Chapter 4
Conclusion

This research study consists of mainly four parts:

(1) Data collection in Brunei Darussalam
   - Temburong district development plan
   - Hourly solar radiation data at Brunei International Airport in 2015 and 2016
   - Hourly rainfall data at Bangar, Temburong District in 2015 and 2016
(2) Assuming floor area of each type of building to be constructed as eco town
(3) Estimating hourly electricity load profile of the new buildings in 2025
(4) Seeking best capacity mix of diesel power, solar PV, and electric storage in 2025

Based on the Temburong district development plan, an ERIA energy efficiency expert assumed the following floor area of buildings to be constructed as eco town in Temburong District:

(1) Hotel: 10,000 m^2 (200 rooms)
(2) Shopping mall: 6,000 m^2 (1/3 of land area [3.2 hectare] will be developed)
(3) Government office: 4,000 m^2 (200 staff)

The expert assumed two building energy intensities (BEI), ordinary and eco, with the following details:

Type of Building	Ordinary	Eco	Unit
Office	250	120	kWh/m^2/year
Hotel	275	233	kWh/m^2/year
Hospital	300	233	kWh/m^2/year

Using the floor area and the BEIs, the expert did a 1-year electricity demand forecast for each building type. The expert made a breakdown of monthly electricity demand and hourly electricity load profile from 1 January to 31 December 2025 based on the existing hourly/daily/monthly load profile in Temburong District. The results show that if eco township will be applied for the construction of an eco town in Temburong District, annual electricity consumption from the buildings will be 37,327 MWh, and reduction from the ordinary township will be 16,200 MWh. It will be 30% of annual electricity consumption of the buildings applied for the ordinary township.

Based on the hourly electricity load profile of the Temburong Eco Town in 2025 and the hourly solar radiation data at Brunei International Airport in 2016, an ERIA smart-grid expert determined the best capacity mix of diesel power, solar PV, and electricity storage applying the static simulation model. The same solar radiation data were assumed for the Temburong District in 2025. The simulation study provided the following results:

(1) Although it was hot season from March to May in Brunei Darussalam, several days were rainy and deep cloudy in 2016. Thus, operation rate of solar PV will be 8%–13% due to lower radiation data.
(2) Three scenarios were conducted as the static simulation approach:

- Case 1: Diesel power (12MW) + Solar/PV + Storage
- Case 2: Diesel power (6MW) + Solar/PV + Storage
- Case 3: Solar/PV + Storage

The results show that the necessary capacity of solar PV will be 5MW–144MW and the storage will be 48MWh–540 MWh, which will have the lowest levelised cost of energy (LCOE).

(3) In Case 3, power supply will be available technically but at a very high cost, of around US$ .40 as LCOE, and it has to be owned by Temburong District.
(4) Case 1, under the eco township, will have the lowest LCOE, at US$ .12.3. It is suggested that Temburong District has to accept the use of diesel power at the initial stage and gradually increase solar PV and storage, leading to lower cost of both solar PV and storage.

This study will provide ample information for the development of Temburong Eco Town in Brunei Darussalam as regards energy efficiency of buildings and power supply using renewable energy sources. Nevertheless, several issues emerged:

(1) There is no energy conservation act in Brunei Darussalam. The Ministry of Energy and Industry is urgently requested to propose a law on energy conservation and clearly specify the application of Green Building Index (GBI) to newly constructed buildings in Brunei Darussalam.
(2) Developing energy managers is also an urgent action plan. Energy managers will apply passive and active energy efficiency technologies to buildings and promote GBI in Brunei Darussalam.
(3) The hourly solar radiation data in 2016 are not enough. Based on 5–10 years solar radiation data, normal distribution of solar radiation will be produced and will forecast solar radiation of next hour applying the Monte Carlo simulation approach.
(4) Future cost of solar PV and storage is needed to forecast technology development.

It is gratifying that this study could contribute to the development of an eco town in Temburong District.

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