

Establishment of Energy Statistics Regulation in Lao PDR

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Establishment of Energy Statistics Regulation in Lao PDR

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ERIA Research Project FY2021 No. 05

Published in June 2021

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Foreword

The Lao PDR has achieved remarkable economic growth. Its average gross domestic product (GDP) growth rate of 7.7% in 2000–2019 was the highest amongst the Association of Southeast Asian Nations (ASEAN) Member States during the same period. However, due to the pandemic, the country's economic growth was expected to contract by 2.5% in 2020. Economic recovery is expected in 2021, during the post-pandemic period, with a predicted growth rate of 4.5%. Again, its strong growth would be driven by government policies promoting private sector investment in all sectors. Energy demand is also expected to bounce back to support economic growth in the foreseeable future. Fortunately, the Lao PDR largely relies on hydropower for its energy source.

As the country continues to rely on electricity export, hydropower and renewable energy will play a crucial role in energy sustainability. Its reliance on fossil fuel imports to meet the growing energy demand in the transport and industry sectors will also need to be diversified to other possible transportation fuel mix, such as electric vehicles. This is because the Lao PDR has abundant electricity produced from hydropower and coal-fired power plants.

In the 2010, the strong economic growth was closely linked to the increase of energy consumption in all sectors and strong energy demand in neighbouring countries, allowing and facilitating Lao PDR's export of electricity. Given the prospect of economic recovery from the pandemic and the future growth of energy demand, the Ministry of Energy and Mines (MEM) will need to have an Energy Statistics Regulation to facilitate energy data collection for energy policy, analyses, and planning. With generous technical and financial support from the Economic Research Institute for ASEAN and East Asia (ERIA), the MEM successfully launched the *Lao PDR Energy Statistics 2018* and updated the country's energy outlook. Again, ERIA's continuous support for this project to formulate the Energy Statistics Regulation will improve the ministry's effectiveness in data collection and analyses.

On behalf of MEM–Lao PDR, I am very grateful for the technical and financial support for this Lao PDR Energy Outlook 2019 Project. We will continue to consult ERIA to build the energy data to support Lao PDR's energy policies and planning.

Dr Khammany Inthirath
Minister of Energy and Mines, Lao PDR

Contents

	Acknowledgement	v
	List of Project Members	vi
	List of Figures and Tables	viii
	List of Abbreviations	x
	Executive Summary	xi
Chapter 1	Introduction	1
Chapter 2	Structure of Energy Statistics Regulations	2
Chapter 3	Questionnaire and Manual for Oil Data	7
Chapter 4	Data Collection on Coal Supply, Transformation, and Consumption	20
Chapter 5	Data Collection on Electricity Supply and Consumption	58
Chapter 6	Biomass Supply and Demand Data	93
Chapter 7	Biomass Consumption Survey in the Household Sector	107
Chapter 8	Conclusions and Recommendations	118

Acknowledgements

This publication was developed by a working group comprising teams from the Lao PDR and the Economic Research Institute for ASEAN and East Asia (ERIA). The Lao team consisted of staff from the Department of Planning and Cooperation of the Ministry of Energy and Mines and line ministries. The ERIA team consisted of experts in energy statistics regulation and energy consumption survey. We acknowledge the members of the working group for their excellent work and contribution. We also express our gratitude to the Lao State Fuel Company; Electricité du Laos; Ministry of Industry and Commerce; Lao National Chamber of Commerce and Industry; Department of Aviation; Lao Airlines Company; Lao Skyways Company; Ministry of Agriculture and Forest; Department of Tax of the Ministry of Finance , Ministry of Information, Cultural and Tourism; and other involved ministries and agencies for their cooperation in providing data and information.

We also especially acknowledge Mr Shigeru Kimura and his team for their excellent contribution to the project.

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July 2020

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List of Figures

Figure 3.1	Supply Flow of Petroleum Products	7
Figure 3.2	Supply Flow of Petroleum Products (Lubricant)	8
Figure 4.1	Coal Flows Diagram	22
Figure 5.1	Electricity Flows Diagram	61
Figure 6.1	Production and Consumption of Fuelwood, 2000–2018	94
Figure 6.2	Production and Consumption of Charcoal, 2000–2018	95
Figure 6.3	Bagasse Production and Consumption, 2013–2018	96
Figure 6.4	Production and Consumption of Charcoal	101
Figure 7.1	Biomass Survey Questionnaire of Household Sector, Lao PDR	108
Figure 7.2	Profile of Surveyed Households	109
Figure 7.3	Biomass Survey Questionnaire in the Household Sector of the Lao PDR	115

List of Tables

Table 3.1	Questionnaire A	8
Table 3.2	Questionnaire B	10
Table 3.3	Questionnaire C	14
Table A3.1	ISIC Classification	15
Table A3.2	Conversion Table of Petroleum Products	18
Table A3.3	Definitions of Petroleum Products	19
Table 4.1	Calorific Values by Coal Type	21
Table 4.2	Coal Supply	46
Table 4.3	Coal Consumption	50
Table 4.4	Imports by Origin	54
Table 4.5	Exports by Destination	56
Table 5.1	Conversion Equivalents between Units of Energy	59
Table 5.2	Electricity Supply	84
Table 5.3	Electricity Consumption	88
Table 5.4	Imports by Origin	90
Table 5.5	Exports by Destination	91
Table 6.1	Supply Data Table for Renewable Energy Joint APEC–ASEAN Questionnaire	98
Table 6.2	Commercial Biomass Questionnaire for Charcoal Company	99
Table 6.3	IEA Standard Density and Heating Value of Solid Biomass	100
Table 7.1	Share of Household Fuel Consumption and Average Monthly Consumption	110
Table 7.2	Average Monthly Fuel Consumption in Household with/without Business Activities	110
Table 7.3	Average Monthly Fuel Consumption in Households with Business Activities	111
Table 7.4	Charcoal Production in Surveyed Urban and Rural Villages	111
Table 7.5	Number and Portion of Surveyed Households Using Biomass	112
Table 7.6	Estimated Biomass Consumption at the National Level Using Surveyed Household Shares, 2018	113
Table 7.7	Comparison of Biomass Consumption at the National Level (2018)	113
Table 7.8	Percentage of Household and Average Monthly Fuel Consumption	114
Table 7.9	Comparison Between Biomass Consumption Survey and 2013 World Bank Study	116

List of Abbreviations

ACE	ASEAN Centre for Energy
ASEAN	Association of Southeast Asian Nations
CAPEX	Capital Expenditure
CCGT	combined cycle gas turbine
ERIA	Economic Research Institute for ASEAN and East Asia
IEA	International Energy Agency
IEEJ	The Institute of Energy Economics, Japan
IFC	International Finance Corporation
IMF	International Monetary Fund
IRENA	The International Renewable Energy Agency
JOGMEC	Japan Oil, Gas and Metals National Corporation
NREL	The National Renewable Energy Laboratory
METI	Ministry of Economy, Trade and Industry
OPEX	Operating Expense
SC	Super Critical
UN	United Nations
USAID	The U.S. Agency for International Development
USC	ultra-supercritical
VRE	variable renewable energy

Executive Summary

The Lao PDR, strongly supported by the Economic Research Institute for ASEAN and East Asia (ERIA), published the *Lao PDR National Energy Statistics 2000–2015* in 2018 based on available primary energy data. Then it updated the national energy statistics 2016–2018 with ERIA’s continuous support. These national energy statistics, however, include estimated primary energy data due to missing data. To produce more accurate and consistent national energy statistics, the Ministry of Energy and Mines (MEM) requested ERIA to support energy statistics regulation. Under the energy statistics regulation, the Department of Planning and Cooperation (DPC) of MEM will collect energy supply and demand data from energy market players in the Lao PDR on a mandatory basis. The establishment of the regulation and specific questionnaires will be needed when the DPC collects energy supply and demand data from the energy market players. Thus, the questionnaires for this project were designed with clear definitions with clear definitions in terms of required information in each questionnaire of oil, gas, electricity and renewables.

This project aims to establish energy statistics regulation to be approved by the MEM. Being a research institute and unfamiliar with legal matters, ERIA focused on preparing the necessary contents of energy statistics regulation. This involved the selection of designated market players, especially private energy supply companies, the frequency of data collection or submission, dissemination of collected data, etc.

This time ERIA thoroughly recommends that the DPC collect accurate supply-side data from energy supply companies. Subsequently, the department will collect sales data from wholesalers and final users as demand data. The DPC might face future challenges when it needs to analyse energy efficiency indicators based on detailed energy consumption data to measure a significant subsector’s energy efficiency level, such as an industry subsector, type of households and commercial buildings in urban and rural areas.

The Lao PDR and other ASEAN countries must formulate appropriate energy policies to maximise energy availability, accessibility, affordability, environment, and security. Reliable, timely, complete, and accurate energy data or statistics will indeed contribute to setting up appropriate and relevant energy policies to accomplish a balanced energy demand–supply situation.

Chapter 1

Introduction

The preparation of the Lao PDR's energy statistics regulation is consistent with the objective of the Ministry of Energy and Mines (MEM) to enhance energy data and statistics to support policy planning and actions for the energy-related sectors. In recent years, the MEM has emphasised the importance of accurate energy statistics to guide energy policy development. In this regard, accurate energy statistics are fundamental to establishing appropriate energy policies that could promote energy efficiency and conservation, deployment of renewable energy, affordable energy supply, maintenance of energy supply security, and investment in clean technologies and clean fuels.

Since 2015, the MEM has received technical support from the Economic Research Institute for ASEAN and East Asia (ERIA) to build a good foundation for energy data and statistics. For instance, the ministry produced its first national energy statistics in 2016–2017, covering energy supply and demand data from 2000 to 2015. Subsequently, in 2018–2019, it updated the energy statistics of 2016–2018 under ERIA's technical assistance. Thus, the MEM will need to update its energy data regularly in the future.

Lao PDR's current energy statistics include several estimated data due to unavailable data. The ministry tried to collect missing data from energy market players from various sectors to fill the data gap. However, it was not easy because of the absence of a mandatory basis or a collection system for energy data. Therefore, energy statistics regulation will help the MEM and its staff collect the missing data and replace the estimated data with actual ones. This will enhance the country's national energy statistics and contribute to establishing more appropriate energy policies. Thus, the MEM needs an energy statistics regulation to ask all energy stakeholders to cooperate and comply with the data acquisition per MEM's mandate.

This report describes the energy statistics regulation for the MEM but does not include legal wording (Chapter 2). This report also discusses technical matters on the mandatory data collection system for targeted energies such as coal, oil, electricity, and biomass, and data collection questionnaires and their definitions (Chapters 3 to 6). The regulation focuses only on supply-side energy players because collecting data from them is easier; they are fewer than those on the demand side. However, data on biomass will be gathered from the demand side. For instance, there are many kinds of non-commercial biomass such as fuelwood, especially in rural areas. This means that collecting biomass data from market suppliers is insufficient; hence, the biomass consumption survey in households was conducted under this project (Chapter 7).

Accurate energy statistics contribute to establishing appropriate energy policies and producing a reliable energy outlook. In this regard, the MEM should develop and enforce a mandatory energy data collection system.

Chapter 2

Structure of Energy Statistics Regulation

1. Introduction

The Ministry of Energy and Mines (MEM)–Lao PDR has been working to improve energy policies to achieve its power sector strategy and energy efficiency and conservation goals. It also promotes other policies to ensure that a stable and affordable supply of primary energy – such as coal, oil, and electricity – could be achieved for sustainable economic development. As the country’s GDP per capita has been increasing due to stable economic growth, its energy consumption is also expected to grow, putting pressure on appropriate and effective energy policies for now and the future.

The MEM also recognises that the country’s current energy data and statistics remain delicate, requiring strengthening regulations, procedures, analytical tools, and systematic data collection from concerned agencies and ministries. The MEM also believes that improving energy data and statistics will serve Lao PDR’s policy purpose and improve regional energy cooperation amongst member countries of the Association of Southeast Asian Nations (ASEAN) and other regional and international bodies that require data for policy and analyses. Examples of these are the ASEAN Centre for Energy and the International Energy Agency (IEA)

To facilitate regular collection of energy data on coal, oil, electricity, and renewables from various institutions, ministries, and agencies, the Lao PDR needs an ‘energy statistics regulation’. This will define the legal and organisational bases for agencies to provide the MEM with energy supply-side data as mandated for regular energy data processing and analysis to meet energy policy objectives. In this case, the law or regulation will instruct the MEM as the responsible ministry to collect energy data from concerned institutions, ministries, and agencies. Data owners are obliged to provide data to the MEM on time.

2. Review of the Legal Framework for Supporting Energy Data Statistics

Lao Statistics Law no. 03/NA, dated 30 June 2010 and updated in 2017, provides the legal framework on all matters relating to the collection, processing, compilation, analysis, publication, and dissemination of statistical data for the whole Lao PDR. Currently, per said law, the assigned Lao Statistics Bureau (LSB) would work with relevant line agencies, ministries, provinces, and all district administrators of the Lao PDR on four types of statistics: (i) economic statistics, (ii) social statistics, (iii) environment and natural resources statistics, and (iv) security and stability statistics.

Article 18 of the Lao Statistics Law mentions the authority to decide on statistical survey and survey authorisation. The article provides that the Prime Minister approve the statistics census upon the Ministry of Planning and Investment’s request. After that, this minister approves the national sample survey request from the LSB after consulting with line ministries, ministry-equivalent agencies, or concerned sectors. The minister or agency head and governors of provinces and the capital city

approve the subnational sample survey in their sector and province, upon the request of their respective sectors through LSB's certification and technical approval.

Article 19 of the Lao Statistics Law mentions the executing agencies for each type of survey – census and national sample surveys and other specific surveys defined in the Strategic Development of National Statistical System – which the LSB executes in each period. However, the statistics centres based at line ministries, ministry-equivalent agencies, provinces, municipalities, districts, and subdistricts execute sample surveys and specific surveys and/or case studies for their respective sectors and local needs through the certification and technical approval by the LSB. Further, the economic units from concerned ministries can carry out sample surveys or case studies to produce data for their need, but these are not official statistics. Also, international organisations and non-government organisations can carry out statistical surveys. Still, approval from line ministries, ministry-equivalent agencies, or local authorities is required, as defined in Article 18 of the Lao Statistical Law.

However, only economic statistics and environmental and natural resources statistics are relevant to energy data and statistics amongst the four statistical data types. Article 10 on socio statistics refers to data reflecting activities related to population, ethnicity, education, public health, labour, social welfare, information and culture, administrative unit registration, poverty, gender, social security, housing, sports and recreation, social organisation, accident, crime, and other social concerns. Article 11 on environment and natural resources statistics refers to data reflecting environment and natural resources activities. Specifically, these refer to the country's geography, mine, hydrology, topology, disaster, pollution, wastage and waste management to balance environment, natural resources, human and human development, and other statistics relating to environment and natural resources.

Therefore, the Lao Statistical Law provides ample room for line ministries to collect the needed data and information to serve the ministries' purpose. However, the lack of data coordination and data centre in each ministry and agency leads to inconsistent data and data gap at various levels. Thus, improving data collection and empowering data and statistical centres in each ministry and agency are critically important.

3. Purpose of Energy Statistics Regulation

Currently, the flow of data is done on an ad-hoc basis to meet data analysis needs. Thus, MEM Lao PDR will need regular data flow from related ministries and agencies that own the supply data, such as coal production, oil, electricity, and renewables. This is to enable MEM to regularly update the data, publish the energy balance tables, and support energy policy analysis for near-term planning. Thus, energy data and statistics aim to:

- Provide a lead role in developing and maintaining comprehensive national and sectoral statistics for energy production, transformation, and end-use data.
- Produce data to advice policymakers and inform investment decisions.
- Share data as a vital input to meeting regional and international reporting obligations.

The responsible energy data and statistics unit within MEM will:

- Collect, process, and publish energy statistics to support policy analysis.
- Conduct statistical and economic analyses of the energy services sectors and sustainable energy options.
- Contribute to the development and promulgation of appropriate sustainability indicators.
- Provide timely and reliable statistics essential to monitor the energy situation.

The MEM will need to strengthen its Lao Energy Data and Statistics Unit's capacity and implementation. The energy statistics regulation will be required to be the legal basis to facilitate this core function's implementation, and get all ministries and agencies involved to comply with the regular data-sharing obligation to the MEM.

The following key elements of energy data collection from energy market players are necessary and mandatory:

- 1) The MEM should designate market players of coal, oil, electricity, and biomass for mandatory data collection and acquisition. The designated market players must register with the Ministry of Industry and Handicrafts for compulsory data sharing.
- 2) Data collection and acquisition from designated market players should follow the frequency of data availability – daily, weekly, monthly, and yearly. As the first step in data collection and acquisition, annual data should first be collected.
- 3) The period of data collection is suggested to follow the fiscal year. For instance, if Lao PDR's fiscal year is January to December, data collection from April to May is appropriate.
- 4) The dissemination of the collected energy data and publications needs to be released on the website after the data is validated and analysed.
- 5) The MEM must produce national energy statistics (energy balance tables) based on collected energy data. The MEM needs to analyse the data and disseminate the results within 2 months after it has collected energy data.

4. Energy Data Collection and Penalty

Energy data collection covers both supply and demand. However, this data collection regulation will focus only on supply-side data to regularly update energy balance tables for energy analysis and planning. However, despite data collection and acquisition are working well in MEM, further data collection from the demand side will be needed to understand the energy consumption behaviour of the residential, commercial, and industry sectors. Then, the MEM can craft the right energy policy for energy efficiency and saving. The supply-side data collection will cover coal, oil, electricity, and renewables.

The data collection format for coal, oil, electricity, and renewables is provided in Chapters 3, 4, 5, and 6. The MEM must ensure that these data are useful for the ministry and all concerned stakeholders, and all data owners should share data regularly. In this regard, the MEM should regularly publish energy data information and energy analysis by supply and demand and share it with stakeholders. The MEM should also regularly hold meetings to update the stakeholders and design more detailed data collection as data becomes available in involved ministries and agencies.

The Prime Minister should sign the energy statistics regulation so that inter-ministries and agencies that own the data will provide data on time. The MEM should identify companies, agencies, and ministries that own supply-side energy data and ask them to supply data to the MEM on time. The MEM should hold technical meetings to clarify the data collection form to ensure data providers from line agencies understand it. The regulation will need to provide enforcement and penalty for agencies that fail to comply with this regulation.

5. Proposed Actions and Collaboration for Data Collection and Acquisition

Worth exploring are the experiences of the Asia-Pacific Economic Cooperation (APEC) economies in energy data collection, analyses, and dissemination. In some APEC countries, such as Japan, Indonesia, Thailand, and the United States, their energy ministry collects energy data. In others, such as Canada, China, and Russia, the National Statistical Office performs such task.

The Lao Statistical Law provides the legal framework for the MEM to set up sectoral statistical units to collect, compile, analyse, publish, and publicly disseminate data and information such as 'energy statistics and mineral resources statistics' in coordination with the LSB. However, the current statistical unit within the MEM needs support to make it a full functioning unit soon. The Lao Energy Data and Statistics Unit in the Department of Planning and Cooperation (DPC) needs to be empowered with effective coordination, policy, and institutional support, including the following:

- **Institutional and data collection coordination**

- Collaborate with the LSB as it has a well-established structure of administrative data collection from line agencies. The first step is to hold an official meeting with the LSB to see how energy data statistics can be collected from line agencies. It is essential to clearly define the types of energy data to be collected. The next step is to have a well-designed energy data collection format for discussion with the LSB and relevant agencies, such as the Ministry of Public Works and Transport, Ministry of Industry and Commerce, Ministry of Finance, Lao State Fuel Company, Électricité du Laos, etc.
- The DPC has designated staff for the statistics centre. Thus, empowering this existing unit to collect data regularly and get data suppliers to comply is necessary. The DPC will need to work with the LSB to acquire data from all involved stakeholders, including state-owned petroleum import companies and other agencies and sectors using intensive energy.
- The DPC may work with the Department of Energy, Policy and Planning. The DPC may also work with departments within the MEM to collect data, particularly the Department of Mineral Management, Institute of Renewable Energy Promotion, Department of Geology and Mines, etc.

- **Technical capacity building and budgets**

- There are capacity constraints in processing, analysing, and publishing the data after it is collected. Therefore, capacity building is needed to train the staff to handle the energy data and statistics.

- The DPC may continue to request ERIA's support to strengthen further the design of petroleum product specifications and downstream the legal framework, regulation, policy, and procedures.
 - The DPC may continue to seek ERIA's technical advice and lead a regular technical high-level working group on energy statistics.
 - The Energy Statistical Unit should have clear financial support and budget for its daily core functions – surveys, data collection and coordination, and capacity building.
 - Maintain staff, update knowledge, and improve analytical skills. The Energy Statistical Unit may aim for a series of publications (monthly, quarterly, and yearly statistics). The unit may also seek to produce the Lao energy outlook and other energy-specific papers to support policy formulation.
- **Lao energy data and statistics unit or centre**
 - The DPC may act as the energy data centre by linking all concerned stakeholders to share, collect, and update data.
 - Equip the DPC, as an energy data centre, with hardware and software (computer, software, staff).

Chapter 3

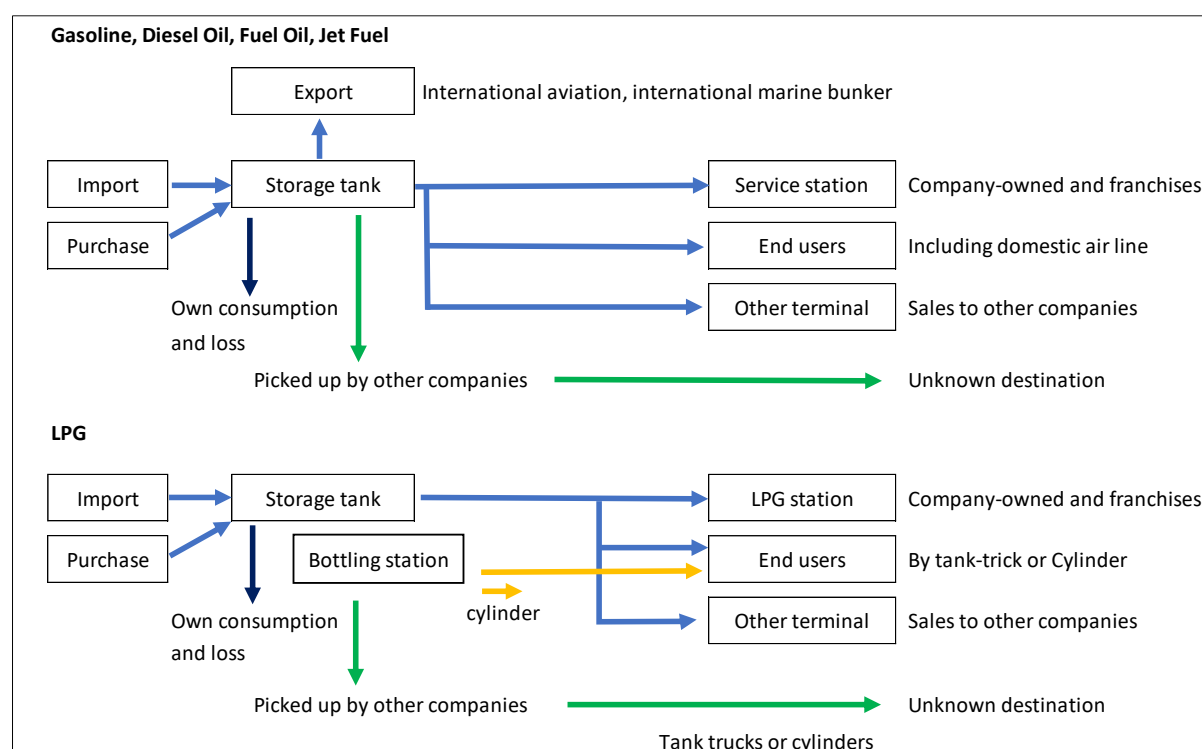
Questionnaire and Manual for Oil Data

All oil and liquefied petroleum gas (LPG) companies in the Lao PDR are requested to answer the oil questionnaire. The questionnaire is about supply chain and sectoral demand for petroleum products. The successful realisation of data collection will contribute to completing the Lao PDR energy statistics. The questionnaire consists of Tables A, B, and C. Questionnaire A relates to the receiving (import or purchase) and shipping (delivery) of petroleum products. Questionnaire B breaks down the shipments to end users by sector. Questionnaire C relates to the import origin (country) of petroleum products. Also, each company responds to the questionnaires based on its total data.

1. Supply flow of petroleum products

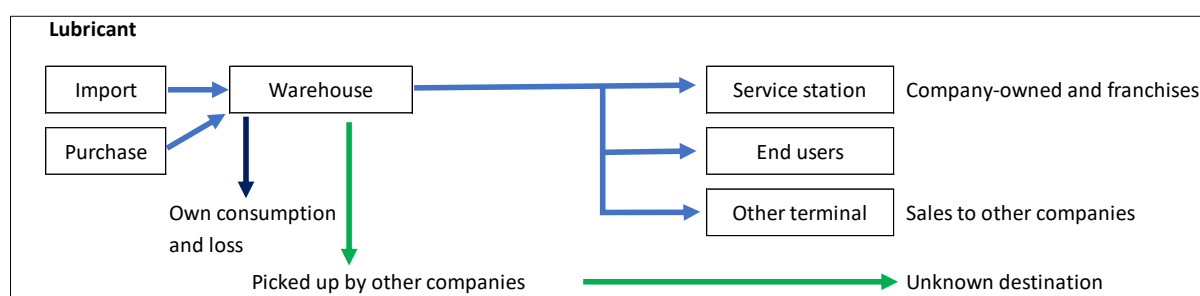
Figures 3.1 and 3.2 illustrate the supply flow of petroleum products. LPG and lubricants have slightly different supply flows than gasoline, diesel oil, fuel oils, and jet fuels. Please keep this in mind when answering the questionnaires.

Figure 3.1 Supply Flow of Petroleum Products



Source: Author.

Figure 3.2 Supply Flow of Petroleum Products (Lubricant)



Source: Author.

2. Questionnaire A

Questionnaire A is on supply and shipment data and focuses on the movement of petroleum products. Please enter the total quantity of the company in each cell.

Table 3.1 Questionnaire A

Name of Company	year [
-----------------	--------	--	--	--	--	--

* Please break down shipment to end users into Questionnaire B

2-1 Enter the name of company and year.

2-2 Opening stock

Enter the opening stock of storage tanks level per petroleum product on the first day of the year (for annual data) of stocks on national territory. If you have multiple terminals and storage tanks, enter the total. However, exclude tank stock at service stations. For LPG, enter the total tank inventory and cylinder inventory. For lubricants, enter the warehouse stock, excluding stock at service stations.

2-3 Total received: (1) – (2) total

(1) Import

Enter the total yearly import volume of your company per petroleum product. The Lao PDR imports all petroleum products, and the Department of Customs of the Ministry of Industry and Commerce collects import data. The total import volume of all oil and LPG companies meets this quantity. Do not include quantities of petroleum products in transit (that is, en route through the country).

(2) Purchase

Enter the total yearly purchase volume of your company from other domestic companies per petroleum product. Since this pertains to domestic sales, it should not be counted in the primary energy supply of the energy balance table.

2-4 Total shipment: (3) – (5) total

(3) Export

Enter the total yearly export volume of your company by petroleum product. The Department of Customs of the Ministry of Industry and Commerce collects export data. The total export volume of all oil and LPG companies meets this quantity. The export volume includes international aviation bunker and international marine bunker. International aviation bunker refers to aviation fuels, such as jet fuel for aircraft for international aviation. Fuels used by airlines for their road vehicles are excluded. The domestic and international split should be determined based on the departure and landing locations and not by the airline's nationality. International marine bunker refers to fuels delivered to ships of all flags that are engaged in international navigation. International navigation may take place at sea, on inland lakes and waterways, and in coastal waters. Exclude consumption of ships engaged in domestic navigation. Determine the domestic and international split based on the port of departure and port of arrival, not by the ship's flag or nationality. Exclude consumption by fishing vessels and military forces.

(4) Direct delivery by your company: (a) – (c) total

- a) Total delivery volume to service stations of your company, including franchises
- b) Total delivery volume to end users; please break down in Questionnaire B later
- c) Total delivery volume to other oil company's terminal; this is wholesale

(5) Picked-up volume by other companies

This is also wholesale, so the final destination is unknown. LPG is picked up in tank trucks or cylinders. Lubricant is picked up in drums or pail cans.

2-5 Own consumption and loss

Enter the total volume of fuel used in-house for automobiles, self-generation, etc.

Loss means inventory loss.

2-6 Closing stock

Closing stock is defined as:

Opening stock + Total received – Total shipment – Own consumption and loss

*Note: Closing stock is automatically calculated in Questionnaire A.

Questionnaire B is the breakdown of the shipment to end users in questionnaire A.

Questionnaire B is the breakdown of the shipment to end users in questionnaire A.

Name of Company []		Year []		(Unit: kl, from LPG onward is tonne)			
Breakdown of Shipment to End Users		Jet Fuel	Gasoline	Diesel Oil	Fuel Oil	LPG	Lubricant
Transfer sector : Quantities of oil used for conversion of energy, e.g (electricity, heat, and power)							
Agriculture, forestry, and fishery							
Industry		0	0	0	0	0	0
	Iron and steel						
	Chemical and petrochemical						
	Non-ferrous metals						
	Non-metallic minerals						
	Transport equipment						
	Machinery						
	Mining (excluding energy producing industries) and quarrying						
	Food, beverages, and tobacco						
	Paper, pulp, and printing						
	Wood and wood products (other than pulp and paper)						
	Construction						
	Textile and leather						
	Not elsewhere specified (Industry)						
Commercial and Public Services : Hotel, restaurant, office, retail, etc.							
Transportation		0	0	0	0	0	0
	Railway company						
	Ship company						
	Land transportation company (Taxi, bus, etc)						
	Airlines (Domestic aviation)						
Residential							
Other – Not elsewhere specified							
Non-energy : Consumed as raw materials, solvent, cleaning agent, etc.							
Total		0	0	0	0	0	0

3-2 Transfer sector

3-2 Agriculture, forestry, and fishing

10

01 – crop and animal production, hunting and related service activities; 02 – forestry and logging; 03 – fishing and aquaculture. Fishing includes coastal and deep-sea fishing and should cover fuels delivered to ships of all flags that refuelled in the country (includes international fishing). It also includes energy used in the fishing industry. Table A3.1, in the annexes, shows all ISIC divisions. Refer to ISIC Rev. 4 <https://unstats.un.org/unsd/classifications/Econ> for the breakdown of each division. Break down of the division is ‘group’; click division number 01, 02, 03.

3-3 Industry

Industry is also classified according to the ISIC divisions. Enter the total quantity that the company has shipped to the industry sector to which the end user's primary activity belongs. Include the amounts of fuels consumed in heat or combined heat and power (CHP) plants to produce used by the plant itself. However, the quantities of fuels consumed to produce heat sold and electricity should be reported under the appropriate transformation sector. Enter the quantity to each industry classification.

- (1) Iron and steel
ISIC group 241 of Division 24 – Manufacture of basic iron and steel. Enter fuel for open hearth and blast furnace. Report in the transformation sector the fuel used in blast furnaces (coke) to avoid double counting.
- (2) Chemical and petrochemical
ISIC Divisions 20 and 21 – Manufacture of chemicals and chemical products and manufacture of basic pharmaceutical products and pharmaceutical preparations. These divisions include the transformation of organic and inorganic raw materials by a chemical process and the formation of products. These also include the manufacture of basic pharmaceutical products and pharmaceutical preparations and medicinal chemical and botanical products.
- (3) Non-ferrous metals
ISIC groups 242 and 243 of Division 24. These groups include the production of basic precious metals; the production and refining of unwrought or wrought precious metals such as gold, silver, and platinum from ore and scrap; and the casting of non-ferrous metals.
- (4) Non-metallic minerals
ISIC Division 23. This division includes manufacturing activities related to a single substance of mineral origin. This division covers the manufacture of glass and glass products (e.g. flat glass, hollow glass, fibres, technical glassware, etc.); ceramic products; tiles and baked clay products; and cement and plaster from raw materials to finished articles. Also included in this division is the manufacture of shaped and finished stone and other mineral products.
- (5) Transport equipment
ISIC Divisions 29 and 30 – Manufacture of motor vehicles, trailers, and semi-trailers; parts and accessories; and other transport equipment. This division also includes the manufacture of transport equipment such as shipbuilding and boat making, railroad rolling stock and locomotives; and aircraft, spacecraft, and parts.
- (6) Machinery
ISIC Divisions 25, 26, 27, and 28 – Manufacture of fabricated metal products; computer, electronic, and optical products; and electrical equipment.
- (7) Mining (excluding energy-producing industries) and quarrying

ISIC Divisions 07 and 08 and group 099 of Division 09 – Mining of metal ores, other mining and quarrying, support activities for other mining and quarrying

(8) Food, beverages, and tobacco

ISIC Divisions 10, 11, and 12 – Manufacture of food products, beverages, and tobacco products

(9) Paper, pulp, and printing

ISIC Divisions 17 and 18 – Manufacture of paper and paper products, printing and reproduction of recorded media

(10) Wood and wood products (other than pulp and paper)

ISIC Division 16 – Manufacture of wood and products of wood and cork, except furniture; articles of straw and plaiting materials.

(11) Construction

ISIC Divisions 41, 42, and 43 – Construction of buildings, civil engineering, specialised construction activities

(12) Textile and leather

ISIC Divisions 13, 14, and 15 – Manufacture of textiles, wearing apparel, leather, and related products

(13) Not elsewhere specified (Industry)

Please enter quantities not included above.

3-4 Commercial and public services

Business and offices in the public and private sectors. For example, hotel, restaurant, hospital, school, office building, etc. Refer to non-transport activities of ISIC Divisions 49, 50, and 51. Refer also to ISIC Divisions 33 (repair and installation of machinery and equipment); 36–39 (water supply; sewerage, waste management, and remediation activities); 45–47 (wholesale and retail trade; repair of motor vehicles and motorcycles); 52 (warehousing and support activities for transportation); 53 (postal and courier activities); 55–56 (accommodation and food service activities); 58–63 (information and communication); 64–66 (financial and insurance activities); 68 (real estate activities); 69–75 (professional, scientific, and technical activities); 77–82 (administrative and support service activities); 84 (public administration and defence; compulsory social security); 85 (education); 86–88 (human health and social work activities); 90–93 (arts, entertainment, and recreation); 94–96 (other service activities); and 99 (activities of extraterritorial organisations and bodies).

3-5 Transport

All transport activities irrespective of the economic sector in which the activity occurs, except military use. Fuels used for heating and lighting at railways, bus stations, and airports should be reported in commercial and public services.

(1) Railway company

Report fuels delivered to railway companies for use in rail traffic, including industrial railways and transport as part of urban or suburban transport systems (e.g. metro, tram).

(2) Ship company

Report fuels delivered to vessels of all flags not engaged in international navigation. The domestic and international split should be determined based on the port of departure and the port of arrival and not by the ships' flag or nationality.

(3) Land transportation company (taxi, bus, etc.)

Report fuels delivered to the land transportation company (taxi, bus, etc.)

The energy balance table 'transportation' is this quantity plus the quantity shipped to the service stations and LPG stations.

(4) Airlines (domestic aviation)

Report fuels to aircraft for domestic aviation – commercial, private, agricultural, etc. These include use for purposes other than flying, e.g. bench testing of engines. The domestic and international split should be determined based on the departure and landing locations and not by the airline's nationality.

3-6 Residential

Report fuels to all households including 'households with employed persons ISIC Divisions 97 and 98'. Activities of households as employers of domestic personnel, undifferentiated goods- and services-producing activities of private households for own use

3-7 Other – Not elsewhere specified

Report fuels to unclassifiable destination.

3-8 Non-energy

Report fuels consumed as raw materials, solvent, cleaning agent, etc.

3-9 Total

Please confirm that each petroleum product's total matches the quantity of 'total shipment to end users for each petroleum product of Questionnaire A'.

4. Questionnaire C

Enter import origin (country). Confirm that each petroleum product's total matches the quantity of 'Total received: import of each petroleum product of Questionnaire A'.

Although crude oil, NGL (natural gas liquids), and natural gas are reported as coming from the country of origin, petroleum products are reported as coming from the last production country (Definition of Energy Balance Table of IEA). <https://www.iea.org/subscribe-to-data-services/world-energy-balances-and-statistics> (access date 20 July 2020).

Questionnaire C is Table 3.3 below.

Table 3.3 Questionnaire C

Name of Company

[] Year [] (Unit: kl, from LPG onward is tonne)

		Jet Fuel	Gasoline	Diesel Oil	Fuel Oil	LPG	Lubricant
APEC Economies	1	0	0	0	0	0	0
Australia	2						
Brunei Darussalam	3						
Canada	4						
Chile	5						
China	6						
Hong Kong, China	7						
Indonesia	8						
Japan	9						
Republic of Korea	10						
Malaysia	11						
Mexico	12						
New Zealand	13						
Papua New Guinea	14						
Peru	15						
Philippines	16						
Russian Federation	17						
Singapore	18						
Chinese Taipei	19						
Thailand	20						
United States of America	21						
Viet Nam	22						
ASEAN (non-APEC) Economies	23	0	0	0	0	0	0
Cambodia	24						
Lao PDR	25						
Myanmar	26						
Rest of the World	27	0	0	0	0	0	0
Other Asia and Pacific	28						
Other Americas	29						
Europe & Former Soviet Union	30						
Middle East	31						
Africa	32						
<i>Unknown</i>	33						
Total	34	0	0	0	0	0	0

Annexes

Table A3.1 ISIC Classification

A - Agriculture, forestry, and fishing
01 - Crop and animal production, hunting, and related service activities
02 - Forestry and logging
03 - Fishing and aquaculture
B - Mining and quarrying
05 - Mining of coal and lignite
06 - Extraction of crude petroleum and natural gas
07 - Mining of metal ores
08 - Other mining and quarrying
09 - Mining support service activities
091 - Support activities for petroleum and natural gas extraction
099 - Support activities for other mining and quarrying
C - Manufacturing
10 - Manufacture of food products
11 - Manufacture of beverages
12 - Manufacture of tobacco products
13 - Manufacture of textiles
14 - Manufacture of wearing apparel
15 - Manufacture of leather and related products
16 - Manufacture of wood and of products of wood and cork, except furniture, manufacture of articles of straw and plaiting materials
17 - Manufacture of paper and paper products
18 - Printing and reproduction of recorded media
19 - Manufacture of coke and refined petroleum products
20 - Manufacture of chemicals and chemical products
21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations
22 - Manufacture of rubber and plastics products
23 - Manufacture of other non-metallic mineral products
24 - Manufacture of basic metals
241 - Manufacture of basic iron and steel
242 - Manufacture of basic precious and other non-ferrous metals

243 - Casting of metals
25 - Manufacture of fabricated metal products, except machinery and equipment
26 - Manufacture of computer, electronic, and optical products
27 - Manufacture of electrical equipment
28 - Manufacture of machinery and equipment
29 - Manufacture of motor vehicles, trailers, and semi-trailers
30 - Manufacture of other transport equipment
31 - Manufacture of furniture
32 - Other manufacturing
33 - Repair and installation of machinery and equipment
D - Electricity, gas, steam, and air-conditioning supply
35 - Electricity, gas, steam, and air-conditioning supply
E - Water supply; sewerage, waste management, and remediation activities
36 - Water collection, treatment, and supply
37 - Sewerage
38 - Waste collection, treatment, and disposal activities; materials recovery
39 - Remediation activities and other waste management services
F - Construction
41 - Construction of buildings
42 - Civil engineering
43 - Specialised construction activities
G - Wholesale and retail trade; repair of motor vehicles and motorcycles
45 - Wholesale and retail trade and repair of motor vehicles and motorcycles
46 - Wholesale trade, except of motor vehicles and motorcycles
47 - Retail trade, except of motor vehicles and motorcycles
H - Transportation and storage
49 - Land transport and transport via pipelines
50 - Water transport
51 - Air transport
52 - Warehousing and support activities for transportation
53 - Postal and courier activities
I - Accommodation and food service activities
55 - Accommodation

56 - Food and beverage service activities
J - Information and communication
58 - Publishing activities
59 - Motion picture, video and television program production, sound recording, and music publishing activities
60 - Programming and broadcasting activities
61 - Telecommunications
62 - Computer programming, consultancy, and related activities
63 - Information service activities
K - Financial and insurance activities
64 - Financial service activities, except insurance and pension funding
65 - Insurance, reinsurance and pension funding, except compulsory social security
66 - Activities auxiliary to financial service and insurance activities
L - Real estate activities
68 - Real estate activities
M - Professional, scientific, and technical activities
69 - Legal and accounting activities
70 - Activities of head offices; management consultancy activities
71 - Architectural and engineering activities; technical testing and analysis
72 - Scientific research and development
73 - Advertising and market research
74 - Other professional, scientific, and technical activities
75 - Veterinary activities
N - Administrative and support service activities
77 - Rental and leasing activities
78 - Employment activities
79 - Travel agency, tour operator, reservation service, and related activities
80 - Security and investigation activities
81 - Services to buildings and landscape activities
82 - Office administrative, office support, and other business support activities
O - Public administration and defence; compulsory social security
84 - Public administration and defence; compulsory social security
P - Education
85 - Education

Q - Human health and social work activities
86 - Human health activities
87 - Residential care activities
88 - Social work activities without accommodation
R - Arts, entertainment, and recreation
90 - Creative, arts, and entertainment activities
91 - Libraries, archives, museums, and other cultural activities
92 - Gambling and betting activities
93 - Sports activities and amusement and recreation activities
S - Other service activities
94 - Activities of membership organisations
95 - Repair of computers and personal and household goods
96 - Other personal service activities
T - Activities of households as employers; undifferentiated goods- and services- producing activities of households for own use
97 - Activities of households as employers of domestic personnel
98 - Undifferentiated goods- and services-producing activities of private households for own use
U - Activities of extraterritorial organisations and bodies
99 - Activities of extraterritorial organisations and bodies

Source: United Nations, Department of Economic and Social Affairs Statistics Division; ISIC (International Standard Industries Classification of all Economic Activities) Revision 4 in 2008.
<https://unstats.un.org/unsd/classifications/Econ>.

Table A3.2 Conversion Table of Petroleum Products

	Density		Heating Value		Ton of oil equivalent	
	Unit	Value	Unit	Value	Unit	Value
Gasoline	kg / l	0.737	kcal / kg	10,450	Metric Tonne	10,450
Jet Fuel	kg / l	0.800	kcal / kg	11,675	Metric Tonne	11,675
Diesel Oil	kg / l	0.839	kcal / kg	10,236	Metric Tonne	10,236
Fuel Oil	kg / l	0.890	kcal / kg	10,105	Metric Tonne	10,105
LPG	kg / l	0.510	kcal / kg	11,778	Metric Tonne	11,778
Lubricants	kg / l	0.858	kcal / kg	9,929	Metric Tonne	9,929

Source: ERIA (2018), *Lao PDR Energy Statistics*. Jakarta: ERIA.

Table A3.3 Definitions of Petroleum Products

1. Jet fuel: Kerosene-type jet fuel for aviation
Kerosene-type jet fuel is a medium distillate used for aviation turbine power units. It has the same distillation characteristics and flashpoint as kerosene (between 150°C and 300°C but not generally above 250°C). It has particular specifications (such as freezing point) established by the International Air Transport Association. It includes kerosene-blending components. Kerosene-type jet fuel excluding bio does not include the liquid biofuels blended with jet kerosene.
2. Jet fuel: Gasoline-type jet fuel for aviation
Gasoline-type jet fuel includes all light hydrocarbon oils for use in aviation turbine power units, which distil between 100°C and 250°C. This fuel is obtained by blending kerosene and gasoline or naphtha so that the aromatic content does not exceed 25% in volume, and the vapour pressure is between 13.7 kPa and 20.6 kPa. Additives can be included to improve fuel stability and combustibility.
3. Gasoline: Motor gasoline for automobiles
Motor gasoline is light hydrocarbon oil used in internal combustion engines such as motor vehicles, excluding aircraft. Motor gasoline is distilled between 35°C and 215°C and is used as a fuel for land-based spark ignition engines. Motor gasoline may include additives, oxygenates, and octane enhancers, including lead compounds such as TEL (tetraethyl lead) and TML (tetramethyl lead). Motor gasoline, excluding biofuels, does not include liquid biofuel or ethanol blended with gasoline.
4. Diesel oil: Gas oil or diesel oil for boilers, heavy equipment, trucks, ships
Gas oil or diesel oil includes heavy gas oils. Gas oils are obtained from the lowest fraction from atmospheric distillation of crude oil, while heavy gas oils are obtained by vacuum redistillation of the residual from atmospheric distillation. Gas oil or diesel oil distils between 180°C and 380°C. Several grades are available depending on uses: diesel oil for diesel compression ignition (cars, trucks, marine, etc.); light heating oil for industrial and commercial uses; and other gas oils including heavy gas oils that distil between 380°C and 540°C and are used as petrochemical feedstocks. Gas oil or diesel oil excluding biofuels does not include the liquid biofuels blended with gas oil or diesel oil.
5. Fuel oil: Fuel oil (residual oil) for boilers, ships
Fuel oil refers to oils that make up the distillation residue. It comprises all residual fuel oils, including those obtained by blending. Its kinematic viscosity is above 10 centi stokes or cSt at 80°C. The flashpoint is always above 50°C and the density is always higher than 0.90 kg/l.
6. LPG: Liquefied petroleum gas for household, restaurant, factories
Liquefied petroleum gases (LPGs) are the light hydrocarbon fraction of the paraffin series, derived from refinery processes, crude oil stabilisation plants, and natural gas-processing plants, comprising propane (C ₃ H ₈) and butane (C ₄ H ₁₀) or a combination of the two. They could also include propylene, butylene, isobutene, and isobutylene. LPGs are usually liquefied under pressure for transportation and storage.
7. Lubricant: Lubricant for automobiles, trucks, ships, factories
Lubricants are hydrocarbons produced from distillate or residue; they are mainly used to reduce friction between bearing surfaces. This category includes all finished grades of lubricating oil – from spindle oil to cylinder oil – and those used in greases, including motor oils and all grades of lubricating oil base stocks.

Source: International Energy Agency (IEA) (2019), World Energy Balances: Database Documentation 2019 Edition. Paris: IEA.

Chapter 4

Data Collection on Coal Supply, Transformation, and Consumption

1. Purpose

This document aims to help any person working for the Energy Data Collection Group of the MEM to collect coal supply and consumption information and generate an energy statistics report.

2. Introduction

ERIA prepared the coal questionnaire to help the DPC–MEM improve energy data collection in the Lao PDR.

3. Questionnaire Instructions

The questionnaire, definition of products, and instructions for completing the coal supply, transformation, and final consumption are based on IEA's coal annual questionnaire published in July 2019; the *Energy Statistics Manual* (IEA, 2005); and ISIC, Revision 4 (UN-DESA, 2008).

3.1. Data sources and time frames

Data from coal producers, coal retailers, and coal power plants can be collected monthly, quarterly, and annually. If collected annually, the data should be reported for the calendar year (January to December).

3.2. Units, calorific values, and conversion factors

Coal is usually measured in tonnes or thousand tonnes. The unit used in the questionnaire for coal is tonnes. Energy (heat) content in calories is calculated by using the following calorific values (Table 4.1).

The net calorific value for lignite is estimated by subtracting 5% from the gross calorific value.

Table 4.1 Calorific Values by Coal Type

Coal	Heating Value		Tonne of Coal Equivalent (tce)		Tonne of Oil Equivalent (toe)	
	Gross Calorific Value	Net Calorific Value	Unit	Value	Unit	Value
	kcal/kg	kcal/kg				
Anthracite	7080–7248	6913–7248	tce	7×10^6 kcal	toe	10^7 kcal
Bituminous Coal	6639–7355	6352–7116	tce	7×10^6 kcal	toe	10^7 kcal
Other Bituminous Coal	5695–6388	5397–6089	tce	7×10^6 kcal	toe	10^7 kcal
Lignite	less than 4165	less than 3957	tce	7×10^6 kcal	toe	10^7 kcal

Note: The gross and net calorific values for coal in kcal/kg are derived from the gross and net calorific values in unit MJ/kg from the *Energy Statistics Manual* (IEA, 2005).

Source: IEA (2005).

Coal data are also in terms of tonne of coal equivalent (tce). The tonne of coal equivalent is not a unit of mass but a unit of energy used in the international coal industry to compare various fuels.

The relation between these two units is 1 tce = 0.7 toe.

3.3. Electronic questionnaire

An electronic questionnaire (e.g. Excel spreadsheet) should be used in collecting data to minimise the risk of data entry inconsistencies or errors.

3.4. What is coal?

Primary coal is a fossil fuel that usually looks like a black or brown rock, and consists of carbonised vegetal matter. The higher the carbon content of coal, the higher is its rank or quality. Coal types are distinguished by their physical and chemical characteristics, which determine the coal's price and suitability for various uses. All primary coal products covered in this questionnaire are solid fuels. The questionnaire includes anthracite, other bituminous coal, sub-bituminous coal, and lignite.

Derived fuels include both solid fuels and gases produced during coal processing and coal transformation. More detailed information on derived coal products is available in Annex 1 – Manufacture of Coal-Derived Fuels of the *Energy Statistics Manual* (IEA, 2005, p.157).

3.5. Definition of products

The three main categories of coal are hard coal, sub-bituminous coal, and brown coal (also called lignite). The gross calorific values for coal (kcal/kg) are based on IEA's coal annual questionnaire, published in July 2009.

- 1) Hard coal – refers to coal of gross calorific value equal to or greater than 5,700 kcal/kg. Hard coal includes:

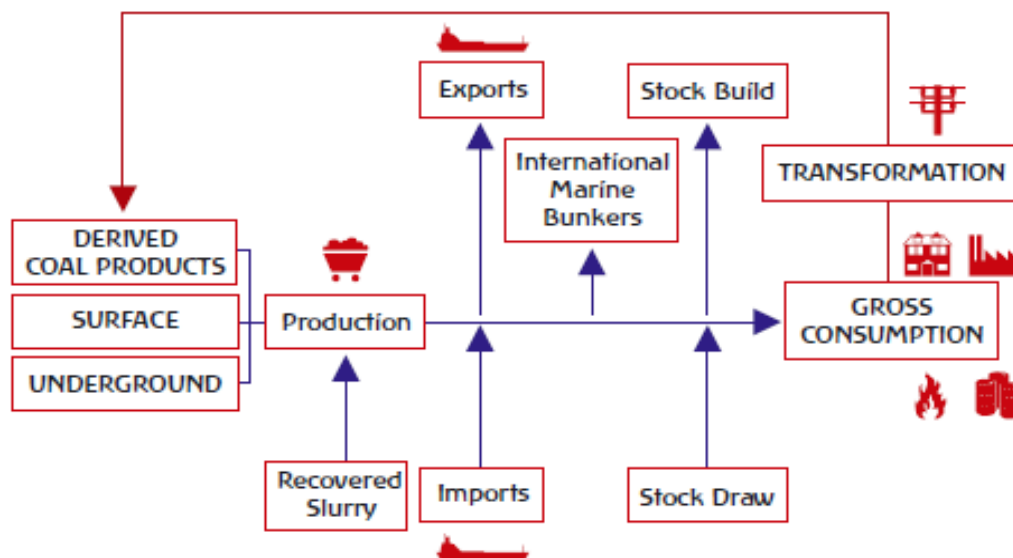
- Anthracite – high-rank coal used for industrial and residential applications. It generally has less than 10% volatile matter and a high carbon content (about 90% fixed carbon). Its gross calorific value is equal to or greater than 5,700 kcal/kg on an ash-free but moist basis.
- Coking coal – bituminous coal with a quality that allows producing coke suitable to support a blast furnace charge. Its gross calorific value is equal to or greater than 5,700 kcal/kg on an ash-free but moist basis.
- Other bituminous coal – coal mainly used for steam-raising purposes and includes all bituminous coal not included under coking coal nor anthracite. It is characterised by higher volatile matter than anthracite (more than 10%) and lower carbon content (less than 90% fixed carbon). Its gross calorific value is equal to or greater than 5,700 kcal/kg on an ash-free but moist basis. Bituminous coal used in coke ovens should be reported as coking coal.

2) Sub-bituminous coal – non-agglomerating coal with a gross calorific value equal to or greater than 4,165 kcal/kg and less than 5,700 kcal/kg containing more than 31% volatile matter on a dry mineral matter–free basis.

3) Lignite – non-agglomerating coal with a gross calorific value less than 4,165 kcal/kg and greater than 31% volatile matter on a dry mineral matter–free basis.

3.6. Instructions for completing supply, transformation, and consumption

Figure 4.1 Coal Flows Diagram



Source: IEA (2005).

3.6.1 Supply of coal

1) Opening stock

Report the opening stock level on the first day of the year (for annual data) of stocks on national territory.

2) Indigenous production

Coal production occurs either underground or surface (open pit).

Report the quantities of fuels extracted or produced, calculated after any operation to remove inert matter. In general, production includes the quantities consumed during the production process (e.g. heating or operation of equipment and auxiliaries) and supplies to other energy producers for transformation or other uses.

3) Purchase of coal from other producers and sources

- Purchase of coal from other producers – Report the quantity of coal purchased from other producers.
- From other sources – this comprises two components:
 - Report recovered slurries, middlings, and other low-grade coal products, which cannot be classified according to the type of coal. These include coal recovered from waste piles and other waste receptacles.
 - Report supplies of fuel whose production is covered in other fuel energy balances but for which consumption will occur in the coal energy balance. Further details of this component will be provided as memo items:

Memo items: From other sources:

of which *from oil products*

(e.g. petroleum coke addition to coking coal for coke ovens)

of which *from natural gas*

(e.g. natural gas addition to gas works gas for direct final consumption)

of which *from renewables*

(e.g. industrial waste as a binding agent in the manufacturing of patent fuel)

4) Imports and exports

Report the quantity of coal obtained from or supplied to other countries. The amount is determined as imported or exported when the coal has crossed a country's political boundary, whether customs has cleared it or not. The amount of fuels in transit (that is, on its way to the country) should not be included.

5) International marine bunkers

Report the quantities of fuels delivered to ships of all flags that are engaged in international navigation. The navigation may occur at sea, on inland lakes and waterways, and in coastal waters. Exclude consumption by ships engaged in domestic navigation (see Domestic navigation). The domestic and international split should be determined based on the port of departure and port of arrival and not by the ship's flag or nationality. Exclude consumption by fishing vessels (see Other

sectors – Fishing) and consumption by military forces (see Other sectors – Not elsewhere specified – Other).

6) Closing stock (actual)

Report the closing stock level on the last day of the year (for annual data) of stocks on national territory.

7) Stock change

Report the difference between the opening and closing stock levels held in the national territory.

8) Losses and own use

Report coal losses and own use in the production process.

9) Total domestic consumption

Report the quantity of coal domestic consumption from coal industries.

10) Calculated closing stock is defined as:

Opening stock + Indigenous production + Purchases of coal from other producers and sources + Imports – Exports – International marine bunkers – Losses and own use – Total domestic consumption

3.6.2 Transformation sector

Report the quantities of fuel used for the primary or secondary conversion of energy (e.g. coal to electricity, coke oven gas to electricity) or used to transform to derived energy products (e.g. coking coal to coke). The transformation sector is included in the following sub-sectors:

- Main activity producer electricity (Electricity generation) – Report quantities of coal used to produce electricity by all main activity producers.
- Main activity producer CHP (Cogeneration) – Report quantities of coal used to produce electricity and heat by all main activity producers.
- Main activity producer heat – Report quantities of coal used to produce heat by all main activity producers.
- Not elsewhere specified (Other Transformation) – Reported others not listed above.

3.6.3 Definition of flows – Final consumption of coal by sector

The final coal consumption is all coal consumed in agriculture, industry, commercial and public services, transport and residential sectors, and other – not elsewhere specified. These sectors are classified by ISIC into the following:

1) Agriculture

- Agriculture and forestry – Report fuels consumed by users classified as agriculture, hunting, and forestry by ISIC as follows: ISIC Divisions 01 and 02 (NACE¹ Divisions 01 and 02).
- Fishing – Report fuels delivered for inland, coastal, and deep-sea fishing. Fishing should cover fuels delivered to ships of all flags that refuelled in the country (includes international fishing). Also includes energy used in the fishing industry as specified in ISIC and NACE Division 03.

2) Industry

Report fuels consumed by the industry sector to support its primary activities.

Report quantities of fuels consumed in heat or CHP plants to produce heat used by the plant itself. Quantities of fuels consumed to produce electricity and heat that is sold should be reported under the appropriate Transformation sector.

- Iron and steel – ISIC Group 241 and Class 2431. Report pulverised coal injection into blast furnaces under ‘blast furnaces, Transformation sector’. Fuels used in blast furnaces should be reported in the Transformation sector to avoid double counting.
 - This class includes conversion operations by reducing iron ore in blast furnaces and oxygen converters or ferrous waste and scrap in electric arc furnaces, or by directly reducing iron ore without fusion to obtain crude steel, which is smelted and refined in a ladle furnace..
 - This class includes the casting of iron and steel, i.e. the activities of iron and steel foundries.
- Chemical and petrochemical – ISIC and NACE Divisions 20 and 21.
 - These divisions include the transformation of organic and inorganic raw materials by a chemical process and the formation of products. These distinguish the production of basic chemicals that constitute the first industry group from producing intermediate and end products produced by further processing basic chemicals that make up the remaining industry classes.

¹ Derived from the French title ‘*Nomenclature générale des Activités économiques dans les Communautés Européennes*’ (Statistical Classification of Economic Activities in the European Communities).

- These divisions include the manufacture of basic pharmaceutical products and pharmaceutical preparations. These also include the manufacture of medicinal chemical and botanical products.
- Non-ferrous metals – ISIC Group 242 and Class 2432 and NACE Group 24.4 and Classes 24.53 and 24.54.
 - These classes include the production of basic precious metals; production and refining of unwrought or wrought precious metals – gold, silver, platinum, etc. – from ore and scrap.
 - Casting of non-ferrous metals:
 - semi-finished products of aluminium, magnesium, titanium, zinc, etc.
 - light metals
 - heavy metals
 - precious metals
 - die-casting of non-ferrous metal castings
- Non-metallic minerals – ISIC and NACE Division 23. This division includes manufacturing activities related to a single substance of mineral origin. This division includes glass and glass products (e.g. flat glass, hollow glass, fibres, technical glassware, etc.); ceramic products; tiles and baked clay products; and cement and plaster – from raw materials to finished articles. The manufacture of shaped and finished stone and other mineral products is also included in this division.
- Transport equipment – ISIC and NACE Divisions 29 and 30
 - Manufacture of motor vehicles, trailers, and semi-trailers

These divisions include the manufacture of motor vehicles for transporting passengers or freight, various parts and accessories, and trailers and semi-trailers.
 - Manufacture of other transport equipment

These divisions include the manufacture of transport equipment, such as shipbuilding and boat making, railroad rolling stock and locomotives, aircraft and spacecraft and their parts.
- Machinery – Report fabricated metal products, machinery, and equipment other than transport equipment. ISIC and NACE Divisions 25–28
- Mining (excluding energy-producing industries) and quarrying – ISIC Divisions 07 and 08 and Group 099 (NACE Divisions 07 and 08 and Group 09.9)
- Food, beverages, and tobacco – ISIC and NACE Divisions 10–12
- Paper, pulp, and printing – ISIC and NACE Divisions 17 and 18. These include the production of recorded media.
- Wood and wood products (other than pulp and paper) – ISIC and NACE Division 16
- Construction – ISIC and NACE Divisions 41–43

- Textile and leather – ISIC and NACE Divisions 13–15
- Not elsewhere specified (Industry) – Report consumption not included above.

3) Commercial and public services

Report fuels consumed by business and offices in the public and the private sectors. Also include fuel used by all non-transport activities of ISIC and NACE Divisions 49–51. ISIC and NACE Divisions 33, 36–39, 45–47, 52–53, 55–56, 58–66, 68–75, 77–82, 84 (excluding Class 8422 [ISIC] and Class 84.22 [NACE]), 85–88, 90–96, and 99.

4) Transport

Report fuels used in all transport activities irrespective of the economic sector in which the activity occurs except for military use – see Not elsewhere specified (Other). Fuels used for heating and lighting at railway and bus stations and airports should be reported in Commercial and public services.

- Rail – Report all consumption used in rail traffic, including industrial railways and transport as part of urban or suburban transport systems (e.g. metro, tram).
- Domestic navigation – Report fuels delivered to vessels of all flags not engaged in international navigation. The domestic and international split should be determined based on the port of departure and port of arrival and not by the ship's flag or nationality.
- Not elsewhere specified (Transport) – Report fuels used for transport activities not included above.

5) Residential

Report fuels consumed by all households including 'households with employed persons ISIC and NACE Divisions 97 and 98'.

6) Other – Not elsewhere specified

Report activities not included elsewhere. This category includes military fuel used for all mobile and stationary consumption (e.g. ships, aircraft, road and energy used in living quarters), whether the fuel delivered is for the military of that country or another country.

4. Imports by Origin and Exports by Destination

Amounts are treated as imported or exported when the coal has crossed the country's political boundary, whether customs clearance has taken place or not. Where no origin or destination can be reported or where the country is not specified in the questionnaire, the category 'Unknown' may be used.

5. International Standard Industries Classification of all Economic Activities (ISIC)

The detailed structure of the ISIC is shown below.

Section A

Agriculture, forestry, and fishing

Division	Group	Class	Description
Division 01			Crop and animal production, hunting, and related service activities
	011		Growing of non-perennial crops
		0111	Growing of cereals (except rice), leguminous crops, and oilseeds
		0112	Growing of rice
		0113	Growing of vegetables and melons, roots, and tubers
		0114	Growing of sugar cane
		0115	Growing of tobacco
		0116	Growing of fibre crops
		0119	Growing of other non-perennial crops
	012		Growing of perennial crops
		0121	Growing of grapes
		0122	Growing of tropical and subtropical fruits
		0123	Growing of citrus fruits
		0124	Growing of pome fruits and stone fruits
		0125	Growing of other tree and bush fruits and nuts
		0126	Growing of oleaginous fruits
		0127	Growing of beverage crops
		0128	Growing of spices, aromatic, drug, and pharmaceutical crops
		0129	Growing of other perennial crops
	013	0130	Plant propagation
	014		Animal production
		0141	Raising of cattle and buffaloes
		0142	Raising of horses and other equines
		0143	Raising of camels and camelids
		0144	Raising of sheep and goats
		0145	Raising of swine and pigs
		0146	Raising of poultry
		0149	Raising of other animals
	015	0150	Mixed farming
	016		Support activities to agriculture and post-harvest crop activities
		0161	Support activities for crop production
		0162	Support activities for animal production

Division	Group	Class	Description
		0163	Post-harvest crop activities
		0164	Seed processing for propagation
	017	0170	Hunting, trapping, and related service activities
Division 02			Forestry and logging
	021	0210	Silviculture and other forestry activities
	022	0220	Logging
	023	0230	Gathering of non-wood forest products
	024	0240	Support services to forestry
Division 03			Fishing and aquaculture
	031		Fishing
		0311	Marine fishing
		0312	Freshwater fishing
	032		Aquaculture
		0321	Marine aquaculture
		0322	Freshwater aquaculture

Section B

Mining and quarrying

Division	Group	Class	Description
Division 05			Mining of coal and lignite
	051	0510	Mining of hard coal
	052	0520	Mining of lignite
Division 06			Extraction of crude petroleum and natural gas
	061	0610	Extraction of crude petroleum
	062	0620	Extraction of natural gas
Division 07			Mining of metal ores
	071	0710	Mining of iron ores
	072		Mining of non-ferrous metal ores
		0721	Mining of uranium and thorium ores
		0729	Mining of other non-ferrous metal ores
Division 08			Other mining and quarrying
	081	0810	Quarrying of stone, sand, and clay
	089		Mining and quarrying n.e.c.
		0891	Mining of chemical and fertiliser minerals
		0892	Extraction of peat
		0893	Extraction of salt
		0899	Other mining and quarrying n.e.c.
Division 09			Mining support service activities
	091	0910	Support activities for petroleum and natural gas extraction
	099	0990	Support activities for other mining and quarrying

Section C

Manufacturing

Division	Group	Class	Description
Division 10		Manufacture of food products	
	101	1010	Processing and preserving of meat
	102	1020	Processing and preserving of fish, crustaceans, and molluscs
	103	1030	Processing and preserving of fruit and vegetables
	104	1040	Manufacture of vegetable and animal oils and fats
	105	1050	Manufacture of dairy products
	106		Manufacture of grain mill products, starches, and starch products
		1061	Manufacture of grain mill products
		1062	Manufacture of starches and starch products
	107		Manufacture of other food products
		1071	Manufacture of bakery products
		1072	Manufacture of sugar
		1073	Manufacture of cocoa, chocolate, and sugar confectionery
		1074	Manufacture of macaroni, noodles, couscous, and similar farinaceous products
		1075	Manufacture of prepared meals and dishes
		1079	Manufacture of other food products n.e.c.
	108	1080	Manufacture of prepared animal feeds
Division 11		Manufacture of beverages	
		1101	Distilling, rectifying, and blending of spirits
		1102	Manufacture of wines
		1103	Manufacture of malt liquors and malt
		1104	Manufacture of soft drinks; production of mineral water and other bottled waters
Division 12		Manufacture of tobacco products	
	120	1200	Manufacture of tobacco products
Division 13		Manufacture of textiles	
	131		Spinning, weaving, and finishing of textiles
		1311	Preparation and spinning of textile fibres
		1312	Weaving of textiles
		1313	Finishing of textiles
	139		Manufacture of other textiles
		1391	Manufacture of knitted and crocheted fabrics
		1392	Manufacture of made-up textile articles, except apparel
		1393	Manufacture of carpets and rugs
		1394	Manufacture of cordage, rope, twine, and netting
		1399	Manufacture of other textiles n.e.c.
Division 14		Manufacture of wearing apparel	
	141	1410	Manufacture of wearing apparel, except fur apparel
	142	1420	Manufacture of articles of fur
	143	1430	Manufacture of knitted and crocheted apparel

Division	Group	Class	Description
Division 15			Manufacture of leather and related products
	151		Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur
		1511	Tanning and dressing of leather; dressing and dyeing of fur
		1512	Manufacture of luggage, handbags and the like, saddlery and harness
	152	1520	Manufacture of footwear
Division 16			Manufacture of wood and products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
	161	1610	Sawmilling and planing of wood
	162		Manufacture of products of wood, cork, straw, and plaiting materials
		1621	Manufacture of veneer sheets and wood-based panels
		1622	Manufacture of builders' carpentry and joinery
		1623	Manufacture of wooden containers
		1629	Manufacture of other products of wood; manufacture of articles of cork, straw, and plaiting materials
Division 17			Manufacture of paper and paper products
		1701	Manufacture of pulp, paper, and paperboard
		1702	Manufacture of corrugated paper and paperboard, and containers of paper and paperboard
		1709	Manufacture of other articles of paper and paperboard
Division 18			Printing and reproduction of recorded media
	181		Printing and service activities related to printing
		1811	Printing
		1812	Service activities related to printing
	182	1820	Reproduction of recorded media
Division 19			Manufacture of coke and refined petroleum products
	191	1910	Manufacture of coke oven products
	192	1920	Manufacture of refined petroleum products
Division 20			Manufacture of chemicals and chemical products
	201		Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms
		2011	Manufacture of basic chemicals
		2012	Manufacture of fertilisers and nitrogen compounds
		2013	Manufacture of plastics and synthetic rubber in primary forms
	202		Manufacture of other chemical products
		2021	Manufacture of pesticides and other agrochemical products
		2022	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
		2023	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
		2029	Manufacture of other chemical products n.e.c.
	203	2030	Manufacture of man-made fibres
Division 21			Manufacture of pharmaceuticals, medicinal chemical and botanical products
	210	2100	Manufacture of pharmaceuticals, medicinal chemical and botanical products

Division	Group	Class	Description
Division 22			Manufacture of rubber and plastics products
	221		Manufacture of rubber products
		2211	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres
		2219	Manufacture of other rubber products
	222	2220	Manufacture of plastics products
Division 23			Manufacture of other non-metallic mineral products
	231	2310	Manufacture of glass and glass products
	239		Manufacture of non-metallic mineral products n.e.c.
		2391	Manufacture of refractory products
		2392	Manufacture of clay building materials
		2393	Manufacture of other porcelain and ceramic products
		2394	Manufacture of cement, lime, and plaster
		2395	Manufacture of articles of concrete, cement, and plaster
		2396	Cutting, shaping, and finishing of stone
		2399	Manufacture of other non-metallic mineral products n.e.c.
Division 24			Manufacture of basic metals
	241	2410	Manufacture of basic iron and steel
	242	2420	Manufacture of basic precious and other non-ferrous metals
	243		Casting of metals
		2431	Casting of iron and steel
		2432	Casting of non-ferrous metals
Division 25			Manufacture of fabricated metal products, except machinery and equipment
	251		Manufacture of structural metal products, tanks, reservoirs, and steam generators
		2511	Manufacture of structural metal products
		2512	Manufacture of tanks, reservoirs, and containers of metal
		2513	Manufacture of steam generators, except central heating hot water boilers
	252	2520	Manufacture of weapons and ammunition
	259		Manufacture of other fabricated metal products; metalworking service activities
		2591	Forging, pressing, stamping, and roll-forming of metal; powder metallurgy
		2592	Treatment and coating of metals; machining
		2593	Manufacture of cutlery, hand tools, and general hardware
		2599	Manufacture of other fabricated metal products n.e.c.
Division 26			Manufacture of computer, electronic, and optical products
	261	2610	Manufacture of electronic components and boards
	262	2620	Manufacture of computers and peripheral equipment
	263	2630	Manufacture of communication equipment
	264	2640	Manufacture of consumer electronics
	265		Manufacture of measuring, testing, navigating, and control equipment; watches and clocks
		2651	Manufacture of measuring, testing, navigating, and control equipment

	2652	Manufacture of watches and clocks
266	2660	Manufacture of irradiation, electromedical, and electrotherapeutic equipment

Division	Group	Class	Description
	267	2670	Manufacture of optical instruments and photographic equipment
	268	2680	Manufacture of magnetic and optical media
Division 27		Manufacture of electrical equipment	
	271	2710	Manufacture of electric motors, generators, transformers, and electricity distribution and control apparatus
	272	2720	Manufacture of batteries and accumulators
	273		Manufacture of wiring and wiring devices
		2731	Manufacture of fibre optic cables
		2732	Manufacture of other electronic and electric wires and cables
		2733	Manufacture of wiring devices
	274	2740	Manufacture of electric lighting equipment
	275	2750	Manufacture of domestic appliances
	279	2790	Manufacture of other electrical equipment
Division 28		Manufacture of machinery and equipment n.e.c.	
	281		Manufacture of general-purpose machinery
		2811	Manufacture of engines and turbines, except aircraft, vehicle, and cycle engines
		2812	Manufacture of fluid power equipment
		2813	Manufacture of other pumps, compressors, taps, and valves
		2814	Manufacture of bearings, gears, gearing, and driving elements
		2815	Manufacture of ovens, furnaces, and furnace burners
		2816	Manufacture of lifting and handling equipment
		2817	Manufacture of office machinery and equipment (except computers and peripheral equipment)
		2818	Manufacture of power-driven hand tools
		2819	Manufacture of other general-purpose machinery
	282		Manufacture of special-purpose machinery
		2821	Manufacture of agricultural and forestry machinery
		2822	Manufacture of metal-forming machinery and machine tools
		2823	Manufacture of machinery for metallurgy
		2824	Manufacture of machinery for mining, quarrying, and construction
		2825	Manufacture of machinery for food, beverage, and tobacco processing
		2826	Manufacture of machinery for textile, apparel, and leather production
		2829	Manufacture of other special-purpose machinery
Division 29		Manufacture of motor vehicles, trailers, and semi-trailers	
	291	2910	Manufacture of motor vehicles
	292	2920	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
	293	2930	Manufacture of parts and accessories for motor vehicles
Division 30		Manufacture of other transport equipment	
	301		Building of ships and boats

	3011	Building of ships and floating structures
	3012	Building of pleasure and sporting boats
302	3020	Manufacture of railway locomotives and rolling stock
303	3030	Manufacture of air and spacecraft and related machinery
304	3040	Manufacture of military fighting vehicles
309		Manufacture of transport equipment n.e.c.
	3091	Manufacture of motorcycles
	3092	Manufacture of bicycles and invalid carriages
	3099	Manufacture of other transport equipment n.e.c.
Division 31		Manufacture of furniture
310	3100	Manufacture of furniture
Division 32		Other manufacturing
321		Manufacture of jewellery, bijouterie, and related articles
	3211	Manufacture of jewellery and related articles
	3212	Manufacture of imitation jewellery and related articles
322	3220	Manufacture of musical instruments
323	3230	Manufacture of sports goods
324	3240	Manufacture of games and toys
325	3250	Manufacture of medical and dental instruments and supplies
329	3290	Other manufacturing n.e.c.
Division 33		Repair and installation of machinery and equipment
331		Repair of fabricated metal products, machinery, and equipment
	3311	Repair of fabricated metal products
	3312	Repair of machinery
	3313	Repair of electronic and optical equipment
	3314	Repair of electrical equipment
	3315	Repair of transport equipment, except motor vehicles
	3319	Repair of other equipment
332	3320	Installation of industrial machinery and equipment

Section D

Electricity, gas, steam, and air-conditioning supply

Division	Group	Class	Description
Division 35		Electricity, gas, steam, and air-conditioning supply	
	351	3510	Electric power generation, transmission, and distribution
	352	3520	Manufacture of gas; distribution of gaseous fuels through mains
	353	3530	Steam and air-conditioning supply

Section E

Water supply; sewerage, waste management, and remediation activities

Division	Group	Class	Description
Division 36			Water collection, treatment, and supply
	360	3600	Water collection, treatment, and supply
	370	3700	Sewerage
Division 38			Waste collection, treatment and disposal activities; materials recovery
	381		Waste collection
		3811	Collection of non-hazardous waste
		3812	Collection of hazardous waste
	382		Waste treatment and disposal
		3821	Treatment and disposal of non-hazardous waste
		3822	Treatment and disposal of hazardous waste
	383	3830	Materials recovery
Division 39			Remediation activities and other waste management services
	390	3900	Remediation activities and other waste management services

Section F

Construction

Division	Group	Class	Description
Division 41			Construction of buildings
	410	4100	Construction of buildings
Division 42			Civil engineering
	421	4210	Construction of roads and railways
	422	4220	Construction of utility projects
	429	4290	Construction of other civil engineering projects
Division 43			Specialised construction activities
	431		Demolition and site preparation
		4311	Demolition
		4312	Site preparation
	432		Electrical, plumbing, and other construction installation activities
		4321	Electrical installation
		4322	Plumbing, heat, and air-conditioning installation
		4329	Other construction installation
	433	4330	Building completion and finishing
	439	4390	Other specialised construction activities

Section G

Wholesale and retail trade; repair of motor vehicles and motorcycles

Division	Group	Class	Description
Division 45			Wholesale and retail trade and repair of motor vehicles and motorcycles
	451	4510	Sale of motor vehicles
	452	4520	Maintenance and repair of motor vehicles
	453	4530	Sale of motor vehicle parts and accessories
	454	4540	Sale, maintenance, and repair of motorcycles and related parts and accessories
Division 46			Wholesale trade, except of motor vehicles and motorcycles
	461	4610	Wholesale on a fee or contract basis
	462	4620	Wholesale of agricultural raw materials and live animals
	463	4630	Wholesale of food, beverages, and tobacco
	464		Wholesale of household goods
		4641	Wholesale of textiles, clothing, and footwear
		4649	Wholesale of other household goods
	465		Wholesale of machinery, equipment, and supplies
		4651	Wholesale of computers, computer peripheral equipment, and software
		4652	Wholesale of electronic and telecommunications equipment and parts
		4653	Wholesale of agricultural machinery, equipment, and supplies
		4659	Wholesale of other machinery and equipment
	466		Other specialised wholesale
		4661	Wholesale of solid, liquid and gaseous fuels, and related products
		4662	Wholesale of metals and metal ores
		4663	Wholesale of construction materials, hardware, plumbing, and heating equipment and supplies
		4669	Wholesale of waste and scrap and other products n.e.c.
	469	4690	Non-specialised wholesale trade
Division 47			Retail trade, except of motor vehicles and motorcycles
	471		Retail sale in non-specialised stores
		4711	Retail sale in non-specialised stores with food, beverages, or tobacco predominating
		4719	Other retail sale in non-specialised stores
	472		Retail sale of food, beverages, and tobacco in specialised stores
		4721	Retail sale of food in specialised stores
		4722	Retail sale of beverages in specialised stores
		4723	Retail sale of tobacco products in specialised stores
	473	4730	Retail sale of automotive fuel in specialised stores
	474		Retail sale of information and communications equipment in specialised stores
		4741	Retail sale of computers, peripheral units, software and telecommunications equipment in specialised stores
		4742	Retail sale of audio and video equipment in specialised stores
	475		Retail sale of other household equipment in specialised stores
		4751	Retail sale of textiles in specialised stores
		4752	Retail sale of hardware, paints, and glass in specialised stores

Division	Group	Class	Description
		4753	Retail sale of carpets, rugs, wall and floor coverings in specialised stores
		4759	Retail sale of electrical household appliances, furniture, lighting equipment, and other household articles in specialised stores
	476		Retail sale of cultural and recreation goods in specialised stores
		4761	Retail sale of books, newspapers, and stationery in specialised stores
		4762	Retail sale of music and video recordings in specialised stores
		4763	Retail sale of sporting equipment in specialised stores
		4764	Retail sale of games and toys in specialised stores
	477		Retail sale of other goods in specialised stores
		4771	Retail sale of clothing, footwear, and leather articles in specialised stores
		4772	Retail sale of pharmaceutical and medical goods, cosmetic and toilet articles in specialised stores
		4773	Other retail sale of new goods in specialised stores
		4774	Retail sale of second-hand goods
	478		Retail sale via stalls and markets
		4781	Retail sale via stalls and markets of food, beverages, and tobacco products
		4782	Retail sale via stalls and markets of textiles, clothing, and footwear
		4789	Retail sale via stalls and markets of other goods
	479		Retail trade not in stores, stalls, or markets
		4791	Retail sale via mail order houses or via Internet
		4799	Other retail sale not in stores, stalls, or markets

Section H

Transportation and storage

Division	Group	Class	Description
Division 49			Land transport and transport via pipelines
	491		Transport via railways
		4911	Passenger rail transport, interurban
		4912	Freight rail transport
	492		Other land transport
		4921	Urban and suburban passenger land transport
		4922	Other passenger land transport
		4923	Freight transport by road
	493	4930	Transport via pipeline
Division 50			Water transport
	501		Sea and coastal water transport
		5011	Sea and coastal passenger water transport
		5012	Sea and coastal freight water transport
	502		Inland water transport
		5021	Inland passenger water transport
		5022	Inland freight water transport
Division 51			Air transport
	511	5110	Passenger air transport
	512	5120	Freight air transport

Division 52		Warehousing and support activities for transportation
521	5210	Warehousing and storage
522		Support activities for transportation
	5221	Service activities incidental to land transportation
	5222	Service activities incidental to water transportation
	5223	Service activities incidental to air transportation
	5224	Cargo handling
	5229	Other transportation support activities
Division 53		Postal and courier activities
531	5310	Postal activities
532	5320	Courier activities

Section I

Accommodation and food service activities

Division	Group	Class	Description
Division 55		Accommodation	
	551	5510	Short-term accommodation activities
	552	5520	Camping grounds, recreational vehicle parks, and trailer parks
	559	5590	Other accommodation
Division 56		Food and beverage service activities	
	561	5610	Restaurants and mobile food service activities
	562		Event catering and other food service activities
		5621	Event catering
		5629	Other food service activities
	563	5630	Beverage-serving activities

Section J

Information and communication

Division	Group	Class	Description
Division 58			Publishing activities
	581		Publishing of books, periodicals, and other publishing activities
		5811	Book publishing
		5812	Publishing of directories and mailing lists
		5813	Publishing of newspapers, journals, and periodicals
		5819	Other publishing activities
	582	5820	Software publishing
Division 59			Motion picture, video and television programme production; sound recording and music publishing activities
	591		Motion picture, video and television programme activities
		5911	Motion picture, video and television programme production activities
		5912	Motion picture, video and television programme post-production activities
		5913	Motion picture, video and television programme distribution activities
		5914	Motion picture projection activities
	592	5920	Sound recording and music publishing activities
	601	6010	Radio broadcasting
	602	6020	Television programming and broadcasting activities
Division 61			Telecommunications
	611	6110	Wired telecommunications activities
	612	6120	Wireless telecommunications activities
	613	6130	Satellite telecommunications activities
	619	6190	Other telecommunications activities
Division 62			Computer programming, consultancy, and related activities
		6201	Computer programming activities
		6202	Computer consultancy and computer facilities management activities
		6209	Other information technology and computer service activities
Division 63			Information service activities
	631		Data processing, hosting, and related activities; web portals
		6311	Data processing, hosting, and related activities
		6312	Web portals
	639		Other information service activities
		6391	News agency activities
		6399	Other information service activities n.e.c.

Section K

Financial and insurance activities

Division	Group	Class	Description
Division 64			Financial service activities, except insurance and pension funding
	641		Monetary intermediation
		6411	Central banking
		6419	Other monetary intermediation
	642	6420	Activities of holding companies
	643	6430	Trusts, funds, and similar financial entities
	649		Other financial service activities, except insurance and pension funding activities
		6491	Financial leasing
		6492	Other credit granting
		6499	Other financial service activities, except insurance and pension funding activities, n.e.c.
Division 65			Insurance, reinsurance, and pension funding, except compulsory social security
	651		Insurance
		6511	Life insurance
		6512	Non-life insurance
	652	6520	Reinsurance
	653	6530	Pension funding
	661		Activities auxiliary to financial service activities, except insurance and pension funding
		6611	Administration of financial markets
		6612	Security and commodity contracts brokerage
		6619	Other activities auxiliary to financial service activities
	662		Activities auxiliary to insurance and pension funding
		6621	Risk and damage evaluation
		6622	Activities of insurance agents and brokers
		6629	Other activities auxiliary to insurance and pension funding
	663	6630	Fund management activities

Section L

Real estate activities

Division	Group	Class	Description
Division 68			Real estate activities
	681	6810	Real estate activities with own or leased property
	682	6820	Real estate activities on a fee or contract basis

Section M

Professional, scientific, and technical activities

Division	Group	Class	Description
Division 69			Legal and accounting activities
	691	6910	Legal activities
	692	6920	Accounting, bookkeeping and auditing activities; tax consultancy
Division 70			Activities of head offices; management consultancy activities
	701	7010	Activities of head offices
	702	7020	Management consultancy activities
Division 71			Architectural and engineering activities; technical testing and analysis
	711	7110	Architectural and engineering activities and related technical consultancy
	712	7120	Technical testing and analysis
Division 72			Scientific research and development
	721	7210	Research and experimental development on natural sciences and engineering
	722	7220	Research and experimental development on social sciences and humanities
Division 73			Advertising and market research
	731	7310	Advertising
	732	7320	Market research and public opinion polling
Division 74			Other professional, scientific, and technical activities
	741	7410	Specialised design activities
	742	7420	Photographic activities
	749	7490	Other professional, scientific, and technical activities n.e.c.

Section N

Administrative and support service activities

Division	Group	Class	Description
Division 77			Rental and leasing activities
	771	7710	Renting and leasing of motor vehicles
	772		Renting and leasing of personal and household goods
		7721	Renting and leasing of recreational and sports goods
		7722	Renting of videotapes and disks
		7729	Renting and leasing of other personal and household goods
	773	7730	Renting and leasing of other machinery, equipment, and tangible goods
	774	7740	Leasing of intellectual property and similar products, except copyrighted works
Division 78			Employment activities
	781	7810	Activities of employment placement agencies
	782	7820	Temporary employment agency activities
	783	7830	Other human resources provision
Division 79			Travel agency, tour operator, reservation service, and related activities
	791		Travel agency and tour operator activities
		7911	Travel agency activities
		7912	Tour operator activities
	799	7990	Other reservation service and related activities
Division 80			Security and investigation activities
	801	8010	Private security activities
	802	8020	Security systems service activities
	803	8030	Investigation activities
Division 81			Services to buildings and landscape activities
	811	8110	Combined facilities support activities
	812		Cleaning activities
		8121	General cleaning of buildings
		8129	Other building and industrial cleaning activities
	813	8130	Landscape care and maintenance service activities
Division 82			Office administrative, office support, and other business support activities
	821		Office administrative and support activities
		8211	Combined office administrative service activities
		8219	Photocopying, document preparation and other specialised office support activities
	822	8220	Activities of call centres
	823	8230	Organisation of conventions and trade shows
	829		Business support service activities n.e.c.
		8291	Activities of collection agencies and credit bureaus
		8292	Packaging activities
		8299	Other business support service activities n.e.c.

Section O

Public administration and defence; compulsory social security

Division	Group	Class	Description
Division 84			Public administration and defence; compulsory social security
	841		Administration of the State and the economic and social policies of the community
		8411	General public administration activities
		8412	Regulation of the activities of providing health care, education, cultural services and other social services, excluding social security
		8413	Regulation of and contribution to a more efficient operation of businesses
	842		Provision of services to the community as a whole
		8421	Foreign affairs
		8422	Defence activities
		8423	Public order and safety activities
	843	8430	Compulsory social security activities

Section P

Education

Division	Group	Class	Description
Division 85			Education
	851	8510	Pre-primary and primary education
	852		Secondary education
		8521	General secondary education
		8522	Technical and vocational secondary education
	853	8530	Higher education
	854		Other education
		8541	Sports and recreation education
		8542	Cultural education
		8549	Other education n.e.c.
	855	8550	Educational support activities

Section Q

Human health and social work activities

Division	Group	Class	Description
Division 86			Human health activities
	861	8610	Hospital activities
	862	8620	Medical and dental practice activities
	869	8690	Other human health activities

Division	Group	Class	Description
Division 87			Residential care activities
	871	8710	Residential nursing care facilities
	872	8720	Residential care activities for mental retardation, mental health, and substance abuse
	873	8730	Residential care activities for the elderly and disabled
	879	8790	Other residential care activities
Division 88			Social work activities without accommodation
	881	8810	Social work activities without accommodation for the elderly and disabled
	889	8890	Other social work activities without accommodation

Section R

Arts, entertainment, and recreation

Division	Group	Class	Description
Division 90			Creative, arts, and entertainment activities
	900	9000	Creative, arts, and entertainment activities
Division 91			Libraries, archives, museums, and other cultural activities
		9101	Library and archives activities
		9102	Museums activities and operation of historical sites and buildings
		9103	Botanical and zoological gardens and nature reserves activities
Division 92			Gambling and betting activities
	920	9200	Gambling and betting activities
Division 93			Sports activities and amusement and recreation activities
	931		Sports activities
		9311	Operation of sports facilities
		9312	Activities of sports clubs
		9319	Other sports activities
	932		Other amusement and recreation activities
		9321	Activities of amusement parks and theme parks
		9329	Other amusement and recreation activities n.e.c.

Section S

Other service activities

Division	Group	Class	Description
Division 94			Activities of membership organisations
	941		Activities of business, employers, and professional membership organisations
		9411	Activities of business and employer membership organisations
		9412	Activities of professional membership organisations
	942	9420	Activities of trade unions
	949		Activities of other membership organisations
		9491	Activities of religious organisations
		9492	Activities of political organisations
		9499	Activities of other membership organisations n.e.c.
Division 95			Repair of computers and personal and household goods
	951		Repair of computers and communication equipment
		9511	Repair of computers and peripheral equipment
		9512	Repair of communication equipment
	952		Repair of personal and household goods
		9521	Repair of consumer electronics
		9522	Repair of household appliances and home and garden equipment
		9523	Repair of footwear and leather goods
		9524	Repair of furniture and home furnishings
		9529	Repair of other personal and household goods
Division 96			Other personal service activities
		9601	Washing and (dry-) cleaning of textile and fur products
		9602	Hairdressing and other beauty treatment
		9603	Funeral and related activities
		9609	Other personal service activities n.e.c.

Section T

Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use

Division	Group	Class	Description
Division 97			Activities of households as employers of domestic personnel
	970	9700	Activities of households as employers of domestic personnel
Division 98			Undifferentiated goods- and services-producing activities of private households for own use
	981	9810	Undifferentiated goods-producing activities of private households for own use
	982	9820	Undifferentiated service-producing activities of private households for own use

Section U

Activities of extraterritorial organisations and bodies

Division	Group	Class	Description
Division 99			Activities of extraterritorial organisations and bodies
	990	9900	Activities of extraterritorial organisations and bodies

6. Sample of filling questionnaires

6.1 Coal supply

Below are dummy, not actual, data for Company A as an example in filling out questionnaires.

Table 4.2 Coal Supply

Company name: Company A
Date: 31 March 2020

Annual Coal Supply Survey - Unit in Tonnes
Calendar Year 2019 (January 2019 to December 2019)

		Anthracite	Other Bituminous Coal	Sub-bituminous Coal	Lignite	Total
		Tonnes	Tonnes	Tonnes	Tonnes	Tonnes
Opening stock	A	1.000	0	0	20.000	21.000
Indigenous production (C+D)	B	170.000	0	0	460.000	630.000
Surface	C	120.000	0	0	400.000	520.000
Underground	D	50.000	0	0	60.000	110.000
Purchases of coal from other producers/from other sources	E					
Imports	F	0	0	0	30.000	30.000
Exports	G	55.000	0	0	200.000	255.000
International marine bunker	H					
Losses and own use in production	I	1.000	0	0	2.000	3.000
Total domestic consumption	J	110.000	0	0	300.000	410.000
Calculated closing stock =A+B+E+F-G-H-I-J		5.000	0	0	8.000	13.000
Actual closing stock	K	4.000	0	0	6.000	10.000

Specify heating value (kcal/kg)

GCV (Kcal/kg)	4.165
NCV (Kcal/kg)	3.957

Notes: The cells highlighted in pink are linked cells from the 'Imports, Exports and Coal Consumption' tabs.

The cells highlighted in **darblue** are not applicable to the Lao PDR.

1) Anthracite

- Opening stock = 1,000 tonnes; in the questionnaire 'Coal Supply tab', enter 1,000 tonnes in the row 'Opening stock, column Anthracite'.
- Indigenous production is automatically calculated by the formula = Surface + Underground
 - Anthracite produced in surface = 120,000 tonnes; enter 120,000 tonnes in the row 'Surface, column Anthracite'.

- Anthracite produced in underground = 50,000 tonnes; enter 50,000 tonnes in the row 'Underground, column Anthracite'.
- Purchases of coal from other producers/from other sources = 0 tonnes (no purchase); enter 0 tonnes in the row 'Purchases of coal from other producers/from other sources, column Anthracite'.
- Imports – Do not enter data in this row. The cells highlighted in pink are linked to and automatically calculated from the 'Import by Origin' tab; i.e. total anthracite imported. Company A must enter data in the 'Import by Origin' tab to fill the 'Import' row. In this example, Company A has no imported anthracite, i.e. import = 0 tonnes.
- Exports – Do not enter data in this row. The cells highlighted in pink are linked to and calculated from the 'Export by Destination' tab; i.e. total anthracite exported. Company A must enter data in the 'Export by Destination' tab to fill the 'Export' row. In this example, Company A exported 55,000 tonnes of anthracite, i.e. export = 55,000 tonnes.
- International marine bunker = 0 tonnes; enter 0 tonnes in the row 'International marine bunker, column Anthracite'.
- Losses and own use in production = 1,000 tonnes; enter 1,000 tonnes in the row 'Losses and own use in production, column Anthracite'.
- Total domestic consumption – Do not enter data in this row. The cells highlighted in pink are linked to and calculated from 'Coal Consumption' tab, i.e. total anthracite consumption. Company A must enter data in the 'Coal Consumption' tab to fill the 'Total domestic consumption' row. In this example, Company A's total consumption of anthracite is 110,000 tonnes.
- Calculated closing stock – Do not enter data in this row which is automatically calculated by the formula = Opening stock + Indigenous + Purchases of coal from other producers/from other sources + Imports – Exports – International marine bunkers – Losses and own use – Total domestic consumption. In this example, Company A's total 'Calculated closing stock' of anthracite is 5,000 tonnes.
- Actual closing stock = 4,000 tonnes; enter 4,000 tonnes in the row 'Actual closing stock, column Anthracite'.

2) Other bituminous coal

- In this example, Company A does not produce other bituminous coal; enter zero in all rows. If data is available in the future, use the same method for 'Anthracite' to fill all coal supply information for 'Other Bituminous Coal'.

3) Sub-bituminous coal

- In this example, Company A does not produce sub-bituminous coal; enter zero in all rows. If data is available in the future, use the same method for 'Anthracite' to fill all coal supply information for 'Sub-bituminous coal'.

4) Lignite

- Opening stock = 20,000 tonnes; in the questionnaire's 'Coal Supply tab', enter 20,000 tonnes

in the row 'Opening stock, column Lignite'.

- Indigenous production – Do not enter data in this row, which is automatically calculated by the formula: Surface + Underground
 - Lignite produced in surface = 400,000 tonnes; enter '400,000 tonnes' in the row 'Surface, column Lignite'.
 - Lignite produced in underground = 60,000 tonnes; enter '60,000 tonnes' in the row 'Underground, column Lignite'.
- Purchases of coal from other producers/from other sources = 0 tonnes (no purchase); enter '0 tonnes' in the row 'Purchases of coal from other producers/from other sources, column Lignite'.
- Imports – Do not enter data in this row, which is automatically calculated from the 'Import by Origin' tab, i.e. total lignite imported. Company A must enter data in the 'Import by Origin' tab to fill the 'Import' row. In this example, Company A imported 30,000 tonnes of lignite, i.e. import = 30,000 tonnes.
- Exports – Do not enter data in this row, which is automatically calculated from the 'Export by Destination' tab, i.e. total lignite exported. Company A must enter data in the 'Export by Destination' tab to fill the 'Export' row. In this example, Company A exported 200,000 tonnes of lignite i.e. export = 200,000 tonnes.
- International marine bunker = 0 tonnes; enter '0 tonne' in the row 'International marine bunker, column Lignite'.
- Losses and own use in production = 2,000 tonnes; enter 2,000 tonnes in the row 'Losses and own use in production, column Lignite'.
- Total domestic consumption – Do not enter data in this row, which is automatically calculated from the 'Coal Consumption' tab, i.e. total lignite consumption.
Company A must enter data in the 'Coal Consumption' tab to fill the 'Total domestic consumption' row. In this example, Company A's total consumption of lignite is 300,000 tonnes.
- Calculated closing stock – Do not enter data in this row, which is automatically calculated by the formula: Opening stock + Indigenous + Purchases of coal from other producers/from other sources + Imports – Exports – International marine bunkers – Losses and own use – Total domestic consumption
In this example, Company A's total 'Calculated closing stock' of lignite is 8,000 tonnes.
- Actual closing stock = 6,000 tonnes; enter '6,000 tonnes' in the row 'Actual closing stock, column Lignite'.

5) Total

- Total opening stock (indigenous production, purchases of coal from other producers/from other sources, imports, etc.) for coal is automatically calculated by the formula: Anthracite + Other Bituminous Coal + Sub-bituminous Coal + Lignite

6) Result of filling the 'Coal Supply' tab of the questionnaire

Table 4.2 illustrates the filled questionnaire using the above information and instructions.

6.2 Coal consumption

Below are dummy, not actual, data for Company A as an example in filling out questionnaires.

Table 4.3 Coal Consumption

Company name: Company A						
Date: 31 March 2020						
Annual Coal Consumption by Sector - Unit in Tonnes						
Calendar Year 2019 (January 2019 to December 2019)						
	ISIS Revision 4, 2008	Anthracite	Other Bituminous Coal	Sub-bituminous Coal	Lignite	Total
		Tonnes	Tonnes	Tonnes	Tonnes	Tonnes
Energy transformation		0	0	0	195.000	195.000
Electricity generation	n.a.				195.000	195.000
Cogeneration	n.a.					
Other transformation	n.a.					
Losses and own use in production or transformation	n.a.					
Agriculture		0	0	0	20.000	20.000
Agriculture/Forestry	Divisions 01 & 02				20.000	20.000
Fishing	Division 03					
Industrial		110.000	0	0	75.000	185.000
Iron and steel	Group 241 & Class 2431					0
Chemical and petrochemical	Divisions 20 & 21					0
Non-ferrous metals	Group 242 & Class 2432					0
Non-metallic minerals	Division 23	110.000			75.000	185.000
Transport equipment	Divisions 29 & 30					0
Machinery	Divisions 25, 26, 27 & 28					0
Mining and quarrying	Divisions 07, 08 & 099					0
Food, beverages, and tobacco	Divisions 10, 11 & 12					0
Paper, pulp, and printing	Divisions 17 & 18					0
Wood and wood products	Division 16					0
Construction	Divisions 41, 42 & 43					0
Textiles and leather	Divisions 13, 14 & 15					0
Not elsewhere specified (Industry)	Divisions 22, 31 & 32					0
Transport	Divisions 49, 50 & 51	0	0	0	0	0
Rail						
Domestic navigation						
Not-specified (Transport)						
Commercial and public services	Divisions 33 to 39, 45 to 47, 52 to 53, 55 to 56, 58 to 66, 68 to 96, & 99					
Residential	Divisions 97 & 98				10.000	10.000
Other - Not elsewhere specified	Not included elsewhere above					0
Total Consumption		110.000	0	0	300.000	410.000

Notes:

ISIS: International Standard Industries Classification of All Economic Activities (ISIC) Revision 4, Department of Economic and Social Affairs, Statistics Division, United Nations New York, 2008.

n.a. : not available

The cells highlighted in dark blue are not applicable for the Lao PDR.

1) Anthracite

- Energy transformation – Do not enter data in this row, which is automatically calculated by the formula: Electricity generation + Cogeneration + Other transformation + Losses and own use in production or transformation
 - Electricity generation – In this example, Company A has not sold anthracite; thus, 'Electricity generation' = 0 tonnes.
 - Cogeneration – Company A has not sold anthracite; thus, 'Cogeneration' = 0 tonnes.
 - Other transformation – Company A has not sold anthracite for 'Other transformation', i.e. Other transformation = 0 tonne.
 - Losses and own use in production or transformation – Company A has not reported anthracite for 'Losses and own use in production or transformation', i.e. Losses and own use in production or transformation = 0 tonne.
- Agriculture – Do not enter data in this row, which is automatically calculated by the formula: Agriculture and Forestry + Fishing.
 - Agriculture and Forestry – In this example, Company A has not sold anthracite for 'Agriculture and Forestry', i.e. Agriculture and Forestry = 0 tonne. Enter zero or leave the cell blank.
 - Fishing – Company A has not sold anthracite for 'Fishing', i.e. Fishing = 0 tonne. Enter zero or leave the cell blank.
- **Industrial** – Do not enter data in this row, which is automatically calculated by the following formula:

Iron and steel + Chemical and petrochemical + Non-ferrous metals + Non-metallic minerals + Transport equipment + Machinery + Mining and quarrying + Food, beverages, and tobacco + Paper, pulp, and printing + Wood and wood products + Construction + Textiles and leather + Not elsewhere specified (Industry)
 - Non-metallic minerals – In this example, Company A has sold anthracite for the Non-metallic minerals group 'Industry sector', i.e. Non-metallic minerals = 110,000 tonnes.
 - Other industrial groups – Company A has not sold anthracite for other industrial groups; thus, enter zeros or leave the cells blank.
- Commercial and public services, transport, and residential sectors – In this example, Company A has not sold anthracite for commercial and public services, transport, and residential sectors. Enter zeros or leave the cells blank.

2) Other bituminous coal

- In this example, Company A does not produce 'Other Bituminous Coal'; enter zero in all rows. If data will be available, use the same method for 'Anthracite' to fill all coal consumption information for 'Other Bituminous Coal'.

3) Sub-bituminous coal

- In this example, Company A does not produce 'Sub-bituminous Coal'; enter zero in all rows. If data will be available, use the same method for 'Anthracite' to fill all coal consumption information for 'Sub-bituminous Coal'.

4) Lignite

- Energy transformation – Do not enter data in this row, which is automatically calculated by the formula: Electricity generation + Cogeneration + Other transformation + Losses and own use in production or transformation
 - Electricity generation – In this example, Company A has sold 195,000 tonnes of lignite to electricity companies; enter '195,000 tonnes' for 'Electricity generation'.
 - Cogeneration – Company A has not sold lignite for 'Cogeneration'; thus, Cogeneration = 0 tonne.
 - Other transformation – Company A has not sold lignite for 'Other transformation', i.e. Other transformation = 0 tonne.
 - Losses and own use in production or transformation – Company A has not reported lignite for 'Losses and own use in production or transformation', i.e. Losses and own use in production or transformation = 0 tonne.
- Agriculture – Do not enter data in this row, which is automatically calculated by the formula: Agriculture and Forestry + Fishing
 - Agriculture and Forestry – In this example, Company A sold 20,000 tonnes of lignite to the Agriculture and Forestry sector, i.e. Agriculture and Forestry = 20,000 tonnes. Enter '20,000 tonnes'.
 - Fishing – Company A has not sold lignite for 'Fishing'; i.e. Fishing = 0 tonnes. Enter zero or leave the cell blank.
- Industrial – Do not enter data in this row, which is automatically calculated by the following formula:
Iron and steel + Chemical and petrochemical + Non-ferrous metals + Non-metallic minerals + Transport equipment + Machinery + Mining and quarrying + Food, beverages, and tobacco + Paper, pulp, and printing + Wood and wood products + Construction + Textiles and leather + Not elsewhere specified (Industry)

- Non-metallic minerals – In this example, Company A has sold lignite for the Non-metallic minerals group – ‘Industrial sector’, i.e. Non-metallic minerals = 75,000 tonnes. Enter ‘75,000 tonnes’.
- Other industrial groups – Company A has not sold anthracite for other industrial groups, commercial and public services, and transport sector. Enter zero or leave the cell blank.
- Residential – In this example, Company A has sold lignite to the ‘residential sector’, i.e. residential = 10,000 tonnes. Enter ‘10,000 tonnes’.
- Other – Not elsewhere specified – In this example, Company A has not sold lignite for ‘Other – Not elsewhere specified’, i.e. Other – Not elsewhere specified = 0 tonnes. Enter ‘0 tonnes’ or leave the cell blank.
- Total consumption – Please do not enter data in this row, which is automatically calculated by the formula: Energy Transformation + Agriculture + Industrial + Transport + Commercial and Public Services + Residential + ‘Other - Not elsewhere specified’.

5) Total – Do not enter data in this row, which is automatically calculated by the formula: Anthracite + Other Bituminous Coal + Sub-bituminous Coal + Lignite. This is the total coal consumption for all types of coal for Energy Transformation, Agriculture, Industrial, Transport, Commercial and Public Services, Residential and Other – Not elsewhere specified.

6) Result of filling the ‘Coal Consumption’ tab of the questionnaire

Table 4.3 illustrates the filled questionnaire using the above information and instructions.

6.3. Imports by origin

If Company A imported coal, enter the import data in this tab to show the total import in the ‘Coal Supply’ tab.

Please note that dummy – and not actual – data is used in the example.

Table 4.4 Imports by Origin

Company name: Company A
Date: 31 March 2020

Imports by Origin
Calendar Year 2019 (January 2019 to December 2019)

		Primary Fuels				
		Anthracite	Other Bituminous Coal	Sub-bituminous Coal	Lignite	Total
		Tonnes	Tonnes	Tonnes	Tonnes	Tonnes
APEC Economies	1	0	0	0	30.000	30.000
Australia	2					0
Brunei Darussalam	3					0
Canada	4					0
Chile	5					0
China	6				30.000	30.000
Hong Kong, China	7					0
Indonesia	8					0
Japan	9					0
Republic of Korea	10					0
Malaysia	11					0
Mexico	12					0
New Zealand	13					0
Papua New Guinea	14					0
Peru	15					0
Philippines	16					0
Russian Federation	17					0
Singapore	18					0
Chinese Taipei	19					0
Thailand	20					0
United States of America	21					0
Viet Nam	22					0
ASEAN (non-APEC) Economies	23	0	0	0	0	0
Myanmar	24					0
Lao PDR	25					0
Cambodia	26					0
Rest of the World	27	0	0	0	0	0
Other Asia and Pacific	28					0
Other Americas	29					0
Europe & Former Soviet Union (excluding Russia)	30					0
Middle East	31					0
Africa	32					0
Unknown	33					0
Total	34	0	0	0	30.000	30.000

Note: Do not enter data in the cells highlighted in yellow. They are automatically calculated for the total coal imported from a group of economies globally.

1) Anthracite

- In this example, Company A has not imported 'Anthracite'; enter zero in all rows or leave the cell blank. If data will be available, enter the import data for 'Anthracite'.

2) Other bituminous coal

- In this example, Company A has not imported 'Other bituminous coal'; enter zero in all rows or leave the cell blank. If data will be available, enter the import data for 'Other bituminous coal'.

3) Sub-bituminous coal

- In this example, Company A has not imported 'Sub-bituminous coal'; enter zero in all rows or leave the cell blank. If data will be available, please enter the import data for 'Sub-bituminous coal'.

4) Lignite

- Import from China – Company A imported 30,000 tonnes of lignite from China; enter '30,000 tonnes' in the row of China.

5) Total – Do not enter data in this row, which is automatically calculated by the formula: Anthracite + Other Bituminous Coal + Sub-bituminous Coal + Lignite. This is the total coal imports for all types of coal from a specific country.

6) APEC, ASEAN (non-APEC), Rest of the World, and Unknown economies – Do not enter data in the cells highlighted in yellow. They are automatically calculated for the total coal imported from a group of economies globally.

Where no origin can be reported or where the country is not specified in the questionnaire, the category 'Unknown' may be used.

7) Result of filling the 'Import' tab of the questionnaire

Table 4.4 illustrates the filled questionnaire using the above information and instructions.

6.4. Exports by destination

If Company A exported coal, enter the export data in this tab to show the total export in the 'Coal Supply' tab.

Note that dummy – and not actual – data was used.

Table 4.5 Exports by Destination

Date: 31 March 2020		Exports by Destination Calendar Year 2019 (January 2019 to December 2019)				
		Primary Fuels				Total
		Anthracite	Other Bituminous Coal	Sub-bituminous Coal	Lignite	
		Tonnes	Tonnes	Tonnes	Tonnes	
APEC Economies	35	55.000	0	0	120.000	175.000
Australia	36					0
Brunei Darussalam	37					0
Canada	38					0
Chile	39					0
China	40					0
Hong Kong, China	41					0
Indonesia	42					0
Japan	43					0
Republic of Korea	44					0
Malaysia	45					0
Mexico	46					0
New Zealand	47					0
Papua New Guinea	48					0
Peru	49					0
Philippines	50					0
Russian Federation	51					0
Singapore	52					0
Chinese Taipei	53					0
Thailand	54	55.000			120.000	175.000
United States of America	55					0
Viet Nam	56					0
ASEAN (non-APEC) Economies	57	0	0	0	80.000	80.000
Myanmar	58					0
Lao PDR	59					0
Cambodia	60				80.000	80.000
Rest of the World	61	0	0	0	0	0
Other Asia and Pacific	62					0
Other Americas	63					0
Europe & Former Soviet Union (excluding Russia)	64					0
Middle East	65					0
Africa	66					0
Unknown	67					0
Total	68	55.000	0	0	200.000	255.000

Note: Do not enter data in the cells highlighted in yellow. They are automatically calculated for the total coal exported to a group of economies globally.

1) Anthracite

- Export to Thailand – Company A exported anthracite to Thailand = 55,000 tonnes; enter ‘55,000 tonnes’ in the row ‘Thailand’.

2) Other bituminous coal

- In this example, Company A has not exported ‘Other bituminous coal’; enter zero in all rows of the ‘Exports by Destination’ tab or leave the cells blank. If data will be available, enter the export data for ‘Other bituminous coal’.

3) Sub-bituminous coal

- In this example, Company A has not exported ‘Sub-bituminous coal’; enter zero in all rows of the ‘Exports by Destination’ tab or leave the cells blank. If data will be available, enter the export data for ‘Sub-bituminous coal’.

4) Lignite

- Export to Thailand – Company A exported 120,000 tonnes of lignite to Thailand; enter ‘120,000 tonnes’ in the row ‘Thailand’.

- Export to Cambodia – Company A exported 80,000 tonnes of lignite to Cambodia; enter ‘80,000 tonnes’ in the row ‘Cambodia’.

5) Total – Do not enter data in this row, which is automatically calculated by the formula: Anthracite + Other Bituminous Coal + Sub-bituminous Coal + Lignite. This is the total export for all types of coal from a specific country.

6) APEC, ASEAN (non-APEC), Rest of the World, and Unknown economies – Do not enter data in the cells highlighted in yellow. They are automatically calculated for the total coal exported to a group of economies or regions globally.

Where no destination can be reported or where the country is not specified in the questionnaire, the category ‘Unknown’ may be used.

7) Result of filling the ‘Export’ tab of the questionnaire

Table 4.5 illustrates the filled questionnaire using the above information and instructions on filling the ‘Export’ tab.

References

International Energy Agency (IEA) (2005), *Energy Statistics Manual*. Paris: IEA.

United Nations Department of Economic and Social Affairs (UN-DESA) (2008), International Standard Industries Classification of All Economic Activities (ISIC), Revision 4. New York: UN.

CHAPTER 5

Data Collection on Electricity Supply and Consumption

1. Purpose

This document aims to help any person working for the Energy Data Collection Group of MEM to collect electricity supply and consumption information and generate an energy statistics report.

2. Introduction

The electricity questionnaire was prepared by the technical support of ERIA to help the DPC of MEM improve energy data collection in the Lao PDR.

3. Questionnaire Instructions

The questionnaire instructions, definition of products, and instructions for completing the electricity supply and final consumption are based on IEA's electricity and heat annual questionnaire 2017–2021 published in July 2019, the Energy Statistics Manual 2005 (IEA, 2005), and ISIC Revision 4 (UN-DESA, 2008).

3.1. Data sources and time frames

Data can be collected monthly, quarterly, and annually from electricity generators, electricity transmission and distribution companies, electricity retailers, and cogenerators. If collected annually, the data should be reported for the calendar year (January to December).

3.2. Units and conversion factors

Electricity is usually measured in watt-hours. The units for electricity used in the questionnaire are megawatt-hours (MWh) and gigawatt-hours (GWh). Energy (heat) content in calories is calculated by using conversion factors, e.g. 1 GWh = 860 Gcal or 1 kWh = 860 kcal.

Common Conversion Factor for Electricity

- Millions of tonnes of oil equivalent (Mtoe) is a unit of energy used to describe the energy content of all fuels, for example, 1 Mtoe = 11,630 GWh or 1 GWh = 86 toe.

Table 5.1 Conversion Equivalents between Units of Energy

To:	TJ	Gcal	Mtoe	MBtu	GWh
From:	multiply by:				
Terajoule (TJ)	1	238,8	2.388×10^{-5}	947,8	0,2778
Gigacalorie	4.1868×10^{-3}	1	10^{-7}	3,968	1.163×10^{-3}
Mtoe	4.1868×10^4	10^7	1	3.968×10^7	11630
Million Btu	1.0551×10^{-3}	0,252	2.52×10^{-8}	1	2.931×10^{-4}
Gigawatt-hour	3,6	860	8.6×10^{-5}	3412	1

Source: IEA (2005).

3.3. Electronic questionnaire

An electronic questionnaire (e.g. Excel spreadsheet) should be used in collecting the data to minimise the risk of data entry inconsistencies or errors.

3.4. What is electricity?

Electricity is an energy carrier with an extensive range of applications. It is used in almost all kinds of human activity, ranging from industrial production, household use, agriculture, commerce (to operate machines), lighting, and heating.

Electricity is produced as primary and secondary energy. Primary electricity is obtained from natural sources such as hydro, wind, solar, tide, and wave power. Secondary electricity is produced from the heat of nuclear fission of nuclear fuels, from geothermal heat and solar thermal heat, and by burning primary combustible fuels such as coal, natural gas, oil, renewables, and waste. After electricity is produced, it is distributed to final consumers through national or international transmission and distribution grids.

3.5. Definition of products

It is important to understand the energy source to complete the questionnaire. Energy source refers to the kinetic (e.g. hydro, wind), thermal (e.g. nuclear, geothermal), or combustible fuel used as input to generate electricity or heat.

- 1) Hydro – potential and kinetic energy of water converted into electricity in hydroelectric plants. Pumped storage from mixed and pure pumped storage plants should be included.
- 2) Geothermal – energy available as heat emitted from within the earth's crust, usually in the form of hot water or steam.
- 3) Solar energy – solar radiation exploited for electricity generation.
 - Solar photovoltaic converts sunlight into electricity by using solar cells, usually made of semi-conducting materials that generate electricity when exposed to light.
 - Solar thermal can consist of

- solar thermal-electric plants, or
- equipment to produce heat for sale (hot water or steam)

4) Combustible fuels – refer to fuels capable of igniting or burning, i.e. reacting with oxygen to produce a significant temperature rise. They are combusted directly to produce electricity and/or heat.

5) Solid biomass – covers organic, non-fossil material of biological origin, which may be used as fuel to produce heat or generate electricity. Solid biomass includes:

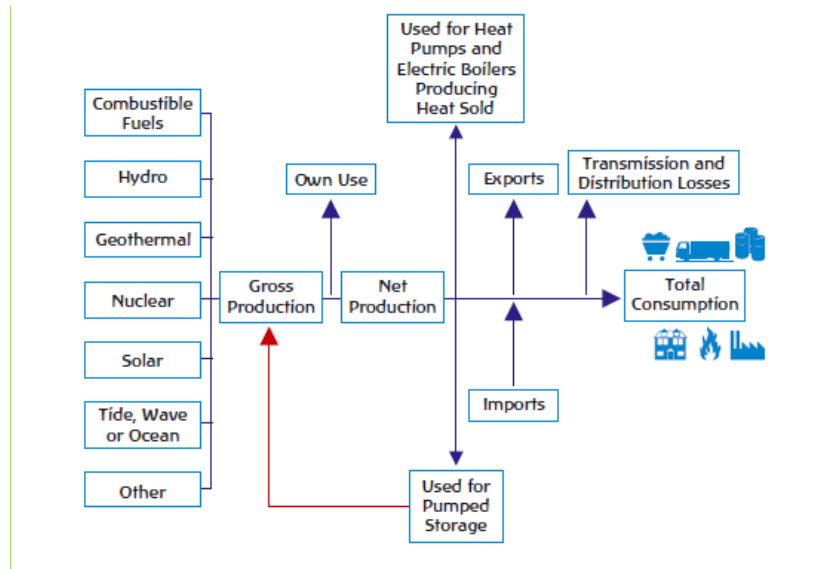
- Charcoal – covers the solid residue of the destructive distillation and pyrolysis of wood and other vegetal material
- Fuelwood, wood residues, and by-products – fuelwood or firewood (in log, brushwood, pellet, or chip form) obtained from natural or managed forests or isolated trees. Also included are wood residues used as fuel and in which the original composition of wood is retained. Charcoal and black liquor are excluded. The quantity of fuel used should be reported on a net calorific value basis.
- Black liquor – energy from the alkaline-spent liquor obtained from the digesters during the production of sulphate or soda pulp required for paper manufacture
- Bagasse – fuel obtained from the fibre, which remains after juice extraction in sugar cane processing
- Animal waste – energy from excreta of animals, meat and fish residues that are used directly as fuel when dry. This excludes waste used in anaerobic fermentation plants. Fuel gases from these plants are included under biogases.
- Other vegetal materials and residuals – biofuels not specified elsewhere and including straw, vegetable husks, groundnut shells, pruning brushwood, olive pomace, and other wastes arising from the maintenance, cropping, and processing of plants.
- Industrial waste (renewable) – solid renewable portion of industrial waste combusted directly at specific installations for meaningful energy purposes (for example, natural rubber in waste rubber tires or natural fibres in textile wastes). The quantity of fuel used should be reported on a net calorific value basis.

6) Wind – kinetic energy of wind exploited for electricity generation in wind turbines

7) Tide, wave, or ocean – Mechanical energy derived from tidal movement, wave motion, or ocean current and exploited for electricity generation.

3.6. Instructions for completing electricity supply and consumption

Figure 5.1 Electricity Flows Diagram



Source: IEA (2005).

3.6.1 Definitions of electricity and heat – electricity supply

The supply of electricity and heat only includes production, imports, and exports. Electricity and heat are produced from several sources according to types of producers and types of plants.

Types of Producers – producers are classified according to the purpose of production:

- Main activity producer commits to generate electricity and/or heat for sale to third parties as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid.
- Auto producer commits to generate electricity and/or heat, wholly or partly for their own use as an activity that supports their primary activity. They may be privately or publicly owned.

Types of Plants – a plant is a set of units. Plants are classified according to the combination of units:

- Electricity plant refers to a plant composed of electricity units only.
- Heat plant refers to a plant composed of heat units only.
- Combined heat and power (CHP) plant refers to all other combinations of units. For example, it can be a plant that has one CHP unit. Another example of a CHP plant is a combination of one electricity unit and one heat unit.

Electricity is produced as a primary or secondary product in power plants; the total electricity produced is called gross electricity production. Power plants consume some amount of electricity for their use. Net electricity production is obtained by deducting this amount from gross production;

this net production is distributed through national transmission and distribution grids to final consumers or transformed into heat in electric boilers or heat pumps, or stored using pumped-storage dams. It can also be exported through international transmission interconnections to another country or imported when a shortage occurs. During transmission and distribution, some losses occur caused by the grid's physical characteristics and the electricity-generating system.

- 1) Gross electricity production – is the sum of the electrical energy production by all the generating sets concerned (including pumped storage) measured at the main generators' output terminals.
- 2) Net electricity production – is equal to the gross electricity production less the electrical energy absorbed by the generating auxiliaries and the losses in the main generator transformers.
- 3) Own use by power plants – is the difference between gross and net electricity production.
- 4) Purchase from other producers – report electricity purchased from other producers or generators.
- 5) Imports and exports – the amounts of electricity and heat are considered imported or exported when these have crossed the country's political boundaries, whether customs clearance has taken place or not. If electricity is 'wheeled' or transited through a country, the amount should be reported as both an import and an export.
- 6) Inland deliveries/sales – report electricity delivered or sold for inland consumption.
- 7) Transmission and distribution losses – all losses due to transport and distribution of electrical energy and heat. For electricity, losses in transformers not considered integral parts of the power plants are also included.
- 8) Energy sector – report all electricity and purchased heat consumed by the energy sector to support the extraction (mining, oil and gas production) and transformation activities. It should exclude Own use by plant, Used for pumped storage, Used by heat pumps, and Used for electric boilers, which are reported elsewhere. Heat consumed by auto producers for their use should not be included. Consumption in support of pipeline operations (e.g. oil, gas, and coal slurry) should be reported in the Transport sector.
- 9) Fuel used for electricity generation – report the fuel input of coal (tonnes), oil (kl), and bagasse (tonnes) for electricity generation.

3.6.2 Definition of flows – final consumption of electricity by sector

The final electricity and heat consumption refers to all electricity and heat used in agriculture, industry, commercial and public services, transport and residential sectors, and Other – not elsewhere specified. These sectors are classified by ISIC as follows.

- 1) Agriculture

- Agriculture and forestry – report electricity consumed by users classified as agriculture, hunting, and forestry by ISIC and NACE Divisions 01 and 02.
- Fishing – report electricity consumed for inland, coastal, and deep-sea fishing as specified in ISIC and NACE Division 03. Fishing should cover energy consumption in ships of all flags that refuelled in the country (include international fishing).

2) Industry – report the electricity consumed by the industry for its primary activities in the appropriate sub-sectors:

- Iron and steel – ISIC Group 241 and Class 2431. Fuels used in blast furnaces should be reported in the energy sector to avoid double counting.
 - This class includes conversion operations by reducing iron ore in blast furnaces and oxygen converters, or of ferrous waste and scrap in electric arc furnaces, or by directly reducing iron ore without fusion to obtain crude steel, which is smelted and refined in a ladle furnace.
 - This class includes the casting of iron and steel, i.e. the activities of iron and steel foundries.
- Chemical and petrochemical – ISIC and NACE Divisions 20 and 21
 - These divisions include the transformation of organic and inorganic raw materials by a chemical process and the formation of products. It distinguishes the production of basic chemicals that constitute the first industry group from the production of intermediate and end products produced by further processing of basic chemicals that make up the remaining industry classes.
 - These divisions include the manufacture of basic pharmaceutical products and pharmaceutical preparations. These also include the manufacture of medicinal chemical and botanical products.
- Non-ferrous metals – ISIC Group 242 and Class 2432 and (NACE Group 24.4 and Classes 24.53 and 24.54).
 - These classes include the production of basic precious metals: production and refining of unwrought or wrought precious metals – gold, silver, platinum, etc. – from ore and scrap.
 - Casting of non-ferrous metals, which include
 - semi-finished products of aluminium, magnesium, titanium, zinc, etc.
 - light metals
 - heavy metals
 - precious metals
 - die-casting of non-ferrous metal castings

- Non-metallic minerals – ISIC and NACE Division 23. This division includes manufacturing activities related to a single substance of mineral origin. This division includes glass and glass products (e.g. flat glass, hollow glass, fibres, technical glassware, etc.); ceramic products; tiles and baked clay products; and cement and plaster – from raw materials to finished articles. The manufacture of shaped and finished stone and other mineral products is also included in this division.
- Transport equipment – ISIC and NACE Divisions 29 and 30.
 - Manufacture of motor vehicles, trailers, and semi-trailers
This division includes the manufacture of motor vehicles for transporting passengers or freight, various parts and accessories, and trailers and semi-trailers.
 - Manufacture of other transport equipment
This division includes the manufacture of (i) transportation equipment such as shipbuilding and boat making; and (ii) railroad rolling stock and locomotives, aircraft, and spacecraft and their parts.
- Machinery – Report fabricated metal products, machinery, and equipment other than transport equipment. ISIC and NACE Divisions 25–28
- Mining (excluding energy-producing industries) and quarrying – ISIC Divisions 07 and 08 and Group 099 (NACE Divisions 07 and 08 and Group 09.9)
- Food, beverages, and tobacco - ISIC and NACE Divisions 10–12
- Paper, pulp, and printing - ISIC and NACE Divisions 17 and 18. Include the production of recorded media
- Wood and wood products (other than pulp and paper) - ISIC and NACE Division 16
- Construction – ISIC and NACE Divisions 41–43
- Textile and leather – ISIC and NACE Divisions 13–15
- Not elsewhere specified (Industry) – Report consumption not included above

3) Commercial and public services – these activities are covered by ISIC and NACE Divisions 33, 36–39, 45–47, 52–53, 55–56, 58–66, 68–75, 77–82, 84 (excluding Class 8422)–88, 90–96, and 99. Report consumption by businesses and offices in the public and private sectors. Note that electricity use at railway, bus stations, shipping piers, and airports should be reported in this category and not shown in the Transport sector. Also include fuel used by all non-transport activities of ISIC and NACE Divisions 49–51.

4) Transport – report electricity use for all transport activities irrespective of the economic sector where the activities occur (except military fuel use, see Not elsewhere specified – Other). Electricity used for heating and lighting at railway, bus stations, and airports should be reported in Commercial and public services. The transport sector is divided into the following sub-sectors:

- Rail – report electricity consumption used in rail traffic, including industrial railways and rail transport as part of urban or suburban transport systems (e.g. metro, tram).
- Pipeline transport – report electricity consumption supporting the operations of submarine and overland pipelines transporting gases, liquids, slurries, and other commodities up to the

distributors' network, including the energy used for pump stations and maintenance of the pipeline. Use for pipeline distribution of natural or manufactured gas, hot water, or steam (ISIC 35) from the distributor to the final users is excluded and should be reported in the Energy sector. Use for the final distribution of water (ISIC 36) to household, industry, commercial, and other users should be included in the Commercial and public services sector.

- Road – report electricity use in road vehicles. This includes electricity consumed in road transport vehicles such as electric buses, electric cars, and trolleybuses when the electricity is supplied from external sources to generate mechanical energy directly or used to charge batteries. Include use by agricultural vehicles on highways. Exclude use in stationary engines (this should be reported under the relevant economic sector), non-highway use in tractors (see Agriculture/Forestry – Other sector), and military use (see Not elsewhere specified – Other). The consumption of vehicles running on rails in urban transport (trams, metro, etc.) should be included under Rail transport.
- *Not elsewhere specified – Transport* – report electricity use for transport activities not included elsewhere.

5) Residential – report fuel consumed by all households, including those with employed persons (ISIC and NACE Divisions 97 and 98)

6) Other – Not elsewhere specified – report activities not included elsewhere (such as ISIC and NACE Class 8422). This category should include military use for all mobile and stationary consumption (e.g. ships, aircraft, and living quarters) within the country regardless of whether the use is by the military of that country or another country.

4 Imports by Origin and Exports by Destination

Report the gross trade in electricity between all countries, including quantities in transit. The country of origin for imports, from which electricity comes, and destination for exports, to which they are sent, are neighbouring countries.

The amount is treated as imported or exported when the electricity has crossed the country's political boundaries, whether customs clearance has taken place or not. Where no origin or destination can be reported or where the country is not specified in the questionnaire, the category 'Unknown' may be used.

5. International Standard Industries Classification of all Economic Activities (ISIC)

The following is ISIC's detailed structure.

Section A

Agriculture, forestry, and fishing

Division	Group	Class	Description
Division 01			Crop and animal production, hunting, and related service activities
	011		Growing of non-perennial crops
		0111	Growing of cereals (except rice), leguminous crops, and oilseeds
		0112	Growing of rice
		0113	Growing of vegetables and melons, roots, and tubers
		0114	Growing of sugar cane
		0115	Growing of tobacco
		0116	Growing of fibre crops
		0119	Growing of other non-perennial crops
	012		Growing of perennial crops
		0121	Growing of grapes
		0122	Growing of tropical and subtropical fruits
		0123	Growing of citrus fruits
		0124	Growing of pome fruits and stone fruits
		0125	Growing of other tree and bush fruits and nuts
		0126	Growing of oleaginous fruits
		0127	Growing of beverage crops
		0128	Growing of spices, aromatic, drug, and pharmaceutical crops
		0129	Growing of other perennial crops
	013	0130	Plant propagation
	014		Animal production
		0141	Raising of cattle and buffaloes
		0142	Raising of horses and other equines
		0143	Raising of camels and camelids
		0144	Raising of sheep and goats
		0145	Raising of swine and pigs
		0146	Raising of poultry
		0149	Raising of other animals
	015	0150	Mixed farming
	016		Support activities to agriculture and post-harvest crop activities
		0161	Support activities for crop production
		0162	Support activities for animal production
		0163	Post-harvest crop activities
		0164	Seed processing for propagation
	017	0170	Hunting, trapping, and related service activities
Division 02			Forestry and logging
	021	0210	Silviculture and other forestry activities
	022	0220	Logging
	023	0230	Gathering of non-wood forest products
	024	0240	Support services to forestry

Division 03	Fishing and aquaculture	
031		Fishing
	0311	Marine fishing
	0312	Freshwater fishing
032		Aquaculture
	0321	Marine aquaculture
	0322	Freshwater aquaculture

Section B

Mining and quarrying

Division	Group	Class	Description
Division 05	Mining of coal and lignite		
	051	0510	Mining of hard coal
	052	0520	Mining of lignite
Division 06	Extraction of crude petroleum and natural gas		
	061	0610	Extraction of crude petroleum
	062	0620	Extraction of natural gas
Division 07	Mining of metal ores		
	071	0710	Mining of iron ores
	072		Mining of non-ferrous metal ores
		0721	Mining of uranium and thorium ores
		0729	Mining of other non-ferrous metal ores
Division 08	Other mining and quarrying		
	081	0810	Quarrying of stone, sand, and clay
	089		Mining and quarrying n.e.c.
		0891	Mining of chemical and fertiliser minerals
		0892	Extraction of peat
		0893	Extraction of salt
		0899	Other mining and quarrying n.e.c.
Division 09	Mining support service activities		
	091	0910	Support activities for petroleum and natural gas extraction
	099	0990	Support activities for other mining and quarrying

Section C

Manufacturing

Division	Group	Class	Description
Division 10			Manufacture of food products
	101	1010	Processing and preserving of meat
	102	1020	Processing and preserving of fish, crustaceans, and molluscs
	103	1030	Processing and preserving of fruits and vegetables
	104	1040	Manufacture of vegetables and animal oils and fats
	105	1050	Manufacture of dairy products
	106		Manufacture of grain mill products, starches, and starch products
		1061	Manufacture of grain mill products
		1062	Manufacture of starches and starch products
	107		Manufacture of other food products
		1071	Manufacture of bakery products
		1072	Manufacture of sugar
		1073	Manufacture of cocoa, chocolate, and sugar confectionery
		1074	Manufacture of macaroni, noodles, couscous, and similar farinaceous products
		1075	Manufacture of prepared meals and dishes
		1079	Manufacture of other food products n.e.c.
	108	1080	Manufacture of prepared animal feeds
Division 11			Manufacture of beverages
		1101	Distilling, rectifying, and blending of spirits
		1102	Manufacture of wines
		1103	Manufacture of malt liquors and malt
		1104	Manufacture of soft drinks; production of mineral water and other bottled water
Division 12			Manufacture of tobacco products
	120	1200	Manufacture of tobacco products
Division 13			Manufacture of textiles
	131		Spinning, weaving, and finishing of textiles
		1311	Preparation and spinning of textile fibres
		1312	Weaving of textiles
		1313	Finishing of textiles
	139		Manufacture of other textiles
		1391	Manufacture of knitted and crocheted fabrics
		1392	Manufacture of made-up textile articles, except apparel
		1393	Manufacture of carpets and rugs
		1394	Manufacture of cordage, rope, twine, and netting
		1399	Manufacture of other textiles n.e.c.
Division 14			Manufacture of wearing apparel
	141	1410	Manufacture of wearing apparel, except fur apparel
	142	1420	Manufacture of articles of fur
	143	1430	Manufacture of knitted and crocheted apparel

Division	Group	Class	Description
Division 15			Manufacture of leather and related products
	151		Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, and harness; dressing and dyeing of fur
		1511	Tanning and dressing of leather; dressing and dyeing of fur
		1512	Manufacture of luggage, handbags and the like, saddlery and harness
	152	1520	Manufacture of footwear
Division 16			Manufacture of wood and products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
	161	1610	Sawmilling and planing of wood
	162		Manufacture of products of wood, cork, straw, and plaiting materials
		1621	Manufacture of veneer sheets and wood-based panels
		1622	Manufacture of builders' carpentry and joinery
		1623	Manufacture of wooden containers
		1629	Manufacture of other products of wood; manufacture of articles of cork, straw, and plaiting materials
Division 17			Manufacture of paper and paper products
		1701	Manufacture of pulp, paper, and paperboard
		1702	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
		1709	Manufacture of other articles of paper and paperboard
Division 18			Printing and reproduction of recorded media
	181		Printing and service activities related to printing
		1811	Printing
		1812	Service activities related to printing
	182	1820	Reproduction of recorded media
Division 19			Manufacture of coke and refined petroleum products
	191	1910	Manufacture of coke oven products
	192	1920	Manufacture of refined petroleum products
Division 20			Manufacture of chemicals and chemical products
	201		Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms
		2011	Manufacture of basic chemicals
		2012	Manufacture of fertilisers and nitrogen compounds
		2013	Manufacture of plastics and synthetic rubber in primary forms
	202		Manufacture of other chemical products
		2021	Manufacture of pesticides and other agrochemical products
		2022	Manufacture of paints, varnishes, and similar coatings; printing ink and mastics
		2023	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
		2029	Manufacture of other chemical products n.e.c.
	203	2030	Manufacture of man-made fibres
Division 21			Manufacture of pharmaceuticals, medicinal chemical and botanical products
	210	2100	Manufacture of pharmaceuticals, medicinal chemical and botanical products

Division	Group	Class	Description
Division 22			Manufacture of rubber and plastics products
	221		Manufacture of rubber products
		2211	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres
		2219	Manufacture of other rubber products
	222	2220	Manufacture of plastics products
Division 23			Manufacture of other non-metallic mineral products
	231	2310	Manufacture of glass and glass products
	239		Manufacture of non-metallic mineral products n.e.c.
		2391	Manufacture of refractory products
		2392	Manufacture of clay building materials
		2393	Manufacture of other porcelain and ceramic products
		2394	Manufacture of cement, lime, and plaster
		2395	Manufacture of articles of concrete, cement, and plaster
		2396	Cutting, shaping, and finishing of stone
		2399	Manufacture of other non-metallic mineral products n.e.c.
Division 24			Manufacture of basic metals
	241	2410	Manufacture of basic iron and steel
	242	2420	Manufacture of basic precious and other non-ferrous metals
	243		Casting of metals
		2431	Casting of iron and steel
		2432	Casting of non-ferrous metals
Division 25			Manufacture of fabricated metal products, except machinery and equipment
	251		Manufacture of structural metal products, tanks, reservoirs, and steam generators
		2511	Manufacture of structural metal products
		2512	Manufacture of tanks, reservoirs, and containers of metal
		2513	Manufacture of steam generators, except central heating hot water boilers
	252	2520	Manufacture of weapons and ammunition
	259		Manufacture of other fabricated metal products; metalworking service activities
		2591	Forging, pressing, stamping, and roll-forming of metal; powder metallurgy
		2592	Treatment and coating of metals; machining
		2593	Manufacture of cutlery, hand tools, and general hardware
		2599	Manufacture of other fabricated metal products n.e.c.
Division 26			Manufacture of computer, electronic, and optical products
	261	2610	Manufacture of electronic components and boards
	262	2620	Manufacture of computers and peripheral equipment
	263	2630	Manufacture of communication equipment
	264	2640	Manufacture of consumer electronics
	265		Manufacture of measuring, testing, navigating, and control equipment; watches and clocks
		2651	Manufacture of measuring, testing, navigating, and control equipment

	2652	Manufacture of watches and clocks
266	2660	Manufacture of irradiation, electromedical, and electrotherapeutic equipment

Division	Group	Class	Description
	267	2670	Manufacture of optical instruments and photographic equipment
	268	2680	Manufacture of magnetic and optical media
Division 27			Manufacture of electrical equipment
	271	2710	Manufacture of electric motors, generators, transformers, and electricity distribution and control apparatus
	272	2720	Manufacture of batteries and accumulators
	273		Manufacture of wiring and wiring devices
		2731	Manufacture of fibre optic cables
		2732	Manufacture of other electronic and electric wires and cables
		2733	Manufacture of wiring devices
	274	2740	Manufacture of electric lighting equipment
	275	2750	Manufacture of domestic appliances
	279	2790	Manufacture of other electrical equipment
Division 28			Manufacture of machinery and equipment n.e.c.
	281		Manufacture of general-purpose machinery
		2811	Manufacture of engines and turbines, except aircraft, vehicle, and cycle engines
		2812	Manufacture of fluid power equipment
		2813	Manufacture of other pumps, compressors, taps, and valves
		2814	Manufacture of bearings, gears, gearing, and driving elements
		2815	Manufacture of ovens, furnaces, and furnace burners
		2816	Manufacture of lifting and handling equipment
		2817	Manufacture of office machinery and equipment (except computers and peripheral equipment)
		2818	Manufacture of power-driven hand tools
		2819	Manufacture of other general-purpose machinery
	282		Manufacture of special-purpose machinery
		2821	Manufacture of agricultural and forestry machinery
		2822	Manufacture of metal-forming machinery and machine tools
		2823	Manufacture of machinery for metallurgy
		2824	Manufacture of machinery for mining, quarrying, and construction
		2825	Manufacture of machinery for food, beverage, and tobacco processing
		2826	Manufacture of machinery for textile, apparel, and leather production
		2829	Manufacture of other special-purpose machinery
Division 29			Manufacture of motor vehicles, trailers, and semi-trailers
	291	2910	Manufacture of motor vehicles
	292	2920	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
	293	2930	Manufacture of parts and accessories for motor vehicles
Division 30			Manufacture of other transport equipment

301		Building of ships and boats
	3011	Building of ships and floating structures
	3012	Building of pleasure and sporting boats
302	3020	Manufacture of railway locomotives and rolling stock
303	3030	Manufacture of aircraft and spacecraft and related machinery
304	3040	Manufacture of military fighting vehicles
309		Manufacture of transport equipment n.e.c.
	3091	Manufacture of motorcycles
	3092	Manufacture of bicycles and invalid carriages
	3099	Manufacture of other transport equipment n.e.c.
Division 31		Manufacture of furniture
310	3100	Manufacture of furniture
Division 32		Other manufacturing
321		Manufacture of jewellery, bijouterie, and related articles
	3211	Manufacture of jewellery and related articles
	3212	Manufacture of imitation jewellery and related articles
322	3220	Manufacture of musical instruments
323	3230	Manufacture of sports goods
324	3240	Manufacture of games and toys
325	3250	Manufacture of medical and dental instruments and supplies
329	3290	Other manufacturing n.e.c.
Division 33		Repair and installation of machinery and equipment
331		Repair of fabricated metal products, machinery, and equipment
	3311	Repair of fabricated metal products
	3312	Repair of machinery
	3313	Repair of electronic and optical equipment
	3314	Repair of electrical equipment
	3315	Repair of transport equipment, except motor vehicles
	3319	Repair of other equipment
332	3320	Installation of industrial machinery and equipment

Section D

Electricity, gas, steam, and air-conditioning supply

Division	Group	Class	Description
Division 35			Electricity, gas, steam, and air-conditioning supply
	351	3510	Electric power generation, transmission, and distribution
	352	3520	Manufacture of gas; distribution of gaseous fuels through mains
	353	3530	Steam and air conditioning supply

Section E

Water supply; sewerage, waste management, and remediation activities

Division	Group	Class	Description
Division 36			Water collection, treatment, and supply
	360	3600	Water collection, treatment, and supply
	370	3700	Sewerage
Division 38			Waste collection, treatment, and disposal activities; materials recovery
	381		Waste collection
		3811	Collection of non-hazardous waste
		3812	Collection of hazardous waste
	382		Waste treatment and disposal
		3821	Treatment and disposal of non-hazardous waste
		3822	Treatment and disposal of hazardous waste
	383	3830	Materials recovery
Division 39			Remediation activities and other waste management services
	390	3900	Remediation activities and other waste management services

Section F

Construction

Division	Group	Class	Description
Division 41			Construction of buildings
	410	4100	Construction of buildings
Division 42			Civil engineering
	421	4210	Construction of roads and railways
	422	4220	Construction of utility projects
	429	4290	Construction of other civil engineering projects
Division 43			Specialised construction activities
	431		Demolition and site preparation
		4311	Demolition
		4312	Site preparation
	432		Electrical, plumbing, and other construction installation activities
		4321	Electrical installation
		4322	Plumbing, heat, and air-conditioning installation
		4329	Other construction installation
	433	4330	Building completion and finishing
	439	4390	Other specialised construction activities

Section G

Wholesale and retail trade; repair of motor vehicles and motorcycles

Division	Group	Class	Description
Division 45			Wholesale and retail trade and repair of motor vehicles and motorcycles
	451	4510	Sale of motor vehicles
	452	4520	Maintenance and repair of motor vehicles
	453	4530	Sale of motor vehicle parts and accessories
	454	4540	Sale, maintenance, and repair of motorcycles and related parts and accessories
Division 46			Wholesale trade, except of motor vehicles and motorcycles
	461	4610	Wholesale on a fee or contract basis
	462	4620	Wholesale of agricultural raw materials and live animals
	463	4630	Wholesale of food, beverages, and tobacco
	464		Wholesale of household goods
		4641	Wholesale of textiles, clothing, and footwear
		4649	Wholesale of other household goods
	465		Wholesale of machinery, equipment, and supplies
		4651	Wholesale of computers, computer peripheral equipment, and software
		4652	Wholesale of electronic and telecommunications equipment and parts
		4653	Wholesale of agricultural machinery, equipment, and supplies
		4659	Wholesale of other machinery and equipment

Division 46		Wholesale trade, except of motor vehicles and motorcycles
466		Other specialised wholesale
	4661	Wholesale of solid, liquid, and gaseous fuels and related products
	4662	Wholesale of metals and metal ores
	4663	Wholesale of construction materials, hardware, plumbing, and heating equipment and supplies
	4669	Wholesale of waste and scrap and other products n.e.c.
469	4690	Non-specialised wholesale trade
Division 47		Retail trade, except of motor vehicles and motorcycles
471		Retail sale in non-specialised stores
	4711	Retail sale in non-specialised stores with food, beverages, or tobacco predominating
	4719	Other retail sale in non-specialised stores
472		Retail sale of food, beverages, and tobacco in specialised stores
	4721	Retail sale of food in specialised stores
	4722	Retail sale of beverages in specialised stores
	4723	Retail sale of tobacco products in specialised stores
473	4730	Retail sale of automotive fuel in specialised stores
474		Retail sale of information and communications equipment in specialised stores
	4741	Retail sale of computers, peripheral units, software and telecommunications equipment in specialised stores
	4742	Retail sale of audio and video equipment in specialised stores
475		Retail sale of other household equipment in specialised stores
	4751	Retail sale of textiles in specialised stores
	4752	Retail sale of hardware, paints, and glass in specialised stores
	4753	Retail sale of carpets, rugs, wall and floor coverings in specialised stores
	4759	Retail sale of electrical household appliances, furniture, lighting equipment, and other household articles in specialised stores
476		Retail sale of cultural and recreation goods in specialised stores
	4761	Retail sale of books, newspapers, and stationary in specialised stores
	4762	Retail sale of music and video recordings in specialised stores
	4763	Retail sale of sporting equipment in specialised stores
	4764	Retail sale of games and toys in specialised stores
477		Retail sale of other goods in specialised stores
	4771	Retail sale of clothing, footwear, and leather articles in specialised stores
	4772	Retail sale of pharmaceutical and medical goods, cosmetic and toilet articles in specialised stores
	4773	Other retail sale of new goods in specialised stores
	4774	Retail sale of second-hand goods
478		Retail sale via stalls and markets
	4781	Retail sale via stalls and markets of food, beverages, and tobacco products
	4782	Retail sale via stalls and markets of textiles, clothing, and footwear
	4789	Retail sale via stalls and markets of other goods
479		Retail trade not in stores, stalls, or markets
	4791	Retail sale via mail order houses or via Internet
	4799	Other retail sale not in stores, stalls, or markets

Section H

Transportation and storage

Division	Group	Class	Description
Division 49			Land transport and transport via pipelines
	491		Transport via railways
		4911	Passenger rail transport, interurban
		4912	Freight rail transport
	492		Other land transport
		4921	Urban and suburban passenger land transport
		4922	Other passenger land transport
		4923	Freight transport by road
	493	4930	Transport via pipeline
Division 50			Water transport
	501		Sea and coastal water transport
		5011	Sea and coastal passenger water transport
		5012	Sea and coastal freight water transport
	502		Inland water transport
		5021	Inland passenger water transport
		5022	Inland freight water transport
Division 51			Air transport
	511	5110	Passenger air transport
	512	5120	Freight air transport
Division 52			Warehousing and support activities for transportation
	521	5210	Warehousing and storage
	522		Support activities for transportation
		5221	Service activities incidental to land transportation
		5222	Service activities incidental to water transportation
		5223	Service activities incidental to air transportation
		5224	Cargo handling
		5229	Other transportation support activities
Division 53			Postal and courier activities
	531	5310	Postal activities
	532	5320	Courier activities

Section I

Accommodation and food service activities

Division	Group	Class	Description
Division 55			Accommodation
	551	5510	Short-term accommodation activities
	552	5520	Camping grounds, recreational vehicle parks, and trailer parks
	559	5590	Other accommodation
Division 56			Food and beverage service activities
	561	5610	Restaurants and mobile food service activities
	562		Event catering and other food service activities
		5621	Event catering
		5629	Other food service activities
	563	5630	Beverage serving activities

Section J

Information and communication

Division	Group	Class	Description
Division 58			Publishing activities
	581		Publishing of books, periodicals, and other publishing activities
		5811	Book publishing
		5812	Publishing of directories and mailing lists
		5813	Publishing of newspapers, journals, and periodicals
		5819	Other publishing activities
	582	5820	Software publishing
Division 59			Motion picture, video and television programme production, sound recording and music publishing activities
	591		Motion picture, video and television programme activities
		5911	Motion picture, video and television programme production activities
		5912	Motion picture, video and television programme post-production activities
		5913	Motion picture, video and television programme distribution activities
		5914	Motion picture projection activities
	592	5920	Sound recording and music publishing activities

Division	Group	Class	Description
Division 60			Programming and broadcasting activities
	601	6010	Radio broadcasting
	602	6020	Television programming and broadcasting activities
Division 61			Telecommunications
	611	6110	Wired telecommunications activities
	612	6120	Wireless telecommunications activities
	613	6130	Satellite telecommunications activities
	619	6190	Other telecommunications activities
Division 62			Computer programming, consultancy, and related activities
		6201	Computer programming activities
		6202	Computer consultancy and computer facilities management activities
		6209	Other information technology and computer service activities
Division 63			Information service activities
	631		Data processing, hosting, and related activities; web portals
		6311	Data processing, hosting, and related activities
		6312	Web portals
	639		Other information service activities
		6391	News agency activities
		6399	Other information service activities n.e.c.

Section K

Financial and insurance activities

Division	Group	Class	Description
Division 64			Financial service activities, except insurance and pension funding
	641		Monetary intermediation
		6411	Central banking
		6419	Other monetary intermediation
	642	6420	Activities of holding companies
	643	6430	Trusts, funds, and similar financial entities
	649		Other financial service activities, except insurance and pension funding activities
		6491	Financial leasing
		6492	Other credit granting
		6499	Other financial service activities, except insurance and pension funding activities, n.e.c.
Division 65			Insurance, reinsurance and pension funding, except compulsory social security
	651		Insurance
		6511	Life insurance
		6512	Non-life insurance
	652	6520	Reinsurance
	653	6530	Pension funding

Division	Group	Class	Description
Division 66			Activities auxiliary to financial service and insurance activities
	661		Activities auxiliary to financial service activities, except insurance and pension funding
		6611	Administration of financial markets
		6612	Security and commodity contracts brokerage
		6619	Other activities auxiliary to financial service activities
	662		Activities auxiliary to insurance and pension funding
		6621	Risk and damage evaluation
		6622	Activities of insurance agents and brokers
		6629	Other activities auxiliary to insurance and pension funding
	663	6630	Fund management activities

Section L

Real estate activities

Division	Group	Class	Description
Division 68			Real estate activities
	681	6810	Real estate activities with own or leased property
	682	6820	Real estate activities on a fee or contract basis

Section M

Professional, scientific, and technical activities

Division	Group	Class	Description
Division 69			Legal and accounting activities
	691	6910	Legal activities
	692	6920	Accounting, bookkeeping, and auditing activities; tax consultancy
Division 70			Activities of head offices; management consultancy activities
	701	7010	Activities of head offices
	702	7020	Management consultancy activities
Division 71			Architectural and engineering activities; technical testing and analysis
	711	7110	Architectural and engineering activities and related technical consultancy
	712	7120	Technical testing and analysis
Division 72			Scientific research and development
	721	7210	Research and experimental development on natural sciences and engineering
	722	7220	Research and experimental development on social sciences and humanities
Division 73			Advertising and market research
	731	7310	Advertising
	732	7320	Market research and public opinion polling
Division 74			Other professional, scientific, and technical activities
	741	7410	Specialised design activities

742	7420	Photographic activities
749	7490	Other professional, scientific, and technical activities n.e.c.

Section N

Administrative and support service activities

Division	Group	Class	Description
Division 77			Rental and leasing activities
	771	7710	Renting and leasing of motor vehicles
	772		Renting and leasing of personal and household goods
		7721	Renting and leasing of recreational and sports goods
		7722	Renting of videotapes and disks
		7729	Renting and leasing of other personal and household goods
	773	7730	Renting and leasing of other machinery, equipment, and tangible goods
	774	7740	Leasing of intellectual property and similar products, except copyrighted works
Division 78			Employment activities
	781	7810	Activities of employment placement agencies
	782	7820	Temporary employment agency activities
	783	7830	Other human resources provision
Division 79			Travel agency, tour operator, reservation service, and related activities
	791		Travel agency and tour operator activities
		7911	Travel agency activities
		7912	Tour operator activities
	799	7990	Other reservation service and related activities
Division 80			Security and investigation activities
	801	8010	Private security activities
	802	8020	Security systems service activities
	803	8030	Investigation activities
Division 81			Services to buildings and landscape activities
	811	8110	Combined facilities support activities
	812		Cleaning activities
		8121	General cleaning of buildings
		8129	Other building and industrial cleaning activities
	813	8130	Landscape care and maintenance service activities
Division 82			Office administrative, office support, and other business support activities
	821		Office administrative and support activities
		8211	Combined office administrative service activities
		8219	Photocopying, document preparation, and other specialised office support activities
	822	8220	Activities of call centres
	823	8230	Organisation of conventions and trade shows
	829		Business support service activities n.e.c.

	8291	Activities of collection agencies and credit bureaus
	8292	Packaging activities
	8299	Other business support service activities n.e.c.

Section O

Public administration and defence; compulsory social security

Division	Group	Class	Description
Division 84			Public administration and defence; compulsory social security
	841		Administration of the State and the economic and social policy of the community
		8411	General public administration activities
		8412	Regulation of the activities of providing healthcare, education, cultural services, and other social services, excluding social security
		8413	Regulation of and contribution to a more efficient operation of businesses
	842		Provision of services to the community as a whole
		8421	Foreign affairs
		8422	Defence activities
		8423	Public order and safety activities
	843	8430	Compulsory social security activities

Section P

Education

Division	Group	Class	Description
Division 85			Education
	851	8510	Pre-primary and primary education
	852		Secondary education
		8521	General secondary education
		8522	Technical and vocational secondary education
	853	8530	Higher education
	854		Other education
		8541	Sports and recreation education
		8542	Cultural education
		8549	Other education n.e.c.
	855	8550	Educational support activities

Section Q

Human health and social work activities

Division	Group	Class	Description
Division 86			Human health activities
	861	8610	Hospital activities
	862	8620	Medical and dental practice activities
	869	8690	Other human health activities
	871	8710	Residential nursing care facilities
	872	8720	Residential care activities for mental retardation, mental health, and substance abuse
	873	8730	Residential care activities for the elderly and disabled
	879	8790	Other residential care activities
Division 88			Social work activities without accommodation
	881	8810	Social work activities without accommodation for the elderly and disabled
	889	8890	Other social work activities without accommodation

Section R

Arts, entertainment, and recreation

Division	Group	Class	Description
Division 90			Creative, arts, and entertainment activities
	900	9000	Creative, arts, and entertainment activities
Division 91			Libraries, archives, museums, and other cultural activities
		9101	Library and archives activities
		9102	Museums activities and operation of historical sites and buildings
		9103	Botanical and zoological gardens and nature reserves activities
Division 92			Gambling and betting activities
	920	9200	Gambling and betting activities
Division 93			Sports activities and amusement and recreation activities
	931		Sports activities
		9311	Operation of sports facilities
		9312	Activities of sports clubs
		9319	Other sports activities
	932		Other amusement and recreation activities
		9321	Activities of amusement parks and theme parks
		9329	Other amusement and recreation activities n.e.c.

Section S

Other service activities

Division	Group	Class	Description
Division 94			Activities of membership organisations
	941		Activities of business, employers, and professional membership organisations
		9411	Activities of business and employers membership organisations
		9412	Activities of professional membership organisations
	942	9420	Activities of trade unions
	949		Activities of other membership organisations
		9491	Activities of religious organisations
		9492	Activities of political organisations
		9499	Activities of other membership organisations n.e.c.
Division 95			Repair of computers and personal and household goods
	951		Repair of computers and communication equipment
		9511	Repair of computers and peripheral equipment
		9512	Repair of communication equipment
	952		Repair of personal and household goods
		9521	Repair of consumer electronics
		9522	Repair of household appliances and home and garden equipment
		9523	Repair of footwear and leather goods
		9524	Repair of furniture and home furnishings
		9529	Repair of other personal and household goods
Division 96			Other personal service activities
		9601	Washing and (dry-) cleaning of textile and fur products
		9602	Hairdressing and other beauty treatment
		9603	Funeral and related activities
		9609	Other personal service activities n.e.c.

Section T

Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use

Division	Group	Class	Description
Division 97			Activities of households as employers of domestic personnel
	970	9700	Activities of households as employers of domestic personnel
Division 98			Undifferentiated goods- and services-producing activities of private households for own use
	981	9810	Undifferentiated goods-producing activities of private households for own use
	982	9820	Undifferentiated service-producing activities of private households for own use

Section U

Activities of extraterritorial organisations and bodies

Division	Group	Class	Description
Division 99			Activities of extraterritorial organisations and bodies
	990	9900	Activities of extraterritorial organisations and bodies

6. Sample of filling the questionnaire

6.1 Electricity supply

The following is the sample information of Company B. Please note that this reflects dummy – and not actual – data.

Table 5.2 Electricity Supply

Date: 31 March 2020	
Annual Electricity Supply Calendar Year 2019 (January 2019 to December 2019)	
	Unit: GWh
Gross Generation	16.205
Hydro	14.000
Biomass (Bagasse, etc.)	5
Solar PV	0,001
Oil	0
Coal	2.200
Total Own Use¹	590
Net Generation	15.615
Hydro	14.000
Biomass (Bagasse, etc.)	3
Solar PV	0,001
Oil	
Coal	1.612
Purchase from IPP²	1.000
Total Imports	2.000
Total Exports	12.000

Inland Deliveries/Sales	5.411
Total Transmission & Distribution Losses	1.204
Fuel Used for Electricity Generation	
Coal (tonnes)	135
Oil (kl)	0
Bagasse (tonnes)	100
Installed Capacity (MW)	4.200
Hydro	1.600
Biomass (Bagasse, etc.)	600
Solar PV	
Oil	
Coal	2.000

Note:

1. Electricity used by the generator for auxiliary services (e.g. lighting, coal grinders) and internal losses.

The cells highlighted in pink are linked cells from the 'Imports, Exports and Electricity Sales Electricité Du Laos (EDL)' tabs.

2. IPP = independent power producer

1) Gross Generation – Do not enter data in this row, which is automatically calculated by the formula: Hydro + Biomass (Bagasse, etc.) + Solar PV + Oil + Coal

- Hydro = 16,205 GWh; under 'Electricity Supply tab' in the questionnaire, enter '16,205 GWh' in the row 'Hydro, column Unit: GWh'.
- Biomass (Bagasse, etc.) = 5 GWh; under 'Electricity Supply tab' in the questionnaire, enter '5 GWh' in the row 'Biomass (Bagasse, etc.), column Unit: GWh'.
- Solar PV = 0.001 GWh; under 'Electricity Supply tab' in the questionnaire, enter '0.001 GWh' in the row 'Solar PV, column Unit: GWh'.
- Oil – In this example, Company B does not use oil to produce electricity. Under 'Electricity Supply tab' in the questionnaire, enter '0 GWh' in the row 'Oil, column Unit: GWh'.
- Coal = 2,200 GWh; under 'Electricity Supply tab' in the questionnaire, enter 2,200 GWh in the row 'Coal, column Unit: GWh'.

2) Total Own Use – In this example, Company B used 590 GWh for internal use. Under 'Electricity Supply tab' in the questionnaire, enter '590 GWh' in the row 'Total Own Use, column Unit: GWh'.

3) Net Generation – Do not enter data in this row, which is automatically calculated by the formula: Hydro + Biomass (Bagasse, etc.) + Solar PV + Oil + Coal

- Hydro = 14,000 GWh; under the 'Electricity Supply tab' of the questionnaire, enter '14,000 GWh' in the row 'Hydro, column Unit: GWh'.

- Biomass (Bagasse, etc.) = 3 GWh; under the 'Electricity Supply tab' of the questionnaire, enter '3 GWh' in the row 'Biomass (Bagasse, etc.)', column Unit: GWh'.
- Solar PV = 0.001 GWh; under the 'Electricity Supply tab' of the questionnaire, enter '0.001 GWh' in the row 'Solar PV', column Unit: GWh'.
- Oil – In this example, Company B has not used oil to produce electricity. In the questionnaire 'Electricity Supply tab', enter zero in the row 'Oil', column Unit: GWh'.

4) Purchase from Independent Power Producer (IPP) – In this example, Company B purchased 1,000 GWh. Under the 'Electricity Supply tab' of the questionnaire, enter '1,000 GWh' in the row 'Purchase from IPPs', column Unit: GWh'.

5) Total Imports – Do not enter data in this row. The cells highlighted in pink are linked to and automatically calculated from the 'Imports by Origin' tab, i.e. total electricity imported. Company B must enter data in the 'Imports by Origin' tab to fill the 'Total Import' row. In this example, Company B imported 2,000 GWh of electricity, i.e. Total Import = 2,000 GWh.

6) Total Exports – Do not enter data in this row. The cells highlighted in pink are linked to and automatically calculated from the 'Exports by Destination' tab, i.e. total electricity exported. Company B must enter data in the 'Exports by Destination' tab to fill the 'Total Export' row. In this example, Company B exported 12,000 GWh of electricity, i.e. Total Export = 12,000 GWh.

7) Inland Deliveries/Sales (for Electricité Du Laos [EDL]) – Do not enter data in this row. The cells highlighted in pink are linked to and automatically calculated from the 'Electricity Sales EDL' tab, i.e. total electricity sold. Company B (EDL) must enter data in the 'Electricity Sales EDL' tab to fill the 'Inland Deliveries/Sales' row. In this example, Company B (EDL) sold 5,411 GWh of electricity, i.e. Inland Deliveries/Sales = 5,411 GWh.

8) Inland Deliveries/Sales (to EDL – for IPP) – Enter data in this row for IPP as IPP does not have an 'Electricity Sale' tab. In this example, Company B (IPP) sold 4,411 GWh of electricity to EDL; enter 4,411 GWh in the row 'Sales to EDL', column Unit: GWh'.

9) Total Transmission and Distribution Losses – In this example, Company B has total transmission and distribution losses of 1,204 GWh of electricity, i.e. Total Transmission and Distribution Losses = 1,204 GWh.

10) Fuel Used for Electricity Generation – In this example, Company B has used the following fuels for electricity generation:

- Coal = 135 tonnes; under the 'Electricity Supply tab' of the questionnaire, enter '135 tonnes' in the row 'Coal (Tonnes)', column Unit: GWh'.
- Oil – In this example, Company B has not used oil for electricity generation. Under the 'Electricity Supply tab' of the questionnaire, enter 0 Kl in the row 'Oil (Kl)', column Unit: GWh'.
- Bagasse = 100 tonnes; under the 'Electricity Supply tab' of the questionnaire, enter '100 tonnes' in the row 'Bagasse', column Unit: GWh'.

11) Installed Capacity (MW) – Do not enter data in this row, which is automatically calculated by the formula: Hydro + Biomass (Bagasse, etc.) + Solar PV + Oil + Coal

- Hydro = 1,600 MW; under the 'Electricity Supply tab' of the questionnaire, enter '1,600 MW' in the row 'Hydro – Installed Capacity (MW)', column Unit: GWh'.
- Biomass (Bagasse, etc.) = 600 MW; under the 'Electricity Supply tab' of the questionnaire, enter 600 MW in the row 'Biomass (Bagasse, etc.) – Installed Capacity (MW)', column Unit: GWh'.
- Solar PV – In this example, Company B has not reported installed capacity for 'Solar PV'. On the questionnaire, enter '0 MW' in the row 'Solar PV – Installed Capacity (MW)', column Unit: GWh'.
- Oil – In this example, Company B has not reported installed capacity for 'Oil'. On the questionnaire, enter '0 MW' in the row 'Oil – Installed Capacity (MW)', column Unit: GWh'.
- Coal = 2,000 MW; under 'Electricity Supply tab' of the questionnaire, enter '2,000 MW' in the row 'Coal – Installed Capacity (MW)', column Unit: GWh'.

12) Result of filling the 'Electricity Supply' tab of the questionnaire

Table 5.2 shows the filled questionnaire using the above information and instructions.

6.2 Electricity consumption

The following is the sample information of Company B. Please note that this reflects dummy – and not actual – data.

Table 5.3 Electricity Consumption

Company name: Company B Date: 31 March 2020		
Annual Electricity Sales by Sector - Unit in MWh Calendar Year 2019 (January 2019 to December 2019)		
Sales classification	ISIC Revision 4, 2008	Electricity Sold (MWh)
Agriculture		35
Agriculture/Forestry	Divisions 01 & 02	35
Fishing	Division 03	
Industrial		2.536
Iron and steel	Group 241 & Class 2431	
Chemical and petrochemical	Divisions 20 & 21	
Non-ferrous metals	Group 242 & Class 2432	
Non-metallic minerals	Division 23	
Transport equipment	Divisions 29 & 30	
Machinery	Divisions 25, 26, 27 & 28	
Mining and quarrying	Divisions 07 & 08	
Food, beverages, and tobacco	Divisions 10, 11 & 12	
Paper, pulp, and printing	Divisions 17 & 18	
Wood and wood products	Division 16	
Construction	Divisions 41, 42 & 43	
Textiles and leather	Divisions 13, 14 & 15	
Not elsewhere specified (Industry)	Divisions 22, 31 & 32	2.536
Transport	Divisions 49, 50 & 51	
Rail		
Domestic navigation		
Not-specified (Transport)		
Commercial and public services	Divisions 33 to 39, 45 to 47, 52 to 53, 55 to 56, 58 to 66, 68 to 96 & 99	1.000
Residential	Divisions 97 & 98	1.800
Other - Not elsewhere specified	Not included elsewhere above	40
Total Sold		5.411

Notes:

ISIC: International Standard Industries Classification of All Economic Activities (ISIC) Revision 4, Department of Economic and Social Affairs, Statistics Division, United Nations New York, 2008.

GST : Goods and Services Tax.

Sources:

This questionnaire is based on the International Energy Agency (IEA)'s electricity annual questionnaire in July 2019, Energy Statistics Division, and the classification is based on UN-DESA (2008).

1) Agriculture – Do not enter data in this row which is automatically calculated by the formula:
Agriculture/Forestry + Fishing.

- Agriculture/Forestry – In this example, Company B sold electricity for 'Agriculture/Forestry', i.e. Agriculture/Forestry = 35 MWh. Enter '35 MWh' in this row.
- Fishing – Company B has not sold electricity for 'Fishing', i.e. Fishing = 0 MWh. Enter zero or leave the cell blank.

2) Industrial – Do not enter data in this row which is automatically calculated by the following formula: Iron and steel + Chemical and petrochemical + Non-ferrous metals + Non-metallic minerals

+ Transport equipment + Machinery + Mining and quarrying + Food, beverages, and tobacco + Paper, pulp, and printing + Wood and wood products + Construction + Textiles and leather + Not elsewhere specified (Industry)

- Industry – In this example, Company B has not sold electricity for the ‘Industry’ sector except for the category ‘Not elsewhere specified (Industry)’. Enter zero or leave the cells blank.
- Not elsewhere specified (Industry) – Company B has sold 2,536 MWh of electricity for the category that is not listed in the ‘Industry’ sector. The category ‘Not elsewhere specified (Industry)’ might be used, i.e. Not elsewhere specified (Industry)= 2,536 MWh.

3) Transport – Do not enter data in this row which is automatically calculated by the formula: Rail + Domestic Navigation + Not-specified (Transport)

- Rail – In this example, Company B has not sold electricity for ‘Rail’, i.e. Rail = 0 MWh. Enter zero in this row or leave the cell blank.
- Domestic navigation – Company B has not sold electricity for ‘Domestic navigation’, i.e. Domestic navigation = 0 MWh. Enter zero in this row or leave the cell blank.
- Not-specified (Transport) – In this example, Company B has not sold electricity for ‘Not-specified (Transport)’, i.e. Not-specified (Transport) = 0 MWh. Enter zero in this row or leave the cell blank.

4) Commercial and public services – In this example, Company B has sold 1,000 MWh of electricity for the ‘Commercial and public services’ sectors. Enter ‘1,000 MWh’ in this row.

5) Residential – In this example, Company B has sold 1,800 MWh of electricity for the ‘Residential’ sector. Enter ‘1,800 MWh’ in this row.

6) Other – Not elsewhere specified – In this example, Company B has sold 40 MWh of electricity for the sector that is not listed above, i.e. ‘Other – Not elsewhere specified’. Enter ‘40 MWh’ in this row.

7) Total sold – Do not enter data in this row which is automatically calculated by the formula: Agriculture + Industrial + Transport + Commercial and Public Services + Residential + ‘Other – Not elsewhere specified’.

8) Result of filling the ‘Electricity Consumption’ tab of the questionnaire

Table 5.3 shows the filled questionnaire using the above information and instructions.

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6.3 Imports by origin

If Company B imported electricity, enter the import data in the ‘Electricity Supply’ tab.

Note that this reflects dummy – not actual – data.

Table 5.4 Imports by Origin

Company name: Company B Date: 31 March 2020	
Imports by Origin - Electricity Calendar Year 2019 (January 2019 to December 2019)	
	Unit: GWh
APEC Economies	2.000
Australia	
Brunei Darussalam	
Canada	
Chile	
China	800
Hong Kong, China	
Indonesia	
Japan	
Republic of Korea	
Malaysia	
Mexico	
New Zealand	
Papua New Guinea	
Peru	
Philippines	
Russian Federation	
Singapore	
Chinese Taipei	
Thailand	500
United States of America	
Viet Nam	700
ASEAN (non-APEC) Economies	0
Myanmar	
Lao PDR	
Cambodia	
Rest of the World	0
Other Asia and Pacific	
Other Americas	
Europe & Former Soviet Union (excluding Russia)	
Middle East	
Africa	
Unknown	
Total	2.000

Note:

Please do not enter data on the cells highlighted in yellow. They are automatically calculated for the total coal imported from a group of economies or regions worldwide.

1) APEC Economies – Do not enter data in the cell highlighted in **yellow**. It is automatically calculated for the total electricity imported from a group of APEC economies.

- Import from China – In this example, Company B imported 800 GWh of ‘Electricity’ from China. Enter 800 GWh in this row.
- Import from Thailand – Company B imported 500 GWh of ‘Electricity’ from Thailand. Enter ‘500 GWh’ in this row.
- Import from Viet Nam – Company B imported 700 GWh of ‘Electricity’ from Viet Nam. Enter ‘700 GWh’ in this row.

2) ASEAN (non-APEC), Rest of the World, and Unknown Economies – Do not enter data in the cells highlighted in **yellow**. They are automatically calculated for the total electricity imported from a group of ASEAN (non-APEC) economies or regions globally.

Where no origin can be reported or where the country is not specified in the questionnaire, the category 'Unknown' may be used.

3) Total – Do not enter data in this row, which is automatically calculated by the formula: APEC Economies + ASEAN (non-APEC) + Rest of the World + Unknown

4) Result of filling the 'Import' tab of the questionnaire

Table 5.4 shows how to fill the 'Import' tab using the above information and instructions.

6.4 Exports by destination

If Company B exported electricity, enter the export data in this tab to show the total export in the 'Electricity Supply' tab. Note that dummy – and not actual – data is used in the example.

Table 5.5 Exports by Destination

Company name: Company B Date: 31 March 2020	
Exports by Destination - Electricity Calendar Year 2019 (January 2019 to December 2019)	
	Unit: GWh
APEC Economies	8.000
Australia	
Brunei Darussalam	
Canada	
Chile	
China	
Hong Kong, China	
Indonesia	
Japan	
Republic of Korea	
Malaysia	
Mexico	
New Zealand	
Papua New Guinea	
Peru	
Philippines	
Russian Federation	
Singapore	
Chinese Taipei	
Thailand	8.000
United States of America	
Viet Nam	
ASEAN (non-APEC) Economies	4.000
Myanmar	
Lao PDR	
Cambodia	4.000
Rest of the World	0
Other Asia and Pacific	
Other Americas	
Europe & Former Soviet Union (excluding Russia)	
Middle East	
Africa	
Unknown	
Total	12.000

Note:

Please do not enter data on the cells highlighted in yellow. They are automatically calculated for the total coal exported to a group of economies or regions worldwide.

1) APEC Economies – Do not enter data in the cell highlighted in yellow. It is automatically calculated for the total electricity exported to all APEC economies.

- Export to Thailand – In this example, Company B exported 8,000 GWh of 'Electricity' to Thailand. Enter 8,000 GWh in this row.

2) ASEAN (non-APEC) Economies – Do not enter data in the cell highlighted in yellow. It is automatically calculated from the total electricity exported to all ASEAN (non-APEC) economies.

- Export to Cambodia – In this example, Company B exported 4,000 GWh of 'Electricity' to Viet Nam. Enter '4,000 GWh' in this row.

3) Rest of the World and Unknown Economies – Do not enter data in the cells highlighted in yellow. They are automatically calculated for the total electricity exported to regions globally.

Where no destination can be reported or where the country is not specified in the questionnaire, the category 'Unknown' may be used.

4) Total – Do not enter data in this row which is automatically calculated by the formula: APEC Economies + ASEAN (non-APEC) + Rest of the World + Unknown

5) Result of filling the 'Export' tab of the questionnaire

Table 5.5 shows how to fill the 'Export' tab using the above examples and instructions.

References

International Energy Agency (IEA) (2005), *Energy Statistics Manual*. Paris: IEA.

United Nations Department of Economic and Social Affairs (UN-DESA) (2008), *International Standard Industries Classification of All Economic Activities (ISIC)*, Revision 4. New York: UN.

Chapter 6

Biomass Supply and Demand Data

1. Introduction

Biomass energy has played an important role in the Lao PDR, especially as cooking fuel in the residential sector. The industry and the commercial sectors also consume biomass but at a lesser amount. The share of biomass in the total final energy consumption was 60.8 % in 2010. The share decreased to 46.1% by 2018 as households consumed more LPG and more efficient biomass stove became available in the rural areas (MEM, 2020).

Biomass consumed were mainly fuelwood and charcoal; bagasse was also used to generate electricity besides the final sectors – residential, commercial, and industry. Biomass data are usually estimated since most of the biomass consumed are non-commercial biomass (fuelwood). The commercial biomass in the Lao PDR is charcoal, and production data are available from large charcoal factories. The amount of fuelwood used to produce the charcoal has not been reported to the MEM. In this regard, it will be necessary to develop a questionnaire for the charcoal companies to enable the MEM to collect commercial biomass energy data.

This chapter aims to inform the biomass supply and demand data of the Lao PDR, assess the missing data, and design a questionnaire for the commercial biomass supply companies to improve these commercial biomass data.

2. Primary Data on Biomass

Based on the *Lao PDR Energy Statistics 2018* (MEM, 2018), primary biomass data cover fuelwood and charcoal production and their consumption in the final sector in 2000–2015. Final sector consumption was estimated, and fuelwood production was assumed to be the same as final sector consumption. Charcoal production was based on the production data available from some charcoal factories. The MEM continues to update the energy data, including biomass, and the latest was up to 2018.

2.1 Fuelwood

Fuelwood is non-commercial biomass since it is mostly obtained from cutting trees in the forest or backyards, and is thus free. No specific company cuts trees only for fuelwood

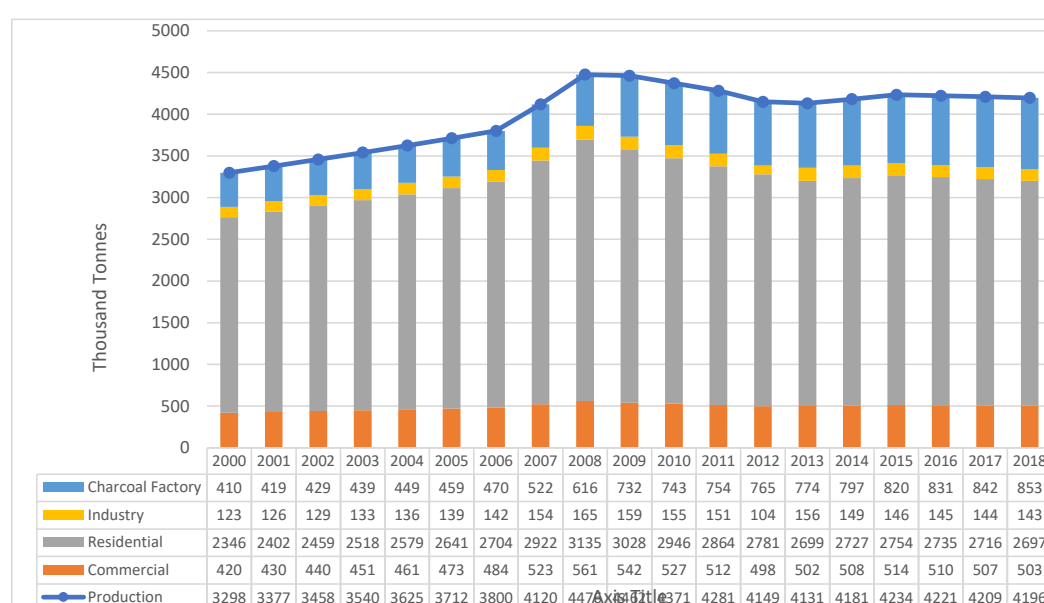
purposes and sells them commercially to households. Data on fuelwood production is therefore not available.

Fuelwood production is estimated based on the consumption in the final and transformation sectors. Final sector consumption is the consumption of the residential, commercial, and industry sectors. The transformation sector's fuelwood consumption is the amount used to produce the charcoal.

The MEM fuelwood consumption data excludes the consumption to produce the charcoal. The fuelwood requirement was estimated using the international efficiency standard of a fuelwood burner in a charcoal factory. Figure 6.1 shows the production and consumption of fuelwood from 2000 to 2018.

The Lao PDR energy statistics covers only up to 2015. From 2016 to 2018, fuelwood production data was estimated based on the rural population growth rate. Final sector fuelwood consumption was calculated based on the share of the 2015 consumption.

Figure 6.1 Production and Consumption of Fuelwood, 2000–2018



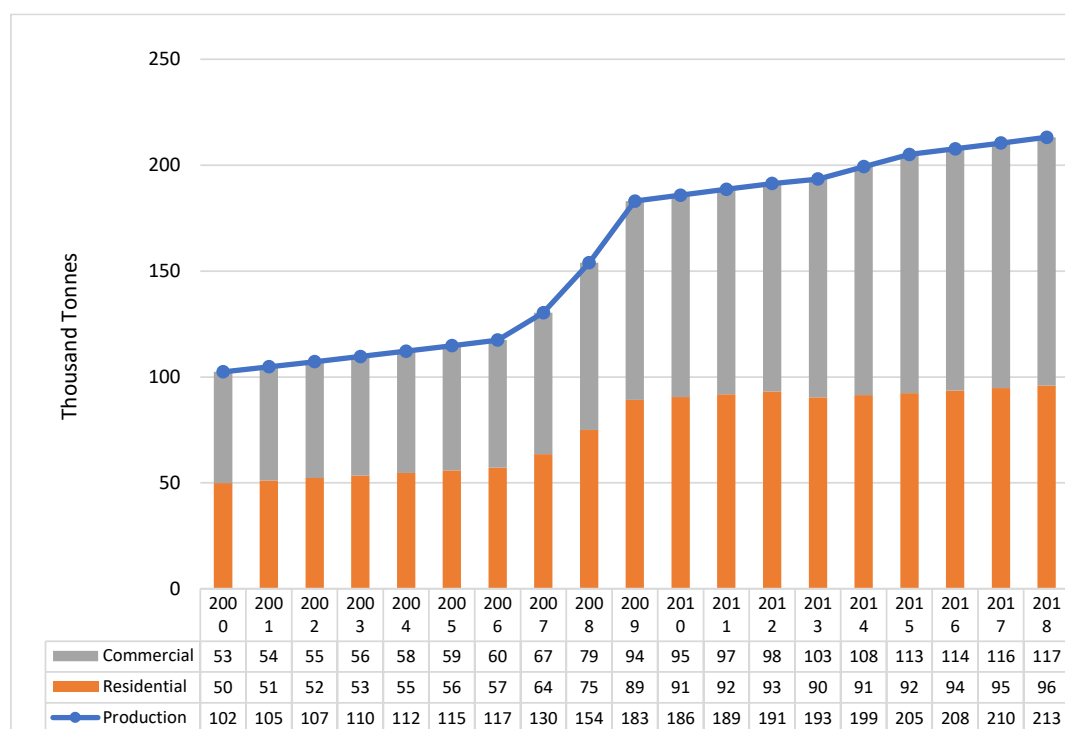
Source : MEM, Lao PDR.

2.2.Charcoal

Charcoal is consumed by the commercial and residential sectors of the Lao PDR. MEM Lao PDR has collected and estimated data on charcoal production and consumption. Charcoal is usually produced commercially and consumed for cooking, including barbecue. Some households produce their charcoal requirement, but this is small. The majority of households purchase their charcoal needs. Figure 6.2 shows the production and consumption of fuelwood from 2000 to 2018.

As in fuelwood, charcoal production data was also estimated based on the total population's growth rate. This is in line with the charcoal production data that has been increasing at almost the same rate as population growth. The charcoal consumption of the final sector was also estimated based on 2015 consumption.

Figure 6.2 Production and Consumption of Charcoal, 2000–2018

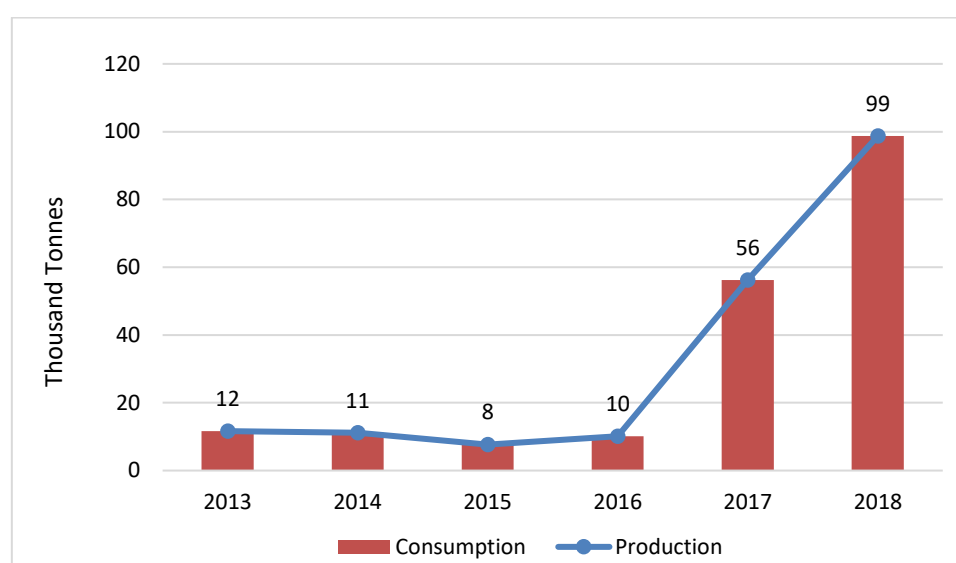


Source: MEM, Lao PDR.

2.3 Others

Other biomass includes bagasse, straw, rice husks, nut shells, etc. Currently, the data on supply and demand of other biomass types are not available. The data of the Department of Energy, Policy and Planning, MEM showed that bagasse was used to produce electricity. The quantity of bagasse used by the biomass power plant was unavailable. In this regard, the missing data was estimated. The efficiency assumption of the biomass power production is based on the international efficiency standard for biomass power production.

Figure 6.3 Bagasse Production and Consumption, 2013–2018



Source: MEM, Lao PDR.

Data on the amount of electricity generated from biomass power plants are available in the Department of Energy, Policy and Planning statistic since its first operation in 2013. Biomass power plant efficiency is assumed to be 20%, and the heating value of bagasse is assumed to be 2,000 kcal/kg. These assumptions were used to estimate the amount of bagasse consumed by the power plant, as shown in Figure 6.3. Bagasse production is the amount of bagasse consumed by the power plant.

3. Format of Biomass Energy Data Collection

The biomass energy discussed in section 2 will be entered in the reporting format for biomass (fuelwood, charcoal, bagasse). The joint questionnaire format of APEC–ASEAN, developed to build the main statistics on renewable energy, was used. This joint questionnaire format checks the data’s completeness because the questionnaire balances the supply and use of the respective products.

The APEC–ASEAN joint questionnaire consists of five questionnaires for coal, oil, gas, oil, electricity, and renewable energy products. Biomass energy is part of the renewable energy questionnaire. The questionnaire consisted of the supply data, transformation, and energy industry own use and final consumption (including non-energy use).

3.1. Commercial biomass questionnaire

The renewable energy joint APEC–ASEAN questionnaire includes biomass and other renewable energy, such as hydro, solar, wind, and biofuel. Table 6.1 shows the renewable energy in the joint questionnaire for the supply data table. As noted, renewable energy covers

biomass, biogas, industrial waste, municipal solid waste, liquid biofuels, hydro, geothermal, solar, wind, tide, wave, and ocean. Based on the primary data, the Lao PDR has only biomass, hydro, and solar. Biofuel and wind data are not yet available. Biomass includes fuelwood and wood waste, charcoal, and other biomass (bagasse, paddy husk, etc.).

Fuelwood and other biomass are mostly non-commercial fuel. Charcoal, on the other hand, is commercial biomass. Considering that hydro and solar are consumed to produce electricity, the data on the install capacity, fuel input, electricity production, losses, etc. will be covered by the electricity questionnaire. The questionnaire will only cover only commercial biomass, which is only for charcoal since biofuel companies are not yet available.

As discussed in Section 6.2.2, charcoal is produced from fuelwood in a charcoal factory. The MEM has been able to provide the charcoal production data. These data should be collected from the charcoal companies. Since charcoal is produced from fuelwood, the charcoal companies should also be able to provide the amount of fuelwood consumed to produce the charcoal. In this regard, the MEM should design the questionnaire for the charcoal companies to submit these data (fuelwood consumed and charcoal produced).

Table 6.1 Supply Data Table for Renewable Energy Joint APEC–ASEAN Questionnaire

		FuelWood & Woodwaste	Bagasse	Charcoal ²	Other Biomass ³	Biogas	Industrial Waste	Municipal Solid Waste	Liquid Biofuels	of which Biogasoline	of which Bioethanol	of which Bio-jet	of which biodiesels	Hydro	Geothermal		Solar		Tide, Wave & Ocean	Wind	
															Electricity	Heat	Photovoltaic	Thermal			
																		Electricity			Heat
1000t	1000t	1000t	1000t	10 ¹⁰ kcal (gross)	1000t	1000t	1000t	1000t	1000t	1000t	1000t	1000t	GWh	GWh	10 ¹⁰ kcal (gross)	GWh	10 ¹⁰ kcal (gross)	GWh	GWh		
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Production ¹	(+) 1	4.196	99	213,17										22.999			60				
Imports	(+) 2																				
Exports	(-) 3																				
Stock Changes (+ or -)	(+) 4	-	-	-	-	-	-	-	-	-	-	-	-								
Gross Inland Deliveries (calculated)	(=) 5	4.196	99	213	-	-	-	-	-	-	-	-	-	22.999	-	-	60	-	-	-	-
Statistical Differences	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gross Inland Deliveries (observed)	7	4.196	99	213	-	-	-	-	-	-	-	-	-	22.999	-	-	60	-	-	-	-
TOTAL STOCKS on NATIONAL TERRITORY																					
Total stocks on national territory - Opening	8																				
Total stocks on national territory - closing	9																				

Notes:

1. This includes production of both primary and secondary energy. However, only quantities used for energy purposes should be reported. For example, only the amount of bagasse that are used as fuel should be reported and not all the amount of bagasse pr
2. Charcoal covers solid residue of the destructive distillation and pyrolysis of wood and other vegetal material.
3. Other Biomass includes agricultural wastes such as straw, rice husks, nut shells, poultry litter, crushed grape dregs, etc. and other wastes that are not classified as woodwaste, industrial and municipal solid wastes.

The basis for designing this questionnaire is the APEC–ASEAN Questionnaire. This includes data on charcoal production, the amount of fuelwood consumed to produce charcoal, the sales of charcoal domestically (by sector), and export of charcoal.

The charcoal company's questionnaire comprises charcoal production and export and sales to the final sector (industry, residential, and commercial). In case of export, specify the volume and country of destination. In addition, the questionnaire also contains the amount of fuelwood and other biomass consumed by the charcoal factory and own use (if any). Table 6.2 shows the commercial biomass questionnaire for the charcoal factories. For each questionnaire, state the charcoal company's name and the date of completion.

Table 6.2 Commercial Biomass Questionnaire for Charcoal Company

Company name:			
Date:			
	Unit	2019	2020
Charcoal Production	ton		
Charcoal Export (specify by country destination)			
Country:	ton		
Country:	ton		
Country:	ton		
Country:	ton		
Country: Others	ton		
Total Charcoal Export	ton		
Charcoal Factory input			
Wood	ton		
Others (please specify)			
--Specify 1	ton		
--Specify 2	ton		
Own Use	ton		
Charcoal Sales (Domestic)			
Industry	ton		
Residential	ton		
Commercial	ton		
Total Charcoal Sales	ton		

3.2 Unit and conversion

The unit for charcoal supply and sales is tonnes. Biomass (wood and/or others) consumption used in a charcoal factory is also in tonnes. The questionnaire also includes a conversion section, which the charcoal company needs to fill in. This is the biomass average heating value (net) by type in kilocalorie per kilogram (kcal/kg).

The values of Lao PDR's renewable energy in the joint questionnaire are as follows:

- Fuelwood and wood waste: 3,820 kcal/kg
- Bagasse: 2,000 kcal/kg
- Charcoal: 6,900 kcal/kg

The IEA also provided a standard density and heating value for solid biomass (Table 6.3).

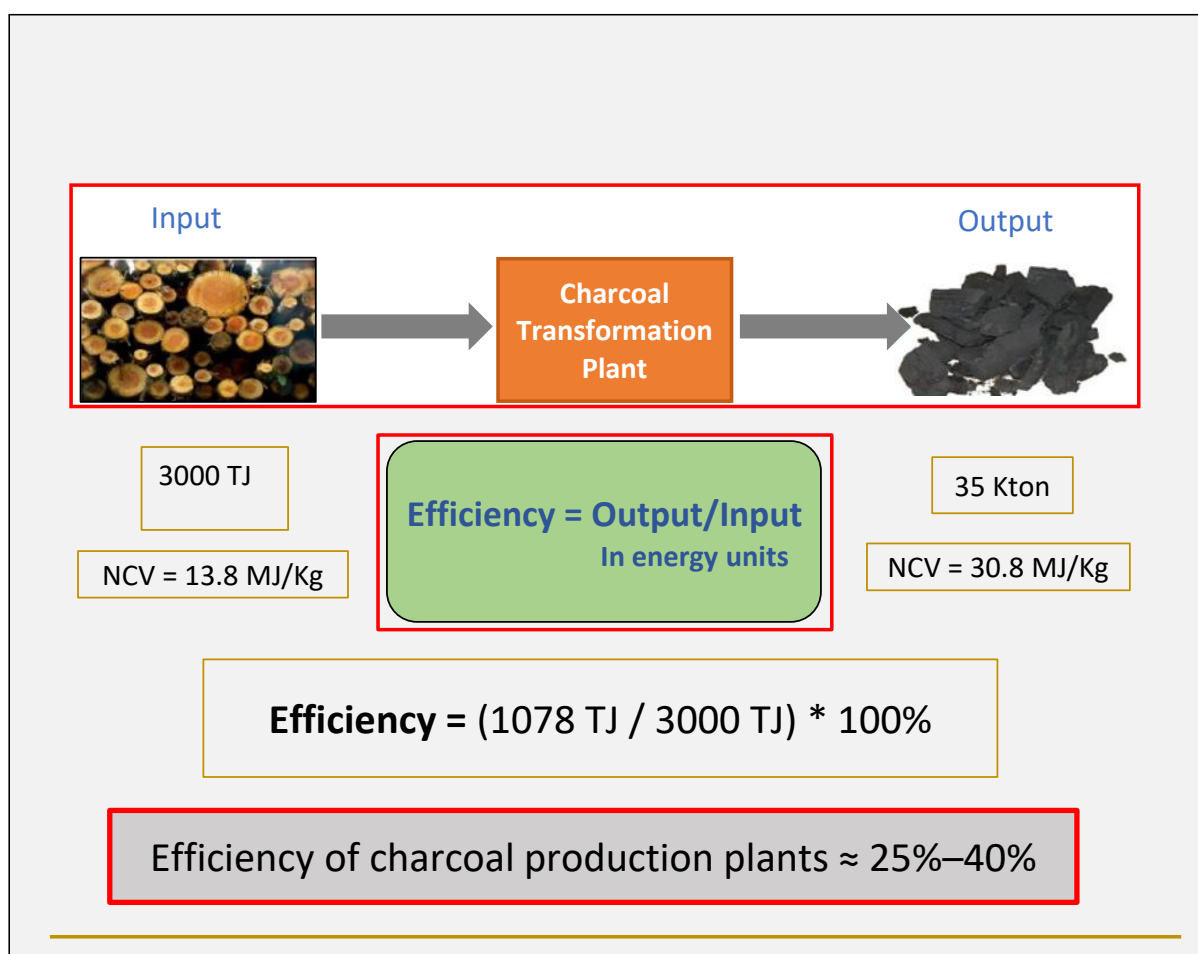
Table 6.3 IEA Standard Density and Heating Value of Solid Biomass

Product	Moisture (%, dry basis)	Density (kg/m³)	Approx. Ash Content	Net Calorific Value (MJ/kg)
Woodfuels	30	0,725	-	13,8
Charcoal	5	-	-	30,8
Bagasse	40-50	-	10-12	8.4-10.5
Broundnut shells	3-10	-	4-14	16,7
Cotton husks	5-10	-	3	16,7
Coconut husks	5-10	-	6	16,7
Rice hulls	9-11	-	15-20	13.8-15.1
Oil-palm fibres	55	-	10	7.5-8.4
Oil-palm husks	55	-	5	7.5-8.4
Corncoobs	15	-	1-2	19,3
Rice straw and husk	15	-	15-20	13,4

Source: IEA (2005).

Figure 6.4 is an example of a charcoal factory and the necessary data requirement. These are charcoal output, wood input, charcoal factory's efficiency, and the net caloric value of both wood and charcoal.

Figure 6.4 Production and Consumption of Charcoal



4. Definitions in the Lao PDR Commercial Biomass Questionnaire

The definitions in the Lao PDR commercial biomass questionnaire cover fuels and flows, including biofuels.

4.1. Definition of fuels

1) Solid biomass

- a) Fuelwood (in log, brushwood, pellet, or chip form) – Obtained from natural or managed forests or isolated trees. Also included are wood residues used as fuel, in which the original composition of wood is retained. Charcoal and black liquor are excluded.
- b) Wood waste – Yard trash and types of waste typically generated by sawmills, plywood mills, and woodyards associated with the lumber and paper industry. Examples are wood residue, cut-offs, wood chips, sawdust, wood shavings, bark, wood refuse, wood-fired boiler ash, and plywood or other bonded materials that contain only phenolic-based glues or other glues approved specifically by the administrative authority.

- c) Bagasse – Refers to the fuel obtained from the fibre, which remains after juice is extracted during sugar cane processing.
- d) Charcoal – The solid residue from the carbonisation of wood or other vegetal matter through slow pyrolysis.
- e) Other Biomass – All other solid biomass products not specifically mentioned above. This includes agricultural wastes, such as straw, rice husks, nutshells, poultry litter, crushed grape dregs, palm oil bunches, etc. The quantity of fuel used should be reported based on a net calorific value.

2) Liquid biofuels

These are liquids derived from biomass and used as fuels. These are:

- a) Biogasoline – Liquid fuels derived from biomass and used in spark ignition internal combustion engines. Biogasoline may be blended with petroleum gasoline or used directly in engines. The blending may take place in refineries or at or near the point of sale.
- b) Bioethanol – Ethanol produced from biomass
- c) Biodiesel – Liquid biofuels derived from biomass and used in diesel engines. Biodiesels may be blended with petroleum diesel or used directly in diesel engines.
- d) Bio-jet kerosene – Refers to liquid biofuels derived from biomass and blended with or replace jet kerosene.

4.2. Definition of flows

1) Supply sector

- a) Opening stock – Report the opening stock level on the first day of the year (for annual data) of stocks on national territory.
- b) Indigenous production – For commercial biomass, report the sum of final consumption (in the industrial, commercial, and residential sectors) and input for gross electricity production, commercial biomass plant, and other energy conversion plants.

PRODUCTION = Consumption of Industry Sector + Consumption of Transformation Sector + Consumption of Other Sector (Commercial, Residential, etc.) + Input gross electricity production + Input for commercial biomass plant +/- Losses

Units should be thousand metric tonnes.

For liquid biofuels, report the final consumption, quantities blended with petroleum products such as diesel and gasoline, and the amount used as input to electricity generation. Units should be thousand metric tonnes.

- c) Import and export – Report the quantity of commercial biomass obtained from or supplied to other countries. Amounts are considered imported or exported when they have crossed the country's political boundary, whether the customs office has cleared it or not. Data should be taken from importers' and exporters' declarations, although these may not be identical with customs data. The amount of fuels in transit (that is, on route through the country) should not be included.
- d) Closing stock (actual) – Report the closing stock level on the last day of the year (for annual data) of stocks in the national territory.
- e) Stock change – Report the difference between opening stock level on the first day of the year and closing stock level on the last day of the year of stocks held in the national territory. A stock build is shown as a negative number and a stock draw as a positive number.
- f) Inland delivery (calculated) – defined as: Indigenous production + Imports + Exports + Stock changes.
- g) Statistical difference – This is equal to the difference between the calculated inland delivery (as defined above) and the observed gross consumption, which corresponds to the final energy consumption plus the transformation sector, the energy sector, and distribution losses. National administrations sometimes obtain the data components of domestic availability from various sources. Owing to differences in concepts, coverage, timing, and definitions, observed and calculated inland consumptions are often not identical. The reasons for any major statistical difference should be stated in the section provided on the Remarks page.

2) Transformation sector

Report the quantities of commercial biomass and waste used for the primary or secondary conversion of energy (e.g. bagasse to electricity and biomass to charcoal) or used to transform to derived energy products (e.g. biogases used for blended natural gas). The Transformation sector is included the following sub-sectors:

- a) Main activity producer of electricity – Report quantities of commercial biomass used to produce electricity by all main activity producers.
- b) Main activity producer of combined heat and power (CHP) – Report quantities of commercial biomass used to produce electricity and heat by all main activity producers.
- c) Main activity producer of heat – Report quantities of commercial biomass used to produce heat by all main activity producers.
- d) Auto-producer of electricity – Report quantities of commercial biomass used to produce electricity by all auto producers. Otherwise, fuel used by plants containing at least one CHP unit is to be reported under auto producer of CHP.
- e) Auto producer of CHP – Report quantities of commercial biomass used that correspond to the quantity of electricity produced and heat sold by all auto producers.
- f) Auto producer of heat – Report quantities of commercial biomass used to produce heat sold by all auto producers.

- g) Biofuel blending – Report quantities of liquid biofuels that are not delivered for final consumption directly but are blended and used with other petroleum products, such as diesel and gasoline.
- h) Charcoal production plants – Report the quantity of wood used to produce charcoal.
- i) Not elsewhere specified (Transformation) – Data should be reported here only as a last resort. If a final breakdown into the above sub-sectors is not available, administrations should provide estimates wherever possible. Please inform the Secretariat of the basis for these estimates.

3) Energy sector (losses and own use in production or transformation) – Report renewable energy consumed by the energy sector to support the transformation activities. For example, renewable energies and waste used for heating, lighting, or operating pumps or compressors. Note those quantities of renewable energies and waste transformed into another energy form should be reported under the Transformation sector.

4) Total final energy consumption

a) Industry – Report fuels derived from commercial biomass consumed by the industrial undertaking in support of its primary activities. Report quantities of fuels consumed in heat or CHP plants to produce heat used by the plant itself. Quantities of fuels consumed to produce heat that is sold and to produce electricity should be reported under the appropriate Transformation sector. The sub-sectors of industry are as follows:

- Iron and steel – ISIC Group 241 and Class 2431. The consumption in coke ovens and blast furnaces are defined as part of Transformation Processes and Energy Industry Own Use.
 - This class includes conversion operations by reducing iron ore in blast furnaces and oxygen converters, or ferrous waste and scrap in electric arc furnaces, or by directly reducing iron ore without fusion to obtain crude steel, which is smelted and refined in a ladle furnace. This is then poured and solidified in a continuous caster to produce semi-finished flat or long products. After reheating in rolling, drawing, and extruding operations, these products are used to manufacture finished products, such as plate, sheet, strip, bars, rods, wire, tubes, pipes, and hollow profiles.
 - This class also includes the casting of iron and steel, i.e. the activities of iron and steel foundries.
- Chemical and petrochemical – ISIC Divisions 20 and 21 (NACE Divisions 20 and 21)

Note: This heading includes petroleum products used as fuel and as feedstock (non-energy use). However, consumption should be net after deducting backflows. The breakdown of net consumption by product should be calculated by applying the same proportion of product split for gross deliveries. The consumption by plants manufacturing charcoal or enrichment or production of nuclear fuels is excluded, as these plants are considered part of the energy industries.

 - These include the manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics, and synthetic rubber in primary forms (ISIC 201).
 - These also include other chemical products (ISIC 202), man-made fibres (ISIC 203).

- Non-ferrous metals – ISIC Group 242 and Class 2432 and (NACE Group 24.4 and Classes 24.53 and 24.54)
 - These include the manufacture of precious and non-ferrous metals (ISIC 242), which are basic precious metals; production and refining of unwrought or wrought precious metals: gold, silver, platinum, etc. from ore and scrap.
 - These also include the casting of non-ferrous metals (ISIC 2432), which covers semi-finished products of aluminium, magnesium, titanium, zinc, etc.; light metals; heavy metals; precious metals; and die-casting of non-ferrous metals.
- Non-metallic minerals – ISIC Division 23, which covers glass, ceramic, cement, and other building materials industries.
 - Manufacture of glass and glass products (ISIC 231), such as flat glass, hollow glass, fibres, technical glassware, etc.
 - Manufacture of non-metallic mineral products (ISIC 239), such as ceramics, tiles, baked clay products, and cement.

Manufacturing is from raw materials to finished articles. Also included is the manufacture of shaped and finished stone and other mineral products.

- Transport equipment – ISIC and NACE Divisions 29 and 30
 - Manufacture of bodies for motor vehicles (ISIC 291), trailers, and semi-trailers (ISIC 292). These divisions include the manufacture of motor vehicles to transport passengers or freight, various parts and accessories, as well as trailers and semi-trailers (ISIC 293).
 - Manufacture of other transport equipment – These divisions include the manufacture of transport equipment, such as ship building and boat making (ISIC 301), railway locomotives and rolling stock (ISIC 302), air and spacecraft-related machinery (ISIC 303), and transport equipment not elsewhere classified (ISIC 309).
- Machinery – Report fabricated metal products, machinery, and equipment other than transport equipment. ISIC and NACE Divisions 25–28.
- Mining (excluding energy-producing industries) and quarrying – ISIC Divisions 07 and 08 and Group 099 (NACE Divisions 07 and 08 and Group 09.9)
- Food, beverages, and tobacco – ISIC and NACE Divisions 10–12
- Paper, pulp, and printing – ISIC and NACE Divisions 17 and 18. Include production of recorded media
- Wood and wood products (other than pulp and paper) – ISIC and NACE Division 16
- Construction – ISIC and NACE Divisions 41–43
- Textile and leather – ISIC and NACE Divisions 13–15
- Not elsewhere specified (Industry) – Report consumption not included above.

5) Commercial and public services

Report fuels derived from commercial biomass consumed by business and offices in the public and private sectors. These also include fuel used by all non-transport activities of ISIC and NACE Divisions 49–51. ISIC and NACE Divisions 33, 36–39, 45–47, 52–66, 68–75, 77–82, 84 (excluding Class 8422 [ISIC] and Class 84.22 [NACE]), 85–96 and 99.

6) Residential

Report fuels derived from commercial biomass consumed by all households, including ‘households with employed persons ISIC and NACE Divisions 97 and 98’.

7) Agriculture

Report fuels derived from commercial biomass consumed by users classified as agriculture, hunting, and forestry by ISIC as follows: ISIC Divisions 01 and 02 (NACE Divisions 01 and 02).

8) Fishing

Report fuels derived from commercial biomass delivered for inland, coastal, and deep-sea fishing. Fishing should cover fuels delivered to ships of all flags that have refuelled in the country (include international fishing). Also include energy used in the fishing industry as specified in ISIC and NACE Division 03.

9) Other – Not elsewhere specified

Report activities not included elsewhere. This category includes military fuel used for all mobile and stationary consumption (e.g. ships, aircraft, road, and energy used in living quarters), regardless of whether the fuel delivered is for the military of that country or another country.

References

Ministry of Mines and Energy (MME) and ERIA (2020), *Energy Demand and Supply of the Lao People’s Democratic Republic 2010–2018*. Jakarta: ERIA.

Ministry of Mines and Energy (MME) and ERIA (2018), *Lao PDR Energy Statistics 2018*. Jakarta: ERIA.

International Energy Agency (IEA) (2005), *Energy Statistics Manual*. Paris: IEA.

Chapter 7

Biomass Consumption Survey in the Household Sector

7.1 Introduction

The MEM, Lao PDR, in cooperation with ERIA, initiated a project to establish energy statistics regulation as a sub-decree in the existing statistic regulation. The regulation is necessary to strengthen MEM to be sustainable and capable of collecting energy data on a mandatory basis. The MEM could systematically collect energy data from various energy supply companies and other government agencies and corporations to compile accurate energy statistics for sustainable energy planning through this regulation.

Based on MEM energy statistics, biomass energy still accounted for most of the total final energy consumption in 2018 (46.1%), with the residential sector being the main consumer. Biomass consumption was estimated from studies and surveys conducted by several national and international institutions. No official data on biomass consumption is available. In this regard, a biomass consumption survey was conducted, which can be the basis for MEM to estimate residential biomass consumption.

This survey aims to collect urban and rural household data on biomass energy consumption to estimate national consumption. A local company will conduct the survey based on the questionnaires prepared by the MEM and ERIA.

This chapter summarises the survey's major results and assesses further if the results can be used to estimate the national biomass consumption in the residential sector from 2020 to 2025.

2. Survey Samples and Questionnaire

2.1. Survey samples

The urban and rural areas surveyed are in Vientiane Capital and Vientiane Province. The target villages were selected according to three criteria: (i) rural and or urban villages in Vientiane and Vientiane Province, (ii) covering a wide geographical spread within the two provinces, and (iii) accessible by car.

A total of 27 villages (10 urban and 17 rural), with a target of 20 surveys per village, were selected for the surveys.

2.2. Survey questionnaire

The questionnaire was prepared in close consultation with the MEM staff and the ERIA expert team. The questionnaire consisted of two parts: general information and consumption data. The questionnaire included information on the survey location, household type, family size, monthly expenditure, use of biomass by type (fuelwood, charcoal, etc.), frequency of usage, and consumption (kg). The survey also covered LPG and electricity consumption as an alternative to biomass, especially

in urban households (kg/month and kwh/month). The survey questionnaire was developed using an Excel spreadsheet (Figure 7.1)

Figure 7.1 Biomass Survey Questionnaire of Household Sector, Lao PDR

Sample Biomass Consumption Survey Questionnaire Lao PDR Residential Sector

Province : Location*) : Select Location*) : Urban
Rural

Interview Date : Interviewer ID/HP/Email :

Name of Household Head :

Type of Dwelling/Residence* : *) Specify types detail : House
Apartment
Flat
Others (Specify)

Main Occupation of Household Head : Phone number / email addr :

Household Size : Person/HH

Average monthly Expenditure**) : USD/month **) Select Expenditure Level : <150 US\$/month
151-350 US\$/month
351-500 US\$/month
501-1000 US\$/month
1001-2000 US\$/month
>2000 US\$/month

Do you have business area in your house***) ***) Select Business Type : No business area
Retail shop
Restaurant
Others (Specify)

Biomass Consumption

1. Total biomass consumption in your household? A kg

2. Usage of wood and wood waste, ... and other biomass

KIND OF BIOMASS	TYPE OF USAGE *1	HOW OFTEN DOES your HOUSEHOLD CONSUMES BIOMASS?		
		TIMES PER DAY	DAYS PER MONTH	KG PER USE
B	D	E	F	G
Firewood	Cooking			
	Water Heating			
	Others			
Wood waste	Cooking			
	Water Heating			
	Others			
Rice husk	Cooking			
	Water Heating			
	Others			
Charcoal	Cooking			
	Water Heating			
	Others			
Other biomass	Cooking			
	Water Heating			
	Others			

*1 TYPE OF USAGE
1. Cooking
2. Heating water for bathing
3. Lighting
4. Others such as clothes ironing, etc.

LPG Consumption

1. Total LPG consumption A kg
B m3

2. Does your household use LPG for the following?

KIND OF EQUIPMENT	UNITS PER HOUSEHOLD	TYPE OF USAGE *1	HOW OFTEN DOES YOUR HOUSEHOLD BUY LPG?		
			NUMBER OF PURCHASES PER MONTH	KG/m3 PER SIZE OF TANK	NUMBER OF TANKS PER PURCHASE
C	D	E	F	G	H
Stove		cooking			kg
Water heater		water heating	0		m3
Other Uses					kg
					m3

*1 TYPE OF USAGE
1. Cooking
2. Heating water for bathing
3. Others such as lighting, etc.

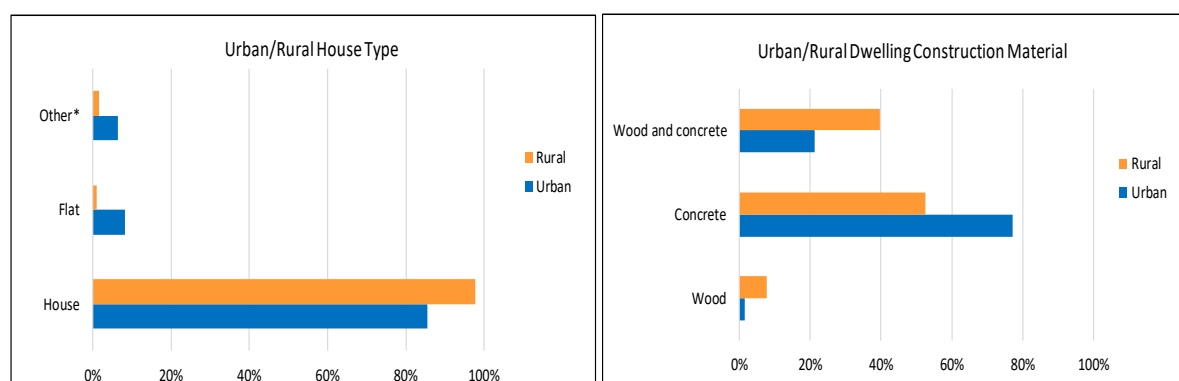
The questionnaire was reviewed and revised by a consultant to suit the Lao context. The questionnaire format was also changed to an online survey platform to enable Android tablets and cell phones to collect data.

2. Major Results from the Survey

The biomass energy consumption surveys covered 551 households in urban and rural villages in Vientiane Capital and Vientiane Province of central Lao PDR. The average household size is around 4.7 persons in rural and urban areas based on the survey results. Most respondents live in houses (97% rural and 85% urban) while the remaining live in flats and others.

All dwellings surveyed are made of either wood or concrete or both. Concrete-only dwellings constituted 77% of the total dwellings surveyed in urban areas. The remaining (1%) are made of only wood, and 21% of both materials (concrete and wood). Concrete-only dwellings also made up most of the dwellings (52%) in the rural areas. Around 8% of the surveyed dwellings in rural areas are made of wood only, and the remaining 40% are made of both concrete and wood (Figure 7.2).

Figure 7.2 Profile of Surveyed Households



Source: Consultant report.

The household energy consumption survey focused on biomass consumption, but the questionnaire also includes households' LPG and electricity consumption. Based on the survey result, the majority of households consume biomass (63% in urban areas and 80% in rural areas), and only a small portion (4%–5%) consume LPG (Table 7.1). The remaining share is that of electricity.

In terms of biomass type, fuelwood is consumed more in rural areas than urban areas. The average monthly consumption, which is the unit consumption or intensity, of fuelwood in rural areas is around 163 kg/household, while in urban areas, it is about 55 kg/household. Charcoal, on the other hand, is consumed more in urban areas than rural areas. The average monthly consumption of charcoal is around 60 kg/household in urban areas and 35 kg/household.

Table 7.1 Share of Household Fuel Consumption and Average Monthly Consumption

Urban/Rural	Household Fuel Consumption Share, %				Average Monthly Fuel Consumption			
	Biomass		LPG	Electricity	Biomass (kg/hh/month)		LPG (kg/hh/month)	Electricity (KWh)
	Wood	Charcoal			Wood	Charcoal		
Urban	21%	42%	5%	32%	54,95	60,28	4,33	373,97
Rural	58%	22%	4%	16%	163,33	35,4	3,89	196,2

Source: Consultant report.

Household fuel consumption includes consumption in households with businesses. Examples of business activities in households are retail shops, restaurants, beauty salons and /barbers, mechanic shops, and others (upholstery business, handicraft, vase business, tailoring, etc.). Table 7.2 shows the breakdown of average energy consumption of households with and without business in urban and rural areas.

Table 7.2 Average Monthly Fuel Consumption in Household with/without Business Activities

Urban/Rural	Average Fuelwood (kg/hh/month)		Average Charcoal (kg/hh/month)		Average LPG (kg/hh/month)		Average Electricity (kWh/hh/month)	
	Business	Without business	Business	Without business	Business	Without business	Business	Without business
Urban	53,61	55,63	97,69	29,03	6,83	3,35	456,65	305,27
Urban Survey Average	54,95		60,28		4,33		373,97	
Rural	144,90	170,48	52,24	22,82	6,53	3,37	277,38	141,50
Rural Survey Average	163,33		35,40		3,89		196,20	

Source: Consultant report.

Amongst households with business activities, those with restaurants in rural and urban areas have the highest consumption of fuelwood and charcoal compared with other business activities (Table 7.3). This is because biomass (fuelwood and charcoal) is mainly used for cooking. For charcoal, the consumption of households with restaurants in urban areas is more than double that in rural areas.

The average LPG consumption was also highest in rural area households with restaurants while average electricity use was highest amongst retail shops in urban areas. Unlike other forms of energy use, average electricity consumption was higher in urban areas for all types of businesses covered in the survey.

Table 7.3 Average Monthly Fuel Consumption in Households with Business Activities

Business Type	Energy Consumption for HH with Business							
	Average Fuelwood (kg/hh/month)		Average Charcoal (kg/hh/month)		Average LPG (kg/hh/month)		Average Electricity (kWh/hh/month)	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Retail Shop	33,16	150,44	84,22	53,89	6,59	7,57	536,34	303,94
Restaurant	138,5	253	303,3	137	11,9	17,3	464,8	354,2
Beauty Salon/Barber	0	31	25,23	15,70	3	7,67	432,15	207,52
Mechanic Shop	27	106,6	77	40,3	10	9,2	395,5	255,8
Others	81,5	138	36,6	41,9	16,3	4,6	455,4	346,9

Source: Consultant report.

Fuelwood consumed by households is mainly self-collected, especially in rural areas. In urban areas, its purchase has a slightly higher share than self-collected fuelwood. Households mainly buy charcoal (97.8% in urban areas and 87% in rural areas). The remaining charcoal sources are self-produced (1.6% urban and 10% rural) and a small amount is free.

The number of surveyed households producing charcoal is 32 (3 in urban areas and 29 in rural areas). About two-thirds of those households (2 urban and 18 rural) produce charcoal for domestic use only while 1 urban and 11 rural households also produce charcoal for sale. The amount of charcoal production is relatively small across the survey sample, with an average total of 338 kg per month in urban areas and an average total of 2,608 kg per month in rural areas (Table 7.4).

Table 7.4 Charcoal Production in Surveyed Urban and Rural Villages

Urban/Rural	No. of HH Producing Charcoal	Volume of Charcoal Produced/Month (kg)	No. of HH Producing Charcoal for Household Used	No. of HH Producing Charcoal for Sale
Urban	3	338	2	1
Rural	29	2.608	18	11

HH = household.

Source: Consultant report.

3. Estimating National Biomass Consumption based on Survey Results

The survey results estimate the monthly biomass consumption of households for fuelwood and charcoal. This unit consumption of household (intensity) will be the basis for calculating the national biomass consumption.

Inflating the survey result to the residential sector's national total was done by multiplying the specific energy consumption (intensity/unit consumption) with the number of households. Since not all households in the Lao PDR consume biomass, it is necessary to estimate the households' share using biomass in each urban and rural area. In general, the estimation formula is as follows:

$$Fuel_i = \sum_{i=regions}^n (PFuel * N_i * UR_i)$$

Where,

$Fuel_i$ is the total fuel consumption (biomass) for area i

$PFuel$ is the fuel consumption per household (fuel intensity/unit consumption)

N_i is the number of households for area i

UR_i is the share of households for area i using biomass

Estimating the national level consumption will require data on the number of households in the Lao PDR by urban and rural areas. If the national statistics have detailed data on the household type by business and non-business activities, it is possible to estimate the consumption in more detail by household activity. Otherwise, the estimation will be only by urban and rural areas.

The data on the number of households by urban and rural areas is available in the (latest) 2015 Lao Population and Housing Census. There is no information on the number of households broken down by the presence and absence of business activities in each rural and urban area. Consequently, the estimation of biomass residential consumption will be based only on the breakdown by urban and rural areas.

Not all surveyed households use biomass. Based on the result, 94% (551) of the surveyed households use biomass in the form of fuelwood and charcoal (Table 7.5). Only one of these households uses biomass in the form of sawdust. The households using sawdust are assumed to be part of the households using fuelwood. By area, 91% of surveyed households in urban areas consume biomass. The share of those in the rural areas is higher (97%).

Table 7.5 Number and Portion of Surveyed Households Using Biomass

Region	Number of Households Surveyed	Households Surveyed Using Biomass	Household Surveyed Using Biomass	Household Surveyed Using Fuelwood	Household Surveyed Using Charcoal	Household Surveyed Using Fuelwood	Household Surveyed Using Charcoal
Urban	206	187	91%	110	183	53%	89%
Rural	345	333	97%	269	246	78%	71%
Total	551	520	94%	379	429	69%	78%

Source: Author's calculation.

The data on the number of households for 2018 was based on the Laos Statistical Information Service data. The breakdown of the number of households between rural and urban areas was not available. In this case, the share of urban and rural households from the 2015 Lao Population and Housing Census was used to estimate the total urban and rural households for 2018.

The share of households using biomass in rural and urban areas (*URi*) were based on the shares from the biomass survey for the residential sector (Table 7.5). These households are further broken down by those using biomass and charcoal.

The average monthly consumption (unit consumption/intensity) of fuelwood and charcoal as shown in Table 7.1 was calculated as the total consumption/month divided by the total number of households surveyed. Since some of these households do not consume biomass, total monthly consumption should be divided only by the number of households consuming biomass. In this regard, a revised unit consumption/fuel intensity of fuelwood and charcoal was used in estimating the national consumption of biomass (fuelwood and charcoal) (Table 7.6).

Table 7.6 Estimated Biomass Consumption at the National Level Using Surveyed Household Shares, 2018

Region	Number of Households	Household Using Biomass	Households Consuming Fuelwood	Households Consuming Charcoal	Fuelwood Intensity (kg/HH/month)	Charcoal Intensity (kg/HH/month)	Fuelwood Consumption (kton)	Charcoal Consumption (kton)
Urban	440.854,80	400.193,43	235.407,90	391.633,15	102,88	67,85	290,62	318,85
Rural	835.916,20	806.840,85	651.772,34	596.044,59	210,53	49,69	1.646,60	355,43
Total	1.276.771,00	1.207.034,29	887.180,24	987.677,74	179,28	57,44	1.937,22	674,29

HH = household.

Source: Author's calculation.

The result shows that the national fuelwood consumption is 1,937 kton while charcoal consumption is 674 kton.

4. Comparison of Results

Compared to the 2018 MEM data on the residential sector's biomass consumption, the estimated national consumption using the survey result is much smaller for fuelwood and extremely high for charcoal (Table 7.7).

Table 7.7 Comparison of Biomass Consumption at the National Level (2018)

Biomass Type	MEM Data	Survey Result
Fuelwood	2.697,39	1.937,22
Charcoal	95,97	674,29
Total	2.793,36	2.611,51

Source: Author's calculation.

The current MEM biomass data is an estimation number, not real data. This MEM data might be overestimated. In an old study conducted by the Energy Sector Management Assistance Programme (ESMAP, 1993) on the Lao PDR Urban Electricity Demand Assessment Study, the average fuelwood consumption for cooking was 100 kg/household while for charcoal it was 64 kg/household (Table 7.8)

Table 7.8 Percentage of Household and Average Monthly Fuel Consumption

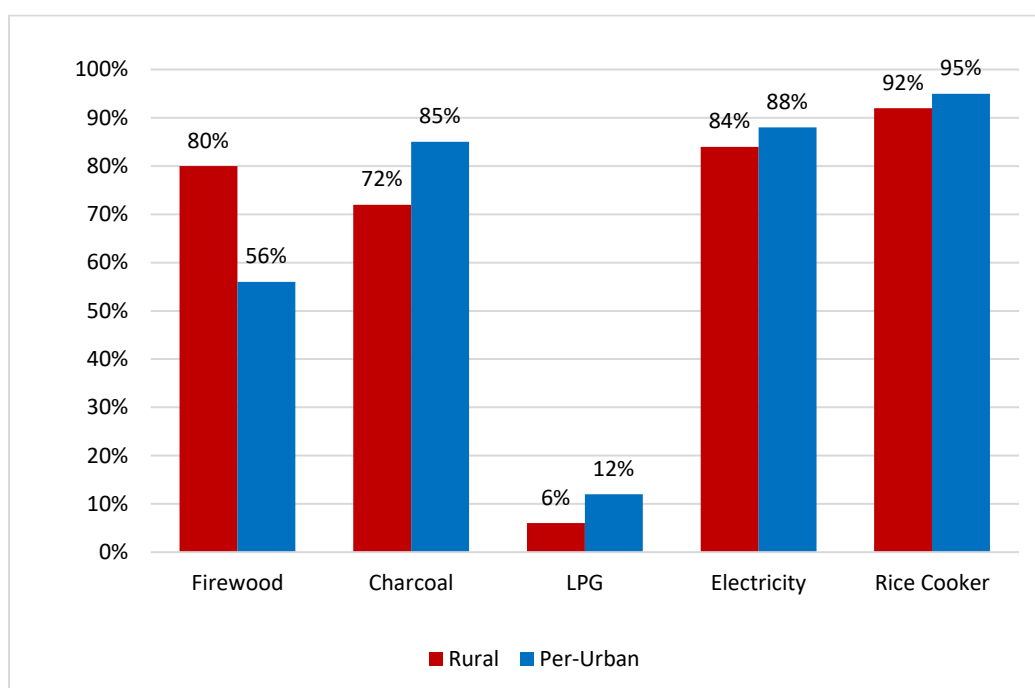
Average Monthly % of HH Using Each Fuel	All Income Classes	Low Less than <75000	Low-Mid 75,000 to 102,000	Middle 103,000 to 150,000	High-Mid 151,000 to 200,000	High 201,000 to 270,000	Very High More than 270,000
Electricity consumption (kWh/household)	271	199	178	197	273	385	606
% of HH electrified	100%	99%	99%	100%	100%	100%	100%
Charcoal consumption (kilogram/household)	64	43	53	47	63	122	70
% of HH using charcoal	54%	36%	42%	55%	67%	74%	65%
Firewood consumption (kilogram/household)	100	50	87	91	139	93	202
% of HH using firewood	64%	67%	68%	66%	63%	58%	48%
Kerosene consumption (Litre/Household)	5	2	2	1	6	10	0
% of HH using kerosene	2%	3%	1%	1%	5%	3%	0%
Diesel consumption (litre/household)	2	3	2	2	2	1	2
% of HH using diesel	9%	4%	8%	12%	10%	11%	10%
LPG consumption (kilogram/household)	15	0	15	0	22	15	5
% of HH using LPG	2%	0%	1%	0%	4%	3%	5%

Source: ESMAP (1993, p.15).

Consumption was higher in higher-income households – 202 kg/household for fuelwood and 122 kg/household for charcoal. On average, 54% of total households consumed charcoal, while the average for fuelwood was 64%. The share of charcoal is highest amongst higher-income households (72%), while fuelwood's share was only 48% amongst higher-income households.

In a later study conducted by the World Bank (2013) on cleaner household cooking in the Lao PDR (2013), around 85% of peri-urban households and 72% of rural households used charcoal for cooking. Conversely, 80% of rural households, compared to only 56% of peri-urban households, were reported to use fuelwood (Figure 7.3)

Figure 7.3 Biomass Survey Questionnaire in the Household Sector of the Lao PDR



Note: The results are from rural and peri-urban areas in Vientiane capital and Vientiane, Bolikhamsai, and Khammouane provinces.

Source: World Bank (2013).

This study's average monthly fuelwood consumption is slightly higher for a rural household, at 183 kg, than a peri-urban one, at 178 kg. The average monthly consumption for charcoal is higher for an urban household, at 70 kg, than a rural one, at about 56 kg.

Nationally, a family consumes 5 kg a day of fuelwood on average for cooking, which amounts to almost 2,000 kilotons per year. Those using charcoal consume about 1.86 kg a day in rural areas and 2.33 kg per day in urban areas.

Another survey conducted as a baseline for improved cookstove programme in the Lao PDR indicates that 53% and 89% of households use fuelwood and charcoal, respectively. Typically, households that use charcoal also tend to consume fuelwood as a fuel source. The average monthly fuel consumption of fuelwood and charcoal is 163 kg (5.3 kg per day) and 33 kg (1.0 kg per day), respectively.

Based on the different studies above, the result from the biomass consumption survey per urban and rural area is similar to the 2013 World Bank study on cleaner household cooking in the Lao PDR (Table 7.9)

Table 7.9 Comparison Between Biomass Consumption Survey and 2013 World Bank Study

Region	Share of Households Using Fuelwood (%)		Share of Households Using Charcoal (%)		Fuelwood Intensity (kg/HH/month)		Charcoal Intensity (kg/HH/month)	
	Biomass Survey	World Bank Study	Biomass Survey	World Bank Study	Biomass Survey	World Bank Study	Biomass Survey	World Bank Study
Urban	53	56	89	85	103	178	68	70
Rural	78	80	71	72	211	183	50	56

Source: Author's calculation.

Based on this, the MEM can use the residential biomass consumption survey results to estimate the national biomass consumption in the residential sector.

5. Conclusion

The MEM data on biomass has always been based on estimation, not actual data. The biomass consumption survey of the residential sector can be used to estimate the 2019 national biomass consumption (2019). In this regard, the MEM needs to re-estimate the historical data (2010–2018) to avoid significant differences. The MEM can also forecast the residential consumption of the country from 2020 to 2025.

The residential biomass consumption (fuelwood and charcoal) can be forecasted as follows:

1. Forecast the Lao PDR's total household from 2020 to 2025 and break down by urban and rural area.
2. Use the share of households using fuelwood and charcoal from the survey results to calculate the number of households using fuelwood and charcoal.

Region	Share of Households Using Fuelwood (%)	Share of Households Using Charcoal (%)
Urban	53	89
Rural	78	71

3. For each type of biomass (fuelwood and charcoal), estimate the consumption using the average fuel intensity from the survey results below.

Region	Fuelwood Intensity (kg/hh/month)	Charcoal Intensity (kg/hh/month)
Urban	103	68
Rural	211	50

The unit consumption for biomass and charcoal needs to be updated since household consumption behaviour changes over time. In this regard, it is recommended that the MEM update the biomass unit consumption regularly, such as every 5 years.

References

Energy Sector Management Assistance Programme (ESMAP) (1993), *Lao PDR Urban Electricity Demand Assessment Study*. Washington DC: ESMAP.

World Bank (2013), *Pathways to Cleaner Household Cooking in Lao PDR: An Intervention Strategy*. Washington, DC: World Bank.

Chapter 8

Conclusions and Recommendations

1. Conclusions

The energy data collection system is of two types: mandatory basis and voluntary basis. The mandatory basis system sets up laws, sub-decrees, and regulations first. A relevant government office collects energy demand and supply data from energy market players – suppliers and consumers – using specific questionnaires and definitions. Under the voluntary basis system, a relevant government office requests the energy market players to submit their energy demand–supply data to the office using specific questionnaires and definitions. But regular communication and a trusting relationship between the office and the market players are indispensable. This time ERIA recommends that the DPC apply the mandatory basis system. The necessary contents of an energy statistics regulation are in Chapter 2.

In chapters 3 to 6 the technical aspects of data collection of coal, oil (petroleum products), electricity, and biomass are examined. The chapters describe questionnaires that cover supply (production and import) and demand (sales to external buyers [export], wholesalers, and final users comprising the industry, transport, commercial, and residential sectors). The beginning and end stock levels are also required. For electricity, two questionnaires were prepared: one for EDL and the other for independent power producers. The questionnaires comprise power generation, import and export of electricity, and fuel input in thermal and biomass power plants. The EDL questionnaires only have the demand-side part comprising sales data of the country's final users. The biomass questionnaire targets the business entity of biomass. And only charcoal is commercial biomass. Thus, the biomass questionnaire covers only charcoal production, fuelwood input, and sales to wholesalers and final users.

Chapter 7 summarises the results of the biomass consumption survey conducted by a local Lao consulting company. This survey also included LPG and electricity consumption for cooking and water heating as a competitor of biomass. The first significant result of the survey made clear that (i) LPG consumption in urban and rural households is minimal; (ii) electricity consumption for cooking and water heating in urban areas is much higher than in rural areas; (iii) biomass is the primary fuel for cooking and water heating in urban and rural areas. The second significant survey result were obtained unit biomass consumptions (kg/month, household) of wood and charcoal by urban and rural areas. The unit consumptions were appropriate because national biomass consumption estimated using the unit consumptions were similar to the DPC's national biomass consumption in 2018.

2. Recommendations

When the DPC starts energy data collection from energy market players in the Lao PDR under regulation, the DPC must designate the energy market players, that is, energy companies. For coal, all coal mining companies to engage in the country's coal business are extracted as objectives for the energy data collection referring to a member list of coal mining associations in the Lao PDR or

registration list of relevant office or department or ministry such as Ministry of Industry and Commerce. For oil, all the oil companies to engage oil businesses which are import of petroleum products out of Lao PDR and wholesales (purchase petroleum products such as gasoline from oil import companies and sales to final users) are extracted referring to a member list of Laos State Fuel Company or registration list to the relevant office, department and ministry in Lao PDR. For electricity, the EDL and independent power producers are selected from a registration list of IPPs with EDL. For biomass, charcoal producers are objectives referring to charcoal associations in the Lao PDR. Thus, the coverage of the supply data of each energy in the country will be 100% and the DPC will prepare the sales data which are balanced between demand and supply. But the DPC must estimate fuelwood consumption based on the number of households in urban and rural areas. The unit fuelwood consumption (kg/month-house) will come from the biomass survey.

Before collecting the energy data using the specific questionnaires under a regulation, the DPC must hold seminars for energy market players regarding the questionnaires and definitions. Market players refer to coal mining companies, oil business companies, the EDL and IPPs, and charcoal producers. After the seminars, the DPC must conduct a pilot data collection from sampled companies (around 10) with volunteer-sampled companies and assess the data quality in the sample companies' questionnaires. The DPC should then fine-tune the questionnaires and definitions based on the pilot collection results. Then official energy data collection starts, first annually with the DPC shifting to a monthly basis using the same questionnaires.

The DPC should release an annual report on the Lao PDR's energy demand and supply situation through MEM's website and publications, based on the primary energy data collected from Lao energy companies under a MEM regulation. This annual report is excellent feedback for the energy market players to submit their yearly energy data to the DPC. Through the annual report, the energy companies can understand their position by comparing national numbers and company numbers. This information will undoubtedly contribute to improving their business policies and planning.