



Samoa Bureau of Statistics

Environment Statistics

Samoa Experimental Energy Account, 2016

1. Executive Summary

Samoa's first Experimental Energy Account 2016 provides information and presents estimates on the Physical Supply and Use of energy in Samoa's economy. The accounts are compiled and developed using the United Nations System of Environmental Economic Accounting (UN SEEA) Framework.

These Experimental Energy accounts mainly focused on the supply and use of energy (in joules¹) for the year 2016 as a baseline, using the Energy Balances as the primary input data for its compilation. The Ministry of Finance through its Energy Division has been compiling the Energy Balances for years, which is the primary input for this experimental energy account. With slightly differences in compilation methodologies, it should be noted that this experimental energy accounts uses the **residence principle**² while Energy Balance uses the **territorial principle**.

Fossil fuels and electricity are the main energy components accounted for in this report with some of the oil products like lubricants and greases not included. This compilation will also be used to determine the strength of existing data and information for sustainable energy compilations.

Energy Accounts is also a useful tool to produce energy indicators and estimates for informed policy decision making and monitoring purposes. In Samoa's Development Strategy 2016/17-2019/20, Key Outcome 12, Quality Energy Supply highlighted Samoa's focus on energy self-sufficiency with reduced reliance on imported fuels. One of the Strategic Outcomes is the increase in investment and generation of renewable energy - i.e. a '**100% of electricity generation from renewable sources by the year 2025**'.

On that note, this experimental energy accounts for 2016 presents estimates of energy supply and use in physical terms and also indicators relating to national strategic plans, SDGs and Samoa's Nationally Determined Contribution (NDC) submission to the United Nations Framework Convention on Climate Change (UNFCCC).

¹ **Joules** – a recommended SI unit for the SEEA Energy Accounts. Energy balances use tons of oil equivalent (TOE), which is converted using conversion factors (MOF, 2016; Samoa Energy Review 2016 [Annex A; Energy Conversion Factors; pg.33])

² **Residence Principle** assigns flows of energy to the country of residence of the producing or consuming unit. **Territorial Principle** assigns flow of energy to the country in which the producing or consuming unit is located at the time (SEEA Energy, 2019 pg. 159-160)

2. Acronyms

ADO	Automotive Diesel Oil
DPK	Dual Purpose Kerosene
EPC	Electric Power Corporation
GDP	Gross Domestic Product
LPG	Liquefied Petroleum Gas
MOF	Ministry of Finance
Mogas	Motor Gasoline
NDC	Nationally Determined Contribution
PPS	Petroleum Products Supply
SBS	Samoa Bureau of Statistics
SDG	Sustainable Development Goals
SEEA	System of Environmental Economic Accounting
IRES	International Recommendations for Energy Statistics
UN	United Nations
UNESCAP	United Nations Economic and Social Commission for Asia Pacific
UNFCC	United Nations Framework Convention on Climate Change

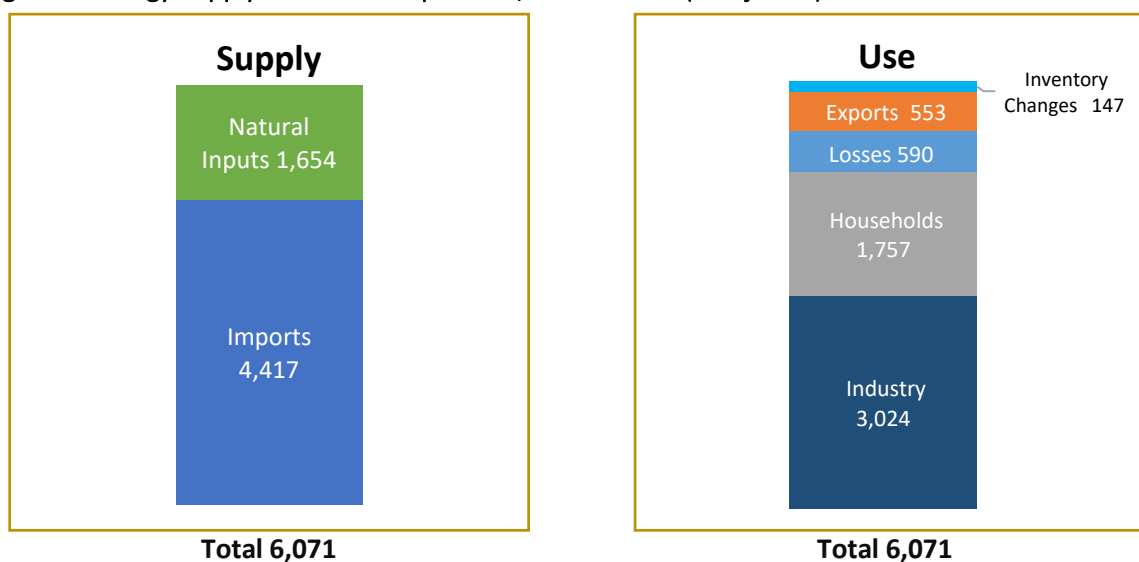
3. Units of Measurements

J	Joule	
KJ	Kilojoules	(Thousand joules)
MJ	Megajoules	(Million joules)
GJ	Gigajoules	(Billion joules)
TJ	Terajoules	(Trillion joules)

4. Account Highlights & Results

Figure 1 is a summary of the Energy Supply and Use components for Samoa in 2016. Samoa's energy supply totaled approximately 6,100 TJ where imported energy products accounted for an estimated 72.8 % (4,417 TJ) of total supply while natural inputs from the environment accounted for the remaining 27.2 % (1,654 TJ).

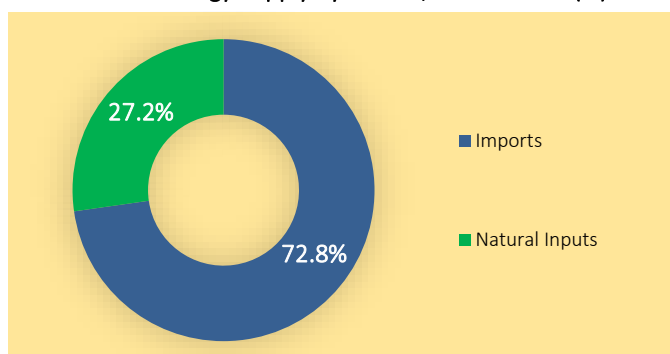
Figure 1: Energy Supply and Use Components, Samoa 2016 (Terajoules)



On the use side, Samoa’s energy was used by industry including government which accounted for about 49.8 % (3,024 TJ) of total use followed by households with 28.9 % (1,757 TJ). Re-exports of energy products accounted for about 9.1 % (553 TJ). The remainder of energy produced were either losses or energy inventories, 9.7 % (590 TJ) and 2.4 % (147 TJ) respectively.

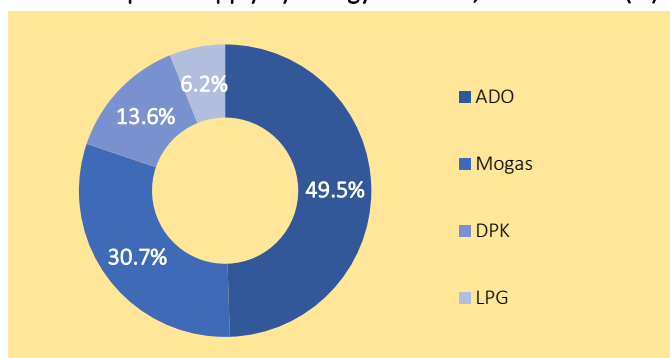
4.1 Samoa Energy Supply

Chart 1: Total Energy Supply by Source, Samoa 2016 (%).



The bulk of the energy supply are from the imports accounting for 72.8 % (4,417 TJ) while the remaining 27.2 % (1,654 TJ) are from natural inputs (Chart 1).

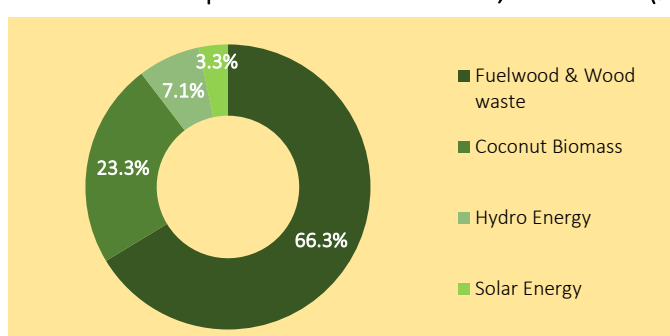
Chart 2: Imports Supply by Energy Products, Samoa 2016 (%).



Fossil Fuel imports is dominated by the Automotive Diesel Oil (ADO) with 49.5% (2,190 TJ) followed by Motor Gasoline (Mogas) with 30.7% (1,360 TJ).

Dual purpose kerosene (DPK) accounted for 13.6% (600 TJ) while the remaining 6.2% (270 TJ) was by LPG (Chart 2).

Chart 3: Natural Inputs from the Environment, Samoa 2016 (%).



Fuelwood and wood waste dominated the amount of energy directly abstracted from the environment (natural inputs) with 66.3% (1,100 TJ) then followed by Coconut biomass with 23.3% (390 TJ) as depicted in Chart 3.

4.2 Supply of Primary Energy Products and Imports

Table 1 and Chart 4 summarize the Supply of Primary Energy Products and Imports for Samoa in 2016. As already mentioned, imports are primarily the major supply of energy products with 72.8 %.

Biofuels³ produced from fuelwood & wood waste and coconut biomass accounted for about 24.0 % of total primary energy products. The remaining 3.0 % is electricity produced from renewable sources namely hydro and solar.

Table 1: Supply of Primary Energy Products and Imports, Samoa 2016 (Terajoules)

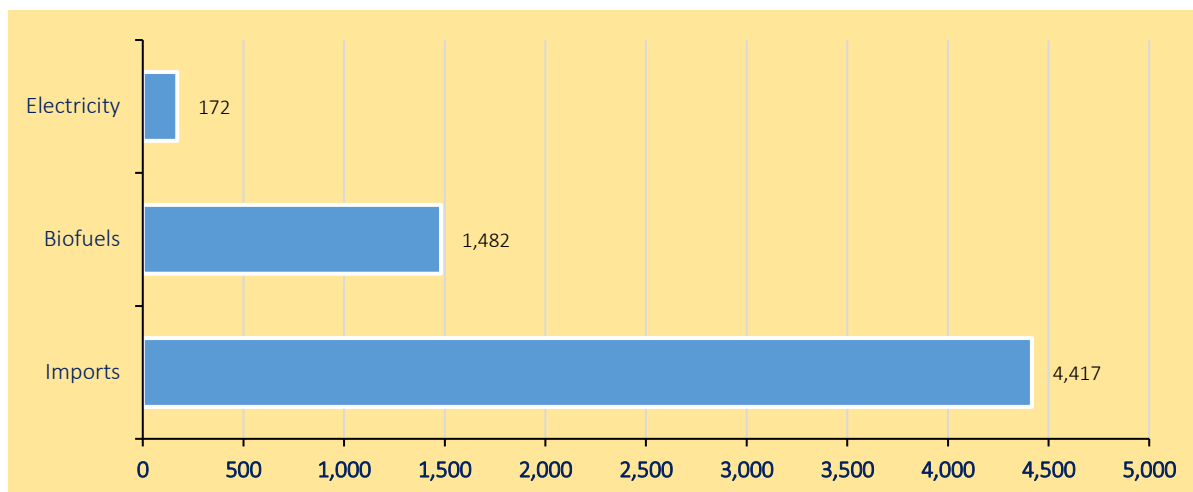
	Agriculture (a)	Electricity (b)	All Other Industries (c)	Imports	Flows from the Environment	Total Primary Energy Supply & Imports
Diesel	-	-	-	2,186	-	2,186
Mogas	-	-	-	1,357	-	1,357
DPK	-	-	-	603	-	603
LPG	-	-	-	272	-	272
Electricity	-	172	-	-	-	172
Biofuels	1,482	-	-	-	-	1,482
Waste	-	-	-	-	-	-
Total Energy Products	1,482	172	-	4,417	-	6,071

Source: Ministry of Finance and Samoa Bureau of Statistics.

Note:

- a) Includes Forestry and Fishing
- b) Includes Gas, Water and Waste Services
- c) Includes Construction & Manufacturing; Transport, Storage & Services; Community, Social Services and Government;
- Nil or rounded to zero

Chart 4: Supply of Primary Energy Products & Imports, Samoa 2016 (TJ)



Source: Ministry of Finance and Samoa Bureau of Statistics

4.3 Samoa Energy Use

Total End use of Energy Products was estimated at about 5,480 TJ. The difference between the Supply and End Use of energy products is 590 TJ, which was accounted for the conversion and other losses⁴ by the Electricity industry which is not actually used.

³ **Biofuels** – refers to any fuel derived directly or indirectly from biomass. Biofuel in this report refers to energy products produced from fuelwood and coconut biomass, to align with IRES 2018.

⁴ **Conversion losses** occur when one energy product is transformed into another. For example, diesel is used to produce electricity. In the conversion process, not all the energy content of diesel is converted to electricity. **Other losses** include losses in distribution; for example, some electricity is lost as it is distributed in the grid.

Table 2: End Use of Energy Products, Samoa 2016 (Terajoules)

	Agriculture (a)	Commercial services	Industrial (b)	Transport (c)	Government (d)	Electricity (e)	Households	Inventories	Exports	Sum of Row
End Use of Energy Products										
ADO	25	230	-	867	-	-	-	75	25	1,223
Mogas	4	4	-	1,290	-	-	-	54	4	1,357
DPK	-	4	-	33	-	-	25	17	523	603
LPG	-	163	-	-	-	-	109	-	-	272
Electricity	-	170	20	-	138	71	145	-	-	544
Biofuels	-	4	-	-	-	-	1,478	-	-	1,482
Total Use	29	576	20	2,190	138	71	1,757	147	553	5,481

Source: Ministry of Finance and Samoa Bureau of Statistics

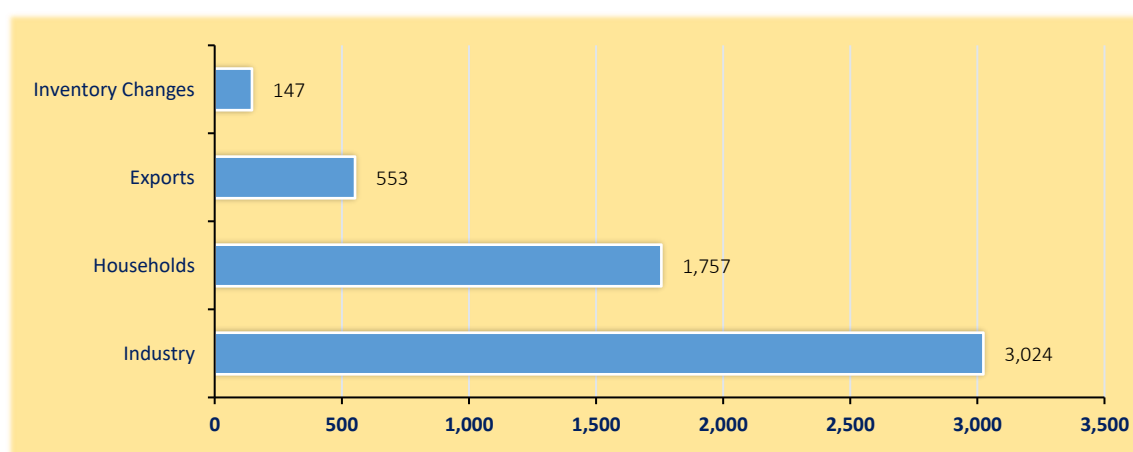
Note:

- a) Includes Forestry and Fishing
 - b) Includes Manufacturing and Construction
 - c) Includes Storage and Services
 - d) Includes community and social services
 - e) Includes Gas, Water and Waste Services
- Nil or rounded to zero

An estimated 3,024 TJ of energy products was used by industries including government which accounted for almost 55% of total end use of energy products. Households used 1,757 TJ or 32% with the remaining 553 TJ (10%) and 147 TJ (3%) were exports and inventory respectively (Chart 5).

Please note, households likely use some portion of diesel and mogas, so the allocation of these sources to the transport industry results in an underestimate of household use and an overestimate of industry use.

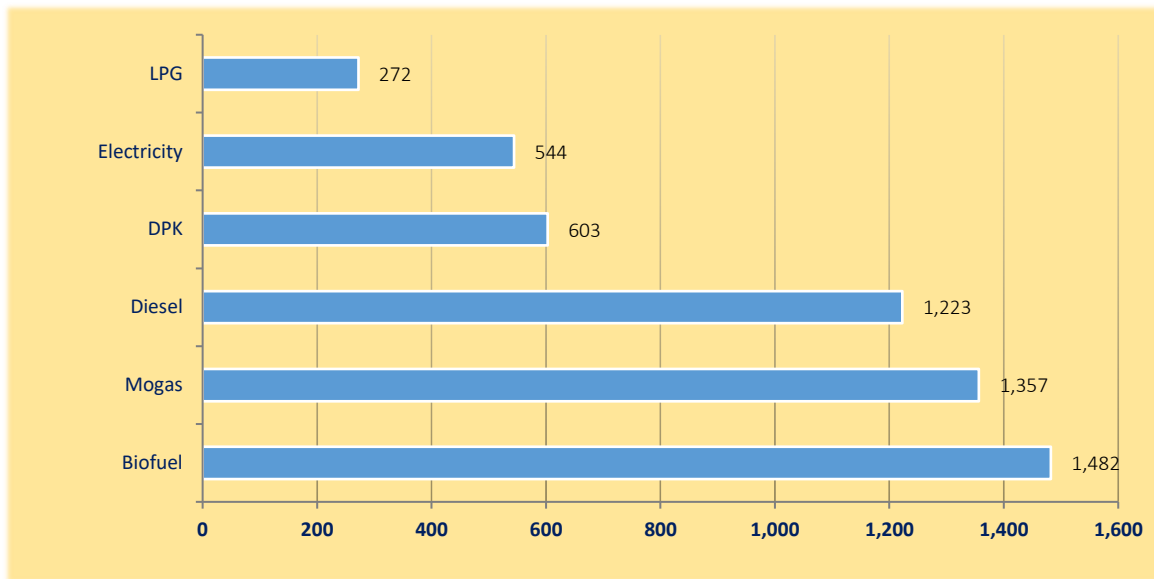
Chart 5: Total Energy Use, Samoa 2016 (TJ)



Source: Ministry of Finance and Samoa Bureau of Statistics

As depicted in Chart 6, Energy use by energy product is dominated by biofuel with about 1,480 TJ or 27.0% of total use. Of this total of 1,480 TJ, about 99.7 % of biofuel was used by households indicating households' dependence on fuelwood and coconut residues for energy mainly for cooking. LPG is the least used energy product at about 5.0% (Chart 6).

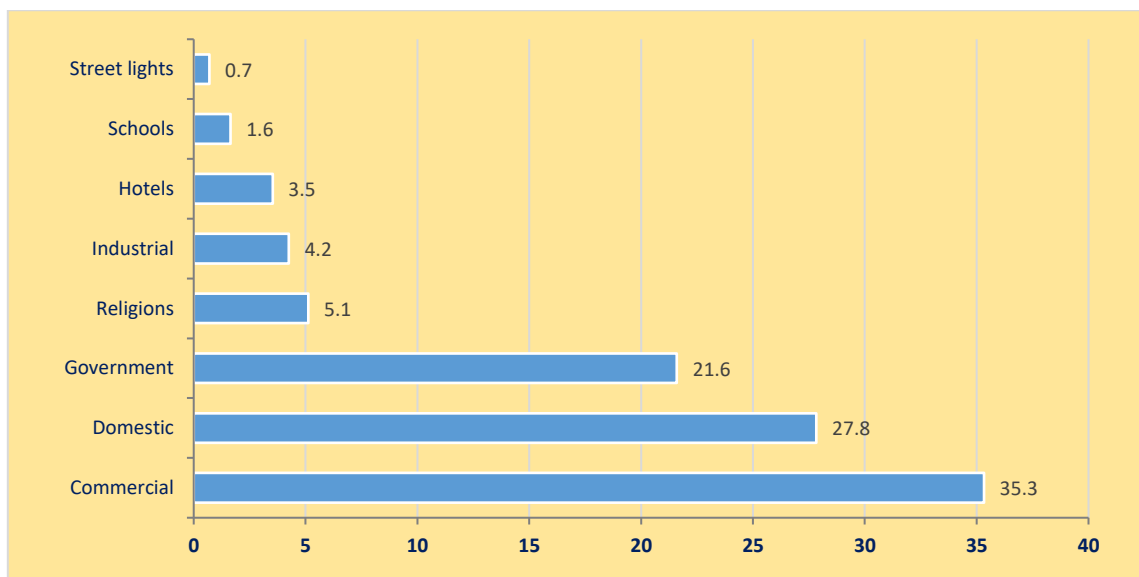
Chart 6: Energy Use by Product Type, Samoa 2016 (TJ)



Source: Samoa Bureau of Statistics

Chart 7 shows the electricity use by industries in 2016 indicating that commercial businesses used the most constituting 35.3% while streets lights used the least with only 0.7%.

Chart 7: Percentage of Electricity Use by Industries, Samoa 2016



Source: Electric Power Corporation (EPC)

Note: Industries here refer to EPC's categories of Consumers. Domestic refers to Households.

5. Energy Accounts and Environment Indicators

Energy accounts can provide indicators for the monitoring of several national development energy and environmental related indicators.

One of Samoa’s Strategic Outcomes in its Development Strategy 2016/17-2019/20 is the increase in investment and generation of renewable energy. For Electricity, ‘a **100% of electricity generation from renewable sources by the year 2025**’.

For 2016, the renewable electricity share is 31.5% compared to 68.5% electricity generated by Diesel (Refer Table 3).

Table 3: Electricity by Source, Samoa 2016

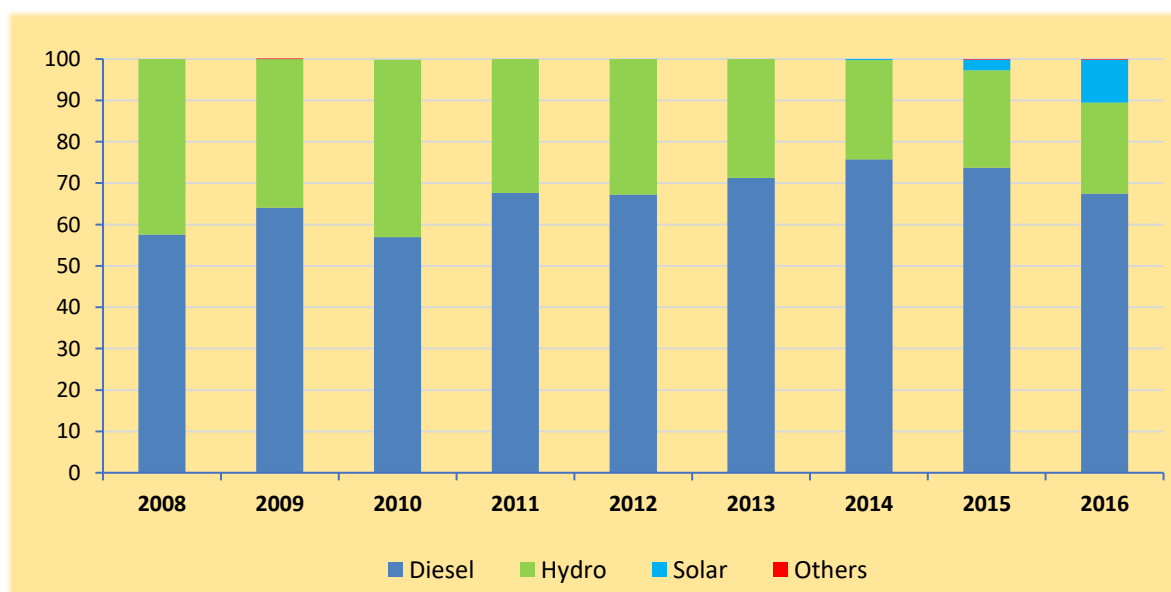
Electricity Sources	Terajoules (TJ)	Percentage (%)
Total Diesel	372.6	68.5
Total Renewable Electricity	171.6	31.5
Hydro Electricity	117.2	21.5
Solar Electricity	54.4	10.0
Wind Electricity	0.0	0.0
Total Electricity Production	544.3	100.0

Source: Electric Power Corporation (EPC)

Note: Contribution of wind is insignificant

Historically, diesel electricity generation dominated the overall production for years. From the years 2014 up to 2016, there was an emergence of other renewable sources namely solar and wind and they have contributed to the increase in renewable electricity share from 24.0 % in 2014 to 31.5 % in 2016 (Refer Chart 9).

Chart 9: Percentage Share of Electricity Generation from Diesel versus Renewable Sources, Samoa 2008-2016 (%)



Source: Electric Power Corporation (EPC)

Note: Others refer to other sources such as wind electricity

6. Climate Change Indicators & SDG 7



Some of the climate change related indicators can be calculated using information from this experimental Energy Accounts.

Table 4: Energy Related Climate Change Indicators, Samoa 2016

Definition & Description		Unit	2016
Gross Domestic Product (GDP - Current Prices)		SAT\$	2,108,588,000
Population (a)		No.	195,979
Energy Related Climate Change Indicators			
1. Net Domestic Energy Use (b)	Refers to the amount of energy that is end used by resident units. End use refers to the final transformation stage of energy use i.e., afterwards the energy is no longer available for human use in the respective accounting period	TJ	5,371.7
2. Share of Fossil Fuels in Total Energy Use	Share of fossil fuels in the total energy use for Samoa. Fossil fuels include gas, diesel, mogas and kerosene.	%	69.2
3. Total Energy Intensity of Production Activities of National Economy (SDG 7.3.1)	It expresses the energy used by production activities in terms of units of GDP. It can be calculated for the whole economy or for the different industries. Calculated by Immediate consumptions of energy products by industries divided by GDP	MJ/GDP	1.7
4. Energy Use by Resident Households Per Capita (c)	It refers to the total use of energy by resident households divided by resident population.	GJ/Person	9.0
5. Renewable Energy Share in Total Energy Use by National Economy (SDG 7.2.1)	Percentage of renewable energy use in total energy use of the national economy.	%	30.8

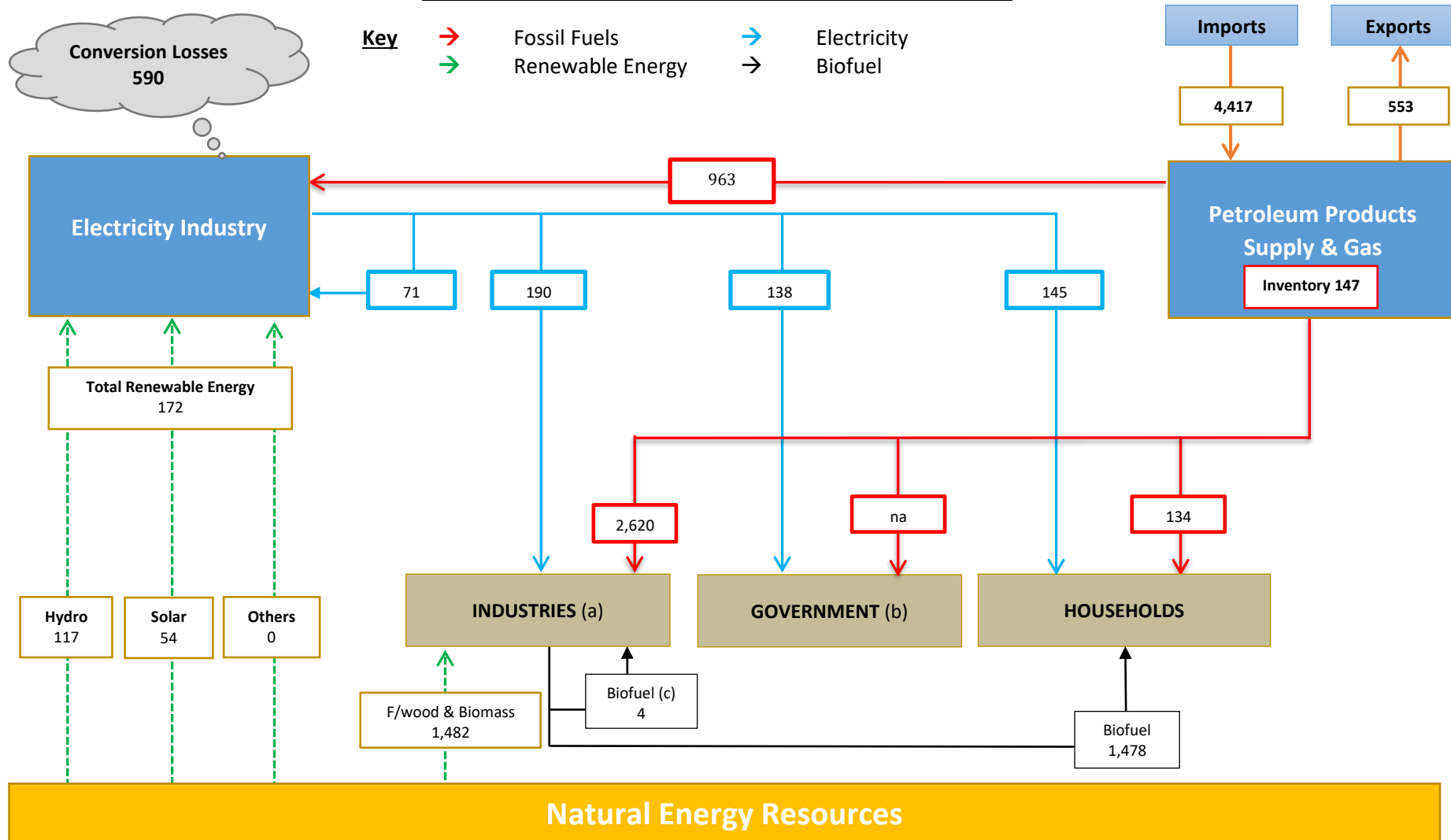
Source: Samoa Bureau of Statistics

Note: (a) Population census conducted in November 2016

(b) Exports excluded.

(c) Not including share of ADO & Mogas as they are all allocated to Transport Sector

Figure 2: Physical Energy Flows, Samoa 2016 (TJ)



Note:

- a. Industries includes Agriculture, Forestry & Fishing, Commercial Sectors, Industrial and Transportation & Storage
- b. Unable to compile the amount of fossil fuel used by government.

Table 5: Physical Supply Table, Samoa 2016 (Gigajoules)

Energy Supply 2016	Agriculture, Forestry & Fishing	Commercial Sectors	Industrial (Manu. & Cons.)	Transportation & Storage	Community, Social Services & Gov't	Electricity	Households	Inventories	Imports	Flows from the Environment	Total Supply
Energy from Natural Inputs											
Natural Resource Inputs											
Fuelwood & Wood Waste										1,097	1,097
Inputs of Energy from Renewable Energy											
Hydro										117	117
Solar										54	54
Wind										-	-
Other Natural Inputs											
Energy Inputs to Cultivated coconut biomass										385	385
Total Energy from Natural Inputs										1,654	1,654
Energy Products											
Production of Energy Products											
ADO	-	-	-	-	-	-	-	-	2,186	-	2,186
Mogas	-	-	-	-	-	-	-	-	1,357	-	1,357
DPK	-	-	-	-	-	-	-	-	603	-	603
LPG	-	-	-	-	-	-	-	-	272	-	272
Electricity	-	-	-	-	-	544	-	-	-	-	544
Biofuels	1,482	-	-	-	-	-	-	-	-	-	1,482
Waste	-	-	-	-	-	-	-	-	-	-	-
Total Energy Products	1,482	-	-	-	-	544	-	-	4,417	-	6,443
Energy Residuals											
Losses during Extraction	-	-	-	-	-	-	-	-	-	-	-
Losses during Transformation	-	-	-	-	-	536	-	-	-	-	536
Losses during Distribution	-	-	-	-	-	54	-	-	-	-	54
Losses during Transmission	-	-	-	-	-	-	-	-	-	-	-
Other Energy Residuals	29	576	20	2,190	138	71	1,757	-	-	-	4,781
Total Energy Residuals	29	576	20	2,190	138	662	1,757	-	-	-	5,372
Other Residual Flows											
Residual from end use for non-energy purposes	-	-	-	-	-	-	-	-	-	-	-
Energy from solid waste	-	-	-	-	-	-	-	-	-	-	-
TOTAL Supply	1,511	576	20	2,190	138	1,206	1,757	-	4,417	1,654	13,469

Note: Dark grey cells are null by definition
 -: Nil or rounded to zero

Table 6: Physical Use Table, Samoa 2016 (Gigajoules)

Energy Use 2016	Agriculture, Forestry & Fishing	Commercial Sectors	Industrial (Manu. & Cons.)	Transportation & Storage	Community, Social Services & Gov't	Electricity	Households	Inventories	Exports	Flows from the Environment	Total Supply
Energy from Natural Inputs											
Natural Resource Inputs											
Fuelwood & Wood Waste	1,097	-	-	-	-	-					1,097
Inputs of Energy from Renewable Energy											
Hydro	-	-	-	-	-	117					117
Solar	-	-	-	-	-	54					54
Wind	-	-	-	-	-	-					-
Other Natural Inputs											
Energy Inputs to Cultivated coconut biomass	385	-	-	-	-	-					385
Total Energy from Natural Inputs	1,482	-	-	-	-	172					1,654
Energy Products											
Transformation of Energy Products											
ADO	-	-	-	-	-	963					963
Mogas	-	-	-	-	-	-					-
DPK	-	-	-	-	-	-					-
LPG	-	-	-	-	-	-					-
Electricity	-	-	-	-	-	-					-
Biofuels	-	-	-	-	-	-					-
Waste	-	-	-	-	-	-					-
Total Transformation of Energy Products	-	-	-	-	-	963					963
End use of Energy Products											
ADO	25	230	-	867	-	-	-	75	25		1,223
Mogas	4	4	-	1,290	-	-	-	54	4		1,357
DPK	-	4	-	33	-	-	25	17	523		603
LPG	-	163	-	-	-	-	109	-	-		272
Electricity	-	170	20	-	138	71	145	-	-		544
Biofuels	-	4	-	-	-	-	1,478	-	-		1,482
Waste	-	-	-	-	-	-	-	-	-		-
Total End use	29	576	20	2,190	138	71	1,757	147	553		5,481
Energy Residuals											
Losses during Extraction										-	-
Losses during Transformation										536	536
Losses during Distribution										54	54
Losses during Transmission										-	-
Other Energy Residuals										4,781	4,781
Total Energy Residuals										5,372	5,372
Other Residual Flows											
Residual from end use for non-energy purposes									-		-
Energy from solid waste											-
TOTAL USE	1,511	576	20	2,190	138	1,206	1,757	147	553	5,372	13,469

Note: - Not available.

7. Accounts Produced

Since this is the first ever Experimental Energy Account for Samoa, this report will serve as a baseline for future reports.

8. Data Sources and Methods

The Ministry of Finance through its Energy Division produced Energy Balances for years, and it's the core component or input for Energy Accounts. The ministry has a history of working with the energy sector partners and SBS had benefited from this partnership with the extraction of the required statistical data and information from various stakeholders such as EPC, PPS and Gas companies.

Other information and statistical data were extracted from within the Bureau such as population, GDP, Imports and Exports.

9. Next Steps

This is the initial attempt towards accounting for the supply and use of energy in Samoa. One of the objectives of this compilation was to assess the capacity of the existing energy information and statistics to produce energy accounts. It has proved that it can be done and improving on some of the data gaps and issues, energy accounts can be a useful platform to address some of the energy policies going forward. That is, further development of the accounts will improve analysis and production of important aggregates and indicators to address national, regional and international goals and targets in regards to energy development.

The gaps and issues also provide room for more work for SBS in order to improve the account for policy decision making. Some of these works are;

- ✓ Continue on compiling energy accounts once energy balances are made available for 2017-2019 to provide better time series of analysis and trends. The application of the accounts and its usefulness for policy and decision making will improve as the accounts are produced consistently over the years.
- ✓ Improve on disaggregating economic activities to align with the International Standard Industrial Classification (ISIC) which allows the proper allocation of energy use per industry for meaningful and detailed analysis.
- ✓ Greater opportunity for self-learning and capacity building for the environment team for better and useful energy accounts.

Further improvement in terms of access to primary data and quality of information, can be achieved through better data sharing between the Bureau and key stakeholders.

10. Feedback on the Accounts

The accounts will be improved significantly as we keep publishing series of water accounts over the years and any feedback provided will further enhance that. The bureau will be very pleased to receive any form of feedback on any issue or account related matters, for future improvements.

Mr. Papalii Benjamin Sila
benjamin.sila@sbs.gov.ws
ACEO- Social Statistics Division
Samoa Bureau of Statistics
FMFM II Building, PO Box 1151
Apia, Samoa

11. Acknowledgement

We would like to thank our valuable partners and stakeholders especially the Energy Division of the Ministry of Finance, for the provision of the Energy Balance report and other set of energy statistics that made this Energy Account possible.

We would also like to thank our SEEA Experts, Mr. Sokol Vako from Statistics Institute for Asia and the Pacific (SIAP) in Japan and also Mr. Anthony Dvaskas from the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) in Thailand for their usual expert advice from time to time

12. Methodological Notes

All energy aggregates and estimates were based on the best available data mainly from the Energy Balance review report 2016 prepared by the Ministry of Finance through its Energy Division. The accounts are closely compiled in accordance with the System of Environmental Economic Accounting for Energy. Most of the initial energy conversions for all the energy products was done by MOF, through their Energy Balances and it made our work a lot easier than expected.

13. References

Electric Power Corporation. EPC Electricity Production and Sales, 2016.

Samoa Bureau of Statistics, GDP Datasets (a), Population and Households Census (b), 2016.

Samoa Energy Review, 2016; Ministry of Finance 2016.

United Nations et al, 2019; *System of Environmental-Economic Accounting for Energy*, United Nations New York.

United Nations et al. 2012; *System of Environmental-Economic Accounting Central Framework*, United Nations New York.