



Chapter 1

Primary Energy Data

The primary energy sources of the Lao People's Democratic Republic (Lao PDR) consist of coal, oil, hydro, and biomass. The country imports oil products to meet its domestic requirements, while it uses its coal resources domestically and exports these at the same time. It exports electricity to Thailand and Cambodia and imports electricity from Thailand, China, and Viet Nam. Its primary source of electricity is hydropower. Since 2015, it has also consumed coal to generate electricity for export purposes. The country also consumes other renewable energies: biomass and solar.

This chapter elaborates on the primary energy data of the Lao PDR that was collected by its Department of Energy, Policy and Planning (DEPP), Ministry of Energy and Mines.

Coal

The Lao PDR classifies its coal resources as anthracite and lignite. It exports most of the lignite it produces. The country exported anthracite from 2012, but in 2015 the government stopped its coal export to prioritise the use of coal to meet the demand of the industry sector. The Hongsa coal power plant started operating in 2015; since then coal has been consumed to generate power.

Coal Production Data

The Ministry of Energy and Mines collects data on coal production and DEPP maintains these data. As shown in Table 1.1, coal production from 2000 until 2015 increased from 229 kiloton (kt) to 4,793 kt.

Table 1.1. Coal Production (kt)

Year	Production		
	Anthracite	Lignite	Total
2000	15	214	229
2001	20	227	247
2002	31	234	265
2003	38	253	291
2004	46	300	346
2005	51	320	371
2006	62	342	404
2007	75	382	457
2008	105	399	504
2009	112	456	568
2010	212	522	733
2011	225	621	846
2012	233	709	941
2013	245	810	1,055
2014	257	911	1,168
2015	136	4,658	4,793

Source: Department of Mines, Ministry of Energy and Mines, Lao PDR.

Coal Export and Import Data

The Department of Customs, Ministry of Finance, collects data on coal exports and DEPP maintains these data (Table 1.2). Lao PDR's coal export is mainly lignite. Anthracite was only exported only from 2012 to 2014. Exports increased from 2000–2012 and declined in 2013–2014. There was no coal export in 2015.

Table 1.2. Coal Export (kt)

Year	Export		
	Anthracite	Lignite	Total
2000		214	214
2001		227	227
2002		234	234
2003		253	253
2004		300	300
2005		320	320
2006		319	319
2007		682	682
2008		379	379
2009		400	400
2010		445	445
2011		465	465
2012	16	498	513
2013	45	200	245
2014	54	254	309
2015	0	0	0

Source: Department of Customs, Ministry of Industry and Commerce, Lao PDR.

Originally, DEPP's coal data included the 2015 import of anthracite totalling 175 kt. After confirmation from the Department of Mines, DEPP deleted this import data. Thus, the Lao PDR has no coal import.

Coal Consumption for Power Generation

In 2015, the Lao PDR constructed the Hongsa Mine Mouth Coal Power Plant, based on its memorandum of understanding with Thailand, to meet electricity demand in Thailand. Thus, electricity produced from the Hongsa power plant is exported to Thailand. Based on DEPP data, the capacity of the Hongsa power plant in 2015 was 1,878 megawatts (MW) and its coal consumption was 3,817 kt lignite.

Coal Consumption of the Industry Sector

Aside from power generation, coal is consumed by the industry sector. The data on total coal consumption by the industry sector is shown in Table 1.3 but it is not broken down into sub-sectors such as cement, textile, and many others.

Table 1.3. Coal Consumption Data (kt)

Year	Industry		
	Anthracite	Lignite	Total
2000	15		15
2001	20		20
2002	31		31
2003	38		38
2004	46		46
2005	51		51
2006	62		62
2007	71		71
2008	84		84
2009	93	36	129
2010	114	47	161
2011	125	50	175
2012	131	50	181
2013	135	55	190
2014	141	68	209
2015	108		108

Source: Department of Energy, Policy and Planning, Ministry of Energy and Mines, Lao PDR.

Oil

Lao PDR's oil data consists of imports and consumption data from DEPP, and sales survey data from some petroleum companies. The country consumes the following types of petroleum products:

- Jet A-1 : kerosene type jet fuel
- Gasoline : motor gasoline
- Diesel oil : gas/diesel oil
- Fuel oil : fuel oil (residual oil)
- Lubricant : lubricant
- LPG : liquefied petroleum gas.

Import Data on Petroleum Products

The Department of Customs of the Ministry of Industry and Commerce collects data on import of petroleum products (Table 1.4).

Table 1.4. Import of Petroleum Products

Year	Jet A-1	Gasoline	DO	FO	Lubricant	LPG
	(kl)	(kl)	(kl)	(kl)	(kl)	(ton)
2000	45,730	101,676	214,461	3,875	260	1,801
2001	45,730	102,439	245,641	3,931	273	1,811
2002	45,730	108,002	247,574	4,392	349	1,892
2003	45,730	112,200	255,769	4,496	383	1,897
2004	45,730	119,879	262,904	4,505	433	1,926
2005	45,730	129,356	271,031	4,646	497	1,936
2006	45,730	143,473	375,295	4,682	588	2,132
2007	45,730	152,502	381,944	10,778	5,389	2,052
2008	45,730	159,455	457,327	9,812	4,038	2,151
2009	18,359	178,296	538,769	6,105	2,960	1,630
2010	13,359	178,296	538,769	6,130	2,960	1,510
2011	17,712	166,442	550,844	8,741	1,987	2,851
2012	29,256	159,627	601,588	8,459	1,900	2,954
2013	37,968	219,251	643,276	8,611	1,952	3,110
2014	47,866	212,950	688,907	10,067	1,594	3,510
2015	46,262	234,199	849,151	11,106	229	3,650

DO = diesel oil, FO = fuel oil, kl = kilolitre, LPG = liquefied petroleum gas.

Source: Department of Customs, Ministry of Industry and Commerce, Lao PDR.

Consumption Data on Petroleum Products

DEPP collects oil consumption data from the Lao State Fuel Company (Table 1.5). Data, however, is available for 2012–2015 only. LPG consumption data, on the other hand, is broken down into commercial and residential sectors.

Table 1.5. Consumption of Petroleum Products

Year	Jet A-1	Gasoline	DO	FO	Lubricant	LPG	
	Transport	Transport	Transport	Industry	Transport	Commercial	Residential
	kl	kl	kl	kl	kl	ton	
2000	54,420	100,476	201,569			970	540
2001	68,009	100,439	236,513			970	541
2002	69,154	107,002	238,059			979	589
2003	78,622	110,200	250,615			981	590
2004	81,992	117,879	257,323			1,001	591
2005	88,909	124,301	266,825			1,001	600
2006	89,908	134,654	282,850			1,122	616
2007	97,723	161,672	307,177			1,130	620
2008	67,564	165,401	365,013			1,136	701
2009	18,359	155,118	430,015			1,389	857
2010	13,359	152,885	436,034			1,431	883
2011	17,712	144,804	439,805			1,506	929
2012	29,256	139,559	510,293	7,459	1,840	1,560	963
2013	37,968	215,650	533,735	8,611	1,852	1,642	1,014
2014	42,603	210,416	654,122	9,717	1,919	1,854	1,144
2015	46,262	223,318	863,281	229	3,904	1,944	1,264

DO = diesel oil, FO = fuel oil, kl = kilolitre, LPG = liquefied petroleum gas.

Source: Department of Customs, Ministry of Industry and Commerce, Lao PDR.

Sales Data on Petroleum Products

DEPP collects data on petroleum sales from the survey of private petroleum companies in the Lao PDR. The survey, conducted in 2015, involved 24 private oil companies under the Lao State Fuel Company.

Since only 14 out of the 24 companies submitted their questionnaires, Table 1.6 does not show the actual total sales of petroleum in 2015 in the Lao PDR. However, these data are classified into the following main categories:

- Sales to power producers
 - Electricité du Laos (EDL)
 - Independent power producers, rural producers, etc.
- Sales to large-scale industrial users
 - Iron and steel
 - Chemical (including petrochemical)
 - Non-ferrous metals
 - Transportation equipment
 - Machinery
 - Mining and quarrying
 - Food, beverages, and tobacco
 - Pulp, paper, and printing
 - Wood and wood products
 - Construction
 - Textiles and leather
 - Not elsewhere specified (Industry)
- Sales to other large-scale transport taxi, bus, road freight, etc.
 - International civil aviation
 - Domestic air transport
 - Inland waterways
 - International marine bunker
- Sales to other large-scale users including
 - Commercial services such as malls, hotels, schools, hospitals, office buildings
 - Public services such as central and local governments
 - Residential
 - Agriculture
 - Fishing
 - Petroleum wholesalers
- Sales to gas stations
 - Company-owned stations
 - Company franchises

Table 1.6. Petroleum Sales Data, 2015

Quantity Descriptions	LPG	Naptha	Motor Gasoline	Kerosene Type Jet Fuel	Other Kerosene	Diesel Oil	Fuel Oil	Lubricants	Bitumen
	ton	kl	kl	kl	kl	kl	kl	kl	Specify
Import	-	-	134,108.01	49,487.93	-	479,612	9,332.29	194.83	308.87
Stock (at the end of the year)	-	-	-	-	-	112,840	-	-	-
Total Sales	-	-	117,890.83	49,487.93	-	438,736	9,245.00	216.95	308.87
Sell to Power Producers	-	-	20.00	-	-	34,323	-	68.97	-
IPP, Rural, etc.	-	-	20.00	-	-	34,323	-	68.97	-
Sell to Large-Scale Industrial Users	-	-	8.00	-	-	124,423	9,245.00	13.17	308.87
Iron and Steel	-	-	-	-	-	370	5,163.00	-	-
Non-ferrous Metals	-	-	-	-	-	797	-	-	-
Transportation Equipment	-	-	-	-	-	6,397	-	-	-
Mining and Quarrying	-	-	8.00	-	-	93,033	-	0.21	-
Food, Beverages, and Tobacco	-	-	-	-	-	1,907	4,082.00	-	-
Pulp, Paper, and Printing	-	-	-	-	-	-	-	-	-
Wood and Wood Products	-	-	-	-	-	578	-	-	-
Construction	-	-	-	-	-	18,140	-	2.93	308.87
Not Elsewhere Specified (Industry)	-	-	-	-	-	3,202	-	10.03	-
Sell to Other Large-Scale Users	-	-	4.00	49,487.93	-	753	-	-	-
Taxi, Bus, Road Freight, etc.	-	-	4.00	-	-	753	-	-	-
International Civil Aviation	-	-	-	-	-	-	-	-	-
Domestic Air Transport	-	-	-	41,074.98	-	-	-	-	-
International Marine Bunker	-	-	-	8,412.95	-	-	-	-	-
Sell to Gas Station	-	-	117,858.83	-	-	279,237	-	134.82	-
Company-Owned Stations	-	-	10,631.32	-	-	19,145	-	-	-
Company Franchises	-	-	107,227.51	-	-	260,092	-	134.82	-

IPP = independent power producer.

Source: Lao State Fuel Company.

Electricity

Electricity Production by Source

DEPP maintains electricity data based on the electricity yearbook published by the EDL-Generation Public Company, which collects power generation data from stakeholders. Until 2013, electricity has been produced solely by hydro plants and by a small fraction of biomass plants. Some small solar power generation plants started operation in 2014. Then, in 2015, the Lao PDR started producing electricity from coal for export purposes. Table 1.7 shows the trend in electricity production.

Table 1.7. Electricity Production by Source (GWh)

Year	Hydro	Coal	Solar	Biomass	Total Production
2000	3,438				3,438
2001	3,654				3,654
2002	3,604				3,604
2003	3,178				3,178
2004	3,348				3,348
2005	3,509				3,509
2006	3,595				3,595
2007	3,374				3,374
2008	3,717				3,717
2009	3,366				3,366
2010	8,449				8,449
2011	12,969				12,969
2012	13,057				13,057
2013	15,505			5	15,510
2014	15,270		0.001	5	15,275
2015	14,039	2,259	0.001	4	16,302

Source: Electricité du Laos.

Electricity Export and Import Data

Lao PDR is a net electricity exporting country since its electricity export is larger than its import (Table 1.8).

Table 1.8. Export–Import of Electricity (GWh)

Year	Export	Import	Net Trade
2000	2,793	180	2,613
2001	2,871	184	2,688
2002	2,798	201	2,598
2003	2,285	229	2,055
2004	2,425	278	2,147
2005	2,506	330	2,176
2006	2,487	631	1,856
2007	1,741	793	948
2008	2,315	845	1,471
2009	1,921	1,175	746
2010	6,646	1,210	5,437
2011	10,669	904	9,764
2012	10,363	1,329	9,034
2013	12,494	1,272	11,222
2014	11,936	1,559	10,377
2015	11,549	2,050	9,499

Source: Electricité du Laos.

Electricity Consumption

The electricity sales data prepared by EDL are broken down into final users in the Lao PDR – residential, commercial, industry, and other sectors (Table 1.9).

Biomass

Biomass Production

Biomass production data in the Lao PDR from 2000 to 2015 is only on fuelwood (Table 1.10).

Table 1.9. Electricity Consumption (GWh)

Year	Residential	Commercial	Industry	Other	Total
2000	325	147	135	33	640
2001	371	163	135	41	710
2002	395	173	164	35	767
2003	454	194	203	32	884
2004	455	189	219	39	903
2005	511	229	237	35	1,011
2006	567	250	549	40	1,406
2007	642	300	626	47	1,616
2008	707	461	703	44	1,916
2009	813	645	760	39	2,258
2010	943	749	707	43	2,441
2011	1,004	765	740	46	2,556
2012	1,160	993	883	39	3,075
2013	1,278	949	1,118	35	3,381
2014	1,424	768	1,564	36	3,792
2015	1,595	866	1,745	33	4,239

Source: Electricité du Laos.

Table 1.10. Fuelwood Production (kt)

Year	Fuelwood	Year	Fuelwood
2000	2,469	2008	3,300
2001	2,528	2009	3,187
2002	2,589	2010	2,101
2003	2,651	2011	1,514
2004	2,715	2012	1,228
2005	2,780	2013	1,041
2006	2,847	2014	985
2007	3,075	2015	819

Source: Department of Energy, Policy and Planning, Ministry of Energy and Mines, Lao PDR.

Transformation Sector

Fuelwood is utilised in transformation processes to produce charcoal. DEPP maintains the charcoal production data (Table 1.11).

Table 1.11. Charcoal Production (kt)

Year	Charcoal Production	Year	Charcoal Production
2000	53	2008	79
2001	54	2009	94
2002	55	2010	95
2003	56	2011	325
2004	58	2012	405
2005	59	2013	532
2006	60	2014	650
2007	67	2015	766

Source: Department of Energy, Policy and Planning, Ministry of Energy and Mines, Lao PDR.

Biomass Consumption

Fuelwood is used in the industry sector of the Lao PDR. Both fuelwood and charcoal are used in the commercial and residential sectors (Table 1.12).

Table 1.12. Biomass Consumption (kt)

Year	Fuelwood			Charcoal	
	Residential	Commercial	Industry	Commercial	Residential
2000	420	2,346	123	53	50
2001	430	2,402	126	54	51
2002	440	2,459	129	55	52
2003	451	2,518	133	56	53
2004	461	2,579	136	58	55
2005	473	2,641	139	59	56
2006	484	2,704	142	60	57
2007	523	2,922	154	67	64
2008	561	3,135	165	79	75
2009	542	3,028	159	94	89
2010	527	2,946	155	95	91
2011	512	2,864	151	97	92
2012	498	2,781	104	98	93
2013	502	2,699	156	103	90
2014	508	2,727	149	108	91
2015	514	2,754	146	113	92

Source: Department of Energy, Policy and Planning, Ministry of Energy and Mines, Lao PDR.

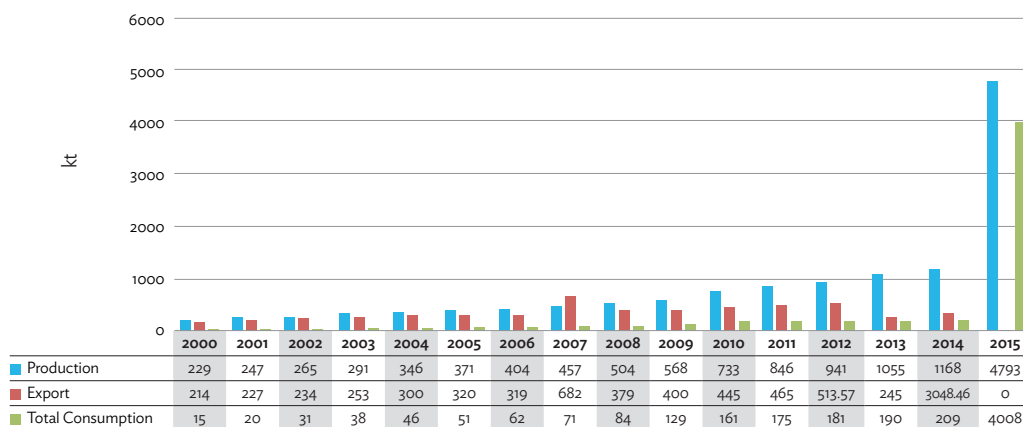
Data Consistency and Missing Data

DEPP energy data from 2000 to 2015 have been analysed for consistency. Inconsistent data have been revised. Although the energy data required to produce an energy balance table (EBT) from 2000 to 2015 in the Lao PDR is available at DEPP, there are still missing data, which require estimation. This chapter identifies the inconsistent and missing data. The methods used to revise the data are discussed in Chapter 2.

Coal Data

DEPP data cover coal production, export, and consumption data (Figure 1.1).

Figure 1.1. Lao PDR Coal Data (kt)



kt = kiloton.

Source: Authors' calculation.

The following observations were made:

- Prior to 2006, DEPP coal data showed a difference between supply and consumption. Coal supply to the domestic market is production data minus export data.
- In 2006, coal export decreased but increased again in 2007. Coal export in 2007 was higher than production, which implies inconsistency in the export data.
- Coal data from 2008 to 2015 also showed increasing excess in coal supply.
- The high increase in coal production in 2015 is due to the operation of the Hongsa coal power plant.

Refining the coal data was necessary to generate the country's EBT. The improvement consisted of

- revising the coal export data in 2006 and 2007, particularly the export data on lignite; and
- revising the consumption of coal from 2008 to 2015 in the industry sector.

Oil Data

The Lao PDR imports all of its petroleum products. Table 1.13 shows the combined DEPP import and consumption data by type of fuel.

The jet kerosene consumption data is higher than the import data. This is similar to the other fuels, but only for certain years. In addition, some import data – such as the gasoline from 2010 to 2012, fuel oil in 2007 and 2008, and LPG data in 2009 and 2010 – do not match the trend. These inconsistent import data have been refined prior to its use in generating the EBT.

DEPP's data on the consumption of petroleum products was only for the final sector and none for power generation. These included the transport, residential, and commercial sectors. The last two sectors only consumed LPG. There was no consumption data for the industry sector.

The oil company survey revealed that oil companies sold to different sub-sectors of the industry and power producers. Since not all oil companies in the Lao PDR submitted their data, other measures had to be taken to estimate the missing industry and power sector consumption.

In addition, jet kerosene is only consumed for air transport. Since the Lao PDR also provided jet kerosene for international flights, it was necessary to separate the domestic and international flights to calculate the country's CO₂ emission. The separation of jet kerosene fuel consumption by domestic and international flights is discussed in Chapter 2.

Table 1.13. Oil Supply and Consumption

Year	Jet A-1 (kl)			Gasoline (kl)			DO (kl)			FO (kl)			Lubricant (kl)			LPG (t)			
	Import	Consumption	Balance	Import	Consumption	Balance	Import	Consumption	Balance	Import	Consumption	Balance	Import	Consumption	Balance	Import	Consumption	Balance	
2000	45,730	54,420	(8,690)	101,676	100,476	1,200	214,461	201,569	12,892	3,875		3,875	260	1,801.32	260	1,801.32	1,510	291	
2001	45,730	68,009	(22,279)	102,439	100,439	2,000	245,641	236,513	9,128	3,931		3,931	273	1,811.32	273	1,811.32	1,511	300	
2002	45,730	69,154	(23,424)	108,002	107,002	1,000	247,574	238,059	9,515	4,392		4,392	349	1,892.45	349	1,892.45	1,568	324	
2003	45,730	78,622	(32,892)	112,200	110,200	2,000	255,769	250,615	5,154	4,496		4,496	383	1,896.79	383	1,896.79	1,571	326	
2004	45,730	81,992	(36,262)	119,879	117,879	2,000	262,904	257,323	5,581	4,505		4,505	433	1,926.42	433	1,926.42	1,592	334	
2005	45,730	88,909	(43,179)	129,356	124,301	5,055	271,031	266,825	4,206	4,646		4,646	497	1,935.66	497	1,935.66	1,601	335	
2006	45,730	89,908	(44,178)	143,473	134,654	8,820	375,295	282,850	92,445	4,682		4,682	588	2,132.08	588	2,132.08	1,739	393	
2007	45,730	97,723	(51,993)	152,502	161,672	(9,170)	381,944	307,177	74,767	10,778		10,778	5,389	2,052.00	5,389	2,052.00	1,750	302	
2008	45,730	45,730	-	159,455	165,401	(5,946)	457,327	365,013	92,314	9,812		9,812	4,038	2,151.00	4,038	2,151.00	1,837	314	
2009	18,359	18,359	-	178,296	155,118	23,179	538,769	430,015	108,754	6,105		6,105	2,960	1,629.73	2,960	1,629.73	2,246	(616)	
2010	13,359	13,359	-	178,296	152,885	25,411	538,769	436,034	102,735	6,130		6,130	2,960	1,510.00	2,960	1,510.00	2,314	(804)	
2011	17,712	17,712	-	166,442	144,804	21,637	550,844	439,805	111,040	8,741		8,741	1,987	2,851.00	1,987	2,851.00	2,435	416	
2012	29,256	29,256	-	159,627	139,559	20,067	601,588	510,293	91,295	8,459		8,459	1,900	2,954.00	60	2,954.00	2,523	431	
2013	37,968	37,968	-	219,251	215,650	3,601	643,276	533,735	109,540	8,611		8,611	-	1,952	100	3,110.00	2,656	454	
2014	47,866	43,603	5,263	212,950	210,416	2,534	688,907	654,122	34,786	10,067		9,717	350	3,510.00	(324)	3,510.00	2,998	512	
2015	46,262	46,262	-	234,199	223,318	10,880	849,151	686,447	162,705	11,106		229	10,876	229	3,904	(3,675)	3,650.40	3,208	442

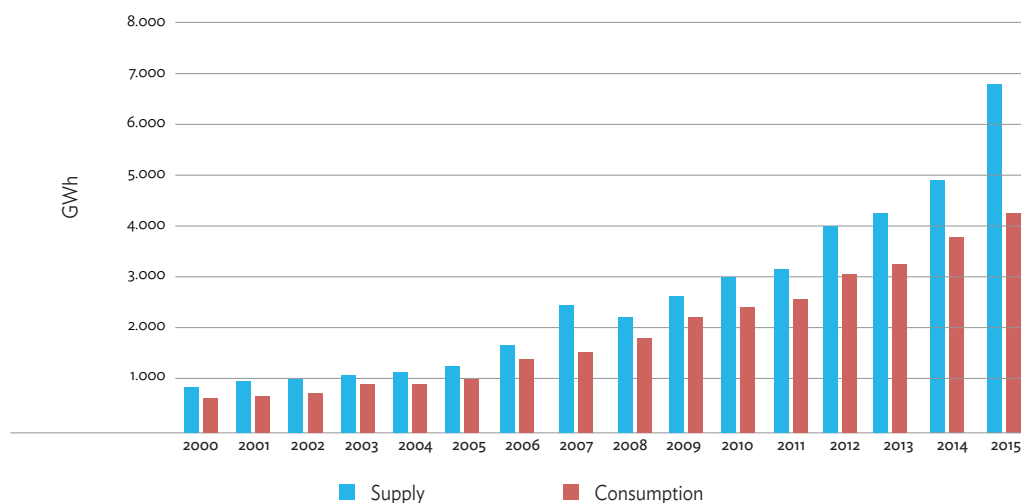
DO = diesel oil, FO = fuel oil, kl = kilolitre, LPG = liquefied petroleum gas.

Source: Authors' calculation.

Electricity Data

Electricity supply and demand in the Lao PDR is shown in Figure 1.2. Electricity supply to the domestic market is the sum of the production and import data minus the export data. The electricity demand data was only on the sectoral electricity consumption. No data was available on own use and transmission and distribution losses. Since the EBT includes own use and losses, it was necessary to estimate the missing data.

Figure 1.2. Lao PDR Electricity Data (GWh)



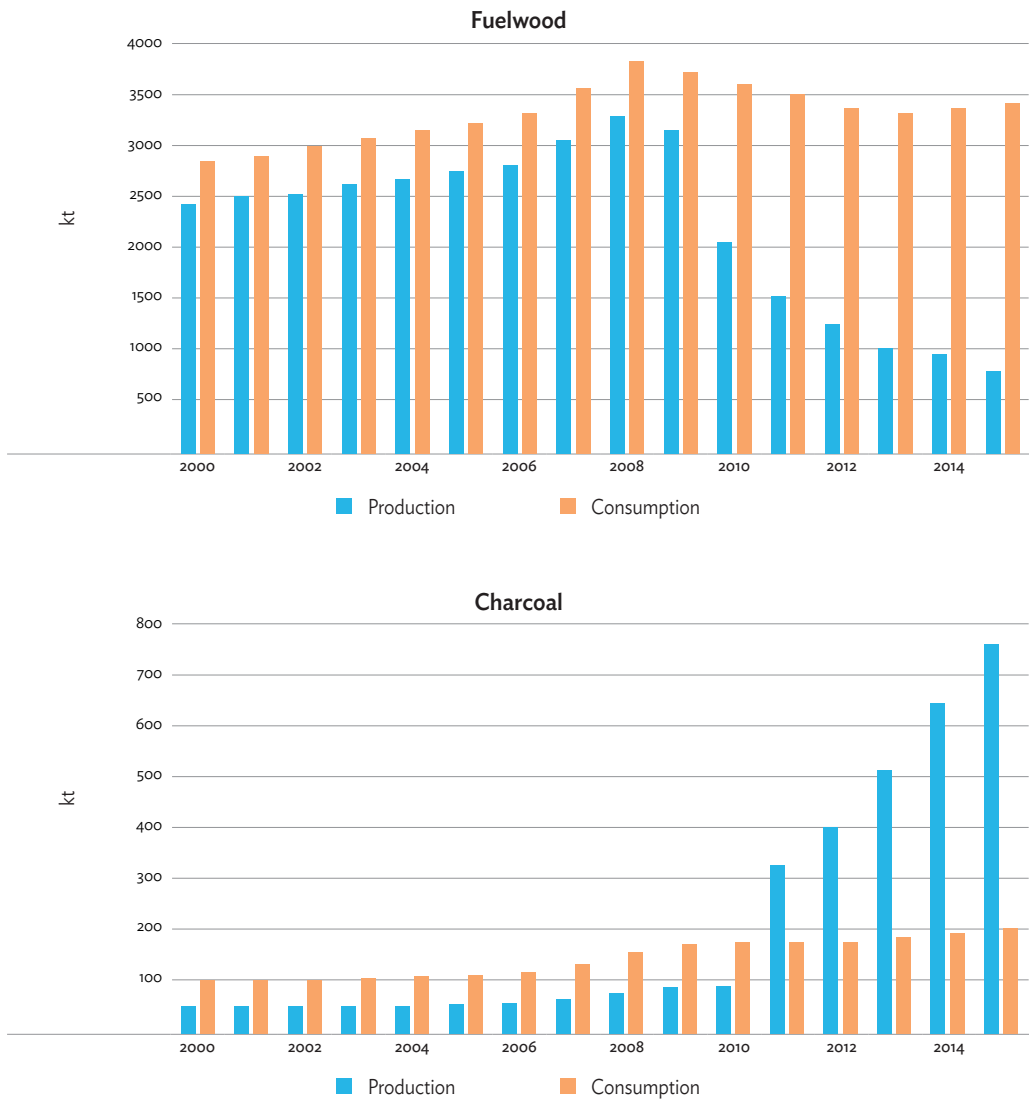
kt = kiloton.

Source: Authors' calculation.

Biomass Data

DEPP data on biomass referred only to the production of fuelwood and charcoal, and their consumption in the final sector. Figure 1.3 shows that production of fuelwood has always been lower than consumption. However, charcoal production increased rapidly after 2010.

Figure 1.3. Lao PDR Biomass Data



kt = kiloton.

Source: Authors' calculation.

DEPP's data excluded the amount of fuelwood used to produce charcoal. In addition, the electricity data showed that bagasse was consumed to produce electricity. The quantity of bagasse consumed by the biomass power plant was also unavailable. In both cases, the missing data needed to be estimated for the EBT.