxide Emissions from Energy Consumption, Business-as-Usual and Alternative Policy Scenario, 1990, 2019 and 2050	351
Figure 16.11	Final Energy Consumption by Sector, Business-as Usual and Low Carbon Energy Transition Scenario (Mtoe)	352
Figure 16.12	Primary Energy Supply by Source, Business-as-Usual and Low Carbon Energy Transition Scenario (Mtoe)	353
Figure 16.13	Thermal Efficiency by Fuel, Low Carbon Energy Transition (%)	354
Figure 16.14	Energy Indicators, Low Carbon Energy Transition	354
Figure 16.15	Carbon Dioxide Emissions from Energy Consumption, Business-as-Usual and Low Carbon Energy Transition (Mt-C)	355
Figure 17.1	Final Energy Consumption by Sector, Business-As-Usual, 1990–2050 (Mtoe)	363
Figure 17.2	Final Energy Consumption by Fuel, Business-As-Usual, 1990–2050 (Mtoe)	364
Figure 17.3	Primary Energy Supply, Business-As-Usual, 1990–2050 (Mtoe)	365
Figure 17.4	Power Generation by Type of Fuel, Business-As-Usual, 1990–2050 (TWh)	366
Figure 17.5	Energy Indicators, 1990–2050	367
Figure 17.6	Total Final Energy Consumption by Sector in Business-as-Usual and Alternative Policy Scenario (Mtoe)	368
Figure 17.7	Total Final Energy Consumption by Fuel, Business-as-Usual and Alternative Policy Scenario5, 2017 and 2050 (Mtoe)	369
Figure 17.8	Final Energy Consumption by Sector, Business-as-Usual and Alternative Policy Scenario 5, 2017 and 2050 (Mtoe)	370
Figure 17.9	Total Primary Energy Supply by Fuel in Business-as-Usual and Alternative Policy Scenarios (Mtoe)	371
Figure 17.10	Primary Energy Saving Potential by Fuel, Business-As-Usual and Alternative Policy Scenario 5, 2017 and 2050 (Mtoe)	371
Figure 17.11	Evolution of Primary Energy Supply, Business-As-Usual and Alternative Policy Scenario 5, 1990, 2019, and 2050 (Mtoe)	372
Figure 17.12	Carbon Dioxide Emissions by Fuel, Business-As-Usual and Alternative Policy Scenarios (Mt-C)	373
Figure 17.13	Evolution of Carbon Dioxide Emissions, Business-as-Usual and Alternative Policy Scenario 5, 1990, 2019, and 2050 (Mt-C)	373
Figure17.14	Total Final Energy Consumption by Sector, Business-as-Usual, Alternative Policy Scenario5, and Low Carbon Energy Transition (Mtoe)	375

Figure 17.15	Total Final Energy Consumption by Fuel, Business-as-Usual and Low Carbon Energy Transition, 2019–2050 (Mtoe)	376
Figure 17.16	Primary Energy Supply by Fuel, Low Carbon Energy Transition Scenario, 2019–2050 (Mtoe)	377
Figure 17.17	Evolution of Primary Energy Supply, Business-as-Usual and Low Carbon Energy Transition, 1990, 2019, and 2050 (Mtoe)	377
Figure 17.18	Evolution of Carbon Dioxide Emissions, Business-As-Usual and Low Carbon Energy Transition, 1990, 2019, and 2050 (Mt-C)	378
Figure 18.1	Gross Domestic Product and Population, 1990–2050	383
Figure 18.2	Final Energy Consumption by Sector, Business-As-Usual (Mtoe)	385
Figure 18.3	Final Energy Consumption by Fuel Under Business-As-Usual (Mtoe)	386
Figure 18.4	Primary Energy Supply Under Business-As-Usual	387
Figure 18.5	Power Generation Under Business-As-Usual (TWh)	388
Figure 18.6	Final Energy Consumption by Sector, Business-As-Usual vs. Alternative Policy Scenario (Mtoe)	389
Figure 18.7	Primary Energy Supply in Business-As-Usual vs. Alternative Policy Scenario (Mtoe)	390
Figure 18.8	Total Primary Energy Supply by Fuel, Business-As-Usual vs. Alternative Policy Scenario, 2019 and 2050 (Mtoe)	391
Figure 18.9	Power Generation Under Alternative Policy Scenario, 1990–2050 (TWh)	392
Figure 18.10	Final Energy Consumption by Sector in Business-As-Usual, Alternative Policy Scenario, Low Carbon Energy Transition, 2000–2050 (Mtoe)	393
Figure 18.11	Primary Energy Supply in Business-As-Usual, Alternative Policy Scenario, Low Carbon Energy Transition (Mtoe)	394
Figure 18.12	Power Generation in Business-As-Usual, Alternative Policy Scenario, Low Carbon Energy Transition, 2000,2010, and 2019 (TWh)	395
Figure 18.13	Carbon Dioxide Emission Trends in Business-As-Usual, Alternative Policy Scenario, Low Carbon Energy Transition, 2000–2050 (Mt-C)	397
Figure A.1	Final Energy Demand by Sector, Business-As-Usual, 1990–2050 (Mtoe)	404
Figure A.2	Final Energy Demand by Fuel, Business-As-Usual, 1990–2050 (Mtoe)	405
Figure A.3	Primary Energy Supply, Business-As-Usual, 1990–2050 (Mtoe)	406
Figure A.4	Electricity Generation, Business-As-Usual, 1990–2050 (TWh)	407
Figure A.5	Energy Indicators, Business-As-Usual, 1990–2050	408
Figure A.6	Total Final Energy Demand in 2050, Business-As-Usual and Alternative Policy Scenario, 1990 and 2050 (Mtoe)	409

Figure A.7	Total Final Energy Demand by Sector in 2050, Business-As-Usual and Alternative Policy Scenario, 2019 and 2050 (Mtoe)	409
Figure A.8	Total Final Energy Demand by Fuel, Business-As-Usual and Alternative Policy Scenario, 2019 and 2050 (Mtoe)	410
Figure A.9	Total Primary Energy Supply, Business-As-Usual and Alternative Policy Scenario, 2019 and 2050 (Mtoe)	411
Figure A.10	Total Primary Energy Supply by Fuel, Business-As-Usual and Alternative Policy Scenario, 2019 and 2050(Mtoe)	411
Figure A.11	Electricity Generation, Business-As-Usual and Alternative Policy Scenario, 2019 and 2050 (TWh)	412
Figure A.12	Electricity Generation by Source, Business-As-Usual and Alternative Policy Scenario, 2019 and 2050 (TWh)	413
Figure A.13	Carbon Emissions from Energy Consumption, Business-As-Usual and Alternative Policy Scenario, 2019 and 2050 (Mt-C)	414
Figure A.14	Total Final Energy Demand, Business-As-Usual and Low Carbon Energy Transition, 2019 and 2050 (Mtoe)	415
Figure A.15	Total Final Energy Demand by Sector, Business-As-Usual and Low Carbon Energy Transition, 2019 and 2050 (Mtoe)	416
Figure A.16	Total Final Energy Demand by Fuel, Business-As-Usual and Low Carbon Energy Transition, 2019 and 2050 (Mtoe)	417
Figure A.17	Total Primary Energy Supply, Business-As-Usual and Low Carbon Energy Transition, 2019 and 2050 (Mtoe)	418
Figure A.18	Total Primary Energy Supply by Fuel, Business-As-Usual and Low Carbon Energy Transition, 2019 and 2050	418
Figure A.19	Electricity Generation, Business-As-Usual and Low Carbon Energy Transition, 2019 and 2050 (TWh)	419
Figure A.20	Electricity Generation by Source, Business-As-Usual and Low Carbon Energy Transition, 2019 and 2050 (TWh)	420
Figure A.21	Carbon Emissions from Energy Consumption, Business-As-Usual and Alternative Policy Scenario, 2019 and 2050 (Mt-C)	421