Chapter 11
Myanmar Country Report

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1. Background

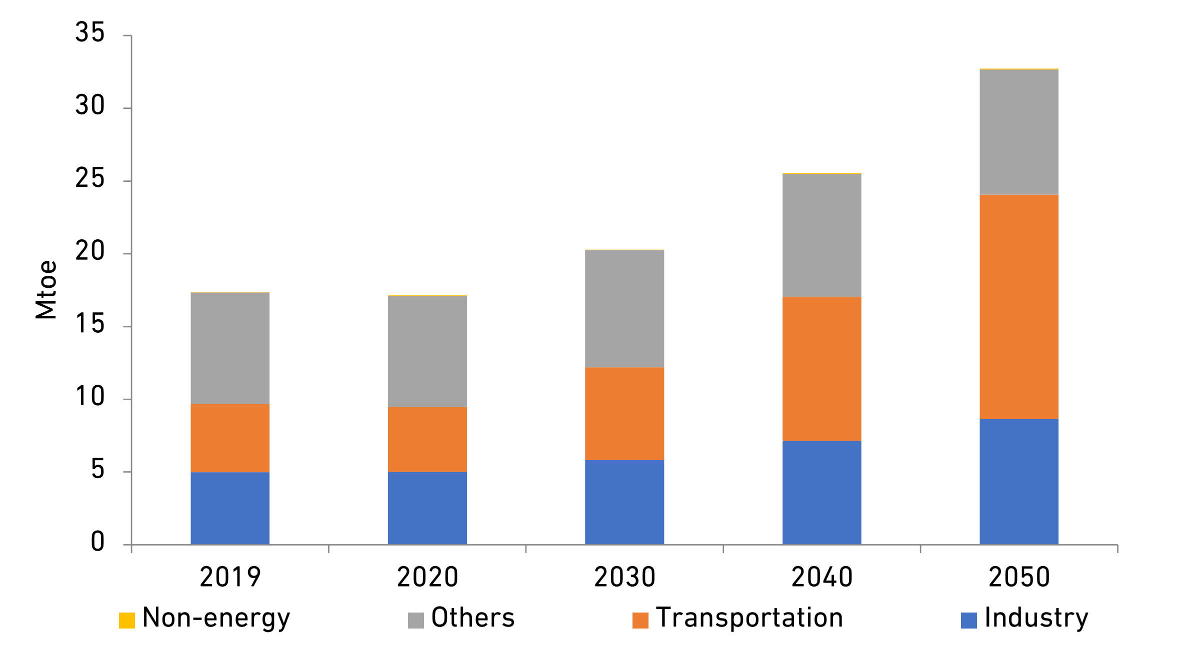
A low-carbon energy transition refers to the shift from high-carbon or fossil fuel-based energy sources to low-carbon or renewable energy sources. The transition involves adopting technologies and practices that produce fewer emissions per unit of energy generated. This can include renewable energy sources such as solar, wind, hydroelectric, geothermal, and biomass, as well as nuclear power, which produces minimal emissions during electricity generation. Additionally, energy-efficiency measures and improvements in energy storage technologies play crucial roles in this transition.

Carbon neutrality or achieving a net-zero carbon footprint entails balancing emissions with carbon removal or offsetting measures. It involves reducing emissions as much as possible and then offsetting any remaining emissions through activities that remove carbon dioxide from the atmosphere or prevent additional emissions. Carbon offsetting can involve activities such as reforestation and afforestation projects, carbon capture and storage (CCS) technologies, and investments in renewable energy projects. This transition requires coordinated efforts from governments, businesses, and individuals to invest in renewable energy infrastructure, adopt energy-efficient technologies, and implement policies that incentivise low-carbon practices. This study aims to describe Myanmar's roadmaps for its energy transition.

2. Final Energy Consumption (Historical Trend: 2019, 2030, 2040, 2050)

Under a low-carbon energy transition–carbon neutral (LCET-CN) scenario, the total final energy consumption (TFEC) for Myanmar is expected to increase 2.1% per year to 2050 from the 2019 level. This rate is much lower compared to the business-as-usual (BAU) scenario at 2.6% per year but higher than the alternative policy scenario (APS) at 2.0% per year. The lower growth rate per year under the LCET-CN scenario would be due to higher energy efficiency in the industrial, residential, and commercial sectors. The potential savings of energy efficiency under the LCET-CN scenario is assumed at 14.1% in the primary energy sector by 2050. The projection of TFEC until 2050 is based on gross domestic product and population growth assumptions.

Figure 11.1. Final Energy Consumption by Sector under the LCET-CN Scenario, 1990–2050
(Mtoe)

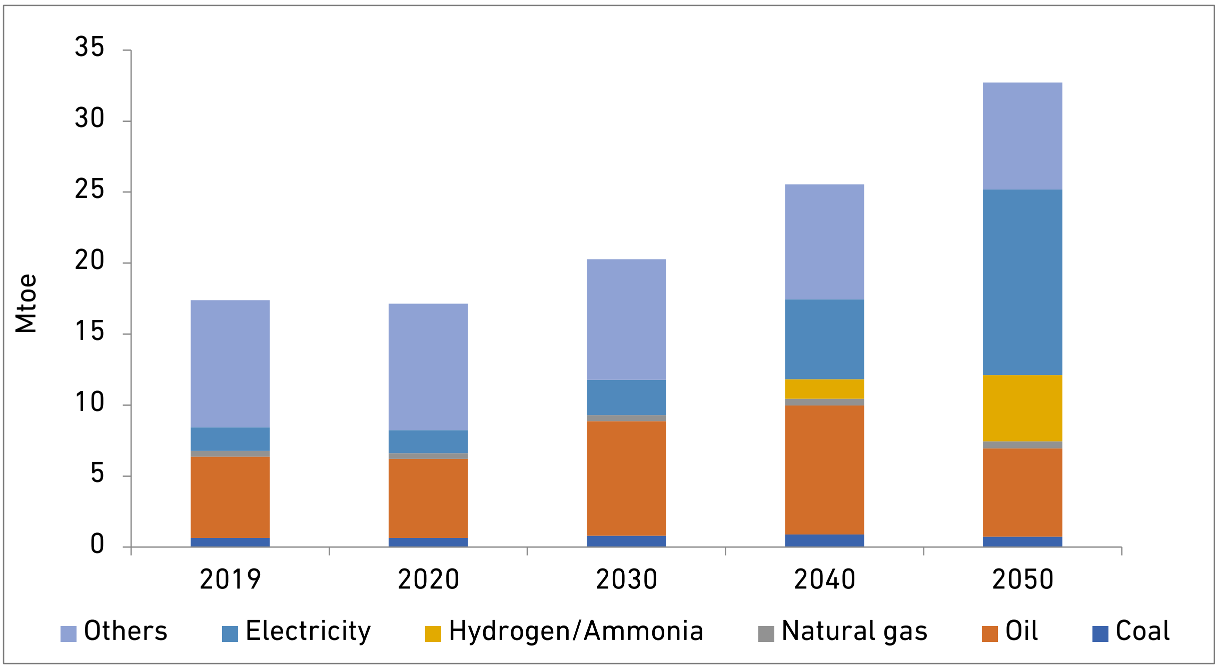


LCET-CN = low-carbon energy transition–carbon neutral, Mtoe = million tonnes of oil equivalent.
Source: Author's calculations.

Figure 11.1 shows the final energy consumption by sector under the LCET-CN scenario. In 2050, the TFEC is expected to be 32.72 million tonnes of oil equivalent (Mtoe). The transport sector would remain the dominant sector in 2050, with 47.1% of the total share. Moreover, the transport sector would increase sharply at 3.9% compared to the other sectors. The industrial sector – the second-largest final energy consumer – is expected to settle at 8.65 Mtoe or 26.4% of the total share by 2050. Due to measures to combat energy efficiency in the industrial sector, the increment per year for the sector would only be 1.8% from 2019 until 2050. Non-energy sector performance would increase 2.0% per year from 2019 until 2050; the share of this sector would remain constant from 2019 to 2050. Lastly, the 'others' sector (i.e. residential, commercial, and agriculture) would constitute about 26.3% of the TFEC in 2050. This sector exhibits a positive trend from 2019 to 2050 at a rate of 0.4% per year.

Figure 11.2. Final Energy Consumption by Fuel under the LCET-CN Scenario, 1990–2050

(Mtoe)



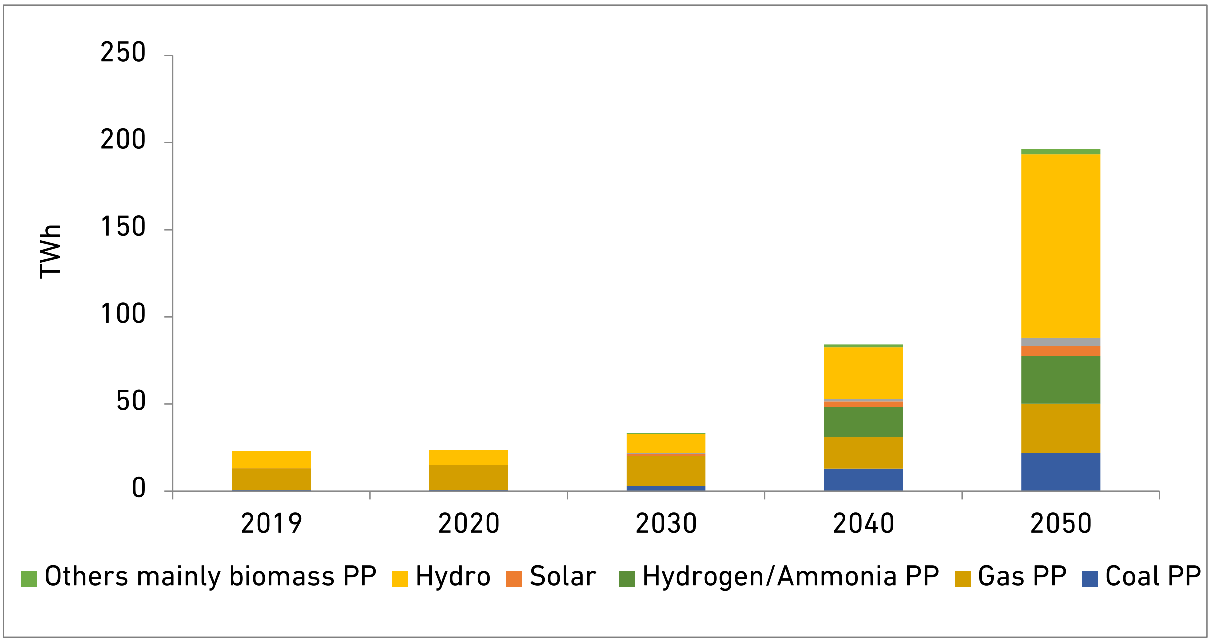
LCET-CN = low-carbon energy transition–carbon neutral, Mtoe = million tonnes of oil equivalent.
Source: Author's calculations.

Under the LCET-CN scenario, the introduction of hydrogen and ammonia fuels would increase, and more electric vehicles (EVs) in the transport sector would aid fuel-switching technology to 2050. The share of oil would fall to a 19% share in 2050 compared to a 33% share in 2019. The electricity share would grow from 2019 to 2050 at a rate of 6.9% per year (Figure 11.2).

3. Power Generation (Historical Trend: 2019, 2030, 2040, 2050)

In 2050, total power generation is expected to register at 196.41 terawatt-hours (TWh) under the LCET-CN scenario. This figure is lower than those in the BAU scenario and APS at 81.00 TWh and 69.12 TWh, respectively.

Figure 11.3. Electricity Generation by Fuel, LCET-CN Scenario, 1990–2050



LCET-CN = low-carbon energy transition–carbon neutral, PP = power plant, TWh = terawatt-hour.
Source: Author's calculations.

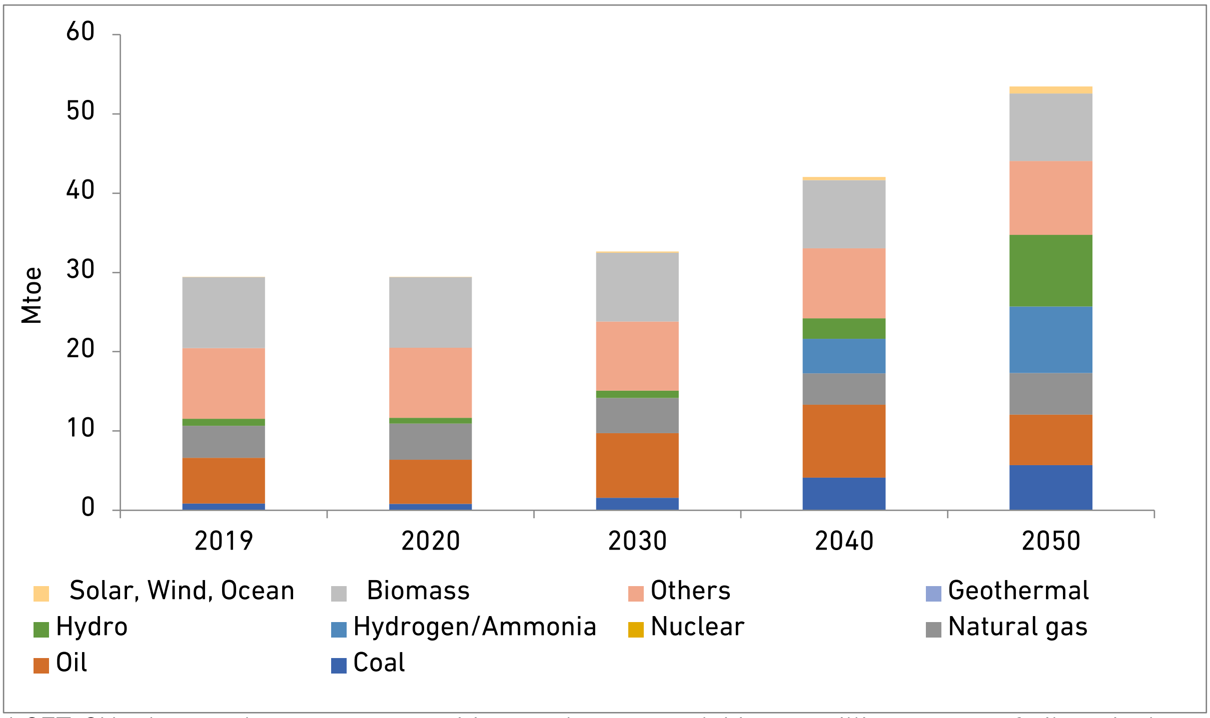
Total electricity generation under the LCET-CN scenario is projected to increase 7.2% per year from 2019 until 2050. Based on Figure 11.3, hydro would comprise the highest share at 53.6% of total electricity generation in 2050, with natural gas following at 14.4%. Both hydrogen and ammonia would increase to 13.9%. The total renewable energy share consists of 2.9% solar, 2.4% wind, 53.6% hydro, and 1.6% others (mainly biomass) of total electricity generation to 2050.

4. Primary Energy Supply (historical trend: 2019, 2030, 2040, and 2050)

The total primary energy supply (TPES) under the LCET-CN scenario is expected to increase 1.9% per year from 2019 until 2050. This incremental rate is lower when compared to the BAU scenario and APS at 2.6% and 2.1% per year, respectively, due to more energy savings under the LCET-CN scenario. Figure 11.4 shows the TPES by fuel type.

Figure 11.4. Total Primary Energy Supply by Fuel Type under the LCET-CN Scenario, 1990–2050

(Mtoe)



LCET-CN = low-carbon energy transition–carbon neutral, Mtoe = million tonnes of oil equivalent.
Source: Author's calculations

Under the LCET-CN scenario, 'others' fuel would record the highest increase at 25.3% per year from 2019 until 2050. Biomass would decrease 0.2% per year, and natural gas and oil would have minimal growth throughout the projection period at 0.9% per year and 0.3% per year, respectively. This is followed by hydro at 12.5% and coal at 6.3%. Overall, the TPES would register at 44.05 Mtoe in 2050.

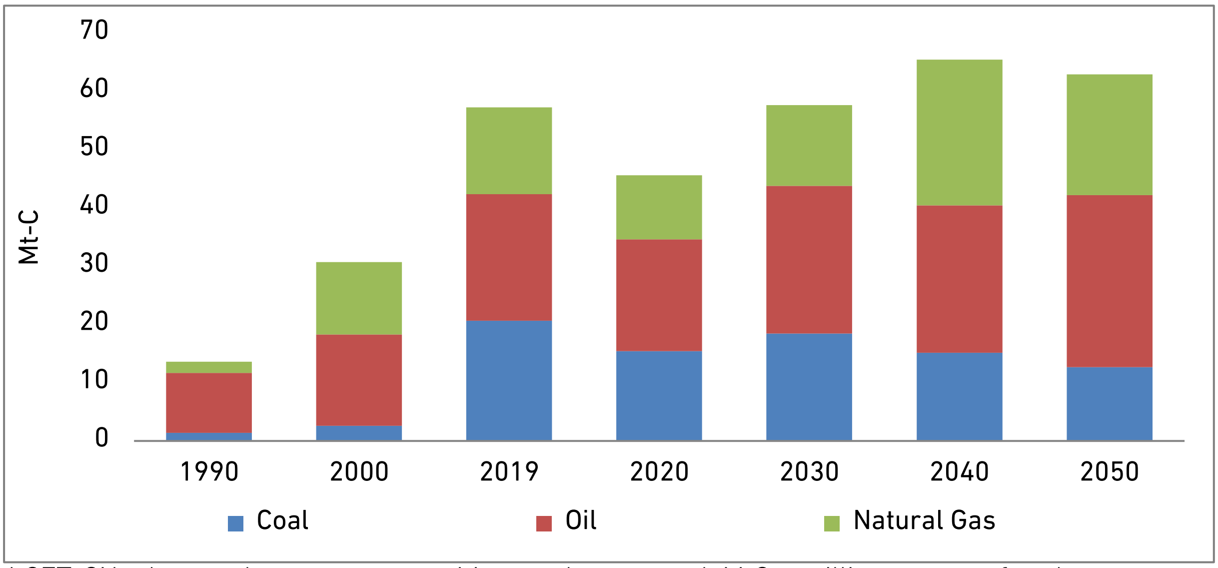
Myanmar has set a conditional target of reducing deforestation by 50% by 2030, resulting in a cumulative emissions reduction of 256.5 million tonnes of carbon dioxide equivalent ($MtCO_2e$) over 2021–2030. The renewable energy share target is 12% of the national energy mix by 2030, which includes small and mini-hydro, biomass, wind, and solar. Finally, it is targeting a 20% electricity-savings potential by 2030 of the TFEC.

Renewable energy would eventually become the main power source under the LCET-CN scenario, accounting for 60.5% in 2050 of the energy mix. Moreover, the efficiency of final energy demand would increase, and thermal power generation would become more efficient.

5. Emissions

Overall, for 2050, total emissions under the LCET-CN scenario would be 14.62 million tonnes of carbon (MtC), an increase of 1.9% per year from the 2019 level. Only emissions for coal would decrease 6.3% from 2019 until 2050, to 6.06 MtC in 2050, due to a new government policy to stop developing new coal power plants. Emissions from natural gas are expected to increase by 0.9% per year from 2019 until 2050 due to the fuel switching from coal. Natural gas is still a better option compared to coal – especially in the power sector – because of the stability of the supply and low cost. Emissions from oil are expected to increase at 0.3% per year, totalling 5.22 MtC in 2050 (Figure 11.5).

Figure 11.5. Total Emissions by Fuel Type under the LCET-CN Scenario, 1990–2050 (MtC)



LCET-CN = low-carbon energy transition–carbon neutral, MtC = million tonnes of carbon.
Source: Author's calculations.

Overall, coal would still dominate total emissions with a 41.5% share in 2050 followed by oil at 35.7% and natural gas at 22.9%.

6. Hydrogen Demand

Under the LCET-CN scenario, two sectors would use hydrogen: transport and industry. In the transport sector, gasoline consumption would decrease due to EVs. Based on this assumption, the fuel switching would result in 2.700 Mtoe in 2041 to 0.389 Mtoe in 2050. The utilisation rate cannot be achieved without hydrogen fuelling stations available as well as affordable hydrogen vehicles on the market. In the industrial sector, hydrogen consumption would represent 13.9% of the TFEC in 2050. In Myanmar, the potential reserve of hydrogen from fossil fuels is 1.7 Mtoe, and hydrogen from renewable energy is 252 Mtoe.

7. Cost Comparison

7.1. Assumptions

An analysis of energy costs was carried out on the BAU and LCET-CN scenarios to examine the total investment costs. The basic assumptions for this analysis are in Tables 11.1–11.3.

Table 11.1. Assumed Fuel Costs

Fuel	2019/2020	2050 (2019 Constant Price)	Unit
Coal	80.03	98.00	US$/tonne
Oil	41.00	100.00	US$/bbl
Gas	7.77	7.50	US$/mmbtu
Hydrogen	0.80	0.30	US$/$Nm^3$
CCS	0	30.00	US$/$tCO^2$

bbl = barrel, CCS = carbon capture and storage, mmbtu = million British thermal unit, Nm^3 = normal cubic metre, tCO_2 = tonne of carbon dioxide equivalent.
Source: Author's calculations.

Table 11.2. Assumed Construction Costs of Power Plants
(US$/kilowatt)

	2019	by 2050
Coal	1,500	1,525
Oil	0	0
Gas	700	700
Hydrogen	0	700
Nuclear	4,500	3,575
Hydro	2,000	2,223
Geothermal	4,000	4,256
Solar	1,600	307
Wind	1,600	1,235
Biomass	2,000	3,019

Source: Author's calculations.

Table 11.3. Assumed Capacity Factors of Power Plants
(%)

Fuel	2019	by 2050
Coal	75	80
Oil	75	80
Gas	75	80
Hydrogen	0	80
Nuclear	100	80
Hydro	50	40
Geothermal	50	50
Solar	17	17
Wind	40	40
Biomass	50	70

Source: Author's calculations.

7.2. Fuel Costs

Based on fuel cost assumptions in Table 11.1, total investments are shown in Table 11.4.

Table 11.4. Total Investments in Fuel under the BAU and LCET-CN Scenarios, 2050

Fuel	Final Energy Consumption, BAU, 2019 (Mtoe)	Final Energy Consumption, BAU, 2050 (Mtoe)	Final Energy Consumption, LCET-CN, 2050 (Mtoe)	Total Investment Cost, BAU, 2050 (US$ million)	Total Investment Cost, LCET-CN, 2050 (US$ million)
Coal	0.85	4.96	5.70	648	766
Oil	5.78	20.93	6.38	10,422	416
Gas	4.03	5.64	5.24	464	350
Hydrogen	0	0	8.37	0	9,757
Total	**10.66**	**31.53**	**25.70**	**11,535**	**11,290**

BAU = business as usual, LCET-CN = low-carbon energy transition–carbon neutral, Mtoe = million tonnes of oil equivalent.
Source: Author's calculations.

From the results above, the total investment fuel cost in 2050 for the BAU scenario is expected to be US$11,535 million. This total is slightly higher than that under the LCET-CN scenario at US$11,290 million.

7.3. Power Investment

Based on power generation investment assumptions in Table 11.2 and Table 11.3, the total investment cost for power plants in 2050 are in Table 11.5.

Table 11.5. Total Investment in Power Plants under the BAU and LCET-CN Scenarios, 2050

Fuel	Electricity Generation, BAU, 2019 (TWh)	Electricity Generation, BAU, 2050 (TWh)	Electricity Generation, LCET-CN, 2050 (TWh)	Additional Capacity, BAU (MW)	Additional Capacity, LCET-CN (MW)	Total Investment Cost, BAU, 2050 (US$ million)	Total Investment Cost, LCET-CN, 2050 (US$ million)
Coal	0.69	13.29	21.90	1,797	3,031	2,741	4,622
Oil	0.07	0	0	–10	0	0	0
Gas	12.27	23.41	28.20	1,588	2,278	1,112	1,594
Hydrogen	0	0	27.40	0	3,909	0	2,736
Hydro	10.03	44.29	105.30	9,777	27,179	21,735	60,420
Solar	0	0	5.70	0	3,794	0	1,165
Wind	0	0	4.80	0	1,362	0	1,682
Biomass	0.01	0.02	3.20	2	515	5	1,555
Total	**23.07**	**81.01**	**196.00**	**13,145**	**42,067**	**25,593**	**73,773**

BAU = business as usual, LCET-CN = low-carbon energy transition–carbon neutral, MW = megawatt, TWh = terawatt-hour.
Source: Author's calculations.

From Table 11.5, the total additional capacity needed under the BAU scenario is 13,145 megawatts (MW) more than the 2019 level. The additional capacity for the LCET-CN scenario in 2050 is much greater – 42,067 MW – due to more aggressive assumptions for renewable energy for power plants to reduce emissions. As a result, the total investment for power plants in 2050 for the BAU scenario is assumed to be US$25,593 million, while under the LCET-CN scenario, it is US$73,773 million.

7.5. Overall Cost

The breakdown of the total investment cost is shown below.

Table 11.6. Overall Total Investment Costs for the BAU and LCET-CN Scenarios, 2050
(US$ million)

Cost	BAU	LCET-CN
Total Fuel Cost Investment	11,535	11,290
Total Power Capital Cost Investment	25,593	73,773
Total CCS Cost Investment	0	0
Total	**37,127**	**85,063**

BAU = business as usual, CCS = carbon capture and storage, LCET-CN = low-carbon energy transition–carbon neutral.
Source: Author's calculations.

Overall investment costs in 2050 are projected to be US$37,127 million for the BAU scenario and US$85,063 million under the LCET-CN scenario.

8. Conclusions and Recommendations

To ensure a more sustainable transition towards cleaner energy sources, Myanmar should foster collaboration and share knowledge on carbon capture, use, and storage technologies, best practices, and experiences. It should also invest in research and innovation for a more sustainable future. Partnerships should be created between academia, industries, and governments to drive innovation in renewable technologies and energy storage solutions.

Future research and development and international collaboration are key factors in accelerating the pace towards carbon neutrality in the Association for Southeast Asian Nations (ASEAN) region, including Myanmar. Cost reduction and international cooperation are vital for achieving carbon neutrality in an affordable manner. Myanmar should formulate a strategic vision to transform into a low-carbon society for the well-being of present and future generations.

In preparing for the changes towards energy transition, Myanmar has been accelerating the development of renewable energy policies, aligning actions and programmes to support climate objectives, and keeping emissions in check by accelerating plans towards reliable and cost-effective renewable energy and reducing energy security risks.