Executive Summary

Once Temburong's ecotown development starts, several commercial buildings – such as a convention centre for international and regional conferences, five-star and higher luxurious hotels for visitors to Temburong district, sophisticated shopping malls, etc. – will be constructed in the district. Commercial buildings should apply energy efficiency and conservation (EEC) designs to curb the escalation of electricity consumption whilst showcasing the concept of ecotown development in Brunei Darussalam. Thus, ERIA prepared the EEC guidelines for commercial buildings. These guidelines covered definitions of designated buildings, necessary labelling of building energy intensity for designated buildings, minimum energy performance standard (MEPS) for energy-intensive equipment and appliances to be used for the designated buildings, and the approval process of new building proposals (concerning building energy system), which the developers of the designated buildings will submit. Also, the EEC guidelines should be upgraded to a regulation on the construction of commercial buildings incorporating the EEC design in Temburong district to establish a mandatory basis for implementation.

Temburong ecotown development should also consider clean energy supply, especially electricity supply from zero-emission power sources, such as variable renewable energy (vRE) including solar/PV and wind. This study assumes to establish a 60 MW solar/PV system in Temburong district and analyses whether this will be available with respect to frequency conditions applying an energy management system (EMS) with automatic generation control (AGC) function. According to analysis and calculation, the 60 MW system will be available to realise optimal generation control to maximise the solar/PV output technically and provide enough capacity to supply electricity to Temburong Ecotown. These comprise 49 GWh yearly demand and 78 GWh yearly generation and transfer surplus electricity to Bandar Seri Begawan (BSB) through a new transmission line on the Temburong Bridge but only for daytime consumption. However, two major issues remain: (i) a huge land area required for solar/PV system (300–600 acres) and (ii) significant investment for solar/PV system (US$160–US$268 million).

Clean transport is also an important concept of an ecotown or smart city. Brunei Darussalam has two options: electric vehicle (EV) and fuel cell electric vehicle (FCEV). EV will be the priority because the price of lithium ion batteries for EV has been decreasing. Another reason is that since Brunei is a relatively small country, large-scale batteries of 500–600 kWh will not be needed. But the introduction of EV will increase electricity demand and, therefore, natural gas consumption for power generation will also increase. Eventually, with the use of EVs plus natural gas consumption for power generation, carbon dioxide (CO_2) will be negative but by just a few percentages from the business-as-usual scenario (BAU) (all internal combustion engine vehicles). Because of hydrogen production in Brunei Darussalam applying the steam reforming process to natural gas, FCEV is an option. However, it will not be available commercially until after 2030 due to further technology development on FCEV and the scale-up of hydrogen production. However, FCEV will be much better than EV in terms of CO_2

mitigation, if Brunei Darussalam will apply carbon capture utilisation and storage (CCUS) for disposing of CO_2 coming from the steam reforming process. Hydrogen can be used as fuel to generate power, so that combining hydrogen power generation and EV will also be another option. Regarding clean transport system in Temburong district, three types of traffic flows should be considered: (i) internal traffic in Temburong district, (ii) out and in traffic of BSB, and (iii) through traffic from and to Sabah and Sarawak. Due to clean transport regulations in Temburong district, only EV and FCEV will be available to internal traffic in terms of passenger cars. Buses and trucks should implement a 'park and ride' programme.

Last but not least, this study also prepares a road map of the Temburong ecotown development. In other words, it provides a guide to necessary infrastructure development in the Temburong district. This road map covers eight major infrastructures: energy (electricity supply), transportation (road), water supply, tourism (hotel), education (university), industry (R&D centre), housing and urban centre (Bangar). On the other hand, the road map is divided into four periods: present–2021, 2022–2023, 2024–2030, and 2031–2040. So far, there is no detailed ecotown development plan in Temburong district. Thus, this road map may seem primitive because of the inconsistency between the infrastructure construction and the timeline. However, this road map will be a useful reference for the people in charge of the Temburong district development.

This report on the phase 4 study shows an overall Temburong ecotown development plan, especially the necessary infrastructure. In terms of energy, this report provides in-depth information, insights, and the concept and methodology of promoting EEC in commercial buildings, clean electricity supply, and clean transport system related to Temburong ecotown development. On the objectives of this report, ERIA wishes that the Ministry of Energy, Brunei Darussalam will (i) prepare an EEC regulation for commercial buildings in collaboration with the Ministry of Development, (ii) construct a solar/PV system connected to Berakas Power Company/Department of Electrical Services (DES) grid network, which will be supported by EMS with AGC, and (iii) prepare a clean transport regulation mandating the use of EV and FCEV in Temburong district.