

SURVEY ON USE OF ODS ALTERNATIVES IN PAPUA NEW GUINEA

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Executive Summary

There is no use of ODS alternatives in the local foam manufacturing nor is there any solvent sector. There are no manufacturers of aerosol nor was any solvent use identified that would be relevant for this survey. Foam manufacturing does exist but the companies have never used ODS and use Methyl chloride and water in foam blowing processes. The main sectors relate to Air-conditioning and Refrigeration only, including Mobile Air-Conditioning.

Key importers of ODS alternatives were identified at a stakeholder workshops held in early 2016. This list was then subsequently modified once the PNG customs' data on RAC imports for the period of 2011 to 2016 became available. The data has been obtained from key importers as well as from smaller stakeholders.

The estimated annual import of RAC equipment is approx. 40,000 units, which is predominated by the AC sector followed by domestic refrigeration.

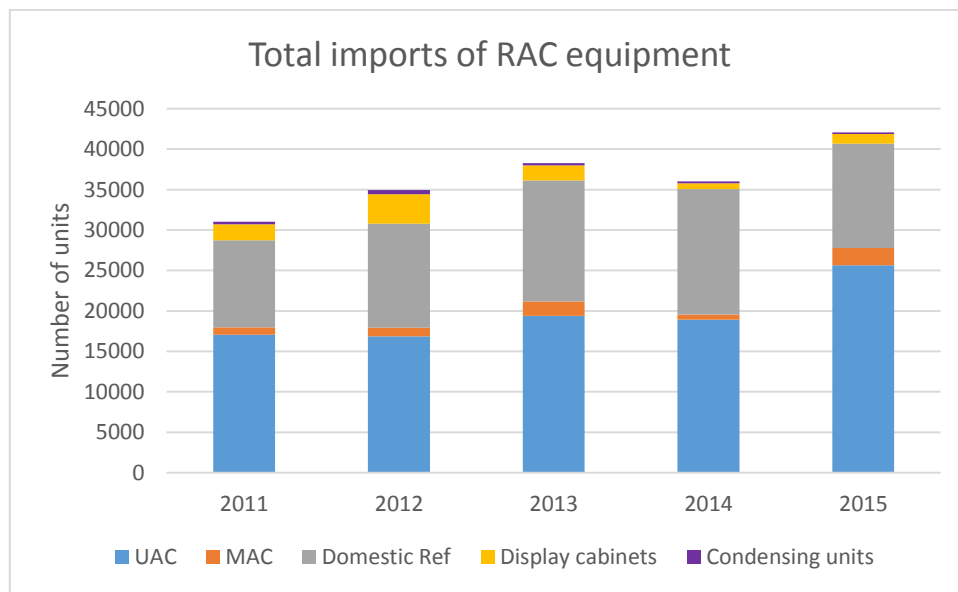


Figure 1: Total imports of RAC equipment (2011-2015)

Nevertheless there is still a considerable volume of AC imports that use ODS. R-22, a potent ODS, represents a share of 47% of all refrigerant imports. However, the striven regulation of ODS will lead to a shift to alternatives, which are likely to be HFC based. In terms of refrigeration, products using natural refrigerants such as R600a are available, yet cheap equipment that uses HFC134a still constitutes a large share of imports.

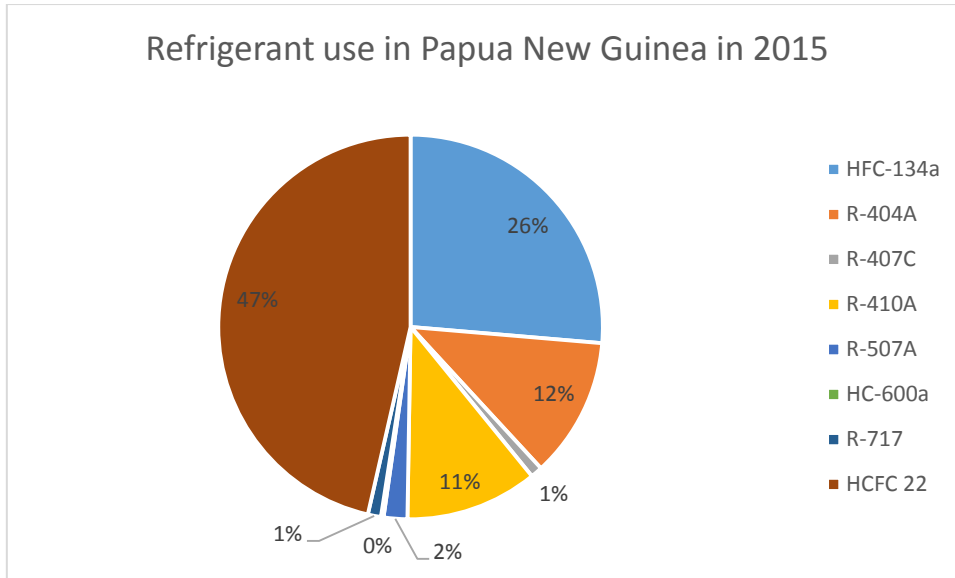


Figure 2: Refrigerant use in Papua New Guinea in 2015

The BAU growth rate of the imports of the RAC sector is predicted to surpass 2.5% annually. This rate will lead to an increase in the total number of RAC units installed in the country.

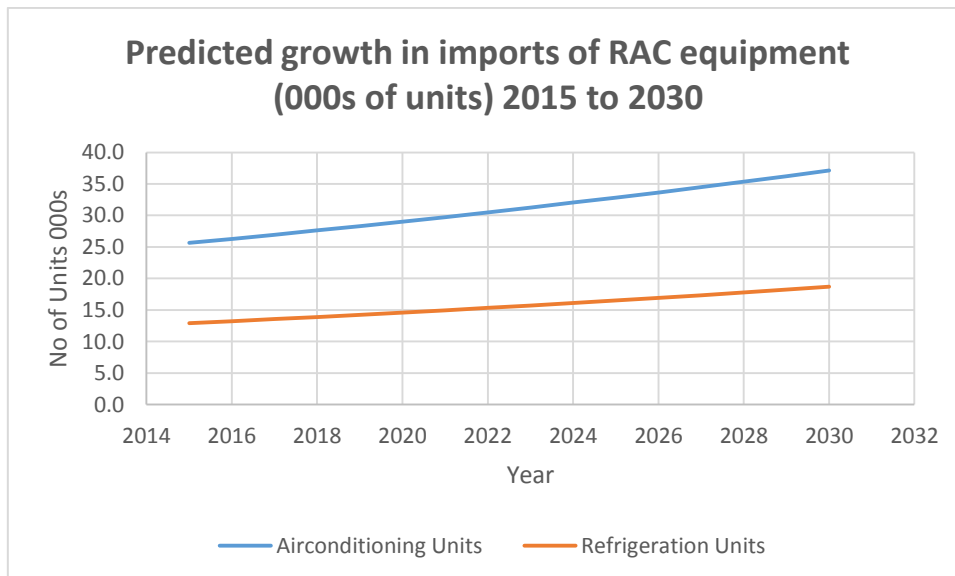


Figure 3: Predicted growth in imports of RAC equipment

An analysis of the equipment currently installed in PNG shows, that the AC sector is predominated by HFCs. However, in the refrigeration sector HFCs and natural refrigerants are being used in similar shares.

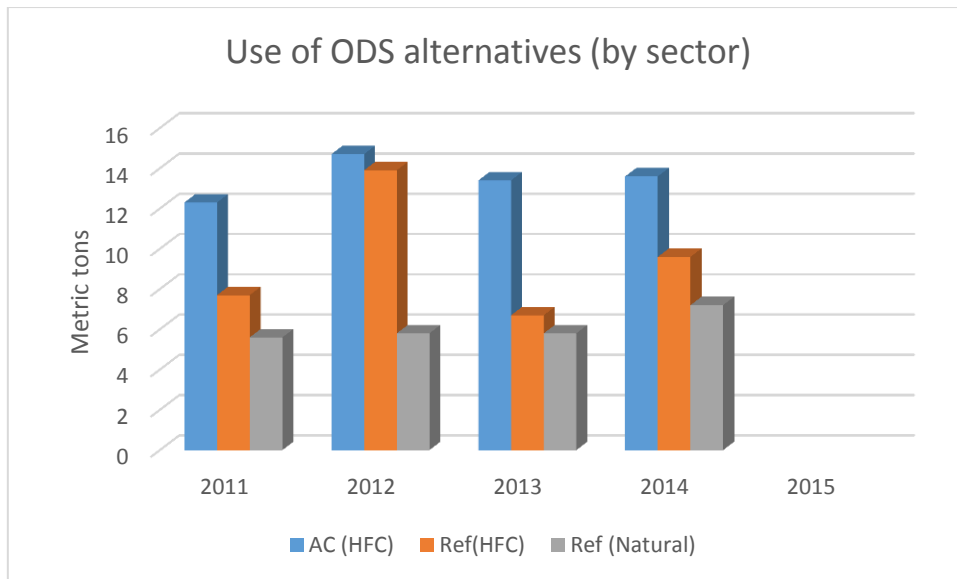


Figure 4: Use of ODS alternatives (by sector)

In order to initiate a shift from current business as usual practices of importing either HCFC or HFC equipment, the government of PNG will have to implement specific measures to enforce a change in the market structure. The key recommendations are as follows:

- Legislation to stop the import of ODS based RAC equipment should be implemented without further delay; otherwise PNG is in danger of becoming a dumping ground for phased out equipment and could experience problems with the supply of HCFC refrigerants for servicing needs in the future
- Developing a licensing system for HFC in order to monitor and control the use of HFCs when restrictions come into force
- Analysis of the possibility to introduce fiscal incentive for importers that could encourage the import of non HFC equipment and increase the competitiveness of the price of HFC equipment on the market

The transfer of comprehensive knowledge to local training institutes is fundamental to the implementation of RAC-systems using HFOs or natural refrigerants. Local RAC-technicians need to be trained properly in order to install and service the new RAC-systems without compromising safety. In addition, the local stakeholders consider skilled technicians to be a necessary prerequisite for the import of the new RAC-technologies.

Customer awareness of the effects of ODS and high-GWP refrigerants is necessary in order to raise interest in alternative solutions. At the same time, these solutions must be advertised accordingly.

1. General Information

1.1 Background

Papua New Guinea is a tropical Article 5 country with a population of nearly 8 million people¹. Most of the population lives in rural areas and has no access to electricity. RAC equipment is therefore only used in provincial towns and in townships associated with extractive industries and large scale agriculture. The people living in these areas make up 18% of PNGs population.

Since the climate in the highlands is much cooler than in the coastal regions, there is no extensive use of AC in this area. Yet, the using behaviour concerning refrigeration is very similar to that in coastal areas.

High rise buildings are mostly associated with the National Capital District and include office buildings, residential apartments and a number of hotels. Provincial centres such as Lae have only a few buildings that exceed four storeys, because the area is prone to earthquakes. Yet, the demand for high rise buildings in other provincial centres is little, since they are significantly smaller than Lae.

The majority of the current survey therefore focuses on the National Capital District, while only few data from the provinces was used.

1.2 Institutional setup

1.2.1 Existing Policy, Regulatory Framework and Controls

The implementing authority for Papua New Guinea's obligations under the Montreal Protocol is the Conservation and Environment Protection Authority (CEPA), formerly known as the Department of Environment and Conservation. The *Environment Act 2000* came into force in 2004 and required all importers and exporters of Ozone Depleting Substances to obtain environment permits. The permits are issued with a range of conditions which include quotas on particular ODSs (when required), limits on use of ODS and reporting requirements. In parallel with this, the PNG Customs Service has included ODS in the Asycuda ++ system to ensure that solely shipments backed by environment permits are imported.

The Environment Regulation 2007 (ODS) introduces further restrictions to the use of ODS and also includes further controlling instruments for the import of corresponding RAC equipment.

The Environment Regulation 2011 (Register of Hazardous Environmental Contaminants) lists all HFCs as Environment Hazardous Contaminants as defined under the Environment Act 2002.

¹ Population at the last national census held in 2011 was over 7 million and based on growth rates at that time it is estimated to be 7.88 million in 2017

1.2.2 Targeted legislation, policies and regulations

At this stage draft amendments to the Environment Regulation (Prescribed Activities) under the Environment Act 2000 have been prepared for the National Executive Council's approval. That will include a requirement for importers of HFCs and according RAC Equipment to obtain Environment Permits under the Environment Act 2000. This will enable control of the imports of the latter, including a ban on certain types of RAC equipment. The issued permits will set requirements for reporting on imports through their conditions. Currently, a number of ODS importers is voluntarily providing data on their import of ODS and HFCs. However, since there is no legal obligation in force other importers refuse to do so.

2. Methodology

Detailed questionnaires were developed by GIZ Proklima for the distribution to key stakeholders. They were distributed along with a joint letter signed by the managing directors of Conservation and Protection Authority and the Climate Change and Development Authority that explained the importance of participating in the data collection. In many cases a more explanatory email containing the questionnaire was sent additionally. In addition, some of the stakeholders were also visited personally.

The questionnaires that were sent initially were designated for importers of RAC equipment. Often many follow up calls, emails or visits where necessary in order to receive a response. In many cases, in spite of promised data, no information was provided. Many stakeholders delegated the task to busy staff members, who were unable to afford the required time. Nevertheless, after many months, sufficient data for an analysis of the RAC imports had been collected.

Questionnaires for end users as well as for service companies were also spread, yet there was only limited success in encouraging the reporting of data from these groups. For some end-users this is due to their limited knowledge of the RAC systems they use. To the extent possible some of the data has been obtained from service companies to enable the completion of the questionnaires and to develop a comprehensive picture of the RAC sector.

Customs data has mainly been used to identify key RAC importers and to help with verifying and supplementing the provided import data.

2.1 Data sources and involved institutions

Data has been collected from the following participants:

- Conservation and Environment Protection Authority – National Ozone Office (available data on imports of HFC refrigerants)
- Motor Vehicles Insurance Ltd – responsible for vehicle registrations across PNG – registered vehicles by vehicle class give a good indication of car air-conditioning
- PNG Customs Service – data on imports of RAC equipment for period 2011 to 2016
- RAC importers and retailers
- RAC installation and servicing Companies
- RAC end users

3. Sectors using ODS and ODS alternatives

The collected data shows that in PNG solely the RAC sector is using ODS. Efforts were undertaken to obtain information on the use of ODS alternatives within the foam manufacturing sector, the firefighting sector and the RAC sector.

3.1 Foam sector

The only foam products manufactured in PNG are mattresses, pillows and cushions. There are two main manufacturers in Port Moresby and in Lae as well as two minor ones. Three on-site visits were made to foam producers. Two of these have also completed questionnaires (Niugini Foam in Lae and Pacific Foam in Port Moresby). The main chemicals used by these foam producers are Toluene Di-isocyanate (TDI) and Methylene Chloride. The foam producers stated that they have never used ODS (noted during the CFC survey in 2002) nor any HFC in their foam production.

3.2 Refrigeration and air-conditioning sector

The customs' data, along with information from the industry stakeholders, has been used to identify the main importers of RAC equipment. Since errors concerning the individual import quantities have been identified, the data was cross-checked with the stakeholders to ensure a reliable estimation.

Imports of RAC equipment over the period of 2011 to 2016 involved over 500 individual companies and organisations. However, the bulk of these were done by the large importers that were identified. These fall into three categories:

- Retailers – i.e. import RAC equipment for resale only
- Installation/retail companies – i.e. companies that import RAC equipment for specific projects and also for general retail
- Installation companies- i.e. only import on installation project basis

The data collected and verified through the customs indicates that there is an overall increase in the total quantity of RAC equipment being imported into PNG. In 2011 the imports amount approx. 30,000 units whereas by 2015 this number had increased to approx. 40,000 units. That implies a growth of around 30% over the 5 year period. Unitary AC and domestic refrigeration represent the majority of the RAC equipment imports.

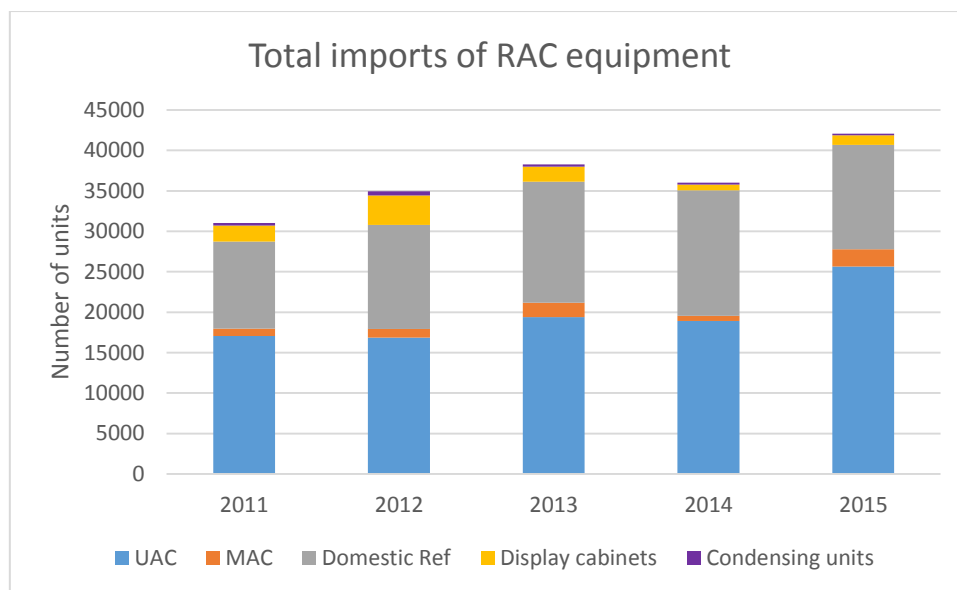


Figure 5: Total imports of RAC equipment

3.2.1 Imports of air conditioning equipment

3.2.1.1 Unitary air conditioning sector (AC)

Data was collected from the various types of importers and verified with the available customs data. The estimated number of unitary AC imports into Papua New Guinea based on the data collected from the six main importers in the country can be found on the following page in Figure 6. These importers make up approximately 80% of the total imports which has been confirmed through customs data as well as through discussions with the stakeholders.

According to the collected data approx. 25,000 AC units have been imported in 2015. The units imported are mostly split ACs that can be subdivided into ducted and ductless types of units. Within the imported split ACs, ductless types provide the larger share. Self-contained AC units, mainly mobile units, were decreasing in number over the reporting period. In the meanwhile the number of VRFs and multi-splits is increasing, as these get installed in commercial spaces as preferred means of cooling. Often they replace outdated centralised AC chiller systems.

Company	2011	2012	2013	2014	2015
Brian Bell Co Ltd	7000	10000	8359	9945	5041
Kenmore Ltd	3420	554	2259	811	944
SPAC	638	1234	860	1183	4583
BNBM	4856	3683	6152	5148	12281
CHM Ltd	12	25	94	68	569
PLP Hardware	1150	1365	1660	1760	2230
Total	17076	16861	19384	18915	25648

Table 1: Summary of air conditioning imports

The ACs entering the country are predominated by Asian brands (Chigo, Akira, GREE, Midea among others) and R410a is expected to become the dominant refrigerant. However, since 2015 it has been noticed that R22 units are entering the country in growing numbers. Dropping prices for those systems due to many national HCFC phase-out plans are causing a number of importers to prefer these units to ODS-free alternatives. As a consequence, the share of split AC equipment running on R22 has increased from 37% in 2014 to 57% in 2015. VRF units and multi-splits however are mostly R410a based.

There are only few centralized AC systems in PNG. The currently installed chillers are running on R407c, R22 and R134a. Nevertheless this sector experiences a transition to VRFs and multi-splits.

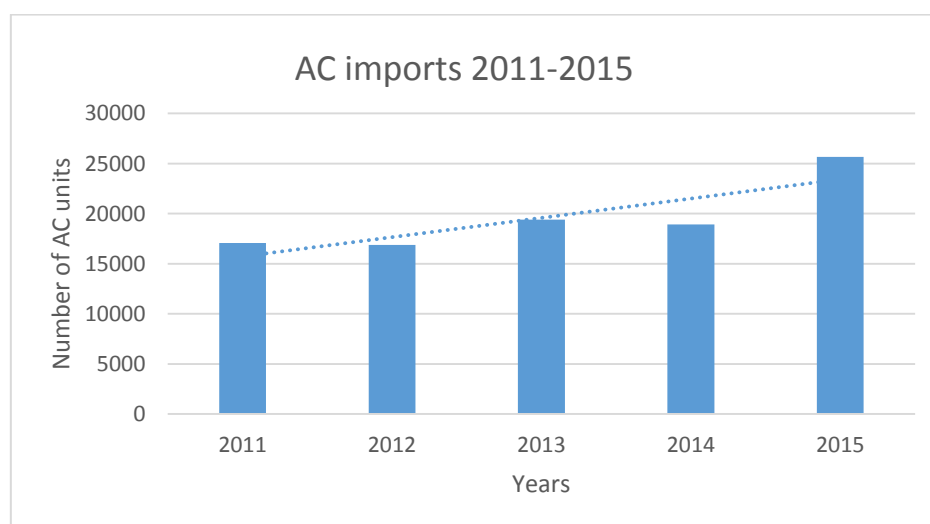


Figure 6: AC units imported 2011-2015

3.3.1.2 Mobile air conditioning sector (MAC)

PNG has ready access to the Asian used car market. PNG's economy has gone through significant growth due to development of the PNG LNG project and mining projects near the Madang and Lae urban centres. As a consequence, there has been a rapid growth in population in these areas as well as increase in disposable incomes. This led to a rapid increase in importation of used cars by companies and by individual importers. Initially the used vehicles were very cheap and import duties relatively low. Due to road congestion in Port Moresby, Lae and Madang and due to the problems with processing the documentation on many imports, duties on used cars were increased in 2013. By 2016 the PNG economy has slowed. This is in part due to completion of the construction phase of the PNG LNG project and also due to the fall of prices for oil, gas and other commodities. Presumably this will impact the number of imports of new and used cars in the immediate future.

Furthermore, the availability of second hand cars from Asian markets, especially from Japan, led to an increase in the number of vehicles being imported by individuals or small importers. At the same time larger companies are dealing with new and second hand vehicles. Approaches to request data on their imports were made to some of the bigger concerns, but only PNG Motors was willing to cooperate. Customs data has also been obtained, though only for vehicle classes and not by individual importer.

It was therefore decided to request official data about vehicles registered from Motor Vehicle Insurance Ltd, which is the responsible agency for registering vehicles on behalf of the Government.

The number of vehicle registrations (Figure 8) indicates a continuous increase from 2011 to 2015. By 2015 the number of registered cars had increased by 8% compared to 2011. 2014 showed a reduction from 2013 but this is presumably due to changes in customs duties. By 2015 the number again has increased. The table on vehicle registrations (below) does not distinguish between used and new vehicles. Registrations for sedans has remained static for the period 2011 to 2015 with the main increases being in the station wagon short and long-wheel base categories (SUV's, Land Cruisers etc.)

Type	2011	2012	2013	2014	2015
Cars & small vans	18,234	17,292	16,916	16,785	17,563
Large vehicles	22,925	23,414	25,564	26,943	28,046
Total	41,159	40,706	42,480	43,728	45,609

Table 2: Registrations of cars (with AC) for the period of 2011-2015

All MACs in PNG use HFC-134a. It is expected that vehicle imports will continue to increase. The increase of the annual vehicle registrations from 2011 to 2014 was in the order of 2% and can be used as a guide to estimate the increase of vehicle imports.

The installed capacity of HFC-134a refrigerant in the air-conditioning of the current vehicle stock is in the order of 67MT (assuming 0.6 kg per small vehicle and 2kg per large vehicle) with an increase of 1.3MT per year (based on a predicted increase in vehicle imports of 2%/year).

Many of the cars imported are second hand and are already some years old. AC systems will only require recharge if refrigerant is lost. Not all owners will recharge AC units due to the cost and the age of their vehicles. Stakeholder feedback indicates approx. 1-2% of vehicles need AC-recharge annually.

3.2.2 Refrigeration equipment

3.2.2.1 Domestic refrigeration equipment

The refrigeration sector is made up of domestic fridges and freezers, commercial refrigeration equipment mainly of beverage coolers and display cabinets, freezer rooms using condensing units, ice making machines and large industrial refrigeration equipment. Through the survey an estimation on the import figures could be gathered.

Once again the import market is dominated by a few players who also are involved in the import of AC equipment. Although complete data was not available from the importers or through customs, it is estimated that 10,000-15000 units of domestic refrigeration equipment is imported into the country annually.

Company	2011	2012	2013	2014	2015
Brian Bell Co Ltd	5990	6302	6917	9706	6870
BNBM	2172	2672	2845	3174	3180
CHM Ltd	176	130	2880	338	312
Courts Ltd	379	1670	313	nil	671
Hardware Haus	nil	591	365	nil	673
Chemica	2044	1473	1647	2284	1202
Total	10761	12838	14967	15502	12900

Table 3: Imports of domestic refrigeration units (including freezers) 2011 - 2015

3.2.2.2 Commercial refrigeration equipment

Soft drink manufacturers and the brewery supply not only the product but the means for cooling their products also. Coca Cola is the largest of the soft drink manufacturers and distributors (supplying coca cola and related soft drinks) ahead of Paradise Foods (Pepsi and related drinks) and Pacific Industries. SP Brewery is the only manufacturer of beer in the country. They also distribute their product throughout the country along with the means for cooling also. Majority of the beverage coolers are installed by coke which dominates the market of beverage coolers in the country.

There are about 20,000 display refrigerators throughout PNG. None of these units are running on ODS and most of them use HFC-134a as the refrigerant (95%) with an average charge per unit of 0.36kg. A number of units supplied by Coca Cola Amatil are running on natural

refrigerants (R744) while SP Breweries and Pacific Industries use systems that use hydrocarbons (R600a and R290), though these are still few in number.

Company	2011	2012	2013	2014	2015	Total
Coca Cola Amatil	1480	2950	267	305	424	5426
SP Brewery	195	281	1117	153	357	2103
Paradise Foods	84	178	298	163	151	874
Pacific Industries	235	247	170	111	255	1018
Total	1994	3656	1852	732	1187	9421

Table 4: Imports of refrigerated showcases 2011 - 2015

Condensing units/freezer and cold rooms are commonly found in hotels, supermarkets, hospitals, tertiary institutions and food processing sectors however there are no real wholesalers of such equipment and the market is dispersed making it quite difficult to determine actual import quantities. Data on total imports of condensing units used in cold /freezer rooms could not be confirmed through the survey but the customs import data does provide some data. Most commercial refrigeration equipment in the country is either R404a or R22 based, with a current 40-60 ratio. The brands imported include Bitzer, Copeland and Maneurop.

Source of data	2011	2012	2013	2014	2015	Total
PNG Customs	322	520	273	231	203	1549

Table 5: Imports of condensing units 2011 - 2015

Industrial refrigeration in Papua New Guinea used mostly in food processing sector is almost entirely dominated with Ammonia systems. The fisheries sector, abattoirs, meat canning, ice-cream and poultry processing companies use ammonia as the refrigerant of choice and have been doing so for several years. There are approx. 20-30 ammonia systems running in the country.

3.3 Aerosol sector

The only use of ODS alternatives is in medical metered dose inhalers (mainly for asthma relief) where R134a is used as the propellant. However there is no manufacturing of Aerosol cans in Papua New Guinea.

4. ODS alternatives: Predictions for 2015-2030

The PNG economy was growing at 10% per year in 2011. This was due to the development of mining and the extraction of oil and gas. As a result of this growth there was a boom in construction activity, especially in Port Moresby where the population growth was three times greater than national average, with new office buildings and residential apartments. The completion of construction activities for the PNG LNG project in 2014 and a fall in commodity, oil and gas prices has brought the economy almost to a standstill by 2016. Currently there is an oversupply of office space and rental properties and new construction has therefore experienced a significant slow-down.

Only a few of the questionnaire respondents made any prediction in terms of growth in the RAC sector over the next 5 years. Kenmore Ltd and PLP Hardware (major importers of air-conditioning equipment) predicted an annual growth of between 2.5-5% in RAC imports. Projections of the future are based on an increase of 2.5% annual growth.

With the development of a second major oil and gas project and once there is a recovery in oil and gas prices, the economy will start growing again. Linked to this growth will be an increase in the number in accommodation and office buildings and the need for air-conditioning and refrigeration.

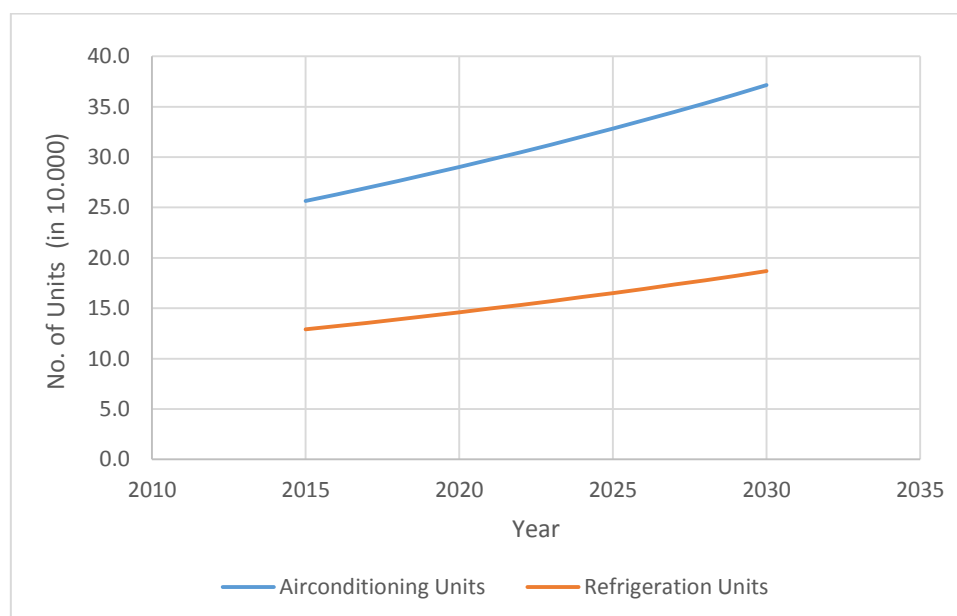


Figure 7: Predicted growth of imports 2015 - 2030

Air-conditioning units will be predominantly R410a once the proposed ban on HCFC 22 systems is enforced. Refrigeration systems are 95% HFC134a based and 5% R600a.



Figure 8: Predicted growth of the MAC stock 2015 - 2030

All mobile ACs imported to PNG are using R134a.

4.1 Availability and prices of alternative refrigerants

The main HFCs are readily available. Within the HC refrigerants R600a is solely available via Brian Bell Co Ltd. while R290 is locally unavailable. The only recorded use of any RAC running on R290 in PNG are 25 two-door display units by Liebherr that are used by SP Brewery Ltd. Since R744 is also unavailable in PNG, Coca Cola Amatil Ltd intends to import it themselves. Furthermore, they are conducting internal training for their own technicians on the use of this refrigerant.

Refrigerant	Cylinder Cost in Kina (in US\$)	Weight (kg)
HCFC22	278.36 (93)	13.6
HFC134a	275.25 (92)	13.6
HFC404a	265.50 (88)	10.9
HFC407c	221.19 (74)	11.3
HFC410a	737.64 (246)	11.3
HFC507	237.38 (79)	11.3
R600a	190 (63)	6.5

Figure 6: Prices for alternative refrigerants

Other alternative refrigerants are in use but are not yet accessible locally. Coca Cola Amatil has begun using R714 and plans to extend its application significantly over the next two to three years. That may cause a knock-on effect and lead to an increase in the dissemination of R714. HC 290 is being used in some refrigerator units owned by SP Brewery Ltd.

Ammonia (R717) is used in fish processing operations by Niugini Tablebirds abattoir and by Laga Industries. The latter produces ice cream. Ammonia has been used in these operations since before the initial CFC survey was conducted in 2002.

4.2 Further information about alternatives to ODS

4.2.1 Comparison of the use of ODS and the alternatives

HFC 134a has replaced the CFCs used up until 2008. It is commonly used in refrigerators, car air conditioning systems and chillers. Some HFC 134a RAC, especially refrigerators are now being replaced by HC600a systems.. The further replacement of this high GWP gas with natural refrigerants is being hampered by the fall in price of HFC134a refrigerators. Without some kind of intervention by the government this is unlikely to change in the foreseeable future.

HCFC 22 is now being increasingly replaced by HFC410a. The three major suppliers – Brian Bell Co Ltd, Kenmore Ltd and SPAC all import and supply HFC410a split units instead of HCFC 22 units. Most end users are now aware of the issues concerning the availability of the HCFC refrigerants. Unfortunately, there are new cheap HCFC22 Split systems and even VRF units on the market and several local retailers are importing large numbers of these units and increasing their market share at the same time. The survey has shown that in 2014 ACs using HFC410a accounted for 63% of the units imported, while HCFC22-units represented a share of 37%. However, due to a significant increase in imports by one company, HFC410a units only made up 43% of imports while HCFC22 accounted for 57%. Changes to legislation that will ban HCFC22 RAC imports are currently at the drafting stage.

The import figures of refrigerants for 2015 indicate that HCFC 22 currently remains the predominant refrigerant in the country. This result has been confirmed through the survey. Among the ODS alternatives, HFC134a is the dominant refrigerant used in both AC and refrigeration sector in the country. HFC404a and HFC 410a make up approx. 12% and 11% of total refrigerants.

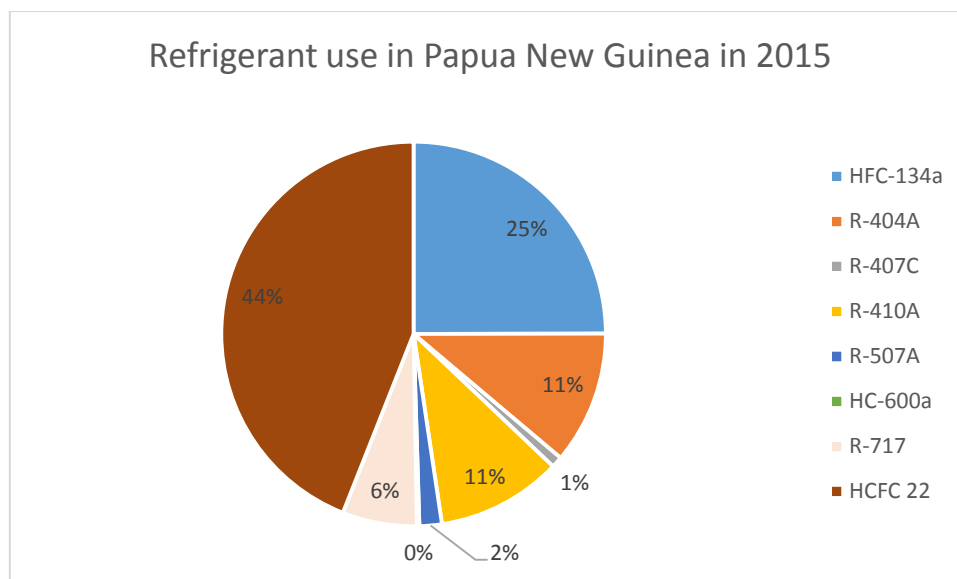


Figure 9: Refrigerant use in Papua New Guinea in 2015

Imports of HFC410a have doubled from five tonnes in 2011 to 10 tonnes in 2014. As the import of HCFC22 continues to decline through the imposition of quotas it is expected that the import of HFC410a will continue to increase.

There is no alternative to the HFC410a AC units currently being considered as realistic in PNG. There are alternative natural refrigerants available, but local businesses are reluctant to use them due to problems with skill sets for locally trained refrigeration technicians. These would be necessary since the use of natural alternatives often implies safety issues which have to be addressed properly. There are steps being taken to improve local training in terms of skills of the local trainers, the curriculum in use and the equipment of the training facilities. All of the latter are currently found to be suspended.

The refrigeration sector there is R600a, ammonia and now increasing use of R714 by Coca Cola Amatil. This is requiring that they carry out their own internal training as well as source their own supplies of R714 from overseas.

Sector	2011	2012	2013	2014	2015
AC (HFC)	12.3	14.7	13.4	13.6	13.6
Ref(HFC)	7.7	13.9	6.7	9.6	13.5
Ref (Natural)	5.6	5.8	5.8	7.2	6.2

Table 7: ODS alternatives used by sector

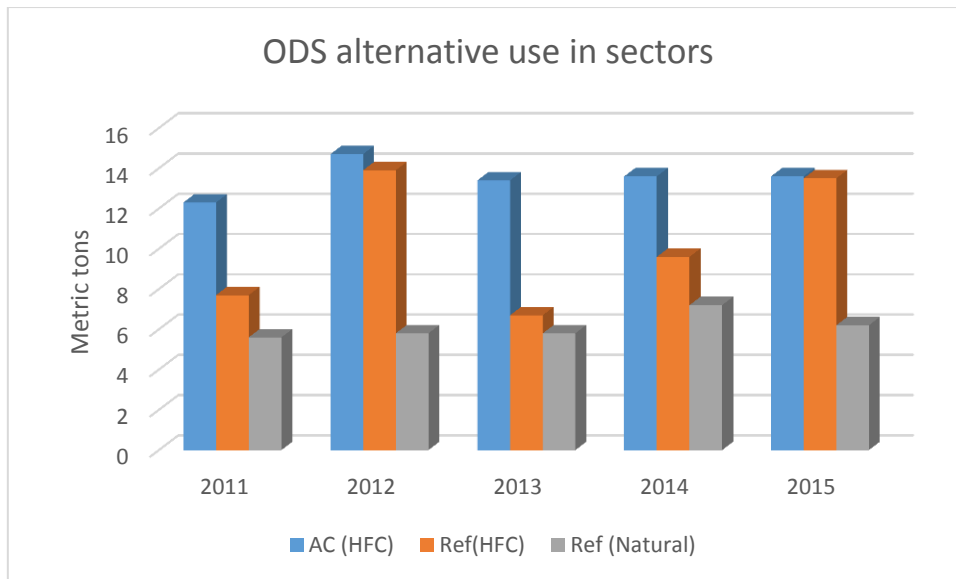


Figure 60: ODS alternatives used by sector

A comparison of the ODS alternatives used among the AC and refrigeration sector clearly shows that the use of HFC is predominant in the AC sector and the refrigeration. The refrigeration sector uses both HFC and natural refrigerants. The bulk of the natural refrigerants refer to the large ammonia systems that are running in the country with hydrocarbons in the form of R600a representing a very small share of the total natural refrigerant imports into the country.

It is evident that the prevalence of RAC equipment in Papua New Guinea, is driven by its cost. Currently relatively cheap HFC134a refrigeration equipment and elsewhere phased-out HCFC22 AC equipment has been pushing into the market. For example, the R600a domestic refrigerators that are sold locally, proved to be very expensive in comparison to HFC 134a refrigerators. The government is addressing this through initiating a ban on the import of HCFC equipment that is estimated to come into force by January 2018. This will ensure that HCFC22 equipment ceases entering the market. Controlling measures on HCFC22 imports that are already in place will also continue to support the phase-out of HCFC22.

4.3 Environmental impact of ODS alternatives

Currently there is an increase in the number of refrigerators using HFC134a and AC units using HFC 410a and other HFC refrigerants. Even imports of HCFC22 AC units, which was in decline, has started to increase again due to cheap units on the market. When RAC units reach the end of their lifetime they are generally dumped. There is no effective recovery of refrigerant from equipment destined for disposal, what results in the release of the refrigerants into the atmosphere.. Although PNG is not a major contributor to the ozone depletion or the global warming problems, the continued use of equipment that is dependent on these refrigerants implies contributing both to global warming and ozone depletion.

It is important also that when Coca Cola Amatil replaces all its existing HFC134a units with R714 units that the estimated 7 tonnes of HFC134a is recovered properly for proper disposal.

4.4 ODS alternatives use scenario

Alternative	Refrigeration air-conditioning Servicing				
	2011	2012	2013	2014	2015
HFC					
HFC-134a	18.4	25.6	6.3	6.2	23.9
R-404A	5.8	11.6	3.8	6.1	10.7
R-407C	0.3	1.1	2.3	5.3	0.9
R-410A	5.5	3.2	7.1	10.1	10.1
R-507A	0.6	3.4	2.8	1.2	1.8
HC-600a	0.2	0.2	0.2	0.2	0.2
R-717	5.6	5.6	5.6	7	6
HCFC 22			54.95	52	42.12

Table 8: Summary of use of refrigerants 2011 - 2014 (only RAC servicing is relevant in PNG)

Table 9: Summarised information on estimates on ODS alternatives used in various sub-sectors from 2011-2015

Sub-sector	Applications	Substance	Unit charge (kg/unit)	Cooling capacity (kw)	Yearly servicing consumption (MT)				
					2011	2012	2013	2014	2015
Air-Conditioning	Small self-contained	R-410A	0.2-2	2-7	0.2	0.1	0.3	0.3	0.3
	Small split	R-410A	0.5-3	2-12	3.6	1.8	4	5.1	5.1
	Split, multi-split and VRF systems	R-407C	3-100	10-150		1	2	3	
		R-410A			1.3	0.9	2	3.5	3.5
	Ducted and package rooftop	R-407C	5-100	12-200					
		R-410A			0.4	0.2	0.8	1.1	1.1
	Small/medium chillers	R-407C	40-500	50-750					
	Large sized water chillers	HFC-134a	500-13,000	750-10,000	6.2	10.1	3.7	0	2.9
	MAC in cars and small vans	HFC-134a	0.4-0.8	3-5	0.1	0.1	0.1	0.1	0.1
MAC in large vehicles	HFC-134a	2-10	10-30	0.5	0.5	0.5	0.5	0.6	

Sub-sector	Applications	Substance	Unit charge (kg/unit)	Cooling capacity(kw)	Yearly servicing consumption (MT)				
					2011	2012	2013	2014	2015
Refrigeration	Domestic refrigerators and freezers	HFC-134a	0.1-0.3	0.1-0.5	1.4	1.3	2.4	3	4
		R-600a				0.2	0.2	0.2	0.2
	Stand-alone equipment for commercial refrigeration	HFC-134a	0.1-0.5	0.1-1,000	0.3	0.6	0.3	0.1	0.5
	Condensing units for commercial refrigeration	R-404A	1-10	2-20	0.5	0.5	0.5	0.5	0.5
	Centralized refrigeration systems for commercial refrigeration	R-404A	20-200	40-200	5	11	3	6	8
	Large distributed industrial refrigeration systems	R-717	250-5,000	100-5,000	5.6	5.6	5.6	7	6
	Refrigerated containers in transport refrigeration	HFC-134a	4-8	5-15	0.5	0.5	0.5	0.5	0.5

5. Conclusions and recommendations

This survey has taken more than one year. The questionnaires developed for this survey were far more extensive than for previous surveys. In most cases it has only been possible to obtain data dating back to 2011.

Stakeholders only reluctantly took part in the survey questionnaires and none provided a full range of the required data. Responses were not received at all or only after a constant follow up with the stakeholders. This has unfortunately delayed the completion of the survey.

End user data has been easier to obtain once the idea of getting stakeholders to complete questionnaires was abandoned. Data has been collected by directly interviewing key personnel. But again it has not been possible to obtain all the data requested.

The end result is the collection of data from nearly one hundred respondents covering imports, servicing and end users.

What the survey has shown is that though the phase-out of HCFCs was commenced five years ago, there is still a considerable use of HCFC22 RAC equipment, especially in air-conditioning. Yet, the impact of the HCFC phase out is now being felt and many of the larger hotels are, if necessary, replacing their old AC equipment with systems using HFC410a. This is supported by the fact that the three major RAC suppliers – Brian Bell Co Ltd, Daikin air conditioning and SPAC- are solely importing and selling HFC410a equipment.

Individual companies, such as TST Group, are more actively renewing their AC systems and are using mostly either HFC407c or HFC410a units. All the bigger supermarkets are, by now, using HFC404a refrigeration systems. Some are using centralised systems that provide refrigeration for both the display units and also the refrigeration or freezer rooms.

Government departments occupying government owned properties are generally still using HCFC22 air-conditioning systems. Due to budget constraints even when replacing units they are obtaining cheaper GRE or Midea units which are using HCFC22. Nevertheless, with donor funded upgrades a transition to HFC410a loaded AC units would be likely.

High rise buildings and the international airport are using HFC134a chillers or are installing HFC410a VRF systems. This includes some of the newer hotels or new blocks in existing hotels.

The use of natural refrigerants is limited to HC600a in a number of refrigerators. Ammonia is being used where bulk low temperature storage is required and has been well established for many years. Coca Cola Amatil is moving towards R714 for all its display units and predicting that the change-over will take three years.

Cheap HFC134a refrigerators are becoming more and more available, possibly due to the fact that HFC phase down in developed countries will commence soon. These cheap units are preventing a more rapid switch to R600a units.

The key recommendations therefore in order to avoid regresses when it comes to implementing ODS alternatives and ultimately natural refrigerants:

5.1 Regulatory recommendations

- Legislation to stop the import of ODS based RAC equipment be enacted without further delay, otherwise PNG is in danger of becoming a dumping ground for equipment that no one else wants and will lead to future problems with supply of HCFC refrigerants for servicing needs
- Need for PNG to put in place a licensing system for HFC in order to monitor and control the use of HFCs as and when restrictions come into force.
- Government should look into the possibility of encouraging fiscal incentive for importers that would create greater incentive to import non HFC equipment and make it competitive to the price of HFC equipment currently entering the country.

5.2 Capacity building of technician base

There is a need in PNG that the local training institutes, trainers and the RAC technicians are appropriately skilled in order to deal with the varied low GWP alternatives available globally, in order for the industry to confidently import these into the country.

5.3 Awareness among consumers

There is need to inform the end user, namely the consumers of RAC equipment about technologies that are environmentally sustainable and encourage them to demand green options.

REFERENCES AND OTHER DOCUMENTS

MLF Guidelines UNEP/OzL.Pro/ExCom/75/77/Rev.1

Custom database 2011 – 2015

ANNEXES

ANNEX 1: EXCEL TABLE

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