

List of Figures

| | | |
|-------------|---|----|
| Figure 2.1 | Generic System Boundary of Biofuel | 4 |
| Figure 2.2 | Process Flow Chart for the Production of Palm Biodiesel | 6 |
| Figure 2.3 | Global Warming Effect from the Production of 1 Tonne of Palm Biodiesel | 8 |
| Figure 2.4 | Biofuel Production and Consumption Expected, Viet Nam | 14 |
| Figure 2.5 | E5RON92 Consumption, Viet Nam | 15 |
| Figure 2.6 | GHG Emissions from Production of Cassava Ethanol, Thailand | 18 |
| Figure 2.7 | GHG Emissions from Production of Molasses Ethanol, Thailand | 19 |
| Figure 2.8 | GHG Emissions from Production of Palm Biodiesel, Thailand | 20 |
| Figure 3.1 | Flow of Bottom-up Energy Demand Model | 26 |
| Figure 3.2 | Schematic Concept of Life Cycle Inventory | 27 |
| Figure 3.3 | LEAP Calculation Flows | 29 |
| Figure 3.4 | Validation of Vehicle Numbers for Five ASEAN Countries and India for (a) Passenger Cars and (b) Motorcycles | 31 |
| Figure 3.5 | Activity and Source Structure in the Energy Sector | 35 |
| Figure 3.6 | Projection of Electric Vehicle Sales Share, Philippines (passenger cars and motorcycles) | 38 |
| Figure 3.7 | Projection of Electric Vehicle Sales Share, Viet Nam (passenger cars and motorcycles) | 38 |
| Figure 3.8 | Number of Passenger Cars in BAU Scenario | 41 |
| Figure 3.9 | Number of Motorcycles in BAU Scenario | 41 |
| Figure 3.10 | Projection of Energy Demand by Country in BAU Scenario | 42 |
| Figure 3.11 | Projection of TTW GHG Emissions by Country in BAU Scenario | 43 |
| Figure 3.12 | Projection of Energy Demand by Fuel in BAU Scenario | 44 |
| Figure 3.13 | Projection of TTW GHG Emissions by Fuel in BAU Scenario | 44 |
| Figure 3.14 | Impact of Electric Vehicle Penetration on Energy Demand Reduction | 45 |
| Figure 3.15 | Impact of Electric Vehicle Penetration on Reduction of TTW GHG Emissions | 46 |

| | | |
|-------------|--|----|
| Figure 3.16 | Impact of Biofuel Promotion on Reduction of TTW GHG Emissions | 47 |
| Figure 4.1 | Electric Vehicle Wholesales by Year, Indonesia | 53 |
| Figure 4.2 | On-Road Passenger Cars in Malaysia (2017–2025 projection) | 54 |
| Figure 4.3 | New and On-Road Motorcycles in Malaysia (2015–2021) | 55 |
| Figure 4.4 | New Passenger Cars Sold and On-Road Passenger Cars, Viet Nam | 56 |
| Figure 4.5 | New Motorcycles Sold and On-Road Motorcycles, Viet Nam | 57 |
| Figure 4.6 | Electric Motorcycles in Viet Nam, 2015–2018 | 58 |
| Figure 4.7 | Electric Vehicles Sold per 1,000 Non-Electric Vehicles in Indian States | 64 |
| Figure 4.8 | Projection of Electric Two-Wheelers in India (in millions) | 65 |
| Figure 4.9 | Projection of Three-wheelers and Auto Rickshaw in India (in millions) | 65 |
| Figure 4.10 | Neodymium Demand Forecast | 69 |
| Figure 4.11 | Cobalt Demand Forecast | 70 |
| Figure 4.12 | Neodymium Waste Forecast | 70 |
| Figure 4.13 | Cobalt Waste Forecast | 71 |
| Figure 4.14 | CO ₂ Emissions Forecast from Neodymium Magnet Production | 72 |
| Figure 4.15 | Emissions Forecast from Lithium-ion Battery Cell Production | 72 |
| Figure 4.16 | CO ₂ Emissions Reduction Forecast from Neodymium Magnet Production | 73 |
| Figure 4.17 | CO ₂ Emissions Reduction Forecast from Lithium-ion Battery Cells Production | 73 |

List of Tables

| | | |
|------------|--|----|
| Table 2.1 | Inventory Data of Palm Biodiesel Production | 7 |
| Table 2.2 | GHG Emissions Computation Based on Refined Palm Oil, Rapeseed Oil, and Soybean Oil | 8 |
| Table 2.3 | GHG Emissions from the Entire Palm Oil Supply Chain (from FFB to palm biodiesel) | 9 |
| Table 2.4 | Estimated GHG Emissions Savings per MJ of Palm Biodiesel Produced | 10 |
| Table 2.5 | Official Usage Targets of Biofuel (in million m ³) | 12 |
| Table 2.6 | Some Main Properties of Gasoline, Diesel and Biofuels, Viet Nam | 16 |
| Table 2.7 | Biofuel Targets of AEDP 2018 and Consumption 2019–2021, Thailand | 17 |
| Table 2.8 | Ethanol Installed Capacity, Thailand (April 2021) | 17 |
| Table 2.9 | Well-to-Tank GHG Emissions from Biofuels | 21 |
| Table 3.1 | Differences Between Top-down and Bottom-up Approach in Energy Model | 25 |
| Table 3.2 | Key Characteristics of LEAP | 28 |
| Table 3.3 | Models of Passenger Car Numbers | 32 |
| Table 3.4 | Models of Motorcycle Numbers | 32 |
| Table 3.5 | Percent of New Vehicle Numbers by On-Road Vehicle Numbers | 33 |
| Table 3.6 | Vehicle Kilometre of Travel | 33 |
| Table 3.7 | Assumption of Fuel Economy | 34 |
| Table 3.8 | Chosen Vehicle Models to Represent TTW GHG Emissions | 35 |
| Table 3.9 | Global Warming Potentials of GHG Emissions from Combustion Process | 36 |
| Table 3.10 | Projection of Gross domestic Products | 36 |
| Table 3.11 | Projection of TTW GHG Emissions by Country in BAU Scenario | 37 |
| Table 3.12 | Population Projection by Country | 39 |
| Table 3.13 | Electric Vehicle Penetration in Five Selected ASEAN Countries and India | 40 |
| Table 4.1 | Vehicle Population, Indonesia | 52 |

| | | |
|------------|---|----|
| Table 4.2 | Vehicle Sales Projection, Indonesia | 52 |
| Table 4.3 | Electric Vehicle Sales Projection, Indonesia | 53 |
| Table 4.4 | Electric Vehicle Wholesale Numbers, Indonesia | 54 |
| Table 4.5 | Production of Motor Vehicles in India: 2015–16 to 2019–20 | 60 |
| Table 4.6 | Registered Vehicles with Different Category Wise, India | 61 |
| Table 4.7 | Electric Vehicle Sales from 2011 to 2022, India | 62 |
| Table 4.8 | Electric Vehicle Type Sales for Last 5 Years, India | 62 |
| Table 4.9 | Sales Share of Electric Vehicles in Financial Year 2021-22 with Vehicle Type, India | 63 |
| Table 4.10 | Electric Vehicle Sales of Top 10 States, India | 64 |
| Table 4.11 | Electricity Cost for Charging in Indian States (in rupees) | 66 |
| Table 4.12 | Neodymium Waste Forecast | 67 |
| Table 4.13 | Approved Charging Stations across Indian States | 67 |