

# Ozone Depleting Substances (ODS) Alternatives Survey in Myanmar

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**Abstract-** : In these days, what we used to know as freak weather is no longer freak after all, but something to be expected, something that occurs, if not with seasonal regularity but with frequencies of alarming quantities. Therefore, weather abnormalities form a clear and present danger and so well all have to chip in to give momentum to that noble and grand effort to establish a green infrastructure on this planet. The essence of putting to place a green infrastructure is to reduce energy consumption, a necessary evil in the present day civilized and progressive society. Energy usage by Air Conditioning and Mechanical Ventilation (ACMV) in buildings being the major portion, its reduction is to be achieved by all means Myanmar architects will have to foster a mindset that building services form as much an integral part of a building as the aesthetic qualities of the façade Special attention is to be paid in designing the southern facades, such as weaving in structurally integrated sunshades building materials with very low thermal conductivity, air passages to let the outside wind flow in and take away some heat away from the walls. To utilize passive or semi passive ways, in other words, to use natural ways to combat high temperatures inside the building, should form the foremost considerations on the part of the architect. In Myanmar, in some places, the land for a buildings site is not so limited as in developed countries, thus the use of thermal storage, involving large footprints is to be encouraged and so reducing the size of motor and other associated electrical costs. Last but not least, is the great scourge of the green planet the CFC refrigerant. Myanmar like other countries is doing its best to phase out R 22 and introduce ozone friendly refrigerants. But the changeover is yet to become a smooth one. The necessary steps have been taken on a national level but many bugs need to be ironed out such as the distribution of refrigerants. ACMV industry has long way to go to become a truly green technology but all the persons involved are fully aware of the need to take that road and it can be said with confidence that more than one step has been taken in the right direction.

**Index Terms-** Environment friendly Refrigerant, CFC Refrigerant, R 22, R410A, R134a

## I. INTRODUCTION

environment and conservation are accorded high priority in the Government's efforts for sustainable development in benefit social and economic development of its people. It has been clearly stated that one of the basic principles under the National Development Plan for 2006-10 is to ensure sustainable management of nation's environment and natural resources.

While Myanmar confirms its commitment to the Montreal Protocol, the HCFC phase out action plan will need to harmonize with the national development policies and result in minimum economic loss to the country Myanmar has considered various possible scenarios 'technology driver,' 'delayed action' and 'recommended'. This accelerated phase-down schedule will phase-out HCFC with more aggressive reduction targets than those agreed the Parties to the Montreal Protocol at its 19th Meeting in September 2007. The aim of the certification of refrigeration technicians is to improve the serving practice of the industry and thereby reduce the use of HCFCs to service RAC equipment. Myanmar will require that the technicians are certified before they are allowed to handle/ service RAC equipment. The Ministry of Environment, in close consultation with the Ministry of Labor and Vocational Training and Refrigeration Association will be responsible for establishment of certification of refrigeration technicians in consultation with NOU.

## II. STRATEGY AND PLAN FOR IMPLEMENTATION OF (HCFC) PHASE OUT

Under the recommended plan, Myanmar will be following a three-pronged approach for the HCFC phase-out comprising the following elements:

1. Limit the supply of HCFCs.
2. Reduce the demand of HCFCs for servicing existing equipment.
3. Limit new demand for HCFCs.

This three-pronged approach aims to reduce the dependence on HCFCs according to the above phase-out schedule. The implementation plan includes measures which are a combination of (a) regulations and economic instruments, (b) training and capacity building, (c) awareness and information outreach, and (d) project initiatives. Given that the phase-out of HCFCs concerns not only the industry and adjustment and preparation must be allocated for these main groups.

Interventions under Strategic Elements A and B described in this document will be implemented during 2011-5 while most of the elements under Strategic Element C will be implemented during 2015-20.

**Strategic Element A: Limit the supply of HCFC**

To limit the supply of HCFC, Myanmar proposes to implement the following activities.

Restrict import of other HCFCs except HCFC – 22 and HCFC – 123

Myanmar only uses HCFC-22. To send strong signal to the industry on Government's HCFC phase-out policy. Myanmar NOU will restrict the import of other HCFCs that have not previously been used in Myanmar.

### III. TRAINING OF ENFORCEMENT OFFICERS

In order to enforce the import quota on HCFC and HCFC-based equipment and to prevent unintended exports, the capacity of enforcement officers from General Department of Customs and Excise and Cam Control will need to be strengthened. While the enforcement officers have already received training during the implementation of RMP/ TPMP, there will be significant changes on the licensing system procedure and additional requirement for supporting documents. Cam Control officers are also expected to inspect and enforce labeling requirement for HCFC container including blends and HCFC-based RAC equipment in the domestic market.

The focus of previous trainings was on CFC and CFC-based equipment such as MAC and refrigerators. The proposed training for this will focus on the revised licensing system procedures and on inspecting HCFCs and HCFC-based equipment such as AC and also will serve as a refresher course for existing officers and as in initial training for new officers on Montreal Protocol, Harmonized System (HS) codes and customs procedure.

#### Labeling of HCFC container

Myanmar will strengthen the enforcement of its existing labeling requirement to ensure that each importer puts a sticker on all imported HCFC containers before they are released to the market. The NOU will carry out regular checks with the retailers to inspect whether the HCFC container carry Ministry of Environment sticker or not.

#### Controlling sales of HCFC

Myanmar plans to restrict the sales of HCFCs only to registered workshops or certified technicians. Under this proposal, the importer/ distributor can only sell HCFCs to servicing workshops that have registered with the Department of Industry, MIME or to a certified refrigeration technician. This measure would allow Myanmar to limit sales of HCFC and to monitor HCFC uses. The importer/ distributor will be required to keep a log book on the amount of refrigerant that are sold to servicing workshop and certified technicians and to report the NOU on an annual basis. Their cooperation with this requirement will be taken into consideration during the granting of HCFC import permits in the following year.

#### Introduction of economic disincentive on HCFC import

The labeling of HCFC container as described above will serve as a deterrent from smuggling of illegally imported HCFCs.

Strategic Element B: Reduce demand of HCFCs for servicing existing Equipment The training would also cover basic information on later native refrigerants to HCFC such R-407C, R-410A, ammonia and propane.

However, given that there are a number of zero-ODP and low-GWP refrigerants under research and development, it is

envisioned that there would be a need for additional training on alternative refrigerants once the technology are matured, widely adopted and available in the region.

Further, it is expected that the private sector (i.e., companies and installing air conditioning equipment) would play a participatory role in training and other project implementation activities given their established geographic sales and service network.

#### Investment component to support good servicing practice

A recovery and reuse initiative will be introduced in Stage 1 to prevent avoidable emissions during servicing maintenance practice and consequently will help in reduction of demand of virgin HCFCs. This will involve supply of equipment and accessories to recover and reuse HCFC refrigerant during servicing and maintenance operators.

#### Retrofit incentive project for end-users

A retrofit project to replace HCFC-based equipment with ODS-free climate friendly alternatives would be undertaken in two phases: 1) initiation phase, and 2) final phase. The main purpose of the initiation phase is to demonstrate retrofit options and disseminate performance information on HCFC free climate friendly alternatives under local conditions. This project will integrate with the recovery and reuse program so that, besides adoption of climate friendly ODS-free alternatives, reduction on dependence on HCFC-based equipment is demonstrated.

### IV. SURVEY METHODOLOGY AND APPROACH

This Survey was undertaken by Myanmar Engineering Society, MES in collaboration with Environmental Conservation Department (ECD) of Ministry of Natural Resource and Environmental Conservation with the assistance of the UN Environment acting as the implementation agency. The Scope of ODS alternative surveys included current consumption of ODS alternatives, estimate growth patterns of ODS alternatives by substances and identify challenges and opportunities for the transition to low-GWP alternatives for various application.

Before conducting ODS alternatives survey, the working committee is formed with the representatives from all stakeholders of both government departments & private sectors for the preparation of surveys by briefing & understanding the purpose of surveys and to be as accurate as possible. The parties involve are Ministry of Commerce and Trade, Custom Department, Ministry of Industry, Department of Research and Innovation, Environmental Conservation Department, Ministry of Natural Resource and Environmental Conservation, Ministry of Transport and Myanmar Engineering Society and other private sectors of Importers & Distributors of chemicals (ODS & ODS alternatives), Refrigeration & Air-conditioning equipment and their respective service companies and end-users.

The data collection was carried out with five task force groups whilst MES project office collected data from various government departments. The collected data include all the official ODS alternatives and equipment imported quantity from ECD, Myanmar Custom, Ministry of Trade, Ministry of Industry, Ministry of Transport as well as data from importers, distributors and end-users. Myanmar as a reactive market, all of the HCFC and HFC refrigerants and Ammonia are imported through importers, investors and project developers with their own projects in various sectors for their applications. But, Ammonia and carbon dioxide gas can be available from some local industries with limited amount.

The consumption of alternatives to ODS are also forecasted to experience a rapid growth and this survey presents a better understanding on ODS alternatives development trends, and all stakeholders need to take appropriate measures for introducing of low GWP ODS alternatives, which including training of technician on the safe use of other ODS alternatives as well with sense of responsibilities; regulating the operation of ODS alternatives related businesses and eventually to develop and enforce the national standards or codes to guide the servicing practices; outreaching to the end-users and the public concerning low GWP ODS alternatives with higher energy efficiency products, etc.

#### V. ODS ALTERNATIVES SURVEY DATA

This section described the data gathered on the use of ODS alternatives and analysis of the data collected in Myanmar. The distribution and supply chain, the sectors and sub-sectors where ODS alternatives are used, and production of ODS alternatives where applicable were also discussed.

##### A) Statistics of ODS alternatives import, export and production (Top-down Approach)

From desk study and data survey, there is no ODS alternatives production or export in Myanmar. The refrigerants are predominantly imported from other countries i.e China and Singapore. At the moment, the import of ODS alternatives is controlled by the Ministry of Commerce. The importers of any ODS alternatives need to have the license issued by the Ministry of Commerce to show to the Customs officer during the clearance process.

However, although the license for import ODS alternatives is required by the Ministry of Commerce, due to limited time to conduct the survey, the data from both Ministry of Commerce and the Customs Department are not available to MES for further analysis.

In this regard, the data collected from the bottom-up approach would be used to analysis the use of ODS alternatives in Myanmar.

##### B) Other Regulations

Regarding present control of & standards, Prevention of Hazard from Chemical and Related Substances Law was introduced by Ministry of Industry in August 2013 and the same with version of Rules was introduced in 2016. However, they are still very general and more specific standard or code is required for storage, handling, transportation, application & usage etc. for ODS alternatives and especially for substances with higher flammability like HFC-32, HC-290 etc.

##### C) ODS alternatives usage by sector in Myanmar

The survey data are presented following the guideline provided by the Compliance Assistance Programme of UN Environment. The details data are shown in the attached table. The observations following the data analysis and best forecast of ODS alternatives growth trends is presented below:

Room Air Conditioning units: For room air conditioning units, HCFC-22 is commonly used and R-410A is started to use in a small quantity since 2012 and the trend is increasing. This market transformation to R-410A technology is attributed to the government strategies to phase-out HCFC-22 under the HCFC Phase-out Management Plan and ECD's plan to ban the import of HCFC room air-conditioning with less than 2.5 HP from 2018 onward and will totally ban the import of all types of HCFC-based equipment in 2021. The import of R-410A is forecasted to increase in the coming years. HFC-32 is expected to import in smaller scale started from 2017 whereas R-290 may be introduced in 2019 with small market share (this also depends on the market availability of R-290 room air-conditioner). However, fire safety is the main concern for new refrigerants and proper training & capacity building of all related parties are needed urgently.

The equipment inventory for 2012 is developed based on the collected data and also referring to the country economic factors such as foreign direct investment (FDI) projects, Naypyitaw city development etc. For R-410A, it was only started imported into Myanmar in 2011 and therefore the quantity is much less than R22. The rest of the year 2013 to 2016 data are based from collected survey. The average growth rate based on the past 4 years in However, it was adjusted to 18% to reflect more realistic growth.

Chiller units: Chillers are currently installed in commercial & industrial projects and HFC-134a is commonly used when compared to R-410a. Growth rate of chillers are expected to increase significantly in the years to come due to the anticipated economic development and foreign investment into Myanmar. It is anticipated that alternatives to HCFCs in the chiller sector will still be HFC-134a and R-410A until 2030.

As per the 4 years (from 2013 to 2016) data, that growth rate of new equipment imported in the year 2015 & 2016 is quite substantial compared to the previous years (*although the absolute number is not so high as the numbers of initial installed*

*equipment are rather small*). As a result, the 4 years' average growth rate is about 49%. Despite the fact that Myanmar GDP growth is about 7%, potential market demand and growth on hospitalities & commercial business are expected to be increased especially FDI investments for the years to come, therefore, the growth rate is adjusted to 12% in lieu of 49% or 7%. In the past R-22 is mainly used, but for the new installation, both R-134a and R-410a based are growing steadily, and they are slowly replacing R-22, which will be phased out in future.

**Commercial Refrigerator:** Commercial refrigerators currently use both HFC-134a as well as R-404A as alternatives to HCFCs for both stand-alone and condensing units. It is anticipated that there will be significant growth in the commercial refrigeration sector. HFC-134a and R-404A will be still the main refrigerants in this sector during the forecasted period.

Four years average growth rate of 23% is observed for commercial refrigerators. It is expected the similar path of growth in the future would be maintained and therefore, 23% is used without adjustment. For the usage of standalone and condensing units, the frequency of servicing is slightly higher due to the quality issue of equipment used in Myanmar. In the past R-22 is mainly used and new installation are basically using HFC-134a and R-404A with similar share. The total import are anticipated to in the year 2030 for R134a and R404A respectively and they will slowly replace all R-22 based installation.

**Mobile air conditioning equipment:** mobile air-conditioning sector uses only HFC-134a. In the past, there was significant growth in the import of vehicle that increased the number of vehicle. This has had the direct impact to the use of HFC-134a. HFO-134yf are unlikely to replace HFC-134a in the near future, but might be introduced into the country in the next 4-5 years.

Inventory is developed based on the collected data from Ministry of Transport. Motor car import licenses are only issued started in 2013 and sudden surge of imported vehicles is observed (it was previously not allowed). Due to the shortage of public transport system in Yangon, 3,000 big buses were imported in 2013. Therefore, the growth rate is rather random. For future forecast, the growth rate need to be carefully adjusted with reference to country future economic policy. For the usage, the numbers of vehicle import became limited recently again. Hence, overall figures for small vehicles could be less in near future especially second-hand vehicle which import is limited nowadays by year of production due to new regulations. In contrary, due to government concession tax rate given to vehicle manufacturers to invest in Myanmar, more vehicles will be produced locally with affordable price in future and the usage rate may eventually still possible to be on high side (Nissan, Suzuki & Ford factories are already started their projects). Regarding the usage for big buses, the practice is the similar to the other countries due to many reasons. Instead of toping-up, refrigerants are totally flush-out at

first and recharge all new gases when arrived Myanmar. Therefore, the top-up quantity is likely to be on high side. Furthermore, market demand for most of buses in future are with air-conditioning units. HFC-134a is mainly used for all vehicles and HFO-1234yf is expected to be used in future for small vehicle. vehicles reaching 20% in year 2030. The average Growth Rate of the Import Statistics is 5% for small vehicle, 15% for buses and 15% for large vehicles respectively. Growth rate for small car after year 2020 is expected to be 10% when local assembly factories are completed, and vehicles are available in the market.

**Domestic Refrigerator:** Domestic refrigerators and freezer use both HFC-134a and HC-600a where HFC-134a based has higher market share. Nevertheless, the overall amount of gas use is quite small compared to other categories due to its limited charging amount requirements and the less frequency for servicing requirement. In the next 15 years, it is anticipated that HFC-134a will be dominated in this subsector with increasing share of R-600a.

The collection of data on numbers of domestic refrigerator inventory in 2012 is almost impossible as they are used in the country for many decades as common household items. The reference data is taken from national electrification plan. Presently, 2.3 million households have electrical connection, less than 30% of total population and Yangon alone has slightly more than 10% of total population. It is estimated at least between 5 to 10% of total households with electricity connection own refrigerators and the inventory for year 2012 is estimated with possible figure of 5% of today households with electrical connection (*The total population in 2012 is 51 million compared with present 53 million*). From 2012 onwards, import of domestic refrigerators data are taken from the present survey and the growth rate is observed as 28%. HFC-134a is mainly used in the past where R-600a started to import in 2014 in small quantity and reaching to 36% of total market by year 2030.

**Cold Storage:** Large refrigeration system e.g. cold storage is dominated by R-404A and ammonia technology respectively. The growth rate is expected to be high as a result of change of life style in 21<sup>st</sup> century, economic development and foreign investment into Myanmar.

Inventory is based on collected data and the growth is calculated from 4 years average from 2013 to 2016. Growth fluctuation is rather high due to its nature of prolong project period taking into consideration of planning, obtaining Myanmar Investment Commission approval and project implementation and most of construction projects overlap to the year after. Cold storage industries are expected to grow strongly catching up with changing life style of 21<sup>st</sup> century. Although the growth rate of four years average is observed as 22%, more feasible growth rate of 15% is taken presently. It might be lowered than the sharp increase of market demand in long run.

## Environmental Characteristics

Traditionally ammonia plants are installed in the past but R-404a plants are catching up and today both installed plants are nearly the same. However, R-404a plants are becoming more preferred and overtaking ammonia plants in the near future due to its safer operation without severe occupational hazards like ammonia.

### VI. CONCLUSION

1. Without continuous efforts by MES members & all the stakeholders, it would be difficult to conduct the survey and obtain required information. The close collaboration and cooperation among concerned stakeholders are the key to the success in the implementation.

2. As per the data collected/analyzed based Bottom-up approach, the dominant ODS alternative is high GWP HFC in various sectors, while the low GWP alternatives such as ammonia are also used in Myanmar, the safety-related issues have not yet been properly addressed. The survey revealed that Myanmar is facing a challenge in

- a. Controlling the growth of stock of HFC-based equipment, which is anticipated from the economic development and the foreign investment trend. There must be a strategy to control the growth of high GWP HFC and to promote lower GWP alternatives.
- b. There is no reliable mechanism in obtaining the import statistics of ODS alternatives. It is critical to establish an effective mechanism to track and monitor the import of these HFCs which is controlled under the Kigali Amendment.

3. For introducing low GWP alternatives, it is important to educate the public; all stakeholders need to take appropriate measures for introducing low GWP alternatives, including training of technicians on the safe use of ODS alternatives with a sense of responsibility; regulating the operation of ODS alternatives related businesses and eventually to develop and enforce the national standards or codes to guide the servicing practices; outreaching to the end-users and the public awareness rising concerning low GWP ODS alternatives with higher energy efficiency products, etc.

4. Provide training with case studies of similar UNEP projects is very useful for the survey and analysis. With sufficient time and

the co-operation of stakeholders, the data collection was much easier with improved results.

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### REFERENCES

- [1] Roy J. Dossat, Principles of refrigeration, 4<sup>th</sup> edition. Pearson education (Singapore) Pte. Ltd., 2003, New Delhi.
- [2] Manohar Prasad, Refrigeration and air conditioning, 2<sup>nd</sup> edition. New Age International publishers, 2010, New Delhi.
- [3] E. Halimic, D. Ross, B. Agnew, A. Anderson, and I. Potts, A comparison of the operating performance of alternative refrigerants. Applied Thermal Engineering 23 (12) (2003), 1441-1451.
- [4] Kyoto protocol, United Nations Framework Convention on Climate Change, United Nations, New York, USA, 1997.
- [5] De. S Forbes Pearson, "New, Natural and Alternative Refrigerants", Star Refrigeration limited, 2013 Edinburgh.
- [6] E. Johnson Global warming from HFC, Environ, Impact Assessment Rev.18 (1998), 4885-492.
- [7] Anon. United Nations Environmental Programme. Montreal Protocol on substances that deplete the ozone layer. Final Act, 1987.

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