

## List of Figures

Figure 2.1: National Policy on Biofuels 2018	6
Figure 2.2: Industry View of Ethanol Production and Consumption	11
Figure 2.3: Comparative View of India’s Gasoline and Diesel Consumption	15
Figure 2.4: Road Map towards Mandatory B30 in 2020	17
Figure 2.5: Historical and Simulated Indonesian Biodiesel Demand	18
Figure 2.6: Inclusion of the Cost of Externalities into the Final Cost of Fuels	27
Figure 2.7: Biofuel Road Map (2018–2040)	33
Figure 2.8: Biofuel Targets in Biofuel Road Map (2018–2040)	33
Figure 2.9: Breakdown of Thailand Alternative Energy Development Plan	38
Figure 2.10: Consumption of Ethanol and Various Grades of Ethanol-blended Gasoline	54
Figure 2.11: Consumption of Biodiesel and Various Grades of Biodiesel-blended Diesel	55
Figure 2.12: Trends for Total Final Energy Consumption, 2007–2017	56
Figure 2.13: Expected Ethanol plus Vegetable Oil Production According to Decision 177/2007/QĐ-TTg	58
Figure 2.14: Expected Biofuel Production According to Decision No. 2068/QĐ-TTg	60
Figure 2.15: Fuel Consumption in Viet Nam, 2011–2018	61
Figure 2.16: Ethanol Production in Viet Nam	63
Figure 2.17: Share of E5 Fuel in Total Gasoline Consumption	64
Figure 2.18: Comparison of Total CO <sub>2</sub> Equivalent Between Cassava-based Ethanol and Gasoline	69
Figure 3.1: Main and Secondary Indicators of Biofuels Sustainability at Different Levels	77
Figure 3.2: New and Traditional Renewable Energy	85
Figure 3.3: Life Cycle Assessment of Palm Biodiesel in Malaysia	88
Figure 4.1: Relationship Between Growing Rate of Number Vehicles Owned and GDP- PPP/capita	101
Figure 4.2: Thailand Smart Mobility Road Map 30@30	102
Figure 4.3: Target of 100% ZEV Registrations by 2035 for (a) Cars and Pickups, (b) Motorcycles, and (c) Buses and Trucks	106
Figure 4.4: Target of ZEV Production by 2035	107
Figure 4.5: Statistics of Conventional Vehicles and xEV Registrations	109

Figure 4.6: Statistics of EV Charging Stations	110
Figure 4.7: EV Components of the Malaysia National Automotive Policy (2020)	113
Figure 4.8: Iskandar Malaysia Bus Rapid Transit Pilot Test of Hybrid Electric and Biodiesel Buses	115
Figure 4.9: The City e-Bus Service, Kuching, Sarawak	116
Figure 4.10: Number of Newly Registered and In-use Motorcycles	116
Figure 4.11: Number of Newly Registered and In-use Cars	117
Figure 4.12: Share of Automobiles Sold in 2020 Based on Type	118
Figure 4.13: Specific Target of the Strategy for Development of Viet Nam's Automobile Industry	118
Figure 4.14: Number of E-Bikes and E-Motorcycles Produced in 2018–2020	119
Figure 4.15: Neodymium Demand Minimum (left) and Maximum (right) Value	125
Figure 4.16: Cobalt Demand Minimum (left) and Maximum (right) Value	126
Figure 4.17: Neodymium Waste Minimum (left) and Maximum (right) Value	126
Figure 4.18: Cobalt Waste Minimum (left) and Maximum (right) Value	127
Figure 4.19: Neodymium Demand Minimum (left) and Maximum (right) Value	128
Figure 4.20: Cobalt Demand Minimum (left) and Maximum (right) Value	128
Figure 4.21: Neodymium Waste Minimum (left) and Maximum (right) Value	129
Figure 4.22: Cobalt Waste Minimum (left) and Maximum (right) Value	129

## List of Tables

Table 2.1: Quantity Supplied (Ethanol) and % Blending Trends	7
Table 2.2: Year-wise and Sector-wise Ethanol Production Projections	9
Table 2.3: Gasoline Demand Projections	10
Table 2.4: Ethanol Demand Projections	10
Table 2.5: Biofuel Consumption in India Since 2011	12
Table 2.6: Gasoline Consumption and Pricing, India	13
Table 2.7: Diesel Consumption and Pricing, India	14
Table 2.8. India: Biodiesel Production from Multiple Feedstocks	15
Table 2.9: Comparison of Current Conditions and Relevant Regulations for the Sources of Biofuels	25
Table 2.10: Biodiesel Implementation Timeline in Malaysia	30
Table 2.11: Projected Demand of Biodiesel in Malaysia	30
Table 2.12: Palm Biodiesel Production (2011–2020)	31
Table 2.13: Bioethanol and Biodiesel Sales	36
Table 2.14: Bioethanol and Biodiesel Sales	37
Table 2.15: Gasoline and Diesel Sales	37
Table 2.16: Specifications for Ethanol Standard	39
Table 2.17: Specifications for Ethanol Blends with Gasoline Standard	40
Table 2.18: Specifications for Biodiesel Standard	46
Table 2.19: Specifications for Biodiesel-blended Diesel Standard	48
Table 2.20: Price Structure of Petroleum Products in Bangkok (28 June 2021)	53
Table 2.21: Specific Targets Mentioned in Current Energy and Climate Policy, Viet Nam	57
Table 2.22: Current Taxes on Ethanol and Gasoline	59
Table 2.23: Ethanol Plants in Viet Nam	62
Table 2.24: Fuel Price	64
Table 2.25: Emissions Reduction Potential of Ethanol-gasoline Blends	65
Table 2.26: GHG Emissions	66

Table 2.27: Summary of the Data on GHG Emissions of Palm Oil Supply Chain	67
Table 2.28: Comparison of GHG Emissions from Diesel and Palm Biodiesel	67
Table 2.29: Well-to-Tank Greenhouse Gas Emissions for Ethanol in Thailand	68
Table 2.30: Well-to-Tank Greenhouse Gas Emissions for Biodiesel in Thailand	69
Table 3.1: Global Bioenergy Partnership Sustainability Indicators for Bioenergy	75
Table 3.2: Life Cycle GHG Emissions from Ethanol in Thailand (gCO <sub>2</sub> eq/MJ)	81
Table 3.3: Life Cycle GHG Emissions from Palm Biodiesel in Thailand (gCO <sub>2</sub> eq/MJ)	81
Table 3.4: Water Consumption for Ethanol in Thailand (L water/L ethanol)	82
Table 3.5: Water Consumption for Biodiesel in Thailand (L water/L biodiesel)	83
Table 3.6: Total Value Added per year from Sugarcane Cultivation and Biorefinery in Thailand	83
Table 3.7: Net Energy Ratio and Renewability of Biofuels in Thailand	84
Table 3.8: Employment Generation (person-years) from Biofuels in Thailand	84
Table 3.9: GHG Emissions Balance of the Ethanol Product	89
Table 3.10: Water Use for Ethanol Production in Viet Nam	89
Table 3.11: Emissions Reduction Potential of Ethanol-gasoline Blends	92
Table 4.1: Thailand Strategic Vision for Electric Vehicles	103
Table 4.2: Forecast Emissions Factor for National Grid until 2037	105
Table 4-3: Average VKT in Thailand	111
Table 4.4: Average FE in Thailand	111
Table 4.5: Production Targets of Electric Vehicles in Indonesia	112