

Chapter **1**

Primary Energy Data

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Primary Energy Data

Cambodia's energy structure is simple. Fossil fuels, such as coal and petroleum products, are imported, while biomass is mostly produced domestically. Electricity production depends on hydro and coal with some import from Viet Nam, Thailand, and the Lao People's Democratic Republic (Lao PDR). In this chapter, currently available primary energy data in Cambodia are introduced. The data collection flow of the existing data is shown in Annex 2.

1.1 Coal

Two types of coal data exist in Cambodia. These are the coal consumption for power generation and for the industry sector. The data are managed by Electricité du Cambodge (EDC) and the General Department of Energy (GDE), Ministry of Mines and Energy (MME).

1.1.1 Coal consumption for power generation

EDC collects coal consumption data from the coal power plants (managed by independent power producers or IPPs) and GDE maintains the data (Table 1.1). Coal consumption for power generation increased largely in 2014 and 2015 due to the operation of new coal power plants (Sihanoukville 100 MW coal power plant and the first 270 MW coal power plants of the CIIDG Erdos Hongjun Electric Power Co. Ltd.).

Table 1.1. Coal Consumption Data for Power Generation

Year	Generation Coal Consumption (kt)
2008	25.51
2009	30.62
2010	35.04
2011	40.09
2012	58.13
2013	91.89
2014	563.32
2015	1,002.82

kt = kiloton.

Source: Electricité du Cambodge.

1.1.2 Coal consumption in the industry sector

GDE maintains the coal consumption data of the industry sector as shown in Table 1.2. Due to the operation of the new cement plant in 2015, coal consumption has largely increased. However, other industries also consume coal in their production activities, so it is difficult to break down the coal consumption by the different industries. In this publication, the coal consumption of the industry sector is all allocated to the cement subsector (non-metallic mineral product subsector).

Table 1.2. Coal Consumption Data for Power Generation, Industry Sector

Year	Industry Coal Consumption (kt)
2010	10.19
2011	11.89
2012	13.02
2013	13.43
2014	18.93
2015	26.67

kt = kiloton.

Source: General Department of Energy, MME.

1.2 Oil

There are several types of oil (petroleum products, including additives) data in Cambodia. These are (i) oil import data prepared by the Customs Office, (ii) fuel consumption for power generation, and (iii) oil sales data collected from oil import companies in Cambodia. In preparing the Cambodia Energy Statistics, oil sales data have been newly collected from the oil import companies.

1.2.1 Oil import data of the Customs Office

The Customs Office oil import data as shown in Table 1.3 covers the following petroleum products:

- Jet A-1: kerosene type jet fuel
- Gasoline: motor gasoline
- DO: gas/diesel oil
- KO: other kerosene
- FO: fuel oil (residual oil)
- Lubricant: lubricant
- LPG: liquid petroleum gas

- Base oil: materials for lubricant
- Naphtha: materials for motor gasoline
- MTBE: additives for motor gasoline

Table 1.3. Import Data of Petroleum Products (Customs Data)

Unit: kt

Year	Jet A-1	Gasoline	DO	KO	FO	Lubricant	LPG	Base Oils	Naphtha	MTBE
2007	48.73	238.40	492.53	32.62	293.95	11.41	47.34	0.00	0.00	0.00
2008	44.31	293.22	456.10	0.00	310.09	0.00	43.29	0.00	0.00	0.00
2009	35.19	313.61	677.06	28.95	269.94	14.25	56.95	3.29	0.00	0.00
2010	46.35	384.09	762.08	30.59	244.07	14.22	65.11	2.52	0.00	0.00
2011	54.60	398.52	814.54	12.07	228.78	14.17	71.94	3.46	0.00	0.00
2012	68.99	387.73	897.64	6.26	213.74	14.77	84.68	3.25	0.00	0.00
2013	79.21	392.01	918.44	4.40	165.93	16.90	98.69	1.95	0.00	0.00
2014	91.66	426.83	1005.48	0.00	89.28	11.69	112.12	0.00	0.00	0.00
2015	96.95	481.07	1073.25	0.00	35.59	46.65	162.33	0.00	18.09	8.10

DO = gas/diesel oil, FO = fuel oil (residual oil), KO = other kerosene, LPG = liquid petroleum gas, MTBE = additives for motor gasoline.

Source: Cambodia Customs Office.

1.2.2 Oil consumption for power generation

EDC collects petroleum fuel consumption data from oil power plants (IPPs) and GDE maintains the data (Table 1.4). Diversification of power sources in Cambodia has been shifting from oil-based power plants to hydropower and coal power plants.

1.2.3 Petroleum sales data from oil import companies

Through the survey of the oil import companies in Cambodia conducted by the General Department of Petroleum, the following historical data from 2010 to 2015 were collected. Presented in this report are only the sales data for the years 2010, 2014, and 2015 (Tables 1.5–1.7). Thirteen oil import companies participated and cooperated in this survey.

The sales data of the companies were differentiated into three main categories as follows:

Table 1.4. Petroleum Consumption for Power Generation

Unit: kt

Year	Generation	
	Heavy Fuel Oil (HFO)	Diesel
2003	22.06	9.83
2004	23.46	13.41
2005	33.45	10.71
2006	48.35	6.54
2007	64.73	4.93
2008	79.55	5.81
2009	90.07	5.33
2010	170.96	6.05
2011	183.61	6.06
2012	174.91	8.95
2013	107.72	3.30
2014	61.81	2.10
2015	43.03	1.46

Source: Electricité du Cambodge.

- Sales to large-scale industrial users
- Sales to other large-scale users including:
 - Commercial services
 - Public services
 - Residential
 - Agriculture
 - Fishing
 - International civil aviation
 - Domestic air transport
 - Inland waterways
 - International marine bunker
- Sales to gas stations covering:
 - Sales to company-owned stations
 - Sales to company franchises

Due to missing important sectors such as the power generation sector and grey definitions of subsectors such as the commercial sector, the survey questionnaires could be revised further to collect more accurate petroleum sales data.

Table 1.5. Petroleum Sales Data in 2010

Petroleum Product Sales Questionnaire

Corporation/Company: All

Contact Person:

Tel:

Year: 2010

Email:

Quantity Descriptions	LPG	Naphtha	Motor Gasoline	Kerosene Type Jet Fuel	Other Kerosene	Diesel Oil	Fuel Oil	Lubricants	Bitumen	Other Products
	ton	kl	kl	kl	kl	kl	kl	kl	ton	kl
Import	35,216.670	-	416,844.456	54,194.264	32,430.191	788,866.334	193,914.851	285,729.897	1,687.820	-
Blending	-	-	-	-	-	-	-	-	-	-
Own Use	-	-	238.811	-	-	1,743.290	-	17.295	-	-
Stock (at the end of the year)	235.120	-	9,102.505	5,447.945	251.068	20,621.793	10,383.192	497.005	-	-
Total Sales	34,484.830	-	405,972.126	50,769.142	28,050.027	654,147.072	177,642.334	283,903.036	1,687.820	-
Sell to Large-Scale Industrial Users	-	-	9,623.250	-	-	45,384.825	78,085.874	56,248.063	1,687.820	-
Iron and Steel	-	-	-	-	-	-	-	-	-	-
Chemical (incl. Petrochemical)	-	-	-	-	-	-	-	-	-	-
Non-ferrous Metals	-	-	-	-	-	-	-	-	-	-
Transportation Equipment	-	-	19.690	-	-	2,493.710	-	64.950	-	-
Machinery	-	-	-	-	-	-	-	-	-	-
Mining and Quarrying	-	-	-	-	-	-	-	-	-	-
Food, Beverages, and Tobacco	-	-	43.520	-	-	3,895.920	-	93.620	-	-
Pulp, Paper, and Printing	-	-	-	-	-	-	-	-	-	-
Wood and Wood Products	-	-	-	-	-	-	-	-	-	-

Petroleum Product Sales Questionnaire

Construction	-	-	3.440	-	-	34,531.960	-	55,837.310	1,687.820	-
Textiles and Leather	-	-	-	-	-	5,799.050	-	29.070	-	-
Not Elsewhere Specified (Industry)	-	-	9,556.600	-	-	20,351.105	78,085.874	223.113	-	-
Sell to Other Large-Scale Users	34,484.830	-	236,942.213	48,093.263	26,869.529	420,944.922	80,213.530	225,280.246	-	-
Commercial Services	26,125.080	-	164,094.449	-	26,869.529	259,758.678	7,775.530	1,310.400	-	-
Public Services	2,458.750	-	70,954.294	-	-	108,983.969	-	168,174.226	-	-
Residential	5,901.000	-	-	-	-	3,857.650	-	10.040	-	-
Agriculture	-	-	-	-	-	32,626.000	-	55,785.580	-	-
Fishing	-	-	-	-	-	-	-	-	-	-
International Civil Aviation	-	-	-	47,533.909	-	-	-	-	-	-
Domestic Air Transport	-	-	-	559.354	-	-	-	-	-	-
Inland Waterways	-	-	-	-	-	-	-	-	-	-
International Marine Bunker	-	-	-	-	-	-	72,438.000	-	-	-
Sell to Gas Station	-	-	160,886.456	2,675.879	1,180.498	167,729.841	19,342.930	2,374.717	-	-
Company-Owned Stations	-	-	106,554.611	2,675.879	59.025	46,236.299	12,912.930	376.352	-	-
Company Franchises	-	-	54,331.845	-	1,121.473	121,493.542	6,430.000	1,998.365	-	-

kl = kilolitre, LPG = liquid petroleum gas.

Source: General Department of Petroleum, MME.

Table 1.6. Petroleum Sales Data in 2014

Petroleum Product Sales Questionnaire

Corporation/Company: All

Contact Person:

Tel:

Year: 2014

Email:

Quantity Descriptions	LPG	Naphtha	Motor Gasoline	Kerosene Type Jet Fuel	Other Kerosene	Diesel Oil	Fuel Oil	Lubricants	Bitumen	Other Products
	ton	kl	kl	kl	kl	kl	kl	kl	ton	kl
Import	63,137.706	-	514,411.612	99,787.355	-	1,026,528.353	66,193.693	616,403.805	4,434.060	-
Blending	-	-	-	-	-	-	-	-	-	-
Own Use	200.000	-	1,391.969	-	-	14,594.971	-	116.088	-	-
Stock (at the end of the year)	1,778.642	-	14,135.967	9,062.404	-	26,827.540	6,889.536	500.667	-	-
Total Sales	63,366.780	-	523,909.718	96,751.395	206.037	971,324.432	65,264.589	614,807.157	4,434.060	-
Sell to Large-Scale Industrial Users	1,160.000	-	1,695.329	-	-	82,860.358	36,400.220	121,882.121	4,434.060	-
Iron and Steel	-	-	-	-	-	-	-	-	-	-
Chemical (incl. Petrochemical)	-	-	-	-	-	-	-	-	-	-
Non-ferrous Metals	-	-	-	-	-	-	-	-	-	-
Transportation Equipment	-	-	10.840	-	-	3,513.620	-	98.920	-	-
Machinery	-	-	-	-	-	-	-	-	-	-
Mining and Quarrying	-	-	-	-	-	-	-	-	-	-
Food, Beverages, and Tobacco	-	-	9.220	-	-	2,125.430	-	45.920	-	-
Pulp, Paper, and Printing	-	-	-	-	-	-	-	-	-	-
Wood and Wood Products	-	-	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	51,084.780	-	121,535.230	4,434.060	-
Textiles and Leather	-	-	-	-	-	2,218.200	-	18.890	-	-

Not Elsewhere Specified (Industry)	-	-	1,675.269	-	-	23,918.328	36,400.220	183.161	-	-
Sell to Other Large-Scale Users	61,706.780	-	302,780.899	93,927.295	206.037	618,027.116	16,942.000	489,284.395	-	-
Commercial Services	56,996.080	-	228,813.874	-	206.037	411,923.657	11,662.000	1,590.876	-	-
Public Services	1,385.500	-	72,027.962	-	-	136,540.582	5,280.000	366,213.179	-	-
Residential	3,325.200	-	-	-	-	2,958.300	-	26.060	-	-
Agriculture	-	-	25.510	-	-	50,844.390	-	121,454.280	-	-
Fishing	-	-	-	-	-	-	-	-	-	-
International Civil Aviation	-	-	-	91,762.047	-	-	-	-	-	-
Domestic Air Transport	-	-	20.083	2,165.248	-	41.562	-	-	-	-
Inland Waterways	-	-	-	-	-	-	-	-	-	-
International Marine Bunker	-	-	-	-	-	-	-	-	-	-
Sell to Gas Stations	500.000	-	219,433.480	2,824.000	-	270,436.968	11,922.369	3,640.630	-	-
Company-Owned Stations	300.000	-	92,079.005	2,824.000	-	62,489.580	1,968.000	518.370	-	-
Company Franchises	200.000	-	127,354.475	-	-	207,947.388	9,954.369	3,122.260	-	-

kl = kilolitre, LPG = liquid petroleum gas.

Source: General Department of Petroleum, MME.

Table 1.7. Petroleum Sales Data in 2015

Petroleum Product Sales Questionnaire

Corporation/Company: All

Contact Person:

Tel:

Year: 2015

Email:

Quantity Descriptions	LPG	Naphtha	Motor Gasoline	Kerosene Type Jet Fuel	Other Kerosene	Diesel Oil	Fuel Oil	Lubricants	Bitumen	Other Products (MTBE)
	ton	kl	kl	kl	kl	kl	kl	kl	ton	kl
Import	77,973.424	37,159.843	662,619.440	120,912.571	-	1,253,012.746	37,529.150	397,206.988	3,493.110	15,423.412
Blending	-	-	-	-	-	-	-	-	-	-
Own Use	220.000	-	967.077	-	-	16,845.247	-	122.832	-	-
Stock (at the end of the year)	3,207.191	-	16,955.112	8,301.391	-	24,343.733	3,640.833	570.919	-	-
Total Sales	79,547.111	-	666,856.888	105,559.472	-	1,110,415.296	33,794.101	396,857.124	3,493.110	-
Sell to Large-Scale Industrial Users	1,380.000	-	3,552.589	-	-	88,417.784	17,565.601	78,179.657	3,493.110	-
Iron and Steel	-	-	-	-	-	-	-	-	-	-
Chemical (incl. Petrochemical)	-	-	-	-	-	-	-	-	-	-
Non-ferrous Metals	-	-	-	-	-	-	-	-	-	-
Transportation Equipment	-	-	17.840	-	-	3,390.630	-	98.120	-	-
Machinery	-	-	-	-	-	-	-	-	-	-
Mining and Quarrying	-	-	-	-	-	-	-	-	-	-
Food, Beverages, and Tobacco	-	-	42.810	-	-	2,526.810	-	66.620	-	-
Pulp, Paper, and Printing	-	-	-	-	-	-	-	-	-	-
Wood and Wood Products	-	-	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	49,065.180	-	77,811.660	3,493.110	-

Petroleum Product Sales Questionnaire

Textiles and Leather	-	-	-	-	-	1,977.900	-	16.370	-	-
Not Elsewhere Specified (Industry)	1,380.000	-	3,491.939	-	-	31,457.264	17,565.601	186.887	-	-
Sell to Other Large-Scale Users	16,515.236	-	395,151.479	105,559.472	-	712,078.441	5,376.000	314,683.650	-	-
Commercial Services	11,366.786	-	305,024.658	-	-	565,503.924	2,208.000	1,682.441	-	-
Public Services	1,514.250	-	88,176.217	-	-	126,331.224	3,168.000	235,286.089	-	-
Residential	3,634.200	-	-	-	-	602.150	-	25.830	-	-
Agriculture	-	-	26.160	-	-	3,913.950	-	77,689.290	-	-
Fishing	-	-	-	-	-	-	-	-	-	-
International Civil Aviation	-	-	-	98,566.470	-	-	-	-	-	-
Domestic Air Transport	-	-	30.974	6,993.002	-	8.568	-	-	-	-
Inland Waterways	-	-	-	-	-	-	-	-	-	-
International Marine Bunker	-	-	-	-	-	-	-	-	-	-
Sell to Gas Stations	655.000	-	268,157.810	-	-	309,919.061	10,852.500	3,993.827	-	-
Company-Owned Stations	400.000	-	116,305.179	-	-	55,397.336	1,375.000	444.636	-	-
Company Franchises	255.000	-	151,852.631	-	-	254,521.725	9,477.500	3,549.191	-	-

kl = kilolitre, LPG = liquid petroleum gas.

Source: General Department of Petroleum, MME.

1.3 Electricity

1.3.1 Power generation by sources

The Electricity Authority of Cambodia (EAC) and/or EDC collects power generation data from all the stakeholders and GDE maintains the data. The data collected so far to generate hydropower, coal power, petroleum power, and biomass power are shown in Table 1.8.

Table 1.8 Power Generation by Source

Unit: GWh

Year	Hydro	Coal	Diesel/HFO	Wood & Biomass
2003	40.51	-	595.38	-
2004	28.42	-	714.81	-
2005	43.54	-	835.71	0.12
2006	50.61	-	1,034.82	1.68
2007	49.71	-	1,294.36	5.25
2008	46.28	23.36	1,409.94	4.53
2009	47.43	28.03	1,152.65	6.49
2010	31.73	32.08	898.73	5.82
2011	51.52	46.50	908.61	11.91
2012	517.37	37.42	856.56	11.75
2013	1,015.54	168.75	578.99	6.68
2014	1,851.60	863.02	326.97	16.79
2015	2,000.38	2,376.49	227.62	40.47

GWh = gigawatt-hour, HFO = heavy fuel oil.

Source: Electricity Authority of Cambodia and Electricity Authority of Cambodia.

1.3.2 Import of electricity

Cambodia still imports electricity due to seasonal factors. Hydropower generation usually declines during the dry seasons due to the lack of water. Therefore, Cambodia needs to import electricity from neighbouring countries such as Viet Nam, Thailand, and the Lao PDR. Currently, the increase in generation from coal power plants contributes to the decrease in electricity imports. Table 1.9 shows the total electricity import of Cambodia.

1.3.3 Electricity consumption by final users

EDC covers electricity sales to the final users in Cambodia (Table 1.10). In the case of electricity data, the numbers can be considered as consumption data because there is usually no electricity storage. The final users consist of the residential, commercial, industry, and other sectors.

Table 1.9. Electricity Import

Year	Import (GWh)
2003	58.28
2004	59.49
2005	82.25
2006	107.98
2007	167.41
2008	374.25
2009	842.40
2010	1,546.44
2011	1,829.79
2012	2,104.32
2013	2,281.63
2014	1,803.04
2015	1,541.00

GWh = gigawatt-hour.

Source: Electricity Authority of Cambodia.

Table 1.10. Electricity Consumption by Final Users

Unit: GWh

Year	Residential	Commercial	Industrial	Other	Total
2003	292.17	229.86	76.46	0.55	599.04
2004	325.19	270.74	105.93	0.46	702.31
2005	365.84	348.03	143.76	0.72	858.36
2006	388.83	449.22	215.98	3.13	1,057.16
2007	458.25	548.91	338.61	3.35	1,349.12
2008	575.40	694.41	389.62	4.96	1,664.40
2009	682.03	778.15	388.59	4.72	1,853.50
2010	869.08	892.89	489.88	2.19	2,254.04
2011	854.16	1,082.45	629.87	6.26	2,572.74
2012	1,079.28	1,275.90	900.32	10.31	3,265.81
2013	1,186.58	1,539.47	820.04	6.50	3,552.59
2014	1,323.08	1,639.29	1,054.35	127.39	4,144.12
2015	1,527.15	2,530.31	1,136.84	7.18	5,201.49

GWh = gigawatt-hour.

Source: Electricité du Cambodge.

1.4 Biomass

1.4.1 Production

Biomass in Cambodia consists of firewood and biogas based on animal dung. Biomass is mainly consumed in rural areas and the production figures are shown in Table 1.11.

Table 1.11. Biomass Production

Unit: ton

Year	Firewood	Biogas
2007	4,272,869	621.57
2008	4,459,457	1,265.29
2009	4,583,360	1,413.93
2010	4,644,997	2,023.60
2011	4,856,076	2,608.41
2012	5,053,881	2,270.61
2013	5,262,683	602.65
2014	5,520,148	881.54
2015	5,681,802	-

Source: General Department of Energy, MME.

1.4.2 Transformation process

Biomass (excluding biogas) are used in two transformation processes: one is for power generation and the other is for charcoal production. Biomass consumption data for these processes as shown in Table 1.12 are collected by EAC and GDE.

Table 1.12. Firewood Consumption for Transformation Processes

Unit: ton

Year	Electricity	Charcoal
2007	6,304	2,280,673
2008	5,438	2,380,875
2009	7,783	2,445,854
2010	6,983	2,479,230
2011	14,288	2,588,155
2012	14,096	2,693,994
2013	8,016	2,808,858
2014	20,148	2,940,000
2015	48,562	2,984,159

Source: General Department of Energy, MME.

Electricity generation by biomass is already shown in Table 1.8 so that only charcoal production is shown in Table 1.13. GDE collects the charcoal production data.

Table 1.13. Charcoal Production

Year	Charcoal Product (ton)
2007	260,648
2008	272,100
2009	279,526
2010	283,341
2011	295,789
2012	307,885
2013	321,012
2014	336,000
2015	341,047

Source: General Department of Energy, MME.

1.4.3 Final consumption

Biomass (firewood and biogas) and charcoal are mainly used in the residential sector, especially in the rural areas. A small quantity of firewood is still being consumed in some industries, such as for heating the boiler or burner. Table 1.14 shows the biomass consumption by the final sectors.

Table 1.14. Final Consumption of Biomass

Year	Firewood		Charcoal	Biogas
	Residential	Industrial	Residential	Residential
2007	1,380,816	605,077	260,648	621.57
2008	1,441,482	631,661	272,100	1,265.29
2009	1,480,823	648,900	279,526	1,413.93
2010	1,501,030	657,755	283,341	2,023.60
2011	1,566,978	686,653	295,789	2,608.41
2012	1,631,058	714,733	307,885	2,270.61
2013	1,700,601	745,207	321,012	602.65
2014	1,780,000	780,000	336,000	881.54
2015	1,806,735	842,347	341,047	881.54

Sources: General Department of Energy; National Biodigester Programme Cambodia.

1.5 Estimation of Missing Data

Clearly, substantial energy data are available for preparing the Cambodia energy balance table historically from 2010 to 2014 and, in some cases, also up to 2015. Nonetheless, some energy data are still missing. In this case, estimation of missing data is indispensable. The following are examples of the estimation under this project (details are shown in Chapter 2):

- Coal import: Coal import estimated based on coal consumption data.
- Final consumption of petroleum products: Petroleum import data between the Customs Office and petroleum companies are not the same due to different definitions of the products. As such, the customs data are the control data for total consumption. The final consumption of petroleum products is estimated from the petroleum companies' data.
- Separation of the jet fuel imports for domestic flights and international flights is based on Cambodia's air transport statistics (international aviation bunker).
- The international standard heat value is applied for converting the physical value into its heat value. The unit for the energy balance table is the heat value (e.g. tons of oil equivalent, TOE).
- Electricity for own use is separated at generation sites into coal, petroleum, hydro, and biomass power generation.