OzonAction

OzonAction Kigali Fact Sheet 11

Barriers to Successful Implementation

UN environment

Background:

It is recommended that Montreal Protocol Parties each prepare a national HFC phase-down strategy as part of the Kigali Amendment implementation process. Details about doing this are given in Kigali Fact Sheet 6. It is useful to understand some of the most common barriers to implementation, so that these can be addressed as early as possible. The most important barriers are discussed in this Fact Sheet, including:

1) Unavailability of new fluids and technologies
2) High costs of new fluids and technologies
3) Lack of technician training
4) Restrictive safety codes and standards

Unavailability of fluids and technologies:

The various lower GWP[1] alternatives to HCFCs and HFCs have been summarised in Kigali Fact Sheet 4. The markets using HCFCs and HFCs are quite complex and there are numerous lower GWP fluids (both as pure substances and blends) being used in the wide range of different applications. A key concern that has been raised by many Article 5 countries is whether the latest lower GWP technologies will be available outside of the non-Article 5 countries with the fastest HFC phase-down schedules.

This is a reasonable concern and must be addressed during the development of an HFC phase-down strategy. This is a "chicken and egg" situation; if there is no demand for a low GWP product in a specific country, then equipment suppliers will not market such products. However, if there are no products being marketed, there will be no demand! Refrigerant manufacturers and equipment suppliers are keen to sell their products in new markets – but they need sufficient demand to justify the investments.

This barrier can be overcome by carefully targeting appropriate markets during the development of the HFC phase-down strategy. It is possible to identify several markets where low GWP alternatives are already well established in some non-Article 5 markets. For example:

- Domestic refrigerators using hydrocarbon refrigerants
- Small integral refrigerated retail displays (e.g. ice cream freezers and bottle coolers) using hydrocarbon or CO_2 refrigerants
- Small split air-conditioning using HFC-32
- Car air-conditioning using HFO-1234yf

With the encouragement of the National Ozone Unit and the cooperation of key equipment supply stakeholders from these market sectors, it will be possible to stimulate demand in a new geographic region. Some of these markets have the additional benefit that they are dominated by large international equipment suppliers (especially the car air-conditioning and small split air-conditioning markets). These companies are already supplying low GWP technologies in large quantities to certain non-Article 5 countries and will be keen to use their latest technologies in new markets. Small refrigerated retail displays are often supplied directly by major food and drink manufacturers (e.g. ice cream and soft drink manufacturers) that have global environmental programmes that include avoiding the use of HFCs[2]. There would also be benefits for neighbouring countries to cooperate to engage with relevant stakeholders to stimulate the market in a larger geographic area.

This approach may not be appropriate in all circumstances (e.g. for markets where lower GWP technologies are currently less mature or in very isolated geographic areas), but it highlights the potential benefits of developing a good phase-down strategy and of good stakeholder engagement.

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[1] See Kigali Fact Sheet 14 for a glossary of all acronyms used

[2] For example, **Refrigerants, Naturally!** is an initiative of international companies (including Coke, Pepsi, Unilever and Red Bull) which promote a shift in technology towards ultra-low GWP natural refrigerants and high energy efficiency. www.refrigerantsnaturally.com

High costs of new fluids and technologies:

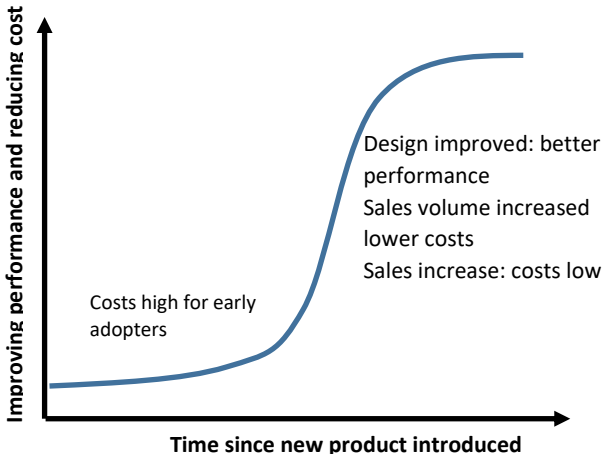
Linked to the concern that low GWP technologies will be unavailable is a further concern that even if they are available, they will be prohibitively expensive. Again, this is a reasonable concern that can be overcome if (a) the technology is reasonably mature and (b) there is a high demand for the low GWP products.

It should not be assumed that all low GWP products will cost more than the high GWP products being replaced. Some of the low GWP alternatives already used have been introduced voluntarily, with drivers such as reduced cost and improved efficiency. For example, domestic refrigerators using iso-butane in place of HFC-134a can be manufactured at slightly reduced cost and with improved energy efficiency. The switch away from CFC propellants in many aerosol products was also done at reduced cost. If the demand for these products is high, cost should not be a barrier.

This situation is not true for all low GWP technologies. In the car air-conditioning market, HFO-1234yf has been introduced as a low GWP alternative to HFC-134a. Currently it is much more expensive than HFC-134a. However, the new HFO refrigerant has only been produced in large volumes for around 3 years and there is currently a supply shortage. Over the next three to five years it is expected that several new production plants will come on stream and the price is expected to fall significantly.

In Kigali Fact Sheet 6 a "product-maturity curve" was used to illustrate the importance of optimum timing for the introduction of new low GWP products:

- Early adopters face extra costs – Article 5 countries can wait until these costs have been absorbed
- The optimum time to adopt the new technology is when costs are low and performance is improved
- A "late start" to a phase-down action could create extra costs over an "optimum start". Innovation by manufacturers will be directed towards products and equipment that use low GWP alternatives. Improvements such as higher energy efficiency will be made to these products, while the older products using high GWP fluids might "stagnate" and create higher running costs and worse environmental impact.



These issues emphasise the importance of developing a good phase-down strategy, of engaging with relevant stakeholders and, where possible, engaging in regional initiatives with neighbouring countries.

Lack of technician training:

An important barrier relates to the need for improved training, especially for technicians carrying out installation and maintenance work. Most technicians working on RACHP equipment are only familiar with non-flammable and non-toxic HCFC and HFC refrigerants. Many of the low GWP alternatives have more "difficult" properties related to flammability, toxicity and operating pressure. The most important areas for training relate to:

1) Using higher flammability refrigerants such as R-290 (propane) and R-1270 (propylene).
2) Using lower flammability refrigerants such as HFO-1234yf and HFC-32.
3) Using toxic refrigerants such as R-717 (ammonia)
4) Using high pressure refrigerants, in particular R-744 (CO_2)
5) Using unfamiliar refrigeration cycles, in particular transcritical cycles using R-744 (CO_2)

In a similar way to the discussion above on the availability of low GWP technologies, there is a "chicken and egg" situation in relation to training. Trained technicians are required before some of the new technologies can be widely used, but training will be ineffective if there is no market demand for the newly trained technicians. This dilemma needs to be considered in the development of the HFC phase-down plan.

There is plenty of excellent training material available that addresses the five requirements listed above, together with other related training issues. Three particularly good sources of training material are:

- **UN Environment OzonAction Training Guides:** Several useful guide books on refrigerant handling and training of technicians have been produced by OzonAction. See Kigali Fact Sheet 14 for references to these publications
- **REAL Alternatives**: blended learning for alternative refrigerants. This is an excellent set of resources developed to address the training barrier in Europe. The free multi-lingual learning materials were launched in 2015 and are now available for individual on-line training or for use as classroom training materials. They include e-learning content, electronic tools and a comprehensive library gathered from existing resources. The e-library contains over 100 useful industry resources. Details can be found at: www.realalternatives.eu
- **Equipment manufacturers training:** companies that supply equipment using low GWP alternatives usually have good training materials available that is targeted at their specific designs of equipment. Training from equipment manufacturers can be an excellent way of "kick-starting" technician training in certain market sectors. For example, some manufacturers of small split air-conditioning using HFC-32 (a lower flammability refrigerant) will only sell their products via contractors that have been on their in-house technician training. This approach has also been adopted by manufacturers of transcritical CO_2 refrigeration systems for supermarkets.

Restrictive safety codes and standards:

The phase-down of HFCs will require end users in the RACHP, foam and aerosol markets to use alternative fluids with lower GWPs. In many cases this necessitates a switch from a non-flammable / non-toxic fluid to a fluid that will require some technical adaptations of the equipment. In particular, many of the low GWP alternatives being proposed might be flammable, toxic or operate at high pressure.

Various standards and pieces of legislation that affect the use of lower GWP alternatives were written at a time when there was no restriction on the GWP or ODP of the fluids available. This often led to a conservative approach being adopted by standards committees; for example, in certain specific applications the conservative approach to ban the use of any flammable fluid was adopted because a non-flammable option was widely available.

It is widely recognised that many current safety standards will restrict the use of low GWP alternatives. At the 28th Meeting of the Parties of the Montreal Protocol in Kigali, it was agreed that this is a priority issue and there are significant international efforts underway to try and revise relevant standards to help maximise the uptake of low GWP alternatives.

In relation to implementation of the Kigali Amendment in an individual country, it is important to recognise that there might be two different "levels" of safety standards / legislation to take into account:

- At international level, there are various safety standards that relate to the use of RACHP equipment. Some examples of important standards are listed in the table on the next page.
- At national level there are two different possibilities:
  1. The international safety standards are used directly, without any national-level changes
  2. National safety standards, national safety legislation or more localised rules are in place, which take precedence over the international standards.

During the development of the national HFC phase-down strategy it will be important to understand how RACHP safety standards are defined. If international standards are used directly the situation is relatively simple – the revised international standards can be adopted as soon as they are published (see details of international revision plans below).

The situation can be more difficult if national or local legislation applies. In many cases, national legislation will make reference to relevant international standards, but may be more restrictive because:

a) National legislation is harmonised with an out-of-date version of an international standard. It is common for national legislation to lag several years behind changes to international standards.

b) National legislation includes extra restrictions and bans which are not in the international standards.

It is recommended that the National Ozone Unit liaises closely with the Government officials responsible for safety legislation to establish what rules apply and whether these create barriers that are more restrictive than the current international standards. A situation that exists in some countries is that local (e.g. municipal) fire departments have authority to ban types of equipment that create a fire risk. The rules being applied could vary from one municipality to another, meaning that a piece of RACHP equipment with a flammable refrigerant might be banned in one town but allowed in another. This is clearly not a desirable situation.

It must be stressed that maintaining high standards of safety remains a priority. Safety standards will not be revised to allow significantly higher levels of risk. The proposed revisions are intended to remove unnecessarily conservative restrictions, whilst still ensuring a suitable level of safety.

International Safety Standards

The landscape of international safety standards for RACHP applications is very complex. The relevant standards fall into three main groups:

a) Generic refrigeration safety standards, which can be applied to any RACHP application

b) Product standards that apply to a narrow range of RACHP products

c) General standards that apply to RACHP and other types of equipment

Following the concerns about standards identified at the Kigali MOP, various initiatives are underway to investigate suitable revisions to the international RACHP standards. The Montreal Protocol Technical and Economic Assessment Panel (TEAP) have set up a special Task Force to review safety standards and the Ozone Secretariat is organising a workshop on safety standards to be held in July 2017 before OEWG 39 in Bangkok. These are important opportunities to cooperate with the relevant standards committees. However, it must be recognised that the process of updating safety standards is usually very slow and laborious.

Examples[3] of International Safety Standards for RACHP Applications		
Generic RACHP standards	ISO 5149	Refrigerating systems and heat pumps -- Safety and environmental requirements
	EN 378	
RACHP Product standards	IEC 60335-2-24	Safety requirements for household and similar electrical appliances
	IEC 60335-2-40	Safety requirements for heat pumps, air conditioners, dehumidifiers
	IEC 60335-2-89	Safety requirements for commercial refrigerating appliances
Other Standards	ISO 13971, ISO 14903	Pressure equipment (vessels, pipes, valves, etc.)
	ISO 4126	Pressure safety devices
	IEC 60079	Protection of equipment within potentially flammable areas

[3] Note: this is a short list of some important standards – numerous other standards may be applicable. See Kigali Fact Sheet 14 for further references on safety standards and on barriers to implementation