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THE PHILIPPINE NATIONAL ENERGY ACCOUNTS: A METHODOLOGICAL NOTE

by

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This note presents a summary of the methodology used in the construction of the Philippine National Energy Accounts (PNEA), 1970-79. The data used and the assumptions involved will be outlined. Procedural details are attached in the appendix for additional reference.

The underlying framework used in the construction of the accounts revolves around the following identity,

$$C_i = P_i + (M_i - X_i - B_i) - \Delta I_i \qquad \text{where}$$

C = consumption of energy, in 10^{10} kilocalories

P = production of energy, in 10^{10} kilocalories

M = import of energy, in 10^{10} kilocalories

X = export of energy, in 10^{10} kilocalories

B = bunker sales, in 10^{10} kilocalories

Δ I = change in inventory of energy, in 10^{10} kilocalories

i = energy product i

Consumption (C_i) is disaggregated across two transformation sectors, namely: (1) electrical utilities and (2) petroleum refineries; and two major consuming sectors; (1) the industrial sector

consisting of seven subsectors, viz., agriculture, mining and quarrying, manufacturing, construction, transportation, communication and storage, commerce, and services; and (2) the household sector. On the other hand, energy production (P_i) is divided between electrical utilities and petroleum refineries. The net trade section in the table consists of imports less exports and bunkers. Actual data have been used to derive these estimates and inventory change was computed as a residual due to data difficulties. (For the succeeding discussion, please refer to the Exhibits cited in Working Paper No. 1).

I. Consumption

On the national level, consumption of energy in its various forms can be estimated from the variables on the right hand side of the equation. The equivalent energy content of various forms of energy expressed in kilocalories or in barrels of fuel oil equivalent may be employed to come up with a single measure of the total amount of energy consumed within a given period. For Philippine energy data, however, we have decided to measure energy consumption directly from the demand side rather than from the supply side as defined by the identity. We have made use of data on energy sales figures allocated accordingly over time and across sectors.[1] It is assumed that the quantity of

[1]The only exception is coal whose consumption is estimated from the supply side.

energy sold in one period is an indication of consumption in the same period.

1. Crude Petroleum

Consumption of crude petroleum (PNEA Item I. A) was derived from refinery production records. These figures exclude naptha, blenders and other feed processes. Semestral data were available from 1973 to 1979 from the Board of Energy (BOE) and the Bureau of Energy Utilization (BEU). For 1970 to 1972 semestral data were derived by applying first and second semester shares of refined products consumption to annual crude petroleum consumption. All estimates in thousand barrels were converted to 10^{10} kilocalories.

2. Refined Petroleum Products

Direct consumer, reseller and government trade data from Philippine National Oil Company (PNOC) were used to estimate aggregate consumption of refined products for the period under study. (Please see Exhibit 1.1 to 1.5). We have excluded the international trade data (as defined by PNOC) from consumption as these were treated as bunkers. These entered instead into the net trade column of the energy accounts table. The U.S. military base trade was similarly deleted since it was not possible to allocate the data across sectors. We impose the restriction that the total consumption of energy per period equals consumption of energy across sectors. Also by definition, U.S. bases were considered outside the scope of Philippine economy. The deletion however does not

constitute a significant understatement since these bases account for less than 1% of total energy consumption.

Semestral consumption data for each of the above consumer trades are available from 1973 to 1979. For 1970 to 1972 where semestral PNOC data were available, the first semester share of each product per type of consumer was taken from Petroleum Institute of the Philippines (PIP) data and applied on annual PNOC data. We chose to use relative shares rather than actual PIP data in reconstructing semestral consumption estimates due to the inconsistencies in the figures reported by both. Second semester figures were computed as residuals.

Refined products consumption estimates for each semester by sector required further adjustments in data. The methodology involves deriving percentage consumption shares across sectors for each type of consumer trade from PIP and PNOC data and applying the same on one set of consumption data (PNOC direct consumer, reseller and government trade data) to ensure consistency. For the following discussion please refer to Exhibits 2 and 3.

We chose to divide the economy into nine sectors: household, agriculture, manufacturing, mining, transportation, utilities, construction, commerce and services. The consumption of the following energy petroleum products was estimated for each of these sectors: avturbo and avgas, LPG, motor gasoline (premium and regular), kerosene, diesel (automotive and industrial) and fuel oil. The percentage shares of the agriculture, manufacturing,

mining, transportation, utilities, and others sectors were taken from the 1970-73 PIP semestral data on direct consumer trade. The same was done on the government trade data for transportation, utilities and others (Exhibit 3). For 1974-79, PNOC direct consumer data classified by industry was used. The 22 industries were reclassified to correspond roughly to the sectoral breakdown given by the PIP for 1970-73 and the percentage shares were also obtained. (Please refer to Table 1) However, 1974 PNOC industrial consumption data was not available on a semestral basis. Thus weighted first and second semester average shares for 1973 and 1975 data were applied instead to the 1974 annual PNOC figures.

Several probblems arose as the PIP did not include sectoral allocations of avturbo and avgas, and motor gasoline was not divided between premium and regular both for the direct consumer trade and government trade for 1970-73. A weighted average percent share taken from 1975-78 PNOC data was used to allocate these products across sectors.

For the government trade, both data sets did not show any breakdown of avturbo, avgas, premium and regular gasoline consumption among the transportation, utilities and others sectors. We then took the percentage shares of these sectors from the direct consumer data and

Table 1. Reclassification of PNOC Industries into PIP Classification

AGRICULTURE	MANUFACTURING	MINING	TRANSPORTATION	UTILITIES	OTHERS
logging/wood production	cement	mining	land transportation	power generation	contractors
	sugar				all others
	coconut and vegetable oil		domestic marine		
fishing trade	fertilizer		domestic aviation		
	paper processing				
	lube refining				
	textile mills				
	glass manufacturing				
	steel/metal/nickel processing				
	ceramics				
	rubber and tires				
	chemical				
	tobacco				
	food processing				

adjusted the totals to correspond with the data for government trade. For the sectoral breakdown of the 1974-79 PNOC government trade data, a weighted average percent share was used based on the PIP government trade data for 1970-73.

For the household sector, reseller trade data from PNOC for 1970-79 was used. Following the methodology employed by Gonzalo,[2] the percentage share of LPG and kerosene was netted out and the rest of the products was allocated to private transportation (30%) which was part of household consumption and public transportation (70%) which formed part of the consumption of the transportation sector.

The "others" sector was disaggregated into construction, commerce and services by their relative shares (in percent) as derived and interpolated from the 1969 and 1974 input-output transactions tables (at producers' prices). These shares are shown in Table 2.

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[2] See "Petroleum Consumption in the Philippines: A Macroeconomic Analysis," DAP Paper Series No. 77-11, PREPF Workshop on Natural Resources, Environment and the Philippine Future, 1977.

Table 2

Three-sector Consumption Share of Petroleum Refineries' Output and Petroleum Products (in percent)

YEAR	CONSTRUCTION	COMMERCE	SERVICES
1969	23.06	15,92	61.02
1970	20.88	17.67	61.45
1971	18.70	19.41	61.89
1972	16.51	21.16	62.33
1973	14.33	22.90	62.76
1974-79	12.15	24.65	63.20

Source of basic data: 1969 Input-Output Tables of the Philippines
1974 Inter-Industry (Input-Output) Accounts of the Philippines

Note: Due to rounding off, figures do not total 100%.

After having obtained the percentage semestral and annual consumption share of each sector per product from each consumer trade, these were applied to the 1970-79 annual and first semester PNOC reseller, direct consumer and government trade data. Second semester estimates were computed as a residual of annual and

first semester data. All estimates in thousand barrels were converted to 10^{10} kilocalories. Table 3 summarizes the sectoral breakdown for each of these consumer trades. The final results are presented in PNEA Item II.A under the heading "Consuming Sectors".

Table 3

Sectoral Classification by Consumer Trade

Direct Consumer Trade	Government Trade	Reseller Trade
Agriculture	Transportation	Transportation
Mining	Utilities	Household
Manufacturing	Others	
Transportation		
Utilities		
Others		

3. Coal

Coal consumption figures in PNEA Item I.C are the sum of imports and domestic production. It was only in recent years that separate consumption figures were made available. Past data from the Bureau of Mines equated consumption with production. Sectoral coal consumption was estimated in the following manner. The first step entails identifying the major consuming entities

and classifying them according to the standard sectoral classification. For instance, the Visayan Electric Company was classified under the "utilities" sector, the APO Cement Company under "manufacturing" and so forth. There were only about four to five companies listed in the Bureau of Mines and the BEU's coal consumption summaries and these belonged to the manufacturing, mining and utilities sectors. The next step involves deriving the sectors' relative shares over total consumption. For 1974 to 1979, semestral shares were derived but for 1970 to 1973 whole year shares were computed. Lastly, these were applied to import and production data to determine sectoral consumption. All data were expressed in metric tons and converted to 10^{10} kilocalories.

4. Electricity

Electricity consumption in million kilowatt-hours by sector (industrial, utilities, residential, commercial and others) for calendar years 1970 to the first semester of 1979 was taken from the NEDA Philippine Statistical Yearbook 1979 (revised table 8.12 - Electric Energy Production and Consumption by Sector CY 1960 to July 1979) which had monthly breakdowns starting 1977. The 1972-1976 NEDA Philippine Economic Indicators also had the same monthly and sectoral form but had different figures. To derive consistent semestral data, first semester shares of the Indicators data were applied to the Yearbook's annual consumption. For 1970 and 1971, first semester factors computed as weighted

averages of the 1972-74 first semester consumption were applied to annual data from the Yearbook. The consumption figures for the second semester of 1979 were taken from the June 1980 NEDA Philippine Economic Indicators.

The classification of sectors was expanded to correspond with our standard classification with the use of electricity consumption shares from the 1969 and 1974 input-output tables (Table 4). These sectoral shares were applied to the first semester and yearly consumption figures based on their original classification and the second semester data were computed as residuals. The final results were converted to kilocalories and are found under PNEA Item II.B of the Consuming Sectors.

Actual electricity consumption data were used for the petroleum refineries subsector and subtracted from the derived consumption of the manufacturing industrial subsector. Annual data were available from the NEDA Philippine Statistical Yearbook (1970-71), the NCSO Annual Survey of Establishments for Manufacturing (1973-74) and the NCSO Economic Census (1972 and 1975). Semestral estimates were derived by taking first and second semester shares based on the refineries' production of petroleum products for each year. This was used as an "activity" variable that varies directly with the consumption of energy inputs. For 1976 to 1979, data of which were unavailable, the average ratio of the quantity of electricity consumed and production of refined products was computed from 1970 to 1975. This was applied to production data

Table 4

Sectoral Electricity Consumption Shares

Year	Industrial (100%)		Commercial (100%)			Utilities (100%)	Residential (100%)	Others (100%)
	Manufacturing	Mining	Construction	Commerce	Services			Agriculture
1970	0.9111	0.0889	0.0292	0.5209	0.4499	1.0000	1.0000	1.0000
1971	0.9161	0.0839	0.0276	0.5561	0.4162	1.0000	1.0000	1.0000
1972	0.9215	0.0785	0.0262	0.5863	0.3875	1.0000	1.0000	1.0000
1973	0.9272	0.0728	0.0250	0.6125	0.3625	1.0000	1.0000	1.0000
1974-79	0.9333	0.0667	0.0240	0.6353	0.3407	1.0000	1.0000	1.0000

Note: 1970-73 shares are interpolations from the 1969 and 1974 I-O figures.

Source of Basic Data: 1969 Input-Output Tables of the Philippines

1974 Inter-Industry (Input-Output) Accounts of the Philippines

(in 10^{10} kilocalories) in order to approximate electricity consumption. Consumption of electricity by petroleum refineries is defined as the sum of internally generated power plus power purchased from the the grid less electric energy sold. It must be noted however that the figures for 1976 to 1979 are preliminary estimates and are somewhat understated. From our survey of two refineries, total electricity consumption for the first half of 1979 was 4.08×10^{10} kilocalories. Our estimate, which includes a third refinery, is placed at 5.79×10^{10} kilocalories. There is no correction though for electric energy sold and actual consumption may still be significantly less than 4.08×10^{10} kilocalories.

Hydro-geothermal electricity consumption was estimated by computing the percent share of hydro-geothermal electricity production to total electricity generated from all sources from National Power Corporation (NPC) data and applying them to the quantity of electricity produced based on the NEDA Philippine Economic Indicators and Philippine Statistical Yearbook data. Production was equated to consumption and all estimates in million kilowatt-hours were converted to 10^{10} kilocalories.

II. Production

All production data are presented in the table of energy accounts as negative figures and are found solely under the transformation sectors. The production of petroleum refineries was

obtained from the Board of Energy (BOE) and the BEU. When semestral production data were unavailable, annual figures were derived according to first and second semester shares of refined products consumption for each year.

Total generation of electrical energy is the sum of the consumption of the industrial and household sectors plus the consumption of petroleum refineries. Own consumption and transmission losses by electrical utilities are implicit in the last figure for column 1 of the PNEA. Refinery fuel and loss is accounted for in the same manner under column 2. All inputs of primary and secondary energy minus the corresponding output of secondary energy available for distribution equals the own consumption of energy by the transformation sector inclusive of conversion losses.

III. Trade

Statistics on total energy imports and exports were taken from the Central Bank (CB) and the National Census and Statistics Office (NCSO). Only the series published by the NCSO was used. No major adjustments were made on the data collected and they were simply converted to corresponding energy units. Table 5 gives the various factors used.

IV. Inventory Changes

Actual inventory data are available from the BEU and the PNOC. We elected however not to use the data as all attempts

to link them with the consumption identity failed. Thus inventory change was computed as a residual.

Table 5

Energy Conversion Factors

Product	Btu/lb	Btu/bbl	Bbl/mt	Kcal/bbl	Kcal/liter	Kcal/Kg
Crude Petroleum	-	5.80×10^6	-	1.46×10^6	-	-
Avturbo	19,300	5.63×10^6	7.75	1.42×10^6	8927.44	11,000.01
Aviation Gasoline	20,950	5.19×10^6	8.90	1.31×10^6	8225.41	11,636.90
Premium Gasoline	20,750	5.63×10^6	8.50	1.36×10^6	8530.27	11,388.90
Regular Gasoline	20,500	5.38×10^6	8.50	1.34×10^6	8427.50	11,388.90
Kerosene	19,800	5.32×10^6	7.75	1.42×10^6	8927.44	11,000.01
Diesel Oil	19,650	5.81×10^6	7.46	1.46×10^6	9204.23	10,916.68
Fuel Oil	18,600	6.16×10^6	6.66	1.55×10^6	9758.94	10,333.34
Liquefied Petroleum Gas	21,180	4.03×10^6	11.60	1.01×10^6	6380.16	11,766.68
Coal (local)	10,000	-	-	-	-	5.56×10^3
Coal (imported)	12,500	-	-	-	-	6.94×10^3

Electricity: 859.845 kcal/kwh

1mmt = 2204.62 lb.
1 kcal = 3.96832 Btu
1bbl = 42 gallons or 158.987 liters

Abbreviations used: Btu = British thermal unit
Bbl = barrel
kcal = kilocalorie
mt = metric ton

Source: PNOC Petron Basic Line
"Conversion Factors Used in Oil Industry" from the Petroleum Economist
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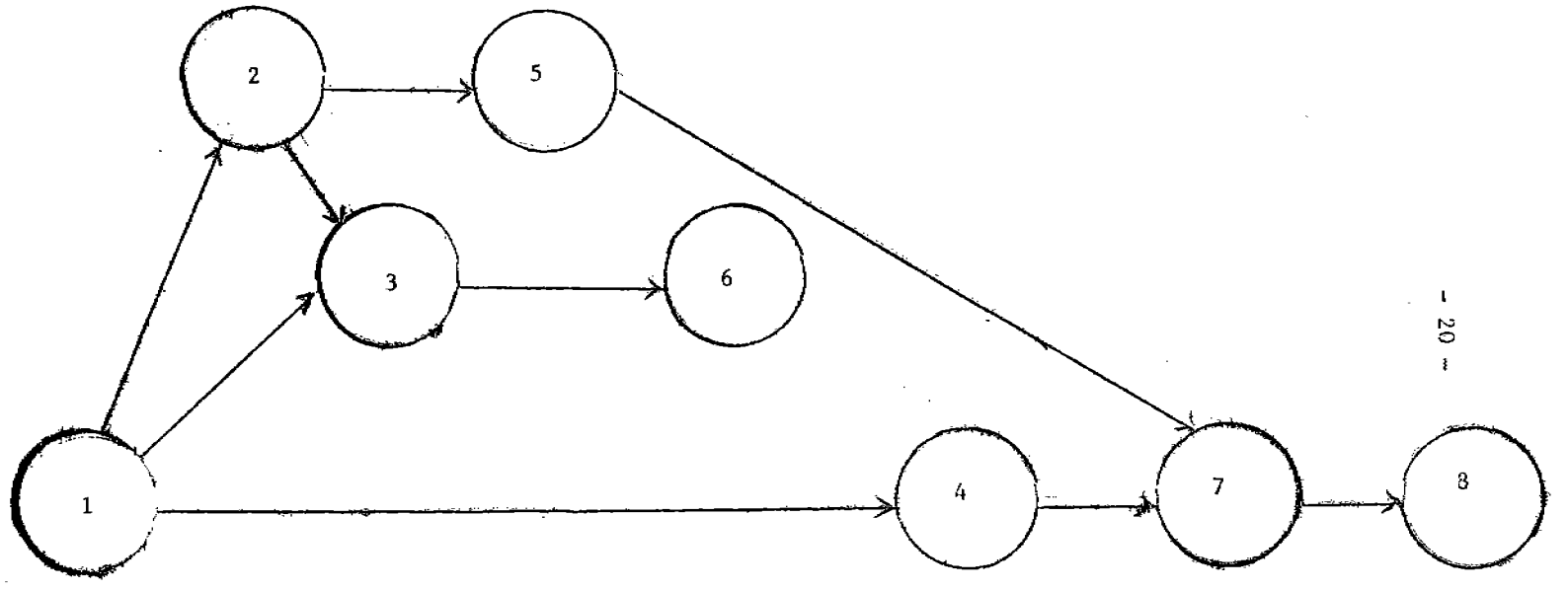
APPENDIX A

The Philippine National Energy Accounts: Detailed Methodology in Network Diagrams

GUIDE TO NETWORK DIAGRAMS

The following figures present a step-by-step detail of the methodology used in deriving the estimates of the energy accounts, with particular emphasis on consumption. The diagrams are networks summarizing activities (dependent and independent) undertaken for each energy product. Nodes are numbered and movement is in ascending order. Activities are represented by lines connecting the various nodes. Activities which may be performed simultaneously are denoted by lines originating from a common node. A path consists of a set of activities which must be performed in order. Lines preceding one another represent pre-requisite steps. When activities are independent of each other, they follow separate paths. For the following discussions please refer to the data cited in Working Paper No. 1.



Figre A.1 Refinery Production and Crude Petroleum Consumption

REFINERY PRODUCTION AND CRUDE PETROLEUM CONSUMPTION

Step	Activity
1-2	Compute shares of first and second semester to annual consumption of refined products (in 10^{10} kilocalories) for each year from 1970 to 1972 from PIP and PMOC data.
2-3	Apply shares derived in Step 1-2 to annual refinery production data from BOE, 1970-72 to obtain semestral production of refined products (in bbls), 1970-72.
1-3	Derive semestral estimates of refined product production and crude petroleum consumption from quarterly refinery production data from BOE, 1973-78 and BEU, 1979 (in bbls).
3-6	Convert to 10^{10} kilocalories.
1-4	Add semestral production and imports of crude petroleum (in bbls) from BEU, 1979, and CB/NCSO, 1970-79 respectively.
4-7	Convert sum from Step 1-4 (in bbls) to 10^{10} kilocalories.
2-5	Apply shares derived in Step 1-2 to annual crude petroleum consumption data from BOE, 1970-72 to obtain semestral crude petroleum consumption (in bbls), 1970-72.
5-7	Convert to 10^{10} kilocalories.
7-8	Subtract semestral crude petroleum consumption, 1970-79 from the sum of crude production and imports as derived from Step 1-4 to obtain semestral inventory change of crude petroleum 1970-79 (in 10^{10} kilocalories).

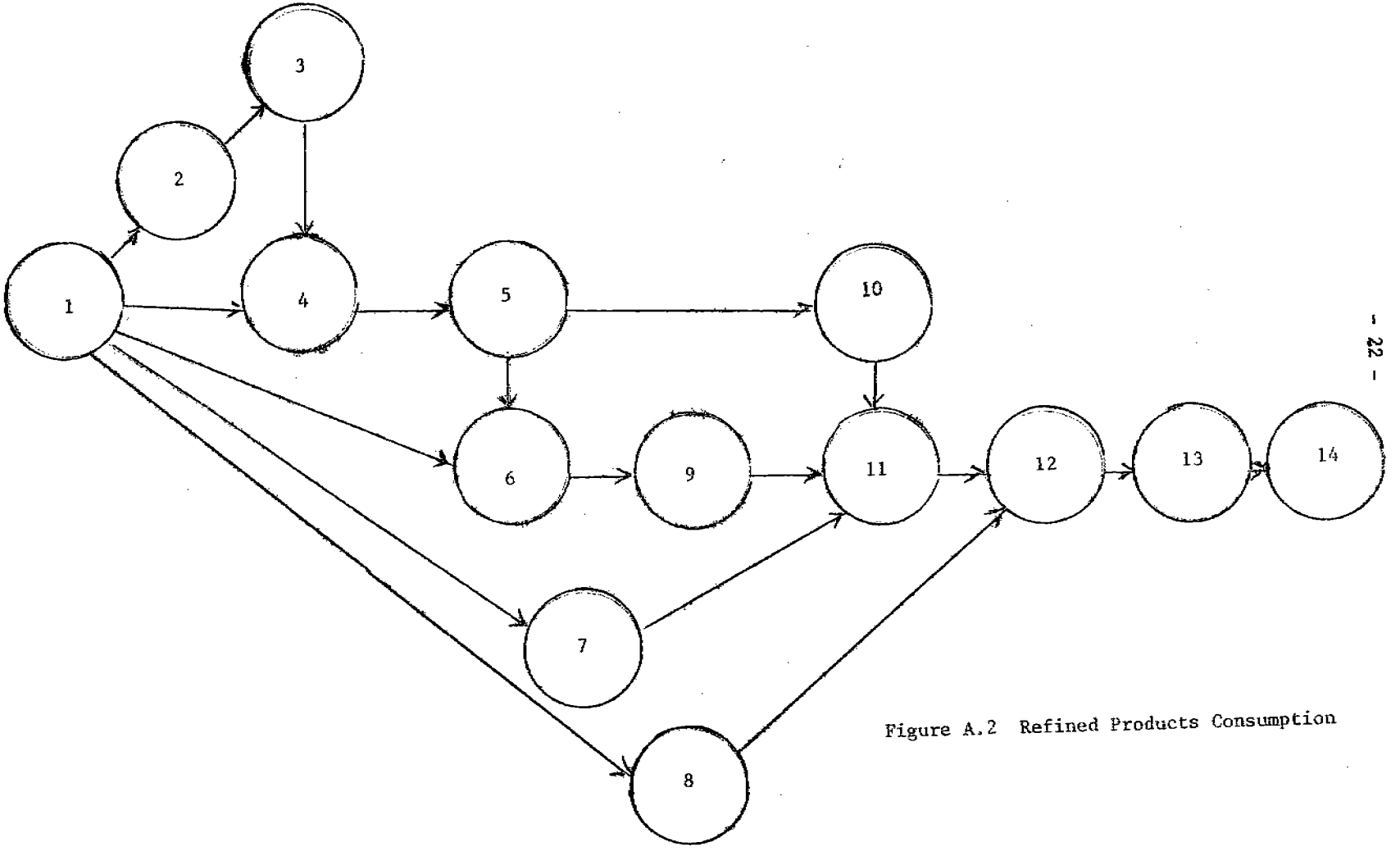


Figure A.2 Refined Products Consumption

REFINED PRODUCTS CONSUMPTION

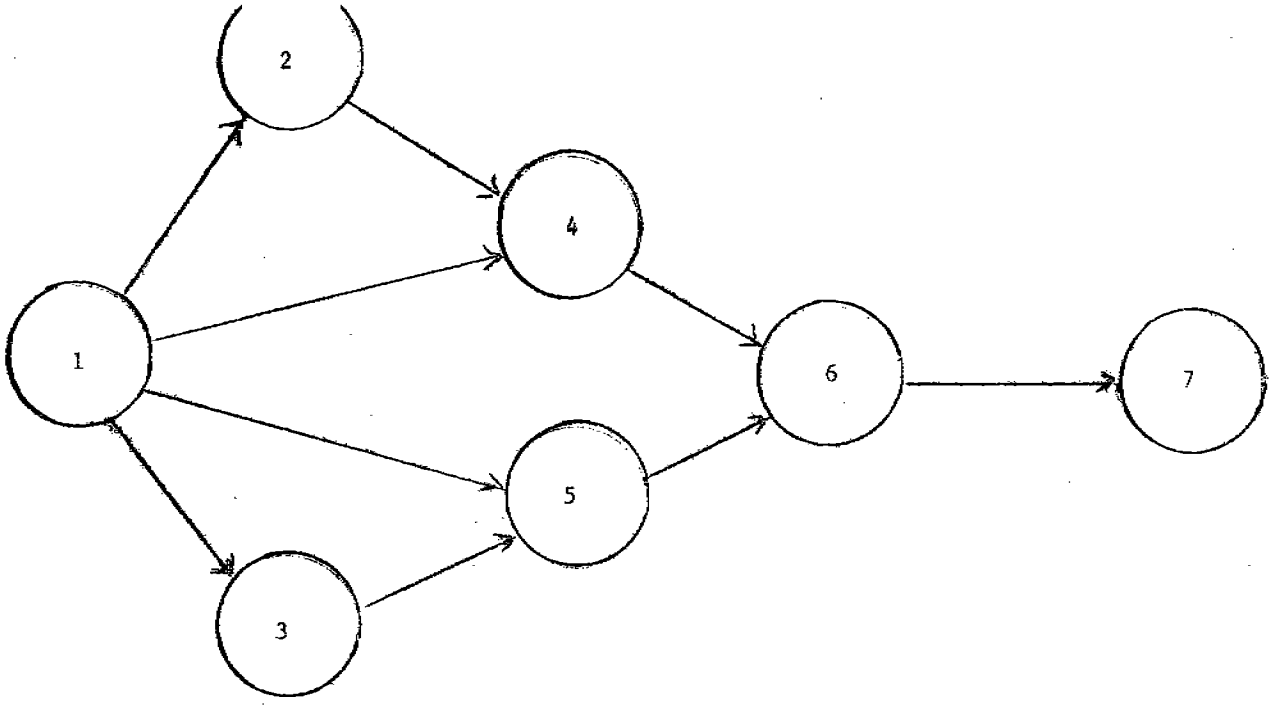
Step	Activity
1-2	Reclassify 1974 annual and 1975-79 semestral PNOC Direct consumer data by industry (in bbls) according to PIP sectoral classification viz., agriculture, mining, manufacturing, transportation, utilities and others.
2-3	Compute consumption share of each product by sector based on Step 1-2 for the whole year from 1974 to 1979 and first semester from 1975 to 1979 (in %).
3-4	Compute a weighted average consumption share per PIP sector of avturbo, aviation gas, premium and regular gasoline for the whole year and first semester of 1975 to 1978 from Step 2-3 to derive whole year and first semester consumption share per PIP sector of avturbo, aviation gas, premium and regular gasoline respectively for 1970 to 1973 (in %).
1-4	Compute the consumption share per PIP sector of LPG, kerosene, diesel oil and fuel oil from 1970 to 1973 PIP Direct Consumer data classified by sector viz., agriculture, mining, manufacturing, transportation, utilities, and others for the whole year and first semester of 1970 to 1973 (in %).
4-5	To derive the first semester consumption share per PIP sector for 1974 of LPG, kerosene, diesel oil, fuel oil, avturbo, aviation gas, premium and regular gasoline, compute a weighted average of 1973 and 1975 first semester consumption shares per PIP sector of these products (in %).
5-10	Apply derived annual and first semester consumption share per PIP sector (in %) to annual and first semester PNOC Direct Consumer data (in bbl) respectively to obtain annual and first semester consumption of refined products for agriculture, mining, manufacturing, transportation, utilities and others from 1970-1979 (in bbls).

REFINED PRODUCTS CONSUMPTION

Step	Activity
10-11	Compute second semester of refined products for these sectors as a residual of annual and first semester consumption (in bbls) from 1970 to 1979.
1-6	Compute whole year and first semester consumption share (in %) of LPG, kerosene, diesel and fuel oil by sector from 1970 to 1973 PIP Government Trade data (in bbls) classified by sector viz, transportation, utilities and others.
5-6	Compute whole year and first semester consumption shares (in %) of LPG, kerosene, diesel and fuel oil from 1974 to 1979 and avturbo, aviation gasoline, premium and regular gasoline from 1970 to 1979 for the transportation, utilities and others sector by taking their respective shares from Direct Consumer data (Steps 2-3, 3-4, 1-4 and 4-5) and adjusting the totals to 100%.
6-9	Apply the shares derived from Step 1-6 and 5-6 to annual and first semester PNOC Government Trade data to obtain annual and first semester consumption of refined products for transportation, utilities and others from 1970 to 1979 (in bbls).
9-11	Compute second semester consumption of refined products for these sectors as a residual of annual and first semester consumption from 1970 to 1979 (in bbls).
1-7	Net out the consumption of LPG, kerosene, and 30% of avturbo, aviation gasoline, premium and regular gasoline, diesel and fuel oil from semestral PNOC Reseller Trade data from 1970 to 1979 in order to derive consumption of refined products by the household sector for each semester from 1970 to 1979 (in bbls).
7-11	Classify the remaining 70% semestral consumption of avturbo, aviation gasoline, premium and regular gasoline, diesel and fuel oil from 1970 to 1979 under the transportation sector.

REFINED PRODUCTS CONSUMPTION

Step	Activity
11-12	Add refined products consumption of the 'transportation' sector : ived from Direct Consumer, Government and Reseller Trade data (in bbl: each semester from 1970 to 1979.
	Add refined products consumption of the 'utilities' sector as de: from Direct Consumer and Government Trade data (in bbls) for each sem from 1970 to 1979.
	Add refined products consumption of the 'others' sector as deriv m Direct Consumer and Government Trade data (in bbls) for each semester 970 to 1979.
1-8	Compute share of the construction, commerce and services sector roleum refineries' output from the 1969 and 1974 Input-Output (I-O) table at producers' price (in %).
8-12	Interpolate 1969 and 1974 I-O shares from 1970 to 1973 and use the 1974 shares for 1975 to 1979 (in %).
12-13	Apply the derived and interpolated I-O shares, 1970-79 to semestral refined products consumption of the 'others' sector to break up this sector into construction, commerce and services 1970-79 (in bbls).
13-14	Convert all semestral consumption estimates of refined products for agriculture, mining, manufacturing, transportation, utilities, construction, commerce, services and households (in bbls) from 1970 to 1979 to 10^{10} kilocalories.



Fi onsumption

COAL CONS

Step	Activity
1-2	Identify major consuming sector from annual coal consumption data (in mt) by company, Bureau of Mines, 1970-73.
2-4	mpute consumption per sector for each year from 1970-73 (in %).
1-3	lentify major consuming sector from semestral coal consumption data (in mt) by mpany, Bureau of Mines, 1974-76, BEU, 1977-79.
3-5	Compute consumption per sector for the first and second semester of each year from 1974-79 (in %).
1-4	Add semestral coal production and imports (in mt) from Central Bank and Bureau of Mines for 1970-73 to derive semestral aggregate coal consumption (in mt).
1-5	Add semestral coal production and imports (in mt) from Central Bank and Bureau of Mines for 1974-79 to derive semestral aggregate coal consumption (in mt).
4-6	Apply computed annual consumption share/sector derived in Step 2-4 to aggregate coal consumption from Step 1-4 for 1970-73.
5-6	Apply computed semestral consumption share/sector derived in Step 3-5 to aggregate coal consumption from Step 1-5 for 1974-79.
6-7	Convert all consumption estimates per sector (mt) to 10^{10} kilocalories, semestral 1970-79.

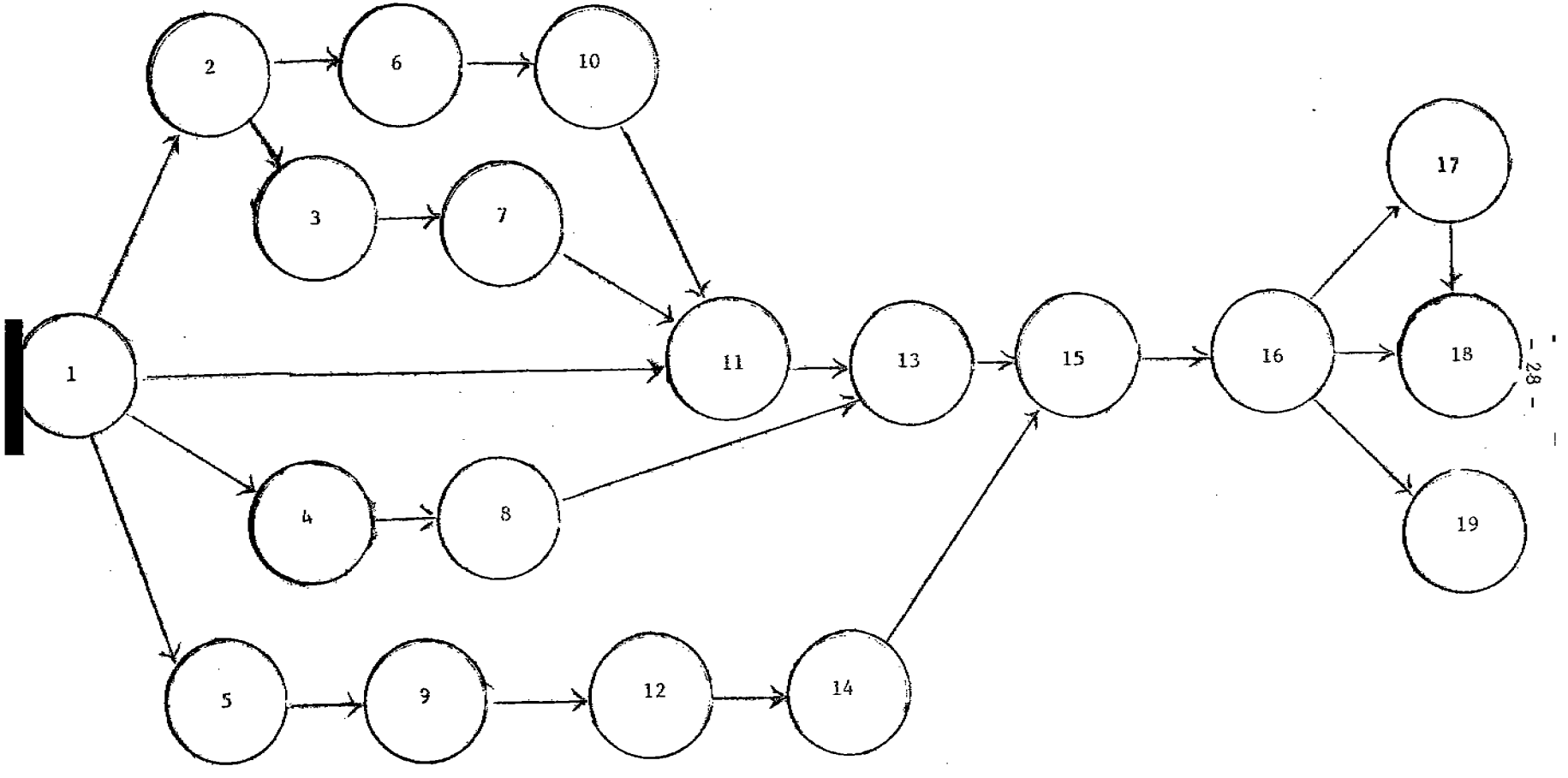


Figure A.4 Electricity Consumption

ELECTRICITY CONSUMPTION

Step	Activity
1-2	Compute semestral electricity consumption from monthly data of the NEDA Economic Indicators electricity consumption by industrial, utilities, residential, commercial and others use (in mkwh), 1972-76.
2-3	Compute first semester consumption shares of commercial, industrial, residential,utilities and others sector from 1972-76 to annual consumption (in %).
3-7	Apply first semester shares derived in Step 2-3 to Revised Table 8-12, 1972-76 annual electricity consumption per sector, i.e., commercial, industrial, residential, utilities and others, to derive first semester consumption (in mkwh).
7-11	Derive second semester electricity consumption by sector as a residual of annual and first semester consumption, 1972-76 (in mkwh).
2-6	For the commercial, industrial, residential, utilities and others sector, compute a weighted average of first semester consumption to annual consumption from 1972-74 (in %).
6-10	Apply the computed weighted first semester consumption share from Step 2-6 to Revised Table 8.12, 1970-71 annual electricity consumption of the commercial, industrial, residential, utilities and others sector to derive first semester electricity consumption.
10-11	Derive second semester consumption by sector as a residual of annual and first semester consumption (in mkwh), 1970-71 after accomplishing Step 6-10.
1-11	Compute semestral electricity consumption from monthly data of Revised Table 8.12 electricity consumption by commercial, industrial, residential, utilities and others use (in mkwh), 1977-79.

ELECTRICITY CONSUMPTION

Step	Activity
1-4	Compute share of manufacturing, mining, construction, commerce and services sectors of electricity consumption from the 1969 and 1974 Input-Output (I-O) Table at producer's prices (in %).
4-8	Interpolate 1970-73 shares from the computed I-O shares for 1969 and 1974 and use the 1974 shares for 1975-79 (in %).
8-13	Apply manufacturing and mining share, 1970-79 (in %) to semestral electricity consumption of the industrial sector (in mkwh), 1970-79 to derive electricity consumption of "manufacturing" and "mining" sectors; apply construction, commerce and services share, 1970-79 (in %) to semestral electricity consumption of the commercial sector (in mkwh) 1970-79 to derive electricity consumption of "construction", "commerce" and "services" sectors.
11-13	Classify semestral electricity consumption of residential sector, 1970-79, under "household ". Classsify semestral electricity consumption of utilities sector, 1970-79 under "utilities". Classify semestral electricity consumption of others sectors, 1970-79, under "agriculture".
13-15	Convert semestral electricity consumption, 1970-79 of agriculture, manufacturing, mining, construction, commerce, services, utilities, and household (in mkwh) to 10^{10} kilocalories.

ELECTRICITY CONSUMPTION

Step	Activity
1-5	Compute first and second semester shares to annual production of petroleum products (in 10^{10} kilocalories) from 1970-75 (in %).
5-9	Apply first and second semester ratios derived in Step 1-5 to annual electricity consumption of petroleum refineries (in mkwh) from the NEDA Statistical Yearbook 1970-71, NCSO Annual Survey of Manufactures 1973-74, and NCSO Economic Census 1972 and 1975 to derive semestral electricity consumption of petroleum refineries from 1970-75 (in mkwh).
9-12	Convert semestral electricity consumption of petroleum refineries, 1970-75 (in mkwh) into 10^{10} kilocalories.
12-14	Compute ratio of electricity consumption of petroleum refineries (in 10^{10} kilocalories) to production of refined products (in 10^{10} kilocalories) for each semester from 1970 to 1975 (in %).
14-15	Apply ratios derived in Step 12-14 to semestral production of refined products from 1976-79 to derive semestral electricity consumption of petroleum refineries (in 10^{10} kilocalories) from 1976-79.
15-16	Subtract 1970-79 semestral electricity consumption of petroleum refineries (in 10^{10} kilocalories) from electricity consumption of "manufacturing" sector for the same period (as derived from Step 8-13); semestral electricity consumption of "manufacturing" sector from 1970-79, now excludes the petroleum refineries subsector.
16-17	Consolidate semestral electricity consumption of "agriculture", "manufacturing", "mining", "construction", "commerce", "services" and "household" from 1970-79, under "Consuming Sectors".

ELECTRICITY CONSUMPTION

Step	Activity
16-18	Classify semestral electricity consumption of petroleum refineries (in 10^{10} kilocalories) 1970-79 under "Transformation Sector".
16-19	Classify semestral electricity consumption of "utilities" sector, 1970-79 as part of losses in the transformation sector.
17-18	Add electricity consumption of "consuming sectors" and "petroleum refineries" to derive electricity generation, semestral, 1970-79 (in 10^{10} kilocalories).

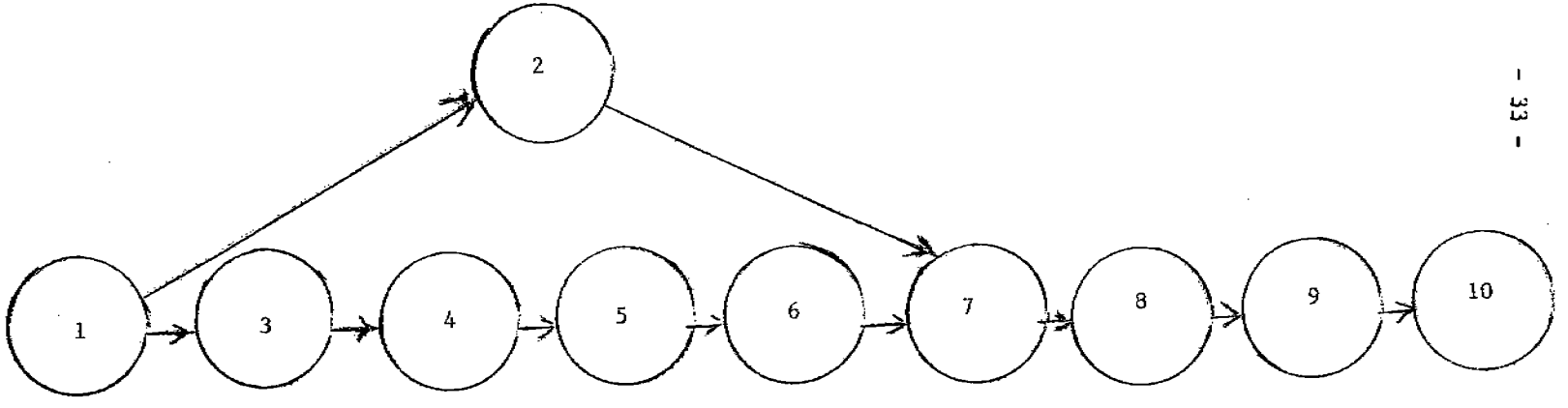


Figure A.5 Hydrogeothermal Electricity Consumption

HYDROGEOTHERMAL ELECTRICITY PRODUCTION AND CONSUMPTION

Step	Activity
1-3	Compute semestral electricity production from monthly data from the NEDA Philippine Economic Indicators from 1972-76 (in mkwh).
3-4	Compute first semester shares of electricity production from semestral data from the Economic Indicators from 1972-76.
4-5	Get weighted percentage of 1972-74 first semester shares of electricity production from Step 3-4 to obtain first semester share of electricity production for 1969-71 (in %).
5-6	Apply first semester shares of electricity production as derived from Steps 3-4, 4-5 to 1972-76 annual electricity production (in mkwh).
6-7	From Step 5-6, derive second semester electricity production from 1969-76 as a residual of annual and first semester electricity production from 1972-76 (in mkwh).
1-2	Compute % share of hydrogeothermal electricity production to total electricity production from all sources for each year from the NPC Ten-Year historical energy generation (in mkwh) per source table from 1969-78 and from the BEU for 1979.
2-7	Compute semestral electricity production (in mkwh) from monthly data of Revised Table 8.12 for 1977-78 and the Economic Indicators for 1979.

HYDROGEOTHERMAL ELECTRICITY PRODUCTION AND CONSUMPTION

Step	Activity
7-8	Apply share of hydrogeothermal electricity production to total electricity generated from all sources, as derived from Step 1-2, to semestral quantity of electricity production (in mkwh), as derived from Steps 2-7, 5-6, 6-7, to obtain semestral production of hydrogeothermal electricity from 1969-79.
8-9	Equate semestral hydrogeothermal electricity production (in mkwh), 1970-79 to hydrogeothermal electricity consumption.
9-10	Convert all estimates (in mkwh) to 10^{10} kilocalories.