

ENERGY REVIEW Report - 2010



MINISTRY OF FINANCE

Issue No 4:

Jan – Dec 2010

OCTOBER 2011

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The "Energy Review" is published by the Economic Policy and Planning Division of the Ministry of Finance. The analysis provides an overview of Samoa's Energy Sector and is intended to provide the Government of Samoa, business community and the general public with a better understanding of the energy sector.

This is the fourth review and covers the period from January to December 2010. The next review for the period January to December 2011 is envisaged to be released in July 2012.

Acknowledgement

The kind assistance of the various agencies in Samoa in supplying the data and information as well as the technical assistance from the Economic Development Division of the Secretariat of the Pacific Community is gratefully acknowledged

1. Executive Summary

Key Features for 2010 Performance

Renewable Energy

- Renewable Energy Consumption in 2010 accounted for 36.2% of total energy consumption in Samoa.
- Total renewable energy consumption in 2010 is estimated at 44.74 kilo tonnes of oil equivalent (kTOE).
- Biomass consumption recorded an estimated consumption of 41.11 kTOE.
- Biofuel consumption for electricity generation as well as for transport in 2010 accounted for an estimated 0.14 kTOE
- Energy generated from Solar in 2010 accounted for an estimated 0.06 kTOE.
- Energy production from hydro power in 2010 accounted for 3.43kTOE.

Petroleum

- Petroleum consumption in 2010 accounted for 63.8% of total energy consumption in 2010.
- Total fuel imports increased by 3.7% from 2009. ULP imports increased by 7.5% whilst diesel imports increased by 4.6%.
- Total petroleum consumption increased by 5.9 % from 2009
- Prices of unleaded petrol and diesel fluctuated throughout 2010. Unleaded Petrol and Diesel both had peak prices of \$2.56 in 2010;
- Average Petrol and diesel prices recorded \$2.43 and \$2.45 respectively for 2010, an average increase of 8.3% and 7.8% from 2009 for the two products.
- Average price of dual purpose kerosene (DPK domestic) was \$2.24 in 2010 with a peak price of \$2.34 in August.
- By sector consumption, the transport sector accounted for 66.6%, Electricity sector 20.8%, and the rest to the commercial and residential sectors.

Transport

- Petroleum consumption in the transport sector decreased by 1.2% in 2010 compared to 2009.
- Land transport recorded an estimated increase in consumption by 6.4% from 2009 to 2010.
- Marine and Air transport recorded decreases in consumption of 27.1% and 8.9% respectively from 2009 to 2010.
- Composition of petroleum usage in the transport sector for 2010 was similar in comparison to 2009 reflecting a breakdown of 68% to land transport, 26% to air transport and 6% to Marine transport.
- A total of 2893 new vehicles were registered in 2010.

Electricity

- Gross Electricity generation decreased by 8.3% from 2009 to 2010 with diesel generation supplying about 63.6%, hydro 35.9%, coconut oil biofuel 0.6%, and Solar 0.01%.
- Consumption by the post payment meter customers dropped by 12.0% between 2009 and 2010.
- Consumption in the Commercial and Manufacturing sectors increased by 10.8% between 2009 and 2010.

2. Renewable Energy

These are sustainable sources of energy that are obtained from locally available natural resources. Those that are currently utilised in Samoa include biomass, biofuel, solar and hydro-power. Biomass use in Samoa consists of firewood, coconut shells and husks which are mainly utilised in domestic cooking. Solar technology use mainly consists of Solar Photovoltaics and Solar Hot Water Systems. Hydro-power over the past 2 decades has been used extensively in Samoa and currently supplies around 36% of electricity to the main grid in Upolu. Other high potentials for renewable energy in Samoa include harnessing energy from wind, biogas, waste and geothermal sources.

Summary:

Total energy consumption from the Renewable Energy sources in Samoa for 2010 is estimated at 44.74 kilo tonnes of oil equivalent (kTOE). Of this, biomass accounted 41.11 kTOE, Hydro 3.43 kTOE, Biofuel 0.14 kTOE, and the remaining 0.06 kTOE to Solar Energy.

Types of renewable energy available in Samoa:

Solar Energy: *Solar Photovoltaic and Solar Water Heaters:*

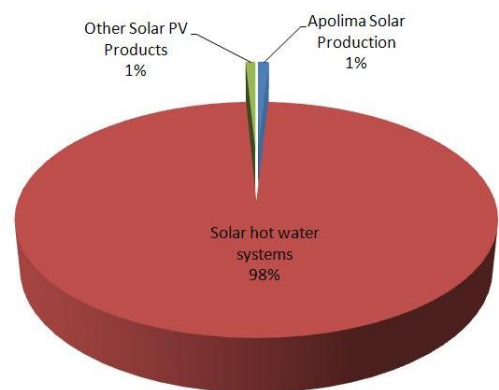
Energy consumed from Solar for water heating, lighting and electrification is estimated at around 2661 GJ or 63.6 TOE in 2010.

Solar Energy for water heating accounted for most of the energy produced from solar in Samoa where based on import records since 2002, it is estimated that there is around 565 solar water units in Samoa with an estimated energy production of 2615 GJ (61 TOE) in 2010. Solar Energy consumption through photovoltaic systems for 2010 is estimated at 45.75 GJ (1.09 TOE). Apolima Solar PV system in 2010 contributed 24.3 GJ (0.57 TOE) of Energy in electricity generation through their 13.5kW solar PV mini grid system. Sixty (60) solar home systems were also distributed to un-electrified households in Upolu and Savaii in 2010 through funding assistance from a Chinese company and contributing an estimated 7.33 GJ (0.18 TOE). Other Solar PV import records since 2002 accounts for 42 PV systems with an estimated peak rating of 165Watts and accounting for 14.11 GJ (0.34 TOE).

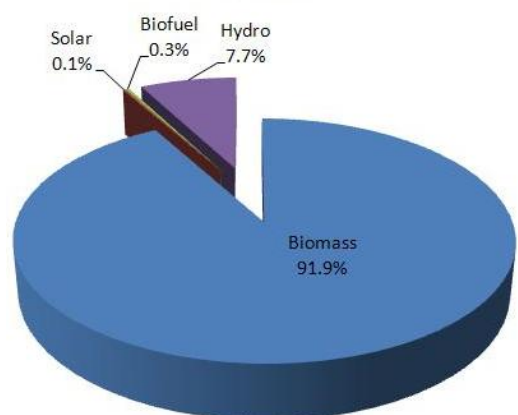
The Solar product market in Samoa has been following the same trend over the years where it is mainly driven by the hotel sector. New developments and growth in the tourism infrastructure sector will correlate to the growth and importation of solar products - mainly solar water heaters. The rest of the commercial and the residential sectors are covered by grid connected electricity. In 2010, Samoa imported solar products mainly from New Zealand and Australia.

Bio-energy: *Biomass (Firewood, coconut shells, coconut husks, plant waste residues, wood charcoal etc), liquid biofuels (coconut oil biofuel, biodiesel, ethanol) and biogas.*

Estimated 2010 Solar Energy Production Breakdown – 63.6 TOE.



Estimated 2010 Renewable Energy breakdown – 44.74 kTOE



For the year 2010, it is estimated that the total biomass consumption in Samoa was in the vicinity of 41.11 kTOE with the Residential Sector accounting for 90% of the total biomass consumption (36.81 kTOE). The year 2010 also recorded growth in biomass consumption from the coconut industry as per the recorded coconut oil exports from Samoa. Last known significant contribution of biomass consumption from the coconut industry was back in 2005 when Samoa last exported copra oil.

Biofuel consumption which included the 2% coconut oil blend trial with EPC generated around 615 MWh of Electricity in 2010 and consuming an estimated 162.9 thousand litres of coconut oil which is equivalent to 135.6 TOE. The Scientific Research Organization of Samoa (SROS) in 2010 has been trialing biodiesel blends as fuel for two vehicles at their premises under a B50 blend ratio. Based on average weekly consumption figures for the two vehicles, it is estimated that SROS consumed around 157 GJ (3.66TOE) of coconut bio diesel in 2010. In total, Biofuel use in 2010 contributed around 138.07 TOE.

Hydro-Power:

Energy from Hydro for electricity generation in 2010 accounted for 3.43 kTOE of energy. Due to the prolonged drought from the El niño event, Hydro production contribution were slightly lower than 2009. Further detailed description of Hydro power is provided under the Electricity sector.

Opportunities and Developments:

Upcoming Renewable Energy developments in Samoa include the expansion of the EPC's renewable energy portfolio through the installation of a US\$4 million 400kWp grid connected solar PV system in 2012 through the Pacific Environment Community (PEC) funding with a feasibility study to be funded under the Pacific Islands Greenhouse Gas Abatement through Renewable Energy (PIGGAREP) with an estimated amount of about US\$60,000. The Ministry of Natural Resources and Environment (MNRE) is also midway through the tendering process for a 500kW biomass gasification pilot plant which is planned to be installed in 2012.

In other developments, a 10,000 litre biogas digester was constructed at Crops Division under the Ministry of Agriculture and Fisheries in 2010 as a pilot project. The Crops Division is interested in further developing a design that could utilize local materials to bring the cost of constructing a suitable biogas digester size to an affordable price for replication in Samoa.

Solar Products now more accessible!!



Simply Sola is the first known local distributor of Solar PV products in Samoa and have been in operation since March 2011. Located in Vailoa, Faleata, Simply Sola offers a variety of solar Photovoltaic products ranging from small systems for general lighting purposes to bigger units capable of electrifying a whole building. Other Solar products are also available which include solar water pumping, Solar water heating units and of course selection of choices for spare part accessories such as batteries, inverters and lightings. The opening of Simply Sola in Samoa has now increased access to more affordable solar products for the residential sector in Samoa.



**Biogas units at CROPS –
2 x 5,000 litre digester capacity**

3. Petroleum

Samoa imports six petroleum products, namely Unleaded Petrol (ULP), Automotive Diesel Oil (ADO), Dual Purpose Kerosene (DPK), Aviation gasoline (Avgas), Lubricants & Greases and Liquid Petroleum Gas (LPG). Main Petroleum imports (ADO, DPK, ULP and Avgas) are solely supplied by Exxon Mobil and locally distributed by Petroleum Products Supplies (PPS). In 1998 the Government of Samoa introduced and controlled effectively new supply and pricing arrangements by owning all the petroleum storage facilities and tendering out operation to a supplier and distributor every 5 years. This arrangement allows the control of domestic petroleum prices to be reflective of international market prices. The Ministry of Finance controls and manages this arrangement. LPG imports and sales are mainly operated by BOC Gas Ltd and ORIGIN Energy Ltd which are foreign owned firms with part local ownership. The Price Control Board which operates under the Ministry of Commerce, Industry and Labour (MCIL), sets LPG ceiling price range. Other products such as lubricants and Greases can be brought in by private companies.

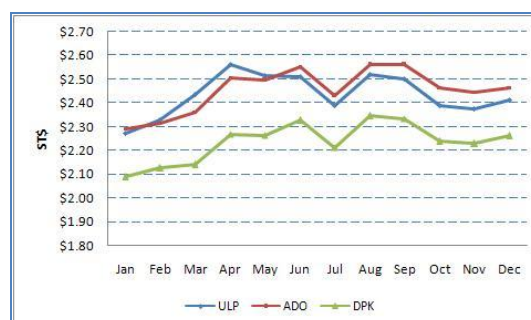
Summary:

In 2010 petroleum consumption totaled at 90.9 million litres, seeing an increase of 5.9 % from 2009 (88.2 million litres). The Transport sector accounted for 66.6% of total petroleum consumption in 2010 compared to 70.2% in 2009. The Electricity sector takes 20.8% of total consumption and the rest of the 12.5% to commercial, agriculture, forestry, and residential sectors. Average retail prices in 2010 increased by 8.3% and 7.8% for unleaded petrol and diesel respectively compared to 2009. Total fuel imports shows an increase of 3.7% from 88.2 million litres in 2009 to 91.5 million litres in 2010.

Petroleum Prices:

Retail prices of unleaded petroleum and diesel were fairly the same with prices fluctuating between a minimum of \$2.27 (ULP) and \$2.29(ADO) to a maximum of \$2.56 for both products in 2010. ULP peaked in April whilst diesel peaked in August. Average prices for 2010 were \$2.43 and \$2.45 for petrol and diesel respectively reflecting an increase by 8.3% and 7.8% for the two products from 2009. Dual purpose kerosene (DPK domestic) fluctuated between \$2.09 and \$2.34 per litre and like diesel, it also peaked in August at \$2.34. Average price for DPK in 2010 was \$2.24 per litre.

2010 Retail Prices



Imports

Total fuel Imports for 2010 stood at 91.5 million litres in total compared to 88.2 million litres in 2009. An increase of about 3.7%. The month of June recorded a sharp increase in fuel importation. This was due to PPS taking advantage of the drop in global fuel price in the month of June in which two fuel shipment discharges were undertaken at the beginning and at the end of the month.

For the period under review, ADO recorded 45.7% of total oil imports with 41.8 million litres, ULP 32.0% with 29.3 million litres, DPK 18.7% with 17.1 million litres, LPG 2.8% with 2.6 million litres and the balance of 0.7% for Solvents, lubricants and grease.

AVERAGE MONTHLY EXCHANGE RATES 2010 (USD\$1 = SAT)	
JANUARY	2.395
FEBRUARY	2.453
MARCH	2.422
APRIL	2.402
MAY	2.477
JUNE	2.484
JULY	2.440
AUGUST	2.422
SEPTEMBER	2.375
OCTOBER	2.317
NOVEMBER	2.291
DECEMBER	2.309

LPG total imports for 2010 recorded no significant change from 2009. ADO and ULP like previous years dominate the total petroleum imports reflecting an increase of 4.6% and 7.5% respectively from 2009. DPK imports recorded a decrease of 7.9% from 2009 (18.6 million litres) to 2010 (17.1 million litres).

Re-exports:

For 2010, Samoa recorded re-export sales totaling 0.94 million litres, an increase by 17.5% from 2009. Of this amount ADO accounted for 0.68 million litres, DPK for 0.03 million litres and ULP accounting for 0.23 million litres. The main country that Samoa re-exports its fuel to is Tokelau. The increase in the total of petroleum products re-exported to Tokelau was due to the increase in their demand for diesel for their power generatio. In this analysis, sales to yachts are also classified as re-exports as this fuel does not contribute to the fuel consumption in Samoa.

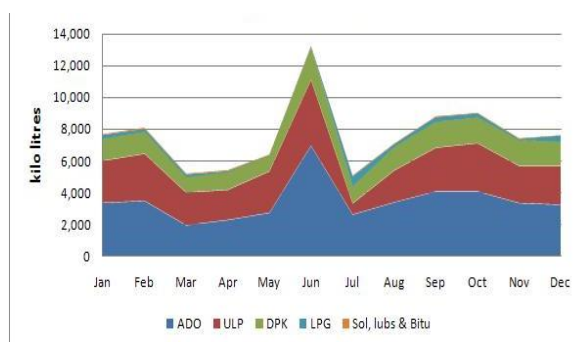
Consumption

Total petroleum consumption¹ for 2010 stood at 90.9 million litres an increase of 5.9% from 2009. Fuel consumption by different types of products accounted 46.4% to diesel, 32.1% to unleaded petrol, 18.2% to dual purpose kerosene, 2.6% to LPG and the rest to other fuel product types (Lubricants, greases, bitumen and solvents). By sector the transport sector consumed 67.9% of total consumption, accounting for 60.6 million litres of fuel in 2010, recording a decrease of 1.2% from 2009. The Electricity sector consumed 20.8% of total petroleum consumption accounting for 18.95 million litres of fuel for electricity generation, an increase by 5.9% from 2009. The remaining 12.5% of fuel consumption is accounted mainly to the commercial and residential sectors.

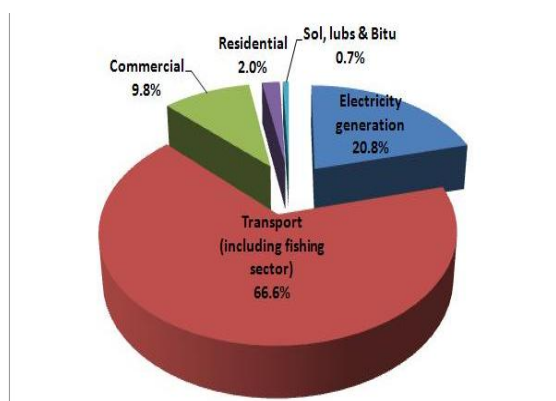
Opportunities and Developments:

The Health, Safety, Security and Environmental (HSSE) Standards has been approved by government, documented and circulated to all service stations operating in Samoa. The standards are designed to reinforce critical safety issues relating to service station sites operating practices, in particular enforcing a strict “No Smoking” policy and setting clear procedures for the filling of containers on sites and refueling of vehicles and treatment of oil spills. The Standards also address procedures for on-site stock control that must be followed to minimize the risk of environmental damage from leaking underground tanks or pipelines. In order to support this initiative the government has produced a set of standardized Safety Signage that all sites must now display and for the public awareness. This initiative is in support of the ministry’s efforts in reviewing the current process for issuance of petroleum license with the intention to implement this initiative as a pre-requisite to renewal of petroleum license to ensure compliance to these set standards. Renovation of service stations has also been proposed however, funding has been identified as a constraint by the service station owners which calls for further review of the retail margin.

Petroleum Imports by products:



Total Oil Consumption by Sector



¹ Total LPG Petroleum consumption figures for 2010 were extrapolated off the 2010 import figures from customs.

4. Transport

Transportation has direct links to the advancements in other sectors of the economy. It is the medium that enables the movement of goods and services both domestically and abroad. The transport sector in Samoa consists mainly of land transport referring only to vehicles, Air transport mainly with reference to international flights and Sea transport as in fishing vessels, cargo ships and ferries.

Summary

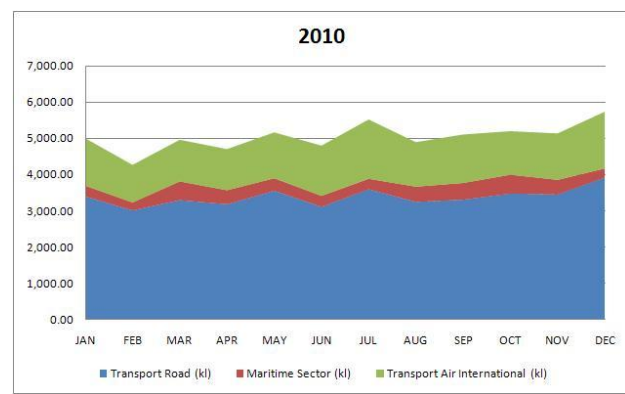
Petroleum consumption in the Transport sector has decreased by 1.2% from 61.3 million litres in 2009 to 60.6 million litres in 2010. This decrease in consumption is reflected from the air and marine transport which showed decreases of 8.9% and 27.1% respectively. Land transport recorded an increase in consumption by 6.4% which is reflected by the increased number of registered vehicles in 2010.

Petroleum consumption in the **Air Transport sector** refers mainly to DPK jet fuel consumption. DPK jet fuel consumption for 2010 was at 15.5 million litres, 8.9% lower than 2009 (17 million litres). The decrease in consumption in the airline sector mainly is a result of the decrease in a number of flights to Samoa in 2010 when compared to 2009.

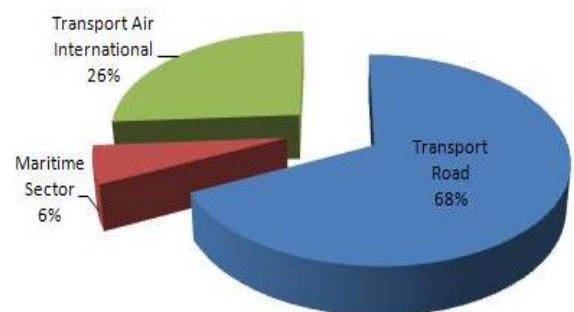
Land Transport fuel consumption increased by 6.4% from 2009 (38.1 million litres) to 2010 (40.6 million litres). ADO fuel consumption recorded an increase by 7.4% (10.8 to 11.6 million litres) and Petrol by 5.4% (27.5 to 29.0 million litres). The significant increase in fuel consumption for land transport can be attributed to the influx of right hand drive vehicles imported into Samoa following the right hand switch in 2009. For 2010, total registered vehicles were 14966 with 2893 being recorded as newly registered vehicles. Vehicles imported in 2010 totaled at 3034 of which 2222 were of the petrol type vehicles. The low number of vehicles been registered is because some of these vehicles goes straight to car dealers until it is sold then the customer will have to register his new vehicle with the LTA.

Consumption for **Marine transport** decreased by 27.1% from 6.1 Million litres in 2009 to 4.5 million litres in 2010. Drop in consumption in the marine sector is a result of the drop in fishing activity which is reflected by the drop in Fishing exports in 2010 as compared to 2009. Noticeable drop in consumption were also recorded from bunker activities which directly points to the significant decline in freight traffic for 2010 as compared to 2009.

Transport petroleum consumption by sub sectors.



Breakdown by sector of Petroleum consumption in the transport Sector:

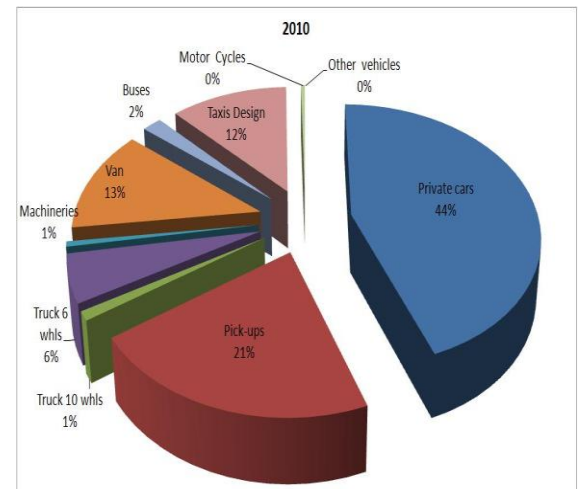


Opportunities and Developments:

The Land Transport Authority (LTA) in Late 2009 have launched a new database for recording registered vehicles in Samoa which they now have better vehicle data records from the year 2009. Future opportunities will see the collation of additional Vehicle data information such as odometer readings which could be the basis for determining fuel consumption from selected vehicle types in Samoa.

In 2010, Samoa reinforced the regulation that prevents the importation of second hand vehicles to 12 years old and over. This was part of the road switch programme to increase the restriction in importing vehicles that is 10 year old to now 12 years to accommodate for the importation of right hand drive vehicles. LTA is working together with the Ministry of Natural Resources on the project of Energy Efficiency in the Transport sector in which they will bring into the country a machine to test the gas emissions from vehicles and this will also improve the standards for all vehicles to be fuel efficient and of a better quality.

Registered Vehicles 2010



Road Safety!!

The Land Transport Authority had been involved in a lot of awareness campaign drives in 2010 on road safety. One of the major feats out of this advocacy work is the enforcing of regulation on seat belt safety and the use of mobile phones while driving. Failure to wear seat belts may result on a spot fine of ST \$100.00 whilst \$200 is the penalty fine for using the mobile phone while driving.



5. Electricity

Electricity is classified as secondary energy sources that are generated from primary sources such as petroleum, hydro and solar. Around 39% of total electricity production in Samoa is generated from hydro, 6% from Solar and the rest from diesel. This percentage varies during the wet and dry seasons. Electricity generation, transmission and distribution are exclusively under the authority of the Electric Power Corporation which is a government state owned enterprise. The 2006 Population Census identified that 96% of the whole population in Samoa is electrified.

Summary

Gross electricity generation in 2010 accounted to 110.5 GWh which records a decrease in generation by 8.3% from 2009 (120.5 GWh). The composition of electricity generation in 2010 recorded 35.9% from hydro, solar 0.01%, coconut oil 0.6% and 63.6% from diesel. Electricity consumption excluding the prepayment meter customers accounted for 61.5 GWh in 2010 recording a decrease of 12.0% from 2009 (69.9 GWh). Commercial and manufacturing sector consumption accounted for 53.3% of total consumption in 2010 recording an increase of 10.8% from 2009. Other sub-sectors which make up the remaining 46.7% of total consumption in 2010 include government departments (13.3%), schools (3.3%), religious organisations (5.2%), hotels (5.7%) and the residential users (12.7%).

Generation

Gross generation decreased by 8.3% from 2009 (120.5 GWh) to 2010 (110.5 GWh). Diesel generation dominated the electricity supply throughout Samoa for the whole year of 2010 and accounting for 63.6% of total electricity generated in 2010. Hydro produced 35.9% of total generation in 2010 due to low rainfall and this shows a decrease of 10.8% from 44.2 GWh in 2009 to 39.9 GWh in 2010. The rainfall recorded in Apia for the first five months (January to May) of 2010 was below the long-term average (1971-2000) due to the persistence of El Nino event in the equatorial Pacific. El Nino events are usually associated with dry conditions across the central and eastern Pacific including Samoa region often resulting in severe drought and bushfires. The 2009-2010 wet season was slightly drier than normal as a result of this event and lasted well into the dry months.

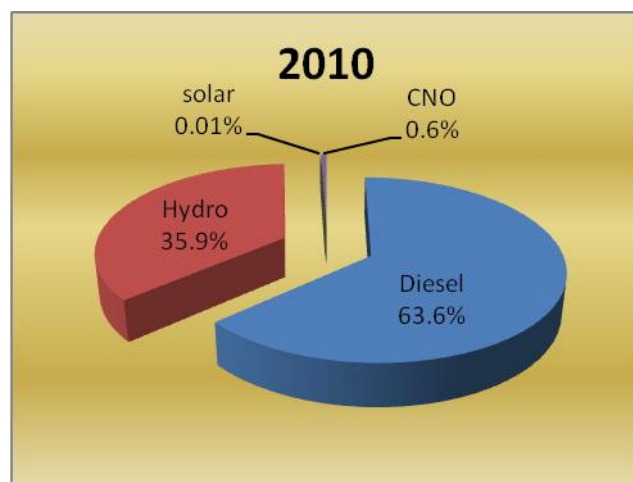
EPC continued with their 2% coconut oil blend trials with diesel in Upolu generating around 615.2 MWh of Electricity.

Apolima island continues to enjoy clean energy that is providing their electricity from solar since commissioning in 2007 with 6.8 MWh of electricity generated in 2010.

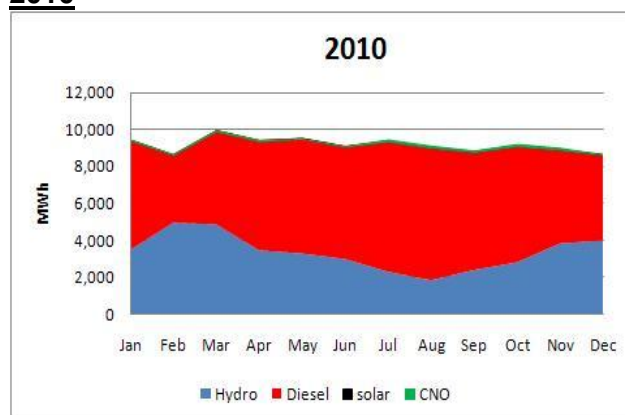
Tariff rates and fuel Surcharges

As a result of the heavy diesel fuel consumption for electricity generation and the continuous increases in diesel fuel prices, electricity tariffs in 2010 increased from 72 sene/kWh in January to 77 sene/kWh in December for the lifeline tariffs and from 85 sene/kWh

Gross electricity generation breakdown by source



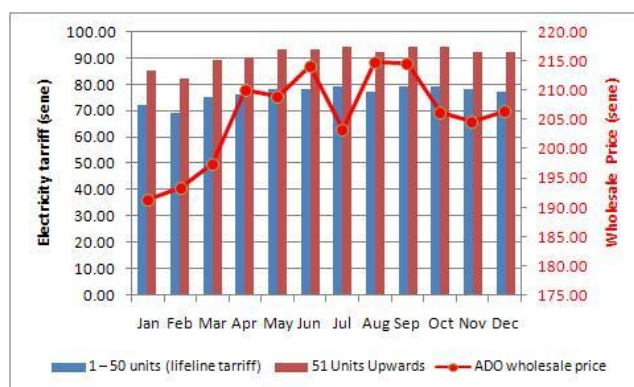
Monthly trend in generation contribution in 2010



to 92 sene/kWh for the commercial customers and domestic customers with monthly consumption greater than 50 kWh. Tabulated below, is a detailed account of the monthly tariff prices in 2010. The monthly fuel surcharge rate of the tariffs is calculated from the diesel price of the previous month.

2010	Base Tariff (sene)		Monthly Fuel Surcharge	Final cost per unit (sene)	
	1 - 50 kWh	50 kWh Upwards		1 - 50 kWh	50 kWh Upwards
Jan	64	76	11.73%	72	85
Feb	64	76	8.37%	69	82
Mar	69	82	8.84%	75	89
Apr	69	82	10.18%	76	90
May	69	82	13.59%	78	93
Jun	69	82	13.29%	78	93
Jul	69	82	14.67%	79	94
Aug	69	82	11.80%	77	92
Sep	69	82	14.88%	79	94
Oct	69	82	14.81%	79	94
Nov	69	82	12.59%	78	92
Dec	69	82	12.15%	77	92

Trend in comparison of the ADO wholesale prices to EPC monthly electricity tariff charges in 2010

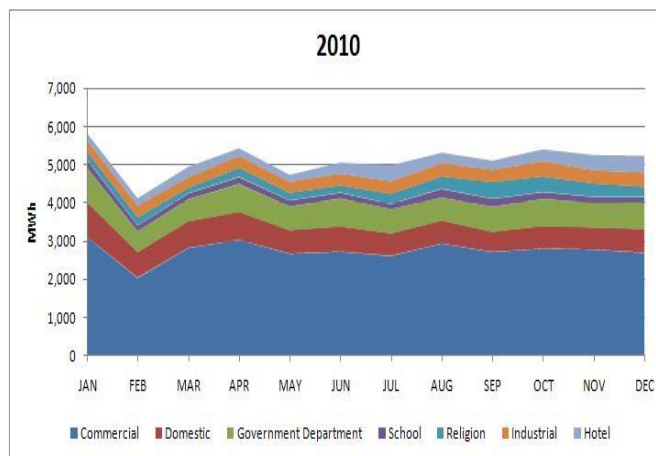


Consumption

Electricity consumption for post payment² customers dropped from 2009 (69.9 GWh) to 2010 (61.5 GWh) recording a decline of about 12.0%. Commercial and Manufacturing sector increased by 10.8% from 2009 (36.3GWh) to 2010(40.2 GWh). The increase consumption in this sector is attributed to the opening of new hotels such as the Orators Hotel, Moanalisa Hotel and resorts returning back to business after the tsunami in 2009.

Consumption from the residential sector recorded a huge decrease of 48.7% from 15.3 GWh (2009) to 7.8 GWh (2010). Residential sector consumption accounts for 12.7% of the total consumption. The remaining sectors namely Schools, religious organisations and hotels also showed decreases in their consumption. The Schools decreased by 8.1% from 2.2GWh (2009) to 2.0GWh (2010) and it maintains 3.3% of the total consumption. Religious organisations consumption also dropped to 3.2GWh in 2010 from 4.1 GWh in 2009, a decrease of 21.6% which contributes to 5.2% of total electricity consumption. The continuous transitioning of the residential customers, the schools

Monthly Electricity Consumption trend in 2010

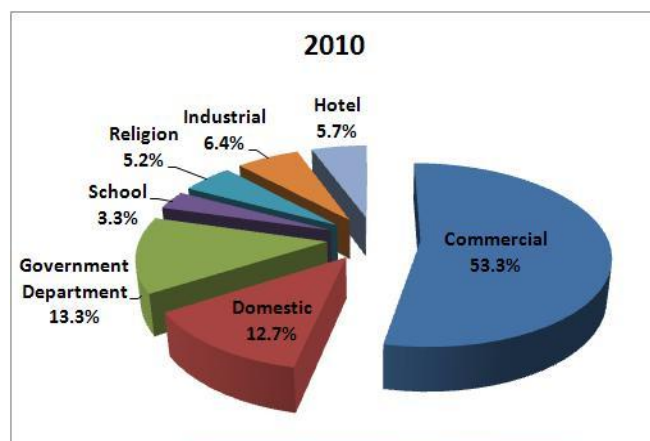


² Electricity consumption data collected from EPC covered mainly the post payment customers. Data from the prepayment meter customers were still being collected during the compilation of the 2010 Energy review report.

and religious organisations to prepayment meters in 2010 is the major reason for the reduction in consumption that is recorded by the post payment customers.

Government sector showed an increase by 8.0% from 7.6GWh in 2009 to 8.2GWh in 2010. Government accounts for 13.3% of total consumption in 2010. The increase in consumption is due to the opening of the new Ministry of Justice, Courts and Administration buildings and the construction of the new Government Convention Center and other government new developments.

Electricity Consumption breakdown by sector



Opportunities and Developments:

The Electric Power Corporation is continuing its implementation of the Electricity Sector Expansion Project (PSEP) through its Project Management Unit. The PSEP is funded by a USD100million loan from the Asian Development Bank and other multilateral donors. Several subprojects are being carried out as part of the PSEP including the building of a new 20MW diesel power station, undergrounding of transmission lines in the town area, installation of prepayment meters for consumers and various other subprojects. EPC also continues to explore opportunities on Renewable Energy Technologies to reduce the burden on diesel price and to contribute to the overall aim of Renewable Energy which is to reduce our dependency on fossil fuel and reduce greenhouse gases. Under the Pacific Islands Greenhouse Gas Abatement through Renewable Energy Project (PIGGAREP), EPC in addition to its Hydro data collection and wind resource assessment projects will be conducting a Grid Connect Solar PV Feasibility Study to support the \$4 million 400kw Grid connected Solar PV system funded under the Pacific Environment Community Fund which is planned to be commissioned in 2012. This will provide a number of benefits to the EPC and the people of Samoa and will certainly increase the share of renewable energy in electricity generation.

OVERVIEW OF SAMOA'S ENERGY SECTOR: 2009 to 2010

In 2010, Samoa was estimated to have consumed around 123.49 kilo-tonnes of oil equivalent, an increase of 4.6% from 2009(118.1 kTOE). Of the total energy consumed, it was estimated that 33.3% was met by biomass, 63.8% by petroleum products while the remaining 2.9% was met by hydropower , coconut oil bio fuel and other minor renewables. This total consumption when broken down by sectors shows that the transport (land, sea and air) and residential sectors were the major energy consumers, consuming 42.2% and 30.9% of total energy consumed in Samoa respectively. Electricity generation and the commercial & manufacturing sector accounted for 17.0% and 9.8% respectively.

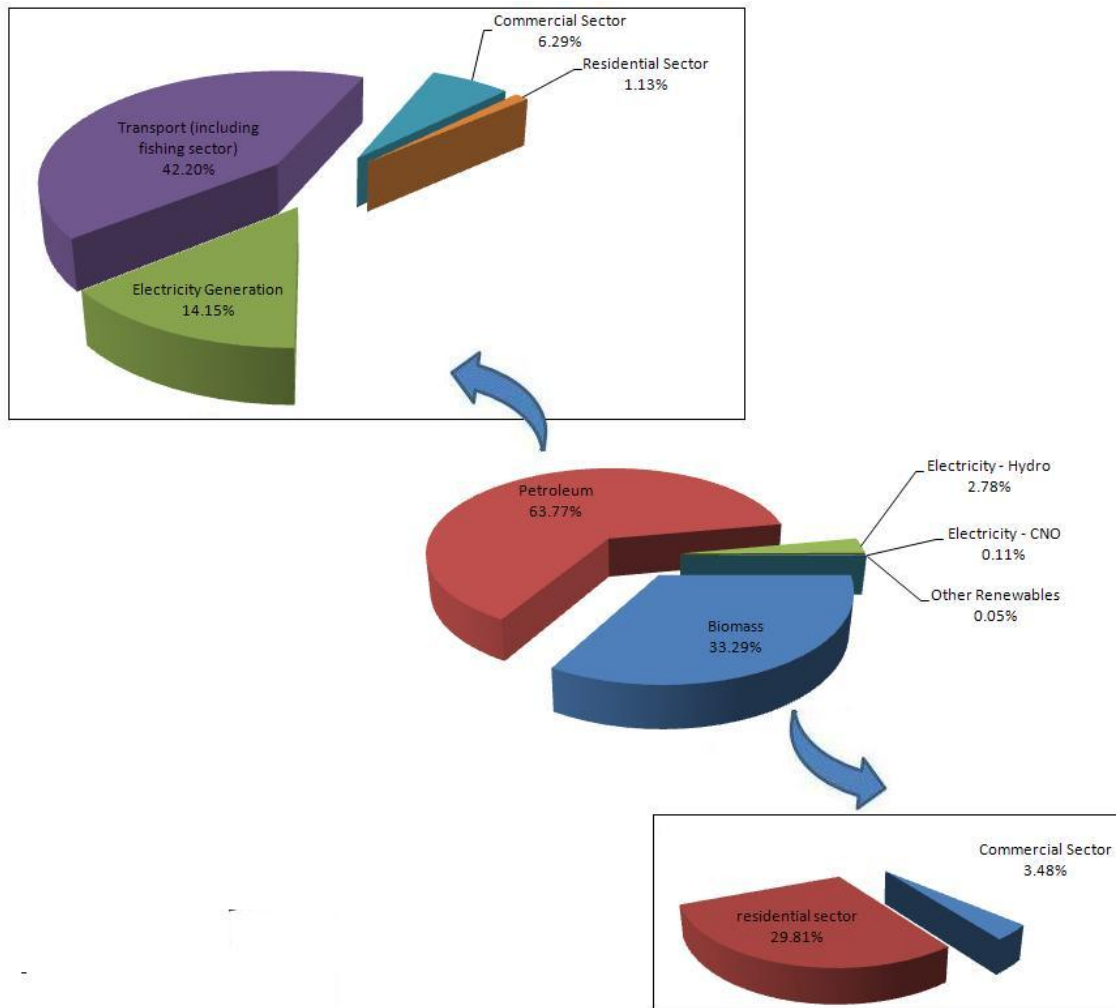
Table of Total Energy Consumption in Samoa

		Total Energy Consumption. (Kilo tonne of Oil Equivalent)	
		2009	2010
Biomass	Commercial Sector	1.3	4.30
	residential sector	35.4	36.81
Petroleum	Electricity Generation	18.92	17.47
	Transport	51.69	50.82
	Commercial Sector	5.36	7.77
	Residential Sector	0.01	1.40
Electricity	fishing	1.36	1.29
	Hydropower	3.8	3.43
	CNO Bio-fuel	0.2	0.14
Other Renewables	Solar and Biofuel	0.06	0.07

Based upon the comparison from 2007 to date, Renewable energy share of the total country consumption stands fairly at a constant level at 35% in 2007 to 36% in 2010. The slight increase in renewable energy share in 2010 is attributed to the growth in biomass consumption in the coconut industry as is reflected from the increase accounts of coconut oil exports. For the period from 2007 to 2010, new recorded increase in the share of renewable energy for Samoa is around 0.16% (other renewables – 0.05% and CNO Biofuel - 0.11%).

Growth in Renewable share is expected to increase from 2012 with the introduction of the 400 KW Solar grid system and the 500 kW biomass gasification unit.

2010 Energy Consumption



123.49 kilo tonnes of Oil Equivalent

Annex: Conversion Factors

The following **factors are indicative**, because a fuel's specifications varies with source, time, place, temperature, etc. The energy factors measure the gross energy content of the fuel.

1. Liquid Fuels

(Note: gallons and tons are US measures)

	Megajoules per Litre	Litres per Tonne	Gigajoules per Tonne
LPG (Propane)	25.3	1960	49.6
LPG (Butane)	27.7	1730	49.0
Aviation Gasoline (Av Gas)	33.2	1410	46.8
Motor/Automotive Gasoline (Mogas)	34.6	1340	46.4
Dual Purpose Kerosene (DPK)	36.8	1260	46.4
Automotive Diesel Oil (ADO)	38.6	1180	45.6
Industrial Diesel Oil (IDO)	39.0	1150	44.9
Fuel Oil - high sulphur (FO)	40.8	1050	42.9
Ethanol (PNG only)	23.4	1266	29.6
Solvents/White Benzene	34.0	1420	48.1
Lubricants and Greases	38.8	1120	43.4
Bitumen	44.0	980	42.7
Crude Oil (PNG Kutubu Light)	35.9	1249	44.9
Coconut Oil	34.9	1100	38.4

3. Solid Fuels

	Gigajoules per Tonne
Black Coal - steaming coal (Fiji only)	30.1
Charcoal	30.0
Fuelwood/Woodwaste (40% mcwb) ¹	10.8
Fuelwood/Woodwaste (13% mcwb) ²	17.1
Coconut Palm Wood	11.5
Coconut Residues ³ :	
Shell (15%)	14.6
Husk (30%)	12.0
Average (air)	14.0
Palm Oil Residues:	
Shell	17.5
Fibre	12.5
Average	15.0
Empty	7.5
Bagasse	9.7

1. Typical moisture content of undried sawmill residue and timber merchant fuelwood.

2. Typical moisture content of air dried fuelwood and residue.

3. Average yield of 2.93 air dry tonnes of residue per tonne of copra produced.

4. Proportion: kernel 33%, shell 23 % and husk 44% by dry weight.

4. Gaseous Fuels

	Megajoules per Cubic Metre	Megajoules per Cubic Foot
Natural Gas	39.0	1.1
Methane	37.7	1.1

* Approximate figures at 15°C.

5. Electricity

	Megajoules per kWh
Electricity	3.6

Sources for the above tables:

- regional specifications.
- Department of Primary Industries and Energy, Australia.
- World Bank PREA reports 1992.
- Energy Data and Conversion Factors (New Zealand Energy R&D Committee 1984).

Compiled from the Petroleum Economist and the Steinmuller 'Pocket Book', based on the international system of units (SI). Factors are either exact or correct to six significant figures.

= 1.15088 miles

Length

1 inch
= 25.4 millimetres (mm)

1 foot
= 12 inches (")
= 0.333333 yard
= 0.3048 metre (m)

1 yard
= 36 inches (")
= 3 feet (')
= 0.9144 metre (m)

1 metre
= 39.3701 inches (")
= 3.28084 feet (')
= 1.09361 yards
= 0.001 kilometre (km)

1 kilometre
= 1,000 metres (m)
= 0.621371 mile

1 mile
= 1,760 yards
= 1.60934 kilometres (km)

1 international nautical mile
= 1.85318 kilometres (km)

Area

1 square inch
= 645.16 square millimetres (mm²)

1 square foot
= 0.0929030 square metres (m²)

1 square yard
= 9 square feet
= 0.836127 square metres (m²)

1 square metre
= 10.7639 square feet (squ.ft)
= 1.19599 square yards

1 acre
= 4,840 square yards
= 4,046.86 square metres (m²)
= 0.404686 hectares

1 hectare
= 10,000 square metres (m²)
= 2.47105 acres
= 0.01 square kilometres (km²)

1 square kilometre
= 100 hectares
= 0.386102 square miles

1 square mile
= 640 acres
= 258.999 hectares
= 2.58999 square kilometres (km²)

Volume

1 cubic inch
= 16.3871 cubic centimetres (cm³)

1 pint
= 0.568261 cubic decimetres
(dm³)

1 litre (l)
= 61.0238 cubic inches (cu")
= 1.75975 pints
= 1 cubic decimetre (dm³)
= 0.264170 American gallons
= 0.219969 Imperial gallons
= 0.0353147 cubic feet (cu ft)

1 hectolitre
= 100 litres

1 American gallon
= 231 cubic inches (cu")
= 3.78544 litres (l)
= 0.832679 Imperial gallons
= 0.133681 cubic feet (cu ft)
= 0.0238095 American barrels
(bbl)
= 0.00378544 cubic metres (m³)

1 Imperial gallon
= 277.42 cubic inches (cu")
= 4.54609 litres (l)
= 1.20094 American gallons
= 0.160544 cubic feet (cu ft)
= 0.0286355 American barrels
(bbl)
= 0.00454609 cubic metres (m³)

1 cubic foot (cu ft)
= 28.3168 litres (l)
= 7.48047 American gallons
= 6.22884 Imperial gallons
= 0.178366 American barrels (bbl)
= 0.0283168 cubic metres (m³)

1 American barrel (bbl)
= 9,687.95 cubic inches (cu")
= 158.757 litres (l)
= 42 American gallons
= 34.9725 Imperial gallons
= 5.60645 cubic feet (cu')
= 0.158757 cubic metres (m³)

1 cubic metre
= 1,000 litres (l)
= 264.170 American gallons
= 219.969 Imperial gallons
= 6.29894 American barrels (bbl)
= 35.3147 cubic feet (cu ft)

1 kilolitre (kl)
= 1,000 litres (l)
= 6.29894 American barrels (bbl)

1 gross ton (shipping)
= 2.83168 cubic metres or 100
cubic feet
of permanently enclosed space

Mass

1 ounce (ozs)
= 28.3495 grams (g)

1 pound
= 0.453592 kilograms (kg)
= 0.00892857 hundredweight

1 kilogram (kg)
= 2.20462 pounds (lbs)
= 0.001 tonne (te)

1 hundredweight
= 112 pounds (lbs)
= 50.8023 kilograms (kg)

1 American (short) ton
= 2,000 pounds (lbs)
= 0.892857 long tons
= 0.907185 tonnes (te)

1 Imperial (long) ton
= 2,240 pounds (lbs)
= 1.12 short tons
= 1.01605 tonnes (te)

1 tonne (te)
= 2,204.62 pounds (lbs)
= 1,000 kilograms (kg)

= 1.10231 short tons
= 0.984206 long tons

= 737.562 foot pounds
force/second
= 1.35962 metric horsepower
= 1.34102 Imperial horsepower

Energy and Power

1 international table (IT) calorie
= 4.1868 joules (J)

1 megacalorie (IT)
= 1,000,000 calories
= 3968.32 British thermal units
(BTU)
= 1163 watt hours (Wh)
= 4.1868 megajoules (MJ)

1 joule (J)
= 0.238846 calories (IT)

1 megajoule (MJ)
= 1,000,000 joules (J)
= 947.817 British thermal units
(BTU)
= 277.778 watt hours (Wh)
= 238,846 calories (IT)
= 0.0238846 kilograms of oil
equivalent

1 kilogram of oil equivalent (koe)
= 41.868 megajoules (MJ)
= 10 megacalories

1 tonne of oil equivalent (TOE)
= 41.868 gigajoules (GJ)
= 10 gigacalories

1 kilowatt hour (kWh)
= 3,412.14 British thermal units
(BTU)
= 859.845 kilocalories (IT)
= 3.6 megajoules (MJ)
= 1.34102 horsepower hours

1 metric horsepower (Pferdesaerke or
Cheval Vapeur)
= 735.499 watts (W)
= 542.476 foot pounds
force/second
= 0.986320 Imperial horsepower

1 Imperial horsepower
= 745.700 watts (W)
= 550 foot pounds force/second
= 1.01388 metric horsepower

1 kilowatt (kW)

