Primer on the Energy Balance Table **(EBT)** of the Philippines

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I. Introduction

Energy is an indispensable factor in human development and economic growth. It fuels all economic activity, and supports the potential for social, environmental and technological progress that will eventually contribute to the improvement of living standards. At the core of any energy system is the purpose of providing convenient and affordable energy services to meet the needs of the people. These energy systems cover a wide range of information from physical energy data to energy facilities and to indicators that measure the interaction of the energy system with the economy and the environment. The main representation of such components of the energy system is the **Energy Balance Table (EBT)**.

A series of energy demand studies was launched under the Regional Energy Development Programme (REDP) in 1987 with funding from the Economic and Social Commission for Asia and the Pacific (ESCAP), the United Nations Development Programme (UNDP) and the Government of France. Three (3) years after, eight (8) countries in the Asia-Pacific region concluded their energy demand studies. Five (5) more countries participated in the second phase from 1990-1991, including the Philippines. Around this time, the former Office of Energy Affairs (OEA), now Department of Energy (DOE), first published an Overall Energy Balance (OEB) in the *Sectoral Energy Demand Studies of the Philippines*. The first batch of published Energy Balance Table (EBT) for the Philippines covered 1984-1990, and provided a set of standardized energy balance sheet expressed in a common unit of tons of oil equivalents (TOE). The balances in the publication were calculated by the Project Team, largely on the basis of original units already published in the annual energy supply and demand situationer of the country. For the first time in 2004,

the Philippine Energy Plan (PEP) provided a national energy accounting system to complement the primary energy mix.

From there on, the EBT is compiled and generated, with inputs from technical bureaus and services within the DOE, by the Policy Formulation and Research Division (PFRD) of the Energy Policy and Planning Bureau (EPPB) on an annual basis and at the national level. With the issuance of Department Order (DO) No. 2018-04-009, the EBT mandated to be released on or before July 15 of every year.

This Primer presents fundamental concepts, frameworks, and operational accounting methodology that can help understand how the country's EBT is compiled and generated.

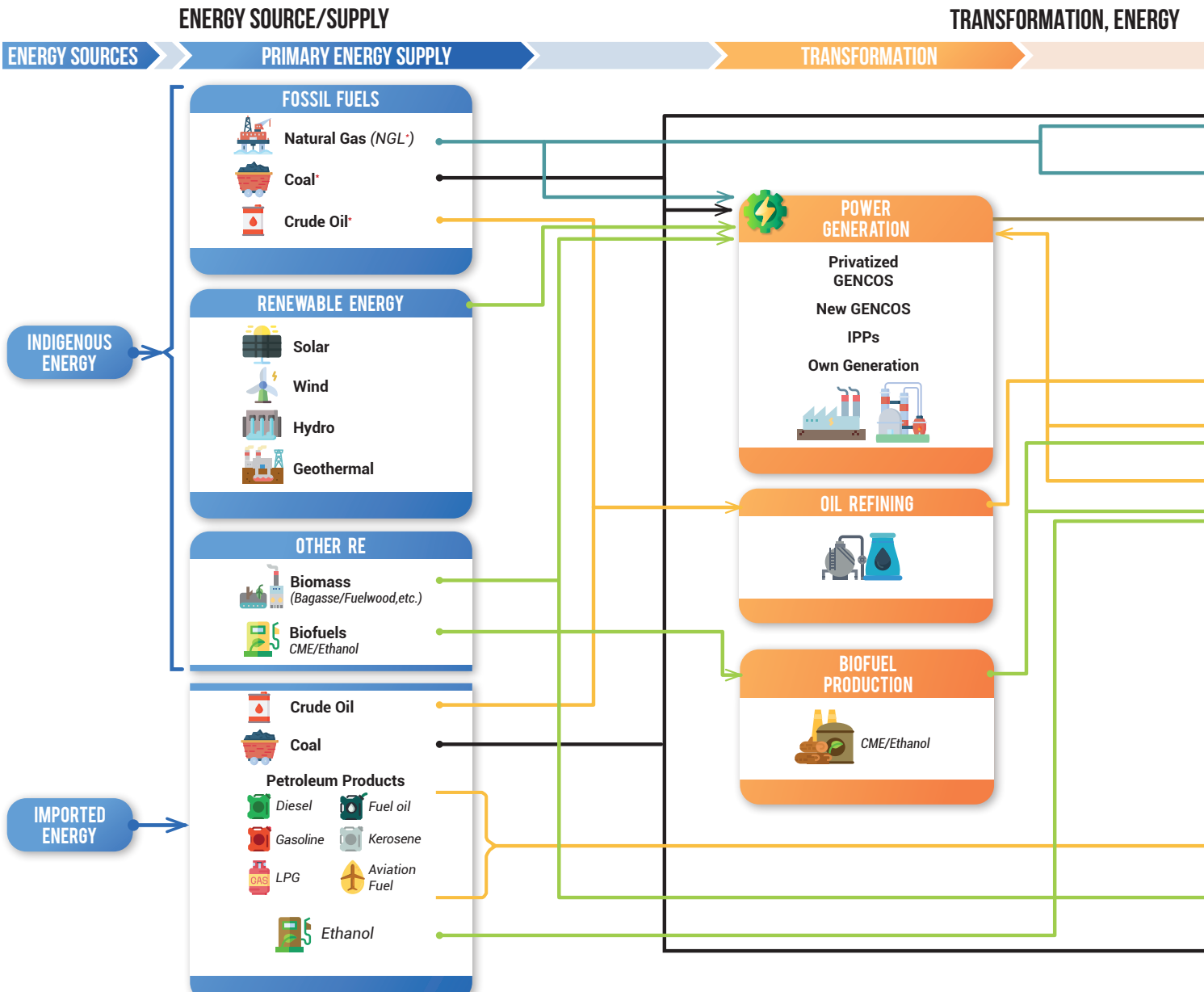
II. Reference Energy System (RES)

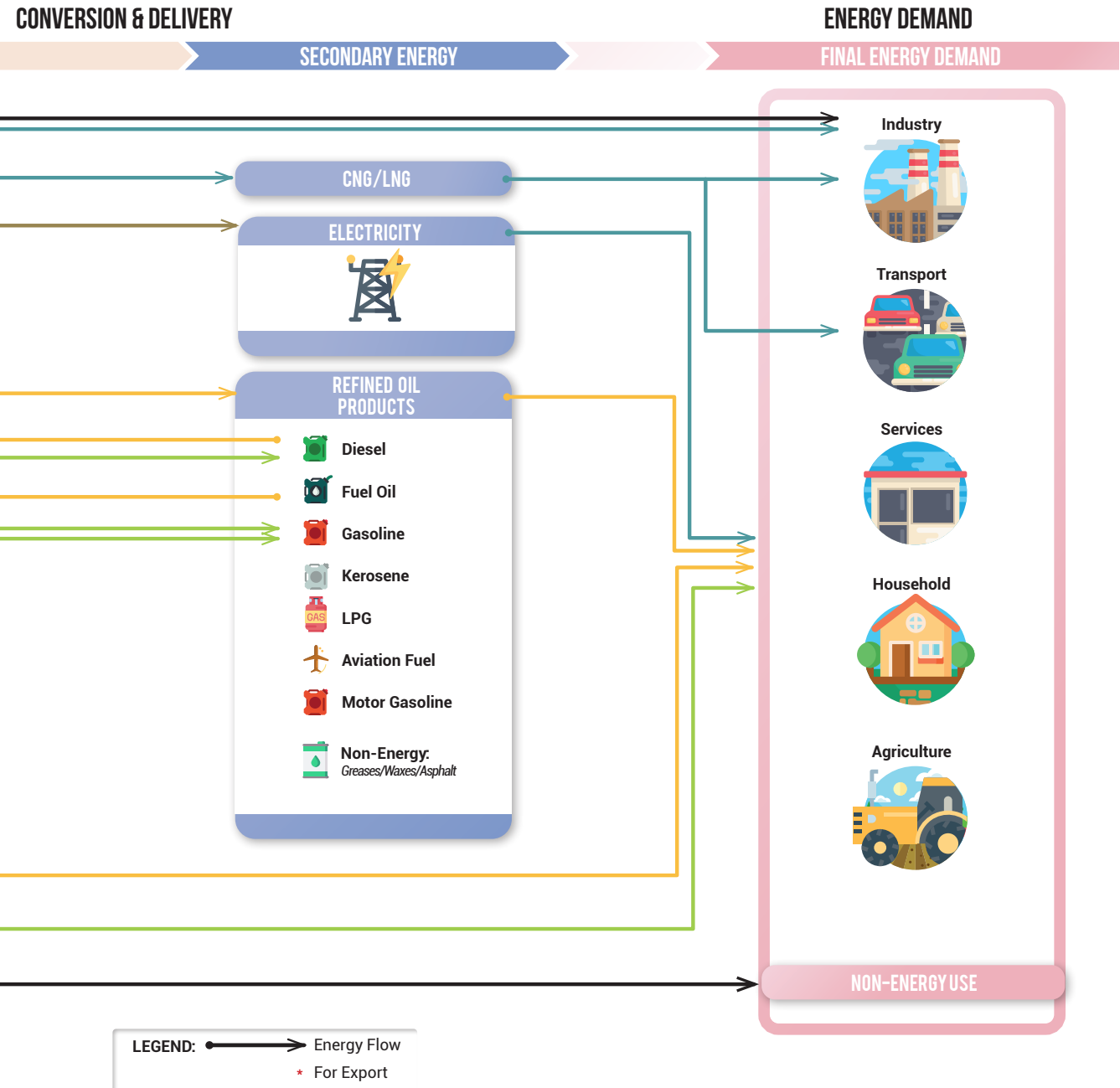
The country's **reference energy system (RES)** outlines the flow of energy from primary energy supply, through transformation processes, and to final energy demand level.

The country sources its energy requirements from domestic energy resources, as well as imported energy. Our indigenous energy includes renewable energy (RE) such as geothermal, hydro, wind, and solar which are mostly used for power generation. Other RE includes biomass like fuelwood, bagasse, and etc., which are mainly used in various household and services applications; as well as biofuels, coco methyl ester (CME), and ethanol derived from sugarcane and other biomass feedstock, that are blended with diesel and gasoline. Considerable volume of fossil fuels such as natural gas, coal,

and oil are likewise produced domestically. On the other hand, our imported energy significantly compensates for the shortfall of our indigenous energy which includes petroleum (crude oil & refined petroleum products) and coal.

Primary energy (indigenous and imported energy, such as petroleum, natural gas, RE, and coal) will be transformed into **secondary energy** (electricity and refined petroleum products) through **transformation activities** of power generation and oil refineries. Finally, energy from the different level of energy sub-sectors will be utilized to fuel the activities of the various economic sectors such as industry, transport, services, household, and agriculture. **Final energy** forms not utilized as fuel but are accounted for, fall under non-energy use.


ENERGY SOURCE/SUPPLY
TRANSFORMATION, ENERGY
ENERGY SOURCES
PRIMARY ENERGY SUPPLY
TRANSFORMATION
FOSSIL FUELS
Natural Gas (NGL*)
Coal*
Crude Oil*
RENEWABLE ENERGY
Solar
Wind
Hydro
Geothermal
INDIGENOUS ENERGY
OTHER RE
Biomass
(Bagasse/Fuelwood,etc.)
Biofuels
CME/Ethanol
Crude Oil
Coal
Petroleum Products
Diesel
Fuel oil
Gasoline
Kerosene
LPG
Aviation Fuel
Ethanol
IMPORTED ENERGY
POWER GENERATION
Privatized GENCOS
New GENCOS
IPPs
Own Generation
OIL REFINING
BIOFUEL PRODUCTION
CME/Ethanol


CONVERSION & DELIVERY
ENERGY DEMAND
SECONDARY ENERGY
FINAL ENERGY DEMAND
CNG/LNG
ELECTRICITY
REFINED OIL PRODUCTS
Diesel
Fuel Oil
Gasoline
Kerosene
LPG
Aviation Fuel
Motor Gasoline
Non-Energy:
Greases/Waxes/Asphalt
Industry
Transport
Services
Household
Agriculture
NON-ENERGY USE
LEGEND:
Energy Flow
* For Export

III. Structure of the Energy Balance Table

The **Energy Balance Table (EBT)** is a presentation of the basic supply and demand data for all fuels. The International Energy Agency (IEA) defines energy balances as a format that presents the supply and use/demand data in a *single energy unit*[1]. It is shown as a matrix showing the relationship between energy products (represented in

ENERGY FORMS → / FLOWS ↓	Coal	Natural Gas	Oil & Oil Products	Hydro
Indigeneous	6,204	3,601	594	2,336
Imports (+)	13,882	0	23,720	0
Exports (-)	-2,668	0	-2,205	0
International Marine Bunkers (-)	0	0	-83	0
International Civil Aviation (-)	0	0	-1,625	0
Stock Change (+/-)	-1,069	0	-408	0
Total Primary Energy Supply	**16,349**	**3,601**	**19,994**	**2,336**
Refinery (Crude Run)	0	0	-632	0
Power Generation (Fuel Input)	-13,776	-3,324	-728	-2,336
Transmission/Dist. Loss (-)	0	0	0	0
Energy Sector Use & Loss (-)	0	-218	-80	0
Net Domestic Supply	**2,573**	**59**	**18,554**	**0**
Statistical Difference				
% Statistical Difference				
Total Final Energy Consumption	**2,573**	**59**	**18,168**	**0**
Industry	2,411	59	1,469	0
Transport	0	0	11,753	0
Household	0	0	1,255	0
Services	0	0	2,223	0
Agriculture	0	0	208	0
Non-Energy Use	162	0	1,261	0

Figure 1: Energy Balance Table

[1] Energy Statistics Manual, IEA 2005

columns) and flows (represented in *rows*). Energy products include those inherent to the Philippines such as coal, oil (crude and finished petroleum products), natural gas, hydro, geothermal, solar, wind, biomass and biofuels, as well as electricity generated and consumed. Flows, on the other hand, correspond to the origins and uses of energy products- from supply to final demand.

Geothermal	Solar	Wind	Biomass	Biodiesel	Bioethanol	Electricity	Total
8,973	107	99	7,668	168	170	0	29,920
0	0	0	0	0	145	0	37,747
0	0	0	0	0	0	0	-4,872
0	0	0	0	0	0	0	-83
0	0	0	0	0	0	0	-1,625
0	0	0	0	14	35	0	-1,427
8,973	**107**	**99**	**7,668**	**182**	**350**	**0**	**59,660**
0	0	0	0	0	0	0	-632
-8,973	-107	-99	-373	-8	0	8,578	-21,147
0	0	0	0	0	0	-774	-774
0	0	0	0	0	0	-700	-998
0	**0**	**0**	**7,295**	**174**	**350**	**7,104**	**36,109**
							386 1
0	**0**	**0**	**7,295**	**174**	**350**	**7,104**	**35,723**
0	0	0	1,199	13	0	2,372	7,523
0	0	0	0	127	350	9	12,238
0	0	0	5,746	0	0	2,430	9,431
0	0	0	350	30	0	2,065	4,668
0	0	0	0	4	0	228	440
0	0	0	0	0	0	0	1,423

•Parts of an Energy Balance Table

The **Top Block** or Primary Supply block includes the flows representing energy entering and leaving the national territory, as well as stock changes to provide information on supply of energy on the national territory during the reference period[2]. It includes (a) indigenous production; (2) exports; (3) imports (4) stock change and (5) marine and civil aviation bunkering.

	Coal	Natural Gas	Oil & Oil Products	Hydro	Geothermal	Solar	Wind	Biomass	Biodiesel	Bioethanol	Electricity	Total
Indigeneous	6,204	3,601	594	2,336	8,973	107	99	7,668	168	170	0	29,920
Imports (+)	13,882	0	23,720	0	0	0	0	0	0	145	0	37,747
Exports (-)	-2,668	0	-2,205	0	0	0	0	0	0	0	0	-4,872
International Marine Bunkers (-)	0							0	0	0	0	-83
International Civil Aviation (-)	0	0	-1,625	0	0	0	0	0	0	0	0	-1,625
Stock Change (+/-)	-1,069	0	-408	0	0	0	0	0	14	35	0	-1,427
Total Primary Energy Supply	**16,349**	**3,601**	**19,994**	**2,336**	**8,973**	**107**	**99**	**7,668**	**182**	**350**	**0**	**59,660**

Top Block = Primary Supply

Figure 2: Top Block

[2] International Recommendations for Energy Statistics (IRES), 2011

The **Middle Block** or Transformation refers to the flows showing how energy is transformed, transferred, used by energy industries for own use and lost in distribution and transmission.[3] Transformation, or conversion, refers to various processes of changing a primary fuel by chemical or physical means, into a secondary energy commodity which is better suited to be used, such as refinery and fuel input to electricity generation. Losses can be in the form of transmission and distribution loss as well as energy sector own use & losses.[4]

	Coal	Natural Gas	Oil & Oil Products	Hydro	Geothermal	Solar	Wind	Biomass	Biodiesel	Bioethanol	Electricity	Total
Refinery (Crude Run)	0	0	-632	0	0	0	0	0	0	0	0	-632
Power Generation (Fuel Input)	-13,776	-3,324	-728	-2,336	-8,973	-107	-99	-373	-8	0	8,578	-21,147
Transmission/Dist. Loss (-)	0	Middle Block = Transformation						0	0	0	-774	-774
Energy Sector Use & Loss (-)	0	-218	-80	0	0	0	0	0	0	0	-700	-998
Net Domestic Supply	**2,573**	**59**	**18,554**	**0**	**0**	**0**	**0**	**7,295**	**174**	**350**	**7,104**	**36,109**

Figure 3: Middle Block

[3] Ibid.
[4] Energy Statistics Manual, IEA 2005

Lastly, the **Bottom Block** or Final Use refers to the flows reflecting final energy consumption and non-energy use of energy products[5]. It covers energy consumption of major economic sectors such as (1) industry - with subsectors for manufacturing (18 industries), mining and construction, (2) transport (with subsectors for rail, road, water and air transport), (3) household, (4) services; and (5) agriculture. It also reports consumption of fuels not exclusively used for fuel (energy) purposes, but as raw material in different sectors (i.e. feedstocks, etc.) as non-energy use.

	Coal	Natural Gas	Oil & Oil Products	Hydro	Geothermal	Solar	Wind	Biomass	Biodiesel	Bioethanol	Electricity	Total
Total Final Energy Consumption	**2,573**	**59**	**18,168**	**0**	**0**	**0**	**0**	**7,295**	**174**	**350**	**7,104**	**35,723**
Industry	2,411	59	1,469	0	0	0	0	1,199	13	0	2,372	7,523
Transport	0	0	11,753	0	0	0	0	0	127	350	9	12,238
Household	0				**Bottom Block = Final Use**			5,746	0	0	2,430	9,431
Services	0	0	2,223	0	0	0	0	350	30	0	2,065	4,668
Agriculture	0	0	208	0	0	0	0	0	4	0	228	440
Non-Energy Use	162	0	1,261	0	0	0	0	0	0	0	0	1,423

Figure 4: Bottom Block

[5] International Recommendations for Energy Statistics (IRES), 2011

IV. Sources of Data

The energy data are reported by various energy stakeholders such as oil companies, power generating companies, transmission and distribution utilities, etc. These data are then compiled by various bureaus/offices in the DOE such as:

- Energy Resources and Development Bureau (ERDB) for oil and gas production, coal (production, imports, exports and consumption);
- Electric Power Industry Management Bureau (EPIMB) for power statistics;
- Oil Industry Management Bureau (OIMB) for data on crude oil and petroleum products such as refinery production, import and export, sales and inventory; including consumption of natural gas;
- Renewable Energy Management Bureau (REMB) for biofuels production and sales; and
- Energy Policy and Planning Bureau (EPPB) for the Household Energy Consumption Survey (HECS) for deriving biomass estimates

Supplemental data are also gathered from the Metro Railway Transit (MRT) and Light Railway Transit (LRT) of the Department of Transportation (DOTr) and Philippine Statistics Authority (PSA) for socio-economic data and indicators.

V. General Accounting Methodology

The accounting methodologies used in compiling our EBT adhere to international standards, such as those of the International Energy Agency (IEA), UN Statistics Division (UNSD) and the Asia-Pacific Economic Cooperation-Expert Group on Energy Data and Analysis (APEC-EGEDA). The sectoral classification used for the final energy demand

follows that of Philippine Standard Industrial Classification (PSIC) to make the EBT consistent with data from other government agencies.

The general accounting methodology for our EBT is, as follows:

a. Supply-Side

- Total primary energy supply (or TPES) is calculated as sum of indigenous production, net imports, stock changes, less bunkering.
- Actual TPES data is available for fossil fuels (coal, oil and natural gas), as well as for biofuels.
- For the case of renewable energy, a thermal efficiency ratio (i.e., 10% for geothermal, 34.54% for hydro, 100% for solar and wind) is used to derive the production quantity which is equal to its fuel input in electricity generation.
- Biomass demand is estimated and is assumed equal to supply based on the assumption that it does not acquire losses during combustion.

b. Transformation

- Data on refinery production of oil is available. Thermal efficiency of RE is used to derived its fuel input quantity, the same as reported in the production data. These values are preceded by a negative sign (-).
- Losses - actual data on distribution and energy-own use is available. These values are preceded by a negative sign (-).
- Net Domestic Supply is calculated as the sum of TPES less transformation and losses.

c. Demand-Side

- Petroleum product and electricity sales are used to account for petroleum and electricity consumption, respectively, and disaggregated by sector. On the other hand, reported consumption of coal and natural gas are used.
- Biomass consumption in the residential sector is estimated using the 2011 HECS; while for commercial and industry, average annual growth rates are applied on the benchmark estimates.

For balancing, a statistical difference is calculated as the difference between net domestic supply and TFEC. Large statistical differences might indicate incompleteness.

VI. Units of Measurement Used

The energy data collected are expressed in "original" or "natural" units as well as "common" units. It also makes reference to the International System of Units often abbreviated as SI.[6] Energy data in physical units are then converted to **tons of oil equivalent** (TOE) using their net calorific values (NCV). In aggregating all energy forms, the EBT uses a *standard* unit of measurement – the TOE.

VII. Uses of the Energy Balance Table

The EBT also provides other information on the energy sector such as fuel mix, transformation efficiencies, power generation structure and sectoral consumption shares. It can also be used for analyzing the changes in the level and mix of energy

[6] Ibid.

sources used for particular purposes before or after transformation, for the study of changes in the use pattern of different fuels, and for examining the extent of or scope for substitution between fuels at different stages of the flow from primary supplies to final energy uses.

VIII. Indicators from the Energy Balance Table

- ***Energy Self-Sufficiency*** – Measures the degree at which domestic energy forms can support total energy demand. It is calculated as the ratio of total indigenous energy supply to TPES.
- ***Energy Intensity*** – the amount of energy required to produce a unit of economic output. It is calculated as units of energy (million tons of oil equivalent, MTOE) per unit of GDP (in billion pesos).
- ***Energy Elasticity*** – the percentage change in total primary energy demand[7] to achieve one percent change in national GDP. Calculated as the ratio of growth of primary energy demand over GDP growth.
- ***Energy per Capita*** – amount of energy use per person. It is calculated as total primary energy demand (in MTOE) over population (in millions).
- ***GHG Emission Intensity and GHG Emission per Capita*** – refers to the amount of GHG emission per unit of economic output and amount of GHG emission per person, respectively. It is calculated as the ratio of total GHG emission over GDP (intensity) or population (per capita).

[7] Total Primary Energy Demand is derived through the summation of total final energy consumption (net of electricity demand), refinery loss (difference of crude run and product output), fuel input to power generation and energy sector use and loss excluding electricity.

The **Energy Balance Table (EBT)** of the Philippines is presented in tabular format: *columns* for various energy products and *rows* for the different origins and uses.

COLUMNS

Across the top of the table from left to right, there are twenty-four (24) columns that contain the various energy forms inherent to the Philippines. These are:

Column 1: *Coal* is defined as a sedimentary rock composed predominantly of solid organic materials with a greater or lesser proportion of mineral matter. It is derived from the accumulation of plant remains in sedimentary basins, and is altered to solid rock by heat and pressure applied during the basin's development. Its quality varies according to the content of ash, impurities, and volatile matter which decreases as coal rank gets higher. It has a natural dark brown to black, graphite like appearance and is primarily used as a fuel. Types of coal according to increasing rank (in terms of hardness, purity and heating value) are peat, lignite, sub-bituminous, bituminous and anthracite (DOE web portal).

Column 2: *Natural gas* is a naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in porous geologic formations beneath the earth's surface, often in association with or near petroleum deposits. The principal constituent is methane but also has varying amounts of ethane, propane, butane, pentane, hydrogen sulfide, carbon dioxide, water vapor, and sometimes helium and nitrogen (DOE-NGMD). Natural gas is usually obtained from boreholes and wells, which at atmospheric conditions of temperature and pressure, are in gaseous phase (DC 2002-08-005).

Column 3: *Condensate* refer to natural gas liquids (NGL), which are either liquid or liquefied hydrocarbons recovered from natural gas in separation facilities or gas processing plants (IEA, 2005).

Column 4: *Crude oil* refers to the oil in its natural state before the same has been refined or otherwise treated, but excluding water, bottoms, sediments and foreign substances (DC 98-03-004).

Column 5: *Gasoline (Premium & Regular)* is a volatile mixture of liquid hydrocarbons, generally containing small amounts of additives, suitable for use as a fuel in spark-ignition internal combustion engines with quality specification in compliance with the Philippines National Standard (PNS). Combustion engines with fuel grades and corresponding Research Octane Number (RON) are: a) premium plus (95 RON); b) premium (93 RON); and, c) regular (81 RON). (PNS-DOE: Quality Standards)

Column 6: *Kerosene* is a refined petroleum distillate suitable for use as fuel in cooking ranges, stoves, lamps, refrigerators, furnaces and other similar appliances and devices engines with quality specification in compliance with PNS. (PNS-DOE: Quality Standards)

Column 7: *Diesel* refers to refined petroleum distillates, which may contain small amount of hydrocarbon on non-hydrocarbon additives to improve ignition engines and other suitable types of engines with quality specification in compliance with PNS. (PNS-DOE: Quality Standards)

Column 8: *Fuel Oil* is defined as residuals from distillation. It may be blend of residual and distillates of petroleum origin engines with quality specification in compliance with PNS. It is also commonly known as Bunker Fuel Oil. (PNS-DOE: Quality Standards)

Column 9: *Liquefied Petroleum Gas (LPG)* is a gas liquefied pressure consisting of flammable hydrocarbons predominantly a mixture of propane and butane engines with quality specification in compliance with PNS. (PNS-DOE: Quality Standards)

Column 10: *Jet A-1* is a kerosene grade of fuel suitable for most turbine engine aircraft. It has a flash point minimum of 38°C (100°F) and a freeze point maximum of -47°C. (The AeroShell Book, 18th Ed., 2003)

Column 11: *Aviation gasoline (Avgas)* defined as gasoline possessing specific properties suitable for fuelling aircraft powered by reciprocating spark ignition engines with quality specification in compliance with PNS. (PNS-DOE: Quality Standards)

Column 12: *Naphtha* is a feedstock used in the petrochemical industry (e.g. ethylene manufacture or aromatic production). (IEA, 2011)

Column 13: *Asphalt* is a natural constituent of crude oil and is usually the residue left after distillation. It is a strong cement, readily adhesive, highly waterproof and durable (Petron 7th Ed).

Column 14: *Other Petroleum Products* include a variety of petroleum products such as mixed xylene, lubes/additives, solvents, reformates, and other minor types of petroleum products not classified elsewhere.

Column 15: *Hydropower (Hydro)* represents the potential and kinetic energy of water converted into electricity in hydroelectric plants (IEA, 2010). Under the RE Law, hydropower resources are water resources found technically feasible for development of hydropower projects which include rivers, lakes, waterfalls, irrigation canals, ponds, and other bodies of water.

Column 16: *Geothermal energy* as a mineral resource is considered renewable, if produced through: 1) natural discharge, where the water is replenished by rainfall and the heat is continuously produced inside the earth; and/or 2) enhanced recharge, where hot water used in the geothermal process is re-injected into the ground to produce more steam as well as to provide additional recharge to the convection system (RA 9513). This column includes the use of geothermal energy for power generation. The quantity of geothermal energy entering electricity generation is inferred from the electricity production at geothermal plants assuming an average efficiency factor of ten percent (10%) (IEA, 2011).

Column 17: *Solar energy* refers to energy derived from solar radiation that can be converted into useful thermal or electrical energy (RA 9513, 2008). This column shows the quantity of solar energy entering electricity generation and is equal to electricity generated, i.e. a 100% efficiency (IEA, 2011). Passive solar energy for the direct heating cooling and lighting of dwellings or other buildings is not included (IEA, 2010)

Column 18: *Wind energy* refers to the energy that can be derived from wind that is converted into useful electrical or mechanical energy (RA 9513, 2008). This column shows the quantity of wind energy entering electricity generation is equal to electricity generated, i.e. a 100% efficiency (IEA, 2011).

Column 19: *Biomass* refers to non-fossilized, biodegradable organic material originating from naturally occurring or cultured plants, animals and microorganisms, including agriculture products, by-products and residues such as, but not limited to, biofuels except corn, soya beans and rice but including sugarcane and coconut, rice hulls, rice straws, coconut husks and shells, corn cobs, corn strovers, bagasse, biodegradable organic fractions of industrial and municipal wastes that can be used in bioconversion process and

other processes, as well as gases and liquids recovered from the decomposition and/or extraction of non-fossilized and biodegradable organic materials (RA 9513, 2008). This column represents the total energy from different biomass forms such as fuelwood, charcoal, bagasse, animal, municipal and agricultural wastes, and biogas.

Column 20: *Biodiesel* refers to the Fatty Acid Methyl Ester (FAME) or mono-alkyl esters derived from vegetable oils or animal fats and other biomass-derived oils that shall be technically proven and approved by the DOE for use in diesel engines, with quality specifications in accordance with the Philippine National Standards (PNS) (RA 9367, 2006). Under the Biofuels Law (RA 9367), all gasoline stations are mandated to implement a two percent (2%) biodiesel blend starting two (2) years after the effectivity of the Act. To date, the country's biodiesel is sourced from coconut oil and is more appropriately known as Coco-Biodiesel or Coconut Methyl Ester (CME).

Column 21: *Ethanol*, or bioethanol, refers to ethanol (C_2H_3OH) produced from feedstock and other biomass. Bioethanol fuels refer to the hydrous and anhydrous bioethanol suitably denatured for use as motor fuel with quality specifications in accordance with the PNS (RA 9367). Bioethanol is a fuel added to gasoline in mixture.

Column 22: *Electricity* includes electricity from large-to-small power generation plants and distributed to all end-use sectors by electric utilities or distribution companies, private utilities and electric cooperatives. This column shows the final consumption of electricity (1 kWh = 8.6 x 10^{-5} kTOE).

Column 23: *Total* refers to the sum of Columns 1 to 22.

ROWS

The categories on the left hand (rows) of the EBT show the various energy flows - the origins and uses of energy products from supply to final demand. These are:

Row 1: *Indigenous (production)* refers to the production of primary energy (such as coal, natural gas, crude oil, renewable energy) that is extracted, harnessed, captured and/or sourced from within the country's natural resources.

Row 2: *Imports* refer to the fuels and/or amounts of energy obtained by the Philippines from other countries including those in transit, and/or with or without customs clearance. Imports are reported with a positive sign (+) since these are considered as additions to total supply.

Row 3: *Exports* refer to the amount of energy commodity that is shipped from the Philippines to another country/economy, as in the conduct of foreign trade. Exports are given a negative sign (-) since they are regarded as withdrawals from total supply[8].

Row 4: *International Marine Bunkers* covers quantities of fuel delivered to ships of all flags that are engaged in international navigation, which may take place at sea, on inland lakes and waterways, and in coastal waters (IEA, 2011).

Row 5: *International Aviation Bunkers* includes deliveries of aviation fuels to aircraft for international aviation. (IEA, 2011)

[8] Note that the energy balance table seeks to show the supply of fuels used within the country, and so exports are subtracted to calculate total domestic supply, while imports are being added (IEA, 2005).

Row 6: *Stock Change (+/-)* reflects the difference between the opening and closing stock level on national territory held by producers, importers, energy transformation industries and large consumers. A stock build is shown as negative number, and a stock draw as a positive number (IEA, 2011)

Row 7: *Total primary energy supply (TPES)* is made up of (indigenous) production *(Row 1)* + imports *(Row 2)* – exports *(Row 3)* – International Marine Bunkers *(Row 4)* – International Aviation Bunkers *(Row 5)* ± stock changes *(Row 6)* (IEA, 2010)

Row 8: *Refinery/Crude Run* shows the use of energy for the manufacture of finished oil products and the corresponding output. Thus, the total reflects transformation fuel and losses (IEA, 2010). Note that the values for *Crude Oil* (column 4), which is a primary energy form, are reported with a negative sign, while values for *petroleum products* (columns 5 to 15) are reported with a positive sign.

Row 9: *Power Generation* is the row's subtitle for the accounting of electricity production process which includes Fuel Input (row 10) and Electricity Generation (row 11).

Row 10: *Fuel Input* shows the quantity of energy used as fuel for power generation. These are reported as negative values, since in principle; these fuels will be replaced by electricity produced in the process of transformation. Note that the following columns have entries for this row: coal (column 1), natural gas (column 2), diesel and fuel oil (column 8-9), renewable energy (column 16-20), and biodiesel (column 21), since these fuels are used for power generation in the Philippines.

Row 11: *Electricity Generation* shows the amount of electricity output by each fuel in Row 10 (i.e., coal, diesel, fuel oil, and renewable energy sources) in the transformation process.

Row 12: *Transmission/Distribution Loss* refers to losses in energy distribution, transmission and transport (IEA, 2010). As such, it includes the amount of electricity lost during transmission from power plants to distribution utilities and from distribution utilities to end-use sectors. Note that this is reported only under the column for *Electricity*, and are reported with a negative sign.

Row 13: *Energy Sector Use and Loss* contains the primary and secondary energy consumed by transformation industries (IEA, 2010). Thus, it includes fuel used and lost during the transformation of crude oil to different petroleum products; in flaring of natural gas; and, in own use of power plants and distribution utilities. Thus, values under the columns for *Natural Gas, Crude Oil,* and *Electricity* are reported with negative signs.

Row 14: *Net Domestic Supply* is equal to the sum of *total primary energy supply* (row 7), *refinery/crude run* (row 8), *fuel input* (row 10), *transmission/distribution loss* (row 12) and *energy sector use and loss* (row 13).

Row 15: *Statistical Difference* or discrepancy includes the sum of the unexplained statistical differences for individual fuels. It also includes differences that may arise because of (1) variety of conversion factors used for each fuel (IEA, 2010), and (2) individual components are often derived from different data sources (IEA, 2011). It is calculated as the difference between *net domestic supply* (row 14) and *total final energy consumption* (row 17).

Row 16: *% Statistical Difference* is calculated as the ratio between *statistical difference* (row 15) and *net domestic supply* (row 14). This shows the percentage of the discrepancy between net supply and demand.

Row 17: *Total Final Energy Consumption (TFEC)* covers the deliveries of energy commodities to consumers for activities that are not fuel conversion or transformation activities. Energy

quantities shown here are intended to represent the energy needs of the economic activity under which these are classified (IEA, 2005). This row is the sum of energy consumed by different end-use sectors such as industry, transport, commercial, residential, and agriculture, fishery & forestry (AFF).

Row 18: *Industry* refers to energy consumption of the industrial sectors, which is comprised of the manufacturing, mining and construction sub-sectors. Note that fuels used for transportation of goods produced by industries is not included here, but reported under transport (IEA, 2005).

Row 19: *Manufacturing* refers to energy consumed in the physical or chemical transformation of materials, substances, or components into new products, which can take place in plants, factories or mills (PSIC, 2009).

Row 20: *Mining* refers to energy consumed in the extraction of minerals (PSIC, 2009).

Row 21: *Construction* refers to energy consumed in construction activities for buildings and civil engineering works (PSIC, 2009).

Row 22: *Transport* refers to energy consumed for all transport activity except international marine bunkers (reported in row 4) (IEA, 2011). It includes the following sub-sectors:

Row 23: *Rail Transport* refers to energy consumed in rail traffic which includes inland and light rail transport.

Row 24: *Road Transport* refers to energy consumed by road vehicles, as well as agricultural and industrial highway use. It excludes consumption of motor gasoline used in stationary

engines and diesel oil for use in tractors that are not for highway use. This row accounts for fuel consumption of light to heavy inland vehicles, including motorcycles and tricycles.

Row 25: *Water Transport* refers to energy consumed by all marine vessels not engaged in international navigation. Fuels used for ocean, and coastal and inland fishing are excluded. This row accounts for fuel consumption of inter-island ships or ferries, and local waterways ferries and bancas.

Row 26: *Air Transport* refers to energy consumed by aircrafts for domestic aviation, either for commercial, private, agricultural, etc. (IEA, 2011).

Row 27: *Household* includes consumption by households, excluding fuels used for transport (IEA, 2011). In the Philippines, consumption in this sector includes electricity, biomass and petroleum products, specifically liquefied petroleum gas and kerosene.

Row 28: *Services* includes all fuels used by the commercial sector. This row reports the total energy consumption of establishments engaged in wholesale and retail trade, finance, public and private services (PSIC, 2009).

Row 29: *Agriculture* refers to energy consumed in the exploitation of vegetal and animal natural resources, comprising the activities of growing crops, raising and breeding of animals, harvesting of timber and other plants, animals or animal products from a farm or their natural habitats (PSIC, 2009).

Row 30: *Agri-Industry* covers the energy consumption of Agri-Crops Production, Livestock/ Poultry and Agri-Services

Row 31: *Fishery* includes all fuels used in the production, harvesting, processing, marketing of fisheries and aquatic products including plants from the oceanic, coastal or inland waters for food consumption and other purposes (PSIC, 2009).

Row 32: *Forestry* includes all fuels used in the production of roundwood, such as timber, etc., as well as the extraction and gathering of wild growing non-wood forest products which can be carried out in natural or planted forests. (PSIC, 2009).

Row 33: *Non-Energy Use* covers those fuels that are used as raw materials in the different sectors and are not consumed as fuel or transformed into another fuel (IEA, 2011).

Row 34: *Energy Self-sufficiency* measures the degree at which domestic energy forms can support total energy demand. It is calculated as the ratio of total indigenous energy supply to TPES.

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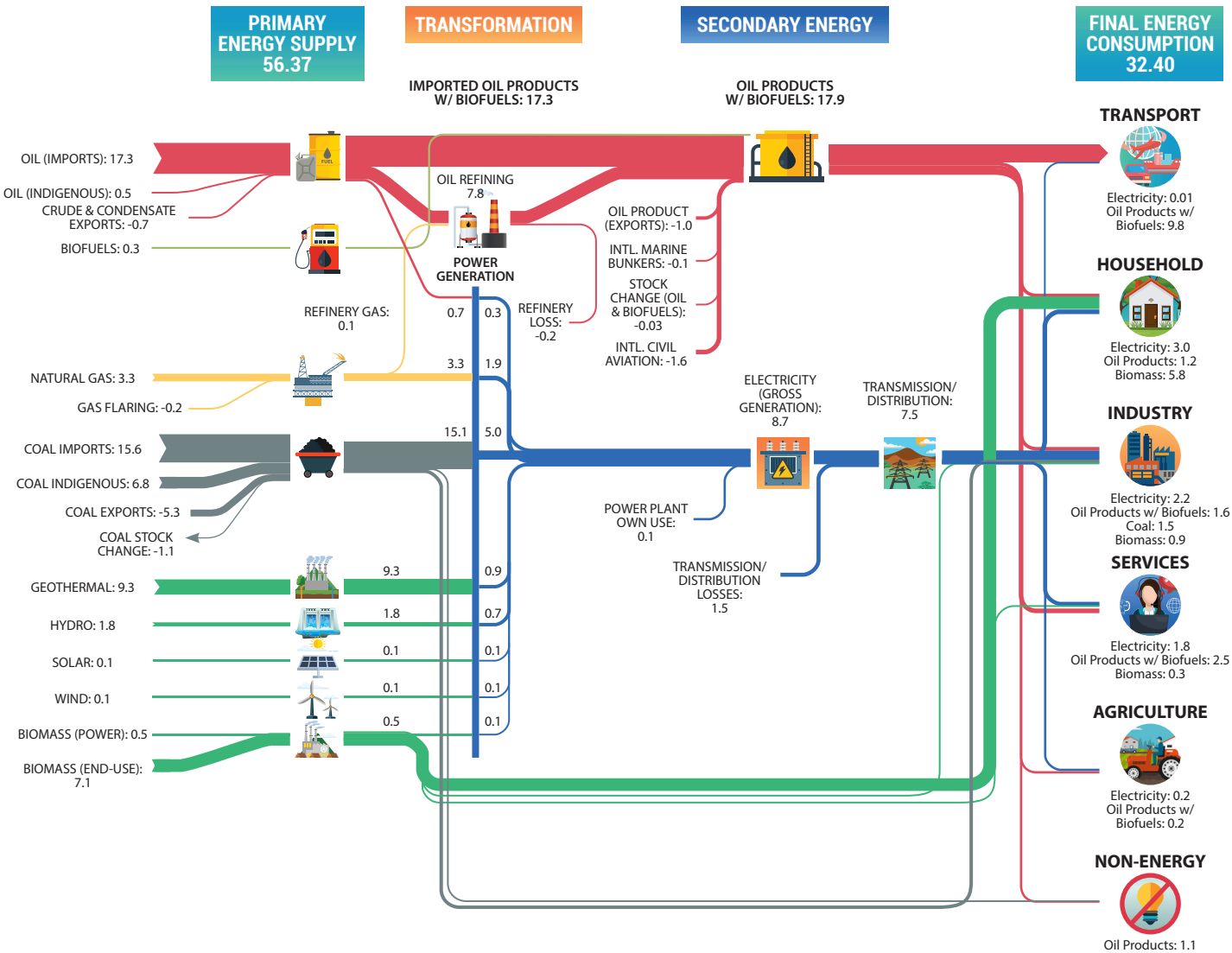
ENERGY BALANCE TABLE

in kTOE **(2020)**

	Coal	Natgas	Oil & Oil Products	Hydro
Indigeneous	6,835.7	3,288.3	456.3	1,790.4
Imports (+)	15,582.6	-	17,253.5	-
Exports (-)	(3,971.9)	-	(1,650.2)	-
International Marine Bunkers (-)	-	-	(100.7)	-
International Civil Aviation (-)	-	-	(567.1)	-
Stock Change (+/-)	(1,110.4)	-	1,061.4	-
Total Primary Energy Supply	**17,335.9**	**3,288.3**	**16,453.2**	**1,790.4**
Refinery (Crude Run)	-	-	(201.4)	-
Power Generation (Fuel Input)	(15,704.8)	(3,074.5)	(507.7)	(1,790.4)
Transmission/Dist. Loss (-)	-	-	-	-
Energy Sector Use & Loss (-)	-	(176.7)	(125.1)	-
Net Domestic Supply	**1,631.2**	**37.2**	**15,619.0**	**-**
Statistical Difference				
% Statistical Difference				
Total Final Energy Consumption	**1,631.2**	**37.2**	**16,015.0**	**-**
INDUSTRY	**1,494.1**	**37.2**	**1,557.5**	**-**
TRANSPORT	**-**	**-**	**9,415.8**	**-**
HOUSEHOLD	**-**	**-**	**1,237.7**	**-**
SERVICES	**-**	**-**	**2,466.8**	**-**
AGRICULTURE	**-**	**-**	**210.9**	**-**
NON-ENERGY USE	**137.1**	**-**	**1,126.3**	**-**
Self-Sufficiency				

Geothermal	Solar	Wind	Biomass	Biodiesel	Bioethanol	Electricity	Total
9,249.2	118.0	88.3	7,563.2	131.4	154.7	-	29,675.5
-	-	-	-	-	138.6	-	32,974.7
-	-	-	-	-	-	-	(5,622.1)
-	-	-	-	-	-	-	(100.7)
-	-	-	-	-	-	-	(567.1)
-	-	-	-	25.4	30.5	-	6.9
9,249.2	**118.0**	**88.3**	**7,563.2**	**156.8**	**323.8**	**-**	**56,367.2**
-	-	-	-	-	-	-	(201.4)
(9,249.2)	(118.0)	(88.3)	(491.0)	(5.7)	-	8,749.4	(22,280.2)
-	-	-	-	-	-	(837.6)	(837.6)
-	-	-	-	-	-	(754.2)	(1,056.0)
-	**-**	**-**	**7,072.2**	**151.1**	**323.8**	**7,157.6**	**31,992.1**
							(396.0)
							(1.2)
-	**-**	**-**	**7,072.2**	**151.1**	**323.8**	**7,157.6**	**32,388.0**
-	-	-	**905.3**	**13.1**	-	**2,198.3**	**6,205.4**
-	-	-	-	**97.0**	**323.8**	**6.5**	**9,843.1**
-	-	-	**5,841.9**	-	-	**2,948.5**	**10,028.1**
-	-	-	**325.1**	**37.0**	-	**1,782.2**	**4,611.1**
-	-	-	-	**3.9**	-	**222.0**	**436.8**
-	-	-	-	-	-	-	**1,263.5**
							52.65

PHILPIPINE ENERGY FLOW 2020,
in Million Tonnes of Oil Equivalent (MTOE)



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