MODULE 8.1

Policy Framework

NAMAs in the refrigeration, air conditioning and foam sectors. A technical handbook.

On behalf of:

Federal Ministry
for the Environment, Nature Conservation,
Building and Nuclear Safety

of the Federal Republic of Germany

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Proklima

Proklima is a programme of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Since 2008 Proklima has been working successfully on behalf of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) under its International Climate Initiative (IKI) to promote ozone-and climate friendly technologies.

Proklima provides technical assistance for developing countries since 1996, commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) to implement the provisions of the Montreal Protocol on substances that deplete the Ozone Layer.

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The International Climate Initiative

Since 2008, the International Climate Initiative (IKI) of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) has been financing climate and biodiversity projects in developing and newly industrialising countries, as well as in countries in transition. Based on a decision taken by the German parliament (Bundestag), a sum of at least 120 million euros is available for use by the initiative annually. For the first few years the IKI was financed through the auctioning of emission allowances, but it is now funded from the budget of the BMUB. The IKI is a key element of Germany's climate financing and the funding commitments in the framework of the Convention on Biological Diversity. The Initiative places clear emphasis on climate change mitigation, adaption to the impacts of climate change and the protection of biological diversity. These efforts provide various co-benefits, particularly the improvement of living conditions in partner countries.

The IKI focuses on four areas: mitigating greenhouse gas emissions, adapting to the impacts of climate change, conserving natural carbon sinks with a focus on reducing emissions from deforestation and forest degradation (REDD+), as well as conserving biological diversity. New projects are primarily selected through a two-stage procedure that takes place once a year. Priority is given to activities that support creating an international climate protection architecture, to transparency, and to innovative and transferable solutions that have an impact beyond the individual project. The IKI cooperates closely with partner countries and supports consensus building for a comprehensive international climate agreement and the implementation of the Convention on Biological Diversity. Moreover, it is the goal of the IKI to create as many synergies as possible between climate protection and biodiversity conservation.

www.international-climate-initiative.com

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Executive Summary

Module 8.1 introduces policy measures for the reduction of direct and indirect emissions in refrigeration, air conditioning and foam (RAC&F) systems and applications. Policy measures to reduce direct emissions address the consumption and emissions of hydrofluorocarbons (HFC).

For the reduction of direct and indirect emissions, different national policy instruments are available and need to be carefully selected and combined.

In the context of phasing out hydrochlorofluorocarbons (HCFC) under the Montreal Protocol, developing countries already have certain policies in place which are stipulated in a country's HCFC phase-out management plan (HPMP). When establishing a policy framework for nationally appropriate mitigation actions (NAMAs), the selected measures will have to fit into the country context, complement the HPMP activities and make sure that other policy arrangements are also integrated. In addition, the assessment of technical alternatives to HFCs and the ranking of appropriate abatement options should have been carried out (cf. modules 3 and 4).

A range of policy instruments addressing emissions in the RAC&F sectors are presented in this module. They are grouped into the following categories:

- Reporting of HFC production, imports and exports,
- Labelling and standards,
- Use,
- Incentives and taxes.

Appropriate policy instruments are selected through the screening of options identified. Criteria for such a screening include the reduction of HFC consumption and direct emissions, reduction of indirect emissions, costs for abatement, time frame, sectors covered, and administrative effort. If detailed information about the emission reduction potential or other criteria is available, a ranking of the policy options is possible and allows the setting of priorities for the choice of policy measures. Finally, for practical application and development of a NAMA policy framework, a step-by-step guide is provided.

1. Introduction

In most countries, policy frameworks relevant for the refrigeration, air conditioning and foam sectors have already been established in the context of the phase-out of ozone depleting substances (ODS) under the Montreal Protocol or as additional national policies to address greenhouse gas (GHG) emissions. This module deals with national policies and financial support mechanisms. Based on the previous sections of this handbook, module 8 provides guidance on how to identify appropriate policy measures and financing mechanisms to implement nationally appropriate mitigation actions in the RAC&F sectors in a country.

Different national policy instruments aiming at the reduction of emissions in the RAC&F sectors will be presented and discussed.

Detailed information on the use of these instruments in the context of the RAC&F sectors is provided. Case studies illustrate the national implementation of such policy measures.

A stepwise approach for the identification and ranking of policy options in a sample country with an emerging economy is suggested at the end of this module.

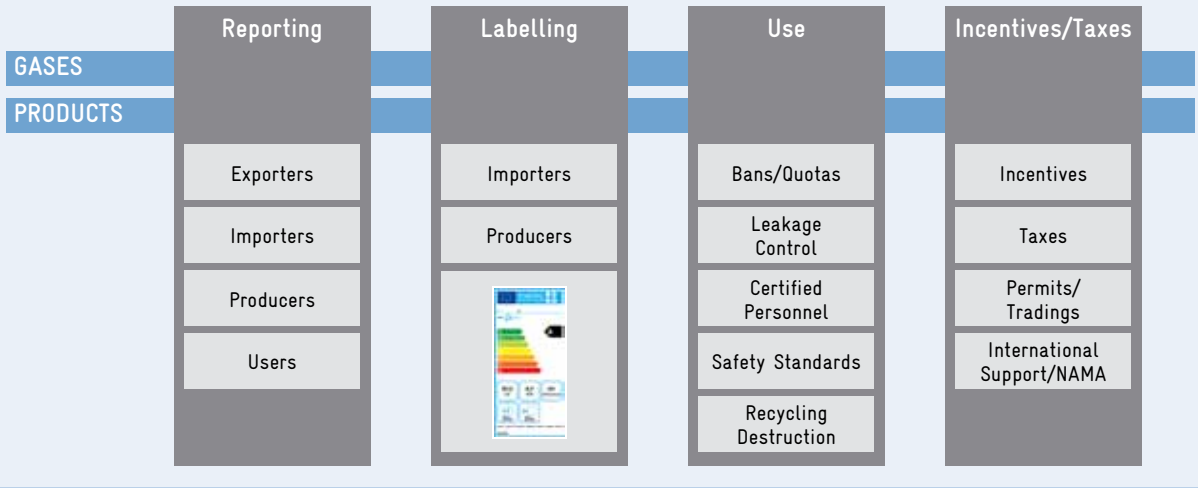
Module 8.2 discusses the range of financial support mechanisms for NAMAs. In the context of unilateral NAMAs, it also discusses certain national policy instruments, such as fiscal measures (taxes, charges) and economic incentives (subsidies).

2. Methodology

Basically, a variety of policies, measures, instruments and approaches are available to national governments to address consumption and emissions of HFCs as well as energy consumption and indirect emissions. However, not all measures may be useful in a specific country as the particular situation of the industry sectors concerned and the given regulatory circumstances need to be taken into account.

Different policy instruments that particularly relate to the RAC&F sectors are described in detail below. The policy instruments refer to the products and the refrigerants used. An overview of the policy instruments for the RAC&F sectors is given in Figure 1.

FIGURE 1
Overview on policy instruments for the RAC&F sectors.



Case studies from countries, where a particular option is already implemented, serve as examples for implementation and allow learning from their experiences. Most countries have implemented legislation and established institutions for monitoring and control of the use of HCFCs under their hydrochlorofluorocarbons phase-out management plans, and some of the above mentioned instruments might be in place already. However, the policy measures listed here relate to HFCs and indirect emissions from the energy consumption of the appliances and systems and could therefore be suggested in NAMAs.

2.1 Reporting of HFC production, export and import

In many countries, the quantities of HFCs produced or imported for different applications and contained in equipment as well as exported quantities are unknown. Hence the potentials for HFC consumption and emission reductions cannot be quantified. Data gained from customs or through national licensing systems often relate to HCFCs only since these substances are controlled internationally under the Montreal Protocol.

As part of a comprehensive reporting scheme, companies producing, importing and exporting HFCs could be also obliged to annually report the quantities per substance and their intended use to a governmental authority. The data would be collected in an electronic database. Such data could serve as framework for an HFC inventory (cf. module 1). In addition, data reporting by companies provides the basis for certain other policy instruments such as national quota systems and various fiscal and incentive measures.

Regulation requiring equipment logbooks

For each equipment unit above a specified threshold (e.g. 3 kg refrigerant charge), which excludes very small systems, the HFC refrigerant quantities are to be recorded. The operators or owners of equipment must maintain records – or logbooks – on the quantity and type of HFC refrigerants filled at installation, quantities added and quantities recovered during servicing, repair, and maintenance of the unit during full equipment life and at end-of-life disposal. Such logbooks could be kept on paper or electronically in a central database in the company or a governmental institution.

While large industrial facilities might already have introduced such logbooks for their RAC systems for safety and cost reasons, this is often not the case in smaller companies and the public sector. Requiring equipment logbooks represents a relatively cheap measure that is easy to introduce. It also creates awareness for the relevance of HFC emissions among servicing companies and equipment operators. Collected and aggregated data highlight the potential for HFC emission reductions within a facility, a company or a subsector, and can support to build up an HFC inventory.

CASE STUDY 1
Equipment records and monitoring system in Hungary[1]

A very ambitious monitoring system for the refrigeration and air conditioning sectors exists in Hungary since 2009. The system is operated by the Hungarian Monitoring and Certification Body (HMCB). All companies in the country must report the data of their equipment to this central authority, which also certifies the companies. The renewal of company certification by HMCB is conditional upon reporting. Over 50,000 refrigeration circuits with refrigerant charges of over 3 kg have been registered in the electronic data base in 2012. This monitoring system indicates the development of HFC consumption and refrigerant leakage over time.

1 More information is available at www.hlhmonitoring.hu (Hungarian only)

2.2 Labelling and standards

Labelling of products and equipment

In general, labelling of products and equipment intends to allow comparison of different products and to communicate information about particular features of the product. Labels can be introduced voluntarily by industry in order to promote particular technologies or they can be a requirement of regulation. In both cases, manufacturers of products and equipment need to attach the label to the units. Labelling schemes for particular product groups concerning energy efficiency or environmental performance, the so-called eco-labels, have already been introduced in several countries. They classify the equipment within a rating system or by means of a maximum allowed target. A rating system can be based on the overall energy efficiency of the appliance or on several distinct criteria.

Setting sector-wide benchmarks for emissions and energy consumption can be used to promote the uptake of more energy-efficient technology. As per the front-runner principle, future technology might only become applicable when meeting certain minimum efficiency benchmarks. Such benchmarks can be linked to bans of equipment that is non-compliant with the national or sector benchmark. This approach is used in the EU and refers to particular product groups, such as commercial refrigeration cabinets, light bulbs etc. An eco-label for HFC-free alternatives could be developed for the RAC-sector.

CASE STUDY 2
European labelling systems

1. Energy efficiency label[2]

In 1995, a European energy label was introduced for energy consumption and performance criteria of major household appliances. The label assists consumers to identify the most energy efficient appliance in order to reduce energy consumption. The label indicates energy efficiency in energy levels from A to G, where 'A' stands for the most energy efficient. This rating label enables a comparison of the energy efficiency of appliances and provides incentives for appliance manufacturers to improve the energy efficiency. Since 1995, the EU energy label is placed on light bulbs, cars and most electrical appliances including RAC equipment.

As technical development proceeds, the requirements need to be updated regularly. Therefore, new qualification criteria have been introduced in recent years: A++ and A+ refer to equipment more efficient than products and equipment labelled A.

The new label has been mandatory for refrigerators, freezers, wine coolers, washing machines, dishwashers and televisions since December 2011.

2. European Ecolabel[3]

The European Ecolabel is a voluntary scheme established in 1992 to encourage businesses to market environmentally friendly products and services. Products and services awarded the Ecolabel carry a flower logo, which allows consumers – including public and private purchasers – to identify them easily. Every European or non-European company producing or selling products that enter in one of the product groups covered by the EU Ecolabel scheme can apply for the programme.

3. EU F-gas regulation[4]

The current F-gas regulation stipulates labelling for

- refrigeration equipment containing perfluorocarbons (PFC),
- refrigeration and air conditioning equipment (except in motor vehicles), heat pumps, fire protection systems and fire extinguishers containing HFCs or compounds containing HFCs,
- switchgear containing sulphur hexafluoride (SF_6) or compounds containing SF_6, and
- all F-gas containers.

The label raises awareness of technicians and provides relevant information for the good practices in installation, use, maintenance and servicing. In future years, the information provided on the label also helps to select the proper end-of-life treatment for equipment at disposal.

2 More information is available at: www.energy.eu/#energy-focus, www.newenergylabel.com/index.php/de/home
3 More information is available at: http://ec.europa.eu/environment/ecolabel
4 More information is available at: http://ec.europa.eu/clima/policies/f-gas/legislation/index_en.htm

A labelling scheme can also relate to the quantity of HFCs contained in particular products and equipment. The label must include the chemical name of the substance, using the accepted industry nomenclature, the quantity of HFC contained in the product or equipment unit expressed in CO_2eq and possibly also the climate impact, i.e. GWP, of this quantity. These labels particularly address technicians.
The costs for introducing a uniform label in a country are comparably small. A labelling scheme for products and equipment containing HFCs can be introduced along with a number of other measures, e.g. containment and recovery measures, monitoring, reporting, licensing, etc. Concerning the reduction of consumption and emissions, the potential of a labelling system on its own can hardly be quantified.

CASE STUDY 3
Labelling of domestic RAC appliances in Argentina[5]

Since 2006, energy labelling of domestic appliances, such as refrigerators has been mandatory in Argentina. The labelling system classifies energy efficiency from A to E, with A being the most energy efficient products and E the least. As hydrocarbon refrigerators save between 17 % and 39 % energy compared to other available technologies, they rate highly in the labelling system.

The effect of fridges the country's energy consumption and greenhouse gas emissions is far from negligible, and the energy labelling helps to steer consumers towards more efficient products. Residential energy consumption is estimated to be responsible for 25 % of the country's energy consumption, and refrigerators are responsible for 30 % of the energy consumed in the residential sector.

Minimum energy efficiency approach
Possible steps for a minimum efficiency approach supported by legislation, standards and complimentary labelling are:
- Develop national or regional legislation, stating a minimum efficiency of a particular product group, according to a specific time period,
- Allow for an initial "grace period" between the legislation coming into force and the first minimum efficiency levels so that enterprises can develop and produce products that meet those requirements,
- Schedule a series of subsequent incremental steps, base the minimum efficiency levels on initial studies which comprise evaluating current products within a subsector and establishing what improvements are feasible at an acceptable level of increased product cost,
- Develop and publish performance test standards in order to enable consistent testing and assessment of the measured efficiencies,
- Undertake market verification in order to confirm that products which are placed on the market do actually achieve the prescribed minimum efficiencies,
- Establish an independent body, if not already existing, to oversee and regulate the verification process,
- Develop technical support and guidelines and provide them to the industry in order to assist with identifying and implementing ways and means of achieving the minimum efficiencies.

Safety Standards for RAC&F sectors
A standard is a technical document designed to be used as a rule, guideline or definition. It describes best practice knowledge. Standards do not impose any regulation and their use is usually on a voluntary basis. However, in practice, many governments, industry groups and trade associations require products or services to adhere to a standard before they can be placed on the market.

Standards support reductions of emissions by promoting practices reducing HFC emissions and the use of HFC-free technologies. Standards are developed in standardisation bodies, which include manufacturers of relevant products, users, research organisations, government departments and consumers.

5 More information is available at: http://www.hydrocarbons21.com/content/articles/119320110927.php

For all sectors relying on HFCs, a number of international, European and national standards exist. In developing countries, however, national norms and standards for alternative technologies often do not exist yet or prohibit the introduction of climate-friendly refrigerants. Such national standards need to be introduced or changed in order to facilitate the introduction of non-HFC alternatives.

Examples for standards relevant in the refrigeration and air conditioning sectors are listed below.

BOX 1
Standard examples relevant for the RAC sectors

International standards:
IEC 60335: Household and similar electric appliances – Safety. For certain appliances, requirements are specified in Part 2, for example:

- EC 60335-2-24: Household and similar electrical appliances - Safety - Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice-makers.
- IEC 60335-2-40: Household and similar electrical appliances - Safety - Part 2-40: Particular requirements for electrical heat pumps, air conditioners and dehumidifiers.
- IEC 60335-2-89: Household and similar electrical appliances - Safety - Part 2-89: Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant unit or compressor.

With regard to flammable refrigerants, it should be noted that international standards limit the charge sizes for equipment placed in occupied spaces. For example, IEC and EN 60335-2-24100 set the maximum charge for hydrocarbon refrigerants in domestic refrigeration at 150 grams.

European standards:
EN 378: Refrigerating systems and heat pumps – safety and environmental requirements. This is the main European standard for refrigeration and air conditioning systems and heat pumps in the domestic, commercial and industrial subsectors. With regard to flammable refrigerants, this standard provides a calculation method for the determination of safe charge sizes for equipment placed in occupied spaces.

- EN 50110: Operation of electrical installations.

Just as the international standards, certain European standards also apply to particular subsectors or specific topics only, for example:

- EN 60335-2-40: Household and similar electrical appliances - Safety - Part 2-40: Particular requirements for electrical heat pumps, air conditioners and dehumidifiers.
- EN 60335-2-89: Household and similar electrical appliances - Safety - Part 2-89: Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant unit or compressor.
- EN 13313: Refrigeration systems and heat pumps – Competence of personnel.
- EN 16084: Refrigeration systems and hear pumps – Qualification of tightness of components and joints.

National standards
National standards might impose additional requirements or restrictions in a particular country in order to account for specific circumstances. In France, for example, the use of flammable refrigerants in public buildings is not allowed due to local building and fire safety standards.

Impact of norms and standards

Impacts of standards on emission reductions within a particular time frame are difficult to quantify. It depends on the market uptake of standardised products and equipment or on the number of personnel and companies applying the standards. But standards do have the potential to contribute to long-term emission reductions through the consensus-based introduction of best practices. Therefore, national industry should be encouraged to participate in standardisation processes. Norms and standards often represent a severe barrier to the introduction of technical options, in particular when dealing with flammable substances such as hydrocarbons (HC). Thus, the adaption of norms and standards can strongly promote the introduction of environmental-friendly alternatives.

For further details on standards in the RAC sectors, see the GIZ Proklima handbook *Guidelines for the safe use of hydrocarbon refrigerants* publically available online at www.giz.de/proklima.

2.3 Use

Ban of the use of HFCs in equipment

Bans are a very strict policy instrument. They do not allow for flexibility. If thoroughly implemented and enforced in a country, they are a very effective instrument for reducing HFC consumption and emissions. However, the strict implementation of bans is possible only if alternatives are available for all applications covered by the ban. If alternatives are not available for particular applications and purposes, an exemption from a ban might be possible for such well defined cases. It is crucial that the applications and purposes exempted from the ban can be specified in detail.

Bans can be established either independently from other policy instruments or as measures complementing a phase-down mechanism.

BOX 2
Examples for bans in the RAC sectors

For the RAC sectors, a ban could be designed in different ways, covering:
The use of a particular substance in a specific application (Example: R-134a in domestic refrigeration equipment, R-23 in fire protection systems),

- The general use of HFCs in a specific application where alternatives can easily replace them (Example: All HFCs in industrial refrigeration, replacement option: ammonia),
- The general use of HFCs in equipment containing certain charge sizes (Example: All HFCs in equipment containing charges larger than 100 kg),
- The general use of a particular substance (Example: R-404A, which has a particularly high global warming potential [GWP] of 3,260).

Licensing systems

Most countries have already established a licensing system under the Montreal Protocol and the preparations for their HPMP. Such systems require companies to hold licenses for quantities of production, import, export and destruction of ODS and thereby allow an overview of the available quantities of substances. Licensing systems are considered a key aspect for the development of an HPMP and to enable compliance with the Montreal Protocol. Such licensing systems for ODS can be extended to HFCs in order to create a solid database on the quantities, the use and the reduction of the use of HFCs in a particular country. When this is done, general reporting obligations for HFC quantities as described in 2.1 are no longer necessary. An extended licensing system can potentially be used as NAMA policy instrument in combination with HPMP activities.

Quantitative limits for the production, import and export or for the consumption of HFCs (phase-down) and national quota systems

A national quota system monitors and gradually limits the quantities for production, consumption, import and export of specific substances, such as HFCs or HCFCs. In this way, availability, use, and thus also emissions of these substances can be reduced in the long-term while alternatives are being developed and introduced. Such quota systems have been introduced in the course of the HCFC phase-out under the Montreal Protocol, in China amongst others.

Before establishing a quota system and limitation on HFC consumption, solid data on the production and consumption of HFCs in the country are required. These can be gained through mandatory reporting or within a licensing system (cf. above).

On the basis of data on production, consumption, imports, exports and destruction of HFCs in bulk and contained in equipment, the government can set quotas, i.e. overall quantitative limits for future years. These are referred to as production quotas, import/export quotas and consumption quotas. Such national quantitative limits can decrease over time in order to support the introduction of alternatives to HFCs, e.g. within NAMA activities, but also to balance national economic needs.

Companies are granted their specific quotas for HFC quantities in a specific year upon application to the responsible governmental institution. Quantities are expressed either in metric tonnes of specific substances or in CO_2 equivalents. For countries with domestic HFC production, production quotas are easier to implement as only few companies are concerned. Additional technical assistance and training for production facilities can ensure that industry understands the benefits and the possibility of production growth despite the quota system. This includes a transfer of required know-how to reduce production of HFCs and likewise introduction of alternatives.

Import/export and production quotas are regarded as prime instruments and they are often preferred to those instruments which aim at controlling consumption, because they concern a smaller number of companies and are generally easier to implement.

In contrast to a ban of HFCs and equipment containing HFCs, a quota allows more flexibility concerning the use of HFCs in various applications.

CASE STUDY 4
Proposal for a new F-gas Regulation in the EU (published on 7. November 2012)[6]

The proposal introduces a phase-down measure. The schedule limits the total amount of HFCs, or F-gases, that can be placed on the market in the EU and reduces this amount in several steps down to one fifth of today's sales by 2030. This phase-down is complemented by measures ensuring that quantities used in new products and equipment is also covered by this mechanism. The phase-down mechanism involves a gradually declining cap on the total placement of bulk HFCs (in tonnes CO_2eq.) on the market in the EU with a freeze in 2015. A first reduction step follows in 2016. By 2030, reduction goes down to 21 % of the average levels sold in the years 2008 to 2011.

Producers of products and equipment who face a restricted supply of F-gases will switch to alternative technologies where feasible. The phase-down mechanism relies on the experience gained from phasing down the consumption of ODS. The European Commission allocates free quotas to companies based on past reporting data, with a reserve for new entrants, i.e. the proposal provides the possibility for companies to place bulk HFCs on the EU market for the first time.

6 See http://ec.europa.eu/clima/policies/f-gas/legislation/documentation_en.htm

Regulation requiring regular leakage control and repair of equipment

Regular checks of equipment for leakage as well as immediate repair in case of leakage are required in order to minimise HFC emissions during equipment life and to increase energy efficiency of the system. Equipment operators are obliged to ensure that stationary and mobile applications containing HFCs are checked for leakage by qualified technicians. A particular schedule specifies the time intervals between leakage checks for equipment with different charge sizes. Applications containing large quantities of HFC refrigerants (e.g. charges larger than 300 kg) should be checked for leakage more often than small applications (e.g. charges larger than 30 kg) as the refrigerant release in case of even small leakage is much higher. Operators and owners of applications must ensure that detected leakage is repaired as soon as possible.

Regulation prohibiting venting of HFC refrigerants and requiring recovery during lifetime of equipment and at end of life

In order to minimise HFC emissions, venting of the refrigerant gas during servicing, maintenance and repair of HFC equipment needs to be prohibited. Instead, refrigerant quantities must be recovered from the equipment by a qualified technician and stored in suitable containers for reuse or, in case the refrigerant is impure, for reclamation or destruction. The recovery of refrigerant gas is also relevant for equipment and appliances containing HFCs at disposal.

When implementing such a regulation, measures raising awareness, information campaigns and training courses for technicians about practices for refrigerant handling are recommended as additional NAMA policy instruments.

Regulation requiring recycling or destruction of HFC quantities recovered from products and equipment

In order to reduce HFC emissions, recovered quantities of HFC refrigerants must not be vented, i.e. released into the atmosphere. Quantities which can be cleaned easily can be recycled and reused in equipment. For quantities that cannot be reused in equipment anymore, destruction in special facilities should be mandatory. Destruction facilities which have been established for ODS in some countries are also suitable for HFCs. Regulations concerning recycling or destruction of HFCs might complement HPMP activities and provide a basis for different NAMA activities in the area of servicing and end-of-life treatment of appliances and equipment.

Possible activities include the introduction of a take-back scheme for used refrigerant gases. This could be part of producers' or suppliers' responsibility scheme (ICF International, 2010). In this way, recovery and appropriate treatment of HFCs could be promoted. The take-back systems may be set-up either as governmental measure to implement a regulation or voluntarily by industry.

In the European Union, voluntary take-back schemes have been established by several Member States for certain applications, e.g. for heat pumps in Belgium. In the Netherlands a voluntary take-back scheme for recovered bulk F-gases was established by the industry; it followed a mandatory take-back scheme for ODS which had been in place since the early 1990s. In France a voluntary system was set up as deposit-refund scheme covering ODS and HFCs in 1993.

When introducing take-back schemes, experiences from existing schemes in other countries should be considered in order to effectively promote recovery for reclamation and destruction and to reduce emissions in a cost-effective manner. Take-back schemes for recovered refrigerants are likely to be more effective if neither the servicing company returning the gas nor the producer has to pay any fees. Such schemes could be funded via taxes on import and production of HFCs. An important aspect is also the size of the country and the possibilities for setting up an infrastructure for the collection, storage and treatment of used refrigerant gases.

Information and capacity building

When policy measures aiming at the reduction of HFC use and emissions and at the introduction of alternative technologies are initiated in a country, information campaigns and measures to raise awareness should take place at the same time or even some time ahead. Depending on the type of policy measure to be introduced, such information and awareness raising campaigns need to be designed for different target groups, for example equipment or component manufacturers for different subsectors, servicing companies and service technicians, owners and operators of equipment, the general public, etc.

BOX 3
Information and awareness raising activities

Potential information and awareness raising activities include
- Seminars and presentations at trade fairs or economic forums,
- Printed or online information material and articles in publications,
- Helpdesks providing information about regulatory and legislative changes via internet, telephone, or located in authorities.

Training of technicians

Large shares of HFC emissions are caused during installation, servicing, maintenance, repair, and at decommissioning of equipment and systems because knowledge and experience concerning proper refrigerant handling, recovery and storage are lacking. To increase the application of best practices and to improve the level of qualification of relevant personnel, special trainings for refrigeration technicians need to be established.

Similar trainings may already have taken place in the context of the ODS phase-out under the Montreal Protocol and existing training infrastructure and professional education programmes may be extended to HFCs. In addition, the introduction of alternative technologies also requires know-how about design and functioning, as well as safety precautions for equipment and systems running on natural refrigerants such as carbon dioxide (CO_2), ammonia (NH_3) and hydrocarbons. Thus, trainings aiming at HFC consumption and emission reductions always need to relate to alternative technologies as well.

Voluntary measures by industry

In environmental policy, decision-makers increasingly favour alternative forms of regulation including voluntary agreements and other self-regulation instead of using traditional legislative instruments. Voluntary measures can be initiated by industry only or as an agreement between industry and authorities.

Concerning HFC emissions, voluntary action has been taken at international, European and national levels (Schwarz et al., 2011). In November 2010, the Consumer Goods Forum (CGF) announced an initiative to phase out the use of HFC refrigerants as of 2015 where natural refrigerant alternatives" are legally allowed and available for new purchases of point-of-sale units and large refrigeration installations"[7]. CGF is an organisation of 400 global manufacturers and retailers of consumer goods, including well-known brands such as Carrefour, Johnson & Johnson, Nestlé, Procter & Gamble, Tesco, Unilever and Wal-Mart. Other global initiatives such as "Refrigerants, Naturally!" and "The Natural Voice" provide platforms for companies committing to the use of natural refrigerants and thereby to the prevention of emissions of ODS and HFCs.

At national level, voluntary agreements between industries and national environmental agencies or other authorities sometimes can be established when a regulatory measure is considered too strict or cannot be implemented for political reasons (cf. case study 5).

CASE STUDY 5
Voluntary partnerships between industries and national authorities in the USA

In the USA, voluntary partnerships between industries and the US Environmental Protection Agency (US EPA) are the major tool for reducing F-gas emissions: Since 2003, a voluntary code of practice intends to reduce HFC and PFC emissions from fire protection. It is based on a partnership between US EPA and several industry associations in the sector. Recommended practices for household refrigerator and freezer producers intend to minimise HFC emissions from foam and refrigerants during manufacture of appliances. For other types of refrigeration and air conditioning equipment, guidelines for responsible use also aim at reducing emissions during manufacture. Another voluntary program, the HFC-23 Emission Reduction Program, aims at reducing HFC-23 by-product emissions in the production of HCFC-22 through process optimisation and thermal oxidation. Disposal emissions from appliances are addressed by the Responsible Appliance Disposal Program since 2006.

7 http://sustainability.mycgforum.com/refrigeration.html

Based on experiences made in the EU, the following **criteria for environmental agreements** should be considered when establishing a voluntary agreement (European Commission, 2002):

- **Representativeness:** Signatories to environmental agreements should represent the majority of the economic sector concerned and should be responsible and organised.
- **Quantified and staged objectives:** The objectives of the agreements must be clearly stated. If the agreement covers a long period, intermediate objectives must likewise be specified. There must be reliable indicators to measure the extent to which objectives have been achieved.
- **Monitoring and reporting:** A monitoring and reporting system for achieving the objectives should be agreed upon.
- **Cost-effectiveness of administration:** Administrative costs should not be higher than those of other available instruments.
- **Involvement of civil society:** Agreements as well as relevant reports and accounts should be accessible to the public on the Internet. Interested parties should be able to express their opinions.

Voluntary agreements are self-regulatory practices and are not legally binding. Problems during the implementation of a voluntary agreement might relate to limited participation, lack of independent control of compliance and enforcement or lack of consequences in case of non-compliance.

Overall, voluntary measures need to be considered "soft" instruments to raise general awareness and to address sectors not covered by mandatory regulation. Voluntary approaches are estimated too weak if emission reduction targets and compliance with international commitments need to be achieved.

2.4 Incentives and taxes

Taxes on HFCs can be introduced in order to support the introduction and market penetration of alternatives with low or zero GWP. Taxes should be based on the GWP of different substances in order to take into account their global warming impact. Lessons learned from other countries, such as Denmark, Norway, and Australia, should be considered. Financial incentives can be provided by the government to promote the market uptake of alternative refrigerants and equipment running on alternatives. For further and more detailed information on these policy measures, please refer to module 8.2 which discusses taxes and incentives as financing instruments in a unilateral NAMA.

2.5 Selection of appropriate policy options per subsector

Screening of policy measures by criteria

In order to effectively address consumption and emissions of HFCs, national governments need to establish a suitable policy framework. In the context of HCFC phase-out under the Montreal Protocol, developing countries already have certain policies in place which are stipulated in a country's HPMP. When establishing a NAMA policy framework, the selected measures will have to fit into the country specific context, complement the HPMP activities and integrate other policy arrangements. Therefore, the selection of appropriate policy options per subsector needs to take into account these circumstances. The selection of policy options should also consider the assessment of alternatives and the ranking of preferable abatement options and their availability in particular subsectors (cf. modules 3 and 4).

One possible way of structuring policy options in the RAC&F sectors is to differentiate between direct emissions of HFCs that occur through leakage or venting, and indirect emissions that are associated with the appliances' power consumption. Table 1 gives an overview of measures that target the two emission sources.

TABLE 1
Structuring of policy options according to emission sources

	Measures which target direct emissions from the use of HFCs	Measures which target indirect emissions caused by energy consumption
Measures to improve containment and recovery	+	
Bans of HFCs	+	
Quota systems for HFC quantities	+	
Norms and standards	+	+
Licensing	+	+
Information and Capacity Building	+	+
Labelling of products	+	+
Taxation and financial incentives	+	

Modules 3 and 4 introduce and assess alternative technologies and identify those alternatives with high potentials for market penetration. For the selection of policy options, criteria need to be established. Such criteria are Reduction of HFC consumption and direct emissions,

- Reduction of indirect emissions through reduction of energy consumption,
- Costs for consumption and emissions abatement,
- Time frame,
- Covered subsectors,
- Administrative effort and costs for administration,
- Integration with other policies,
- etc.

Furthermore, policy options complementing each other or excluding each other need to be identified in order to narrow down the full range of options and instruments. A comprehensive policy framework addresses HFC emissions from existing equipment and products in the market while also aiming at avoiding HFC emissions in the future by introducing alternative technologies and thereby reducing HFC consumption. Certain policy measures may be very unlikely to be implemented because of high administrative effort, high costs, or due to political or other reasons. Considering these barriers, certain policy options may be excluded from further consideration.

An example for establishing and allocating criteria for the selection of policy options is shown in Table 2.

Ranking of policy options

After the screening of policy options, a ranking should take place. This ranking needs to take into account the future impact of a policy framework. The following aspects provide guidance:

- **Effectiveness:** What is the expected contribution of specific policy options to the emission reductions within a specific time frame?
- **Efficiency:** Are the objectives achieved at reasonable cost? Is the maximum impact reached by use of the calculated costs?
- **Technical constraints:** Which technical constraints exist, in particular related to the replacement of current HFC technology by technical options?
- **Other qualitative criteria.**

For a NAMA, the focus is on mitigation potential. Therefore the maximum additional reduction of emissions and consumption should be achieved in a particular time frame. Detailed information and calculation of the emission reduction potential has to be available, for example via industry forecasts about future production or through a national F-gas inventory (cf. module 1).

The selected policy options can be ranked according to their potential for reducing emissions and consumption within a specified time frame. The time frame could be defined as from the start in 2015 until 2020 or until 2030. An example for the ranking of policy options is given in Table 3.

TABLE 2
Policy instruments, relevant technical options and the target of each policy instrument

Policy instrument	Technical option to mitigate HFCs	Target	Criteria
Regulation requiring regular leakage control of HFC equipment and logbooks	Containment (leak reduction)	HFC emissions from existing equipment (operating emissions)	Immediate impact, significant emission reductions
Take-back system for used refrigerants and refrigerant containers	Recovery and recycling of HFCs	HFC emissions from existing equipment and end of life equipment	Immediate impact
Training programme for technicians	Containment, recovery, end-of-life treatment of equipment	HFC emissions from existing equipment and disposed equipment	Long-term impact, can be integrated with ODS policy
Norms and standards for introducing HCs	HCs (R-600a, R-290, R-1270)	Introduction of new equipment not relying on HFCs	Long-term impact, low costs
Ban on using HFCs in large commercial and industrial applications	Restriction of HFC charge	Introduction of new equipment not relying on HFCs but on NH_3 or HCs	Immediate impact, demonstration projects available

TABLE 3
Example for the ranking of policy options by emission reduction potential in 2030

Proposed policy option	Sectors concerned	Suggested start	Emission reduction potential in 2030 (kt CO_2eq) calculated on the basis of a national HFC inventory	Ranking
Ban of HFCs in domestic refrigeration	Domestic refrigeration	2015	50	low
Quota system for HFCs	All sectors	2018	8,000	high
Training programme for RAC servicing technicians	Stationary refrigeration and AC sectors	immediate	unknown	high
Regular leakage control of systems with charges › 5 kg	Stationary refrigeration and AC sectors	immediate	2,000	medium
Etc.	...	...	...	
TOTAL			...	

3. Practical application

The government may wish to establish a suitable policy framework to effectively address HFC emissions and to support the introduction of green cooling technologies. While developing a NAMA policy framework in a country, existing policies, stipulated in particular by the country's HPMP, need to be taken into account.

In case study 6, experiences from a demonstration project with the South African supermarket chain Pick n Pay is used to illustrate how appropriate policy instruments for a NAMA in the subsector of commercial refrigeration could be established.

CASE STUDY 6
Supermarket Refrigeration in South Africa

In a project implemented by the Programme Proklima of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and funded by the International Climate Initiative of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), two South African Pick n Pay stores were converted to natural refrigerant technology. The project included technology advice during planning, installation and operation as well as training for engineers and technicians and financial support for the investment and monitoring of the new equipment (in terms of performance, energy consumption etc.). The following exercise on how to develop a NAMA is based on the experiences in this demonstration project.

Country context
In South Africa, electricity prices are rapidly increasing due to energy supply shortage. The country is presently looking for possibilities to manage energy demand and to lower its greenhouse gas emissions. Supermarkets are an important sector of the economy. However, they need significant amounts of electricity, most of that is used in their refrigeration and air-conditioning systems. In addition, supermarket refrigeration systems are a significant source of direct F-gas emissions. Currently, nearly all supermarket refrigeration systems in Southern Africa operate on fluorinated refrigerants with high ozone depleting potential (ODP) and high global warming potential (GWP). In light of possible scaling up to the overall supermarket refrigeration sector, the demonstration projects on alternative low-GWP technologies were carried out with the company Pick n Pay, one of the largest supermarket chains in Southern Africa. Due to increasing energy costs, Pick n Pay decided to explore new energy efficient refrigeration technologies with low direct emissions and to engage in a bilateral assistance project with Germany. The projects were implemented in two stores in climatically different zones of South Africa, in Johannesburg and in Cape Town (Ederberg et al, 2012).

Based on these experiences, a NAMA policy framework can be designed. The following policy instruments could be used to implement a sector mitigation strategy.

Policy instruments
1. Reduction of HFC emissions from existing and new HFC equipment
Several measures aim at reducing HFC emissions from existing and new HFC equipment during installation, operation, servicing and at end-of-life of equipment:
- Introduction of a take-back system for used HFCs. Servicing companies can deliver used HFCs to distributors and producers who are obliged to accept the delivered quantities and to recycle, reclaim or destroy them properly.
- National legislation may set up no-cost schemes for recovered refrigerants, which then need to be funded through another source (e.g. tax system), or a system based on fees. Also, these systems may be in the framework of a voluntary industry scheme.
- Introduction of an HFC charge threshold of certain equipment
- Introduction of maximum leakage rates in certain applications
- Introduction of training and certification requirements to personnel undertaking activities at RAC equipment

CASE STUDY 6
Supermarket Refrigeration in South Africa

2. Substitution of HFC refrigerants by natural refrigerants
Equipment for non-HFC, natural refrigerants for supermarkets faces higher investment cost (at least additional 20 %). However, improved energy efficiencies of natural refrigerant based systems reduce energy consumption costs by at least a similar amount within a time frame of a few years. The higher investment can be recovered through the energy savings. "Energy saving investment" carries an investment return of approximately 15 %. Even though long term energy saving might be significant, most companies focus mainly on short term investment. This may result in the use of cheaper but yet more climate damaging alternatives. However, with regard to the economic market development, resource efficiency and energy security of a country, it is in the interest of the national government to promote the substitution of HFCs by natural refrigerant solutions. Several policy instruments are available:

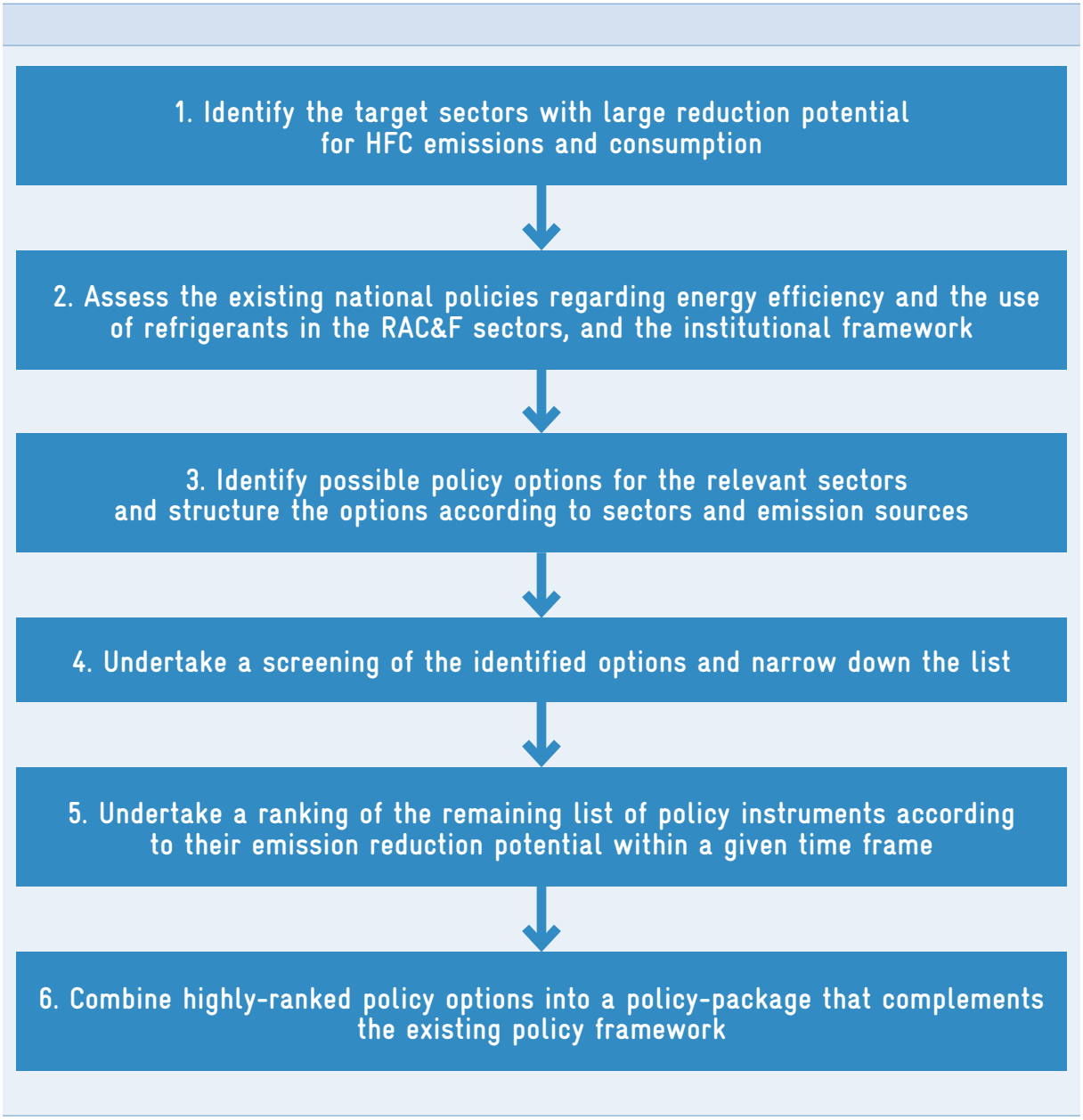
- Financial incentive schemes: Higher investment costs for alternatives can be effectively addressed through financial incentive schemes, such as upfront grants for more climate friendly technological options or by providing guarantee-coverage in order to facilitate access to banking loans.
- Quota system: A quota system can be used to control the production and/or consumption of HFCs in the country. The system should not refer to supermarket refrigeration only.
- Bans: An HFC ban for the entire sector or for certain appliances (e.g. stand alone equipment) can be highly effective in reducing HFC consumption when suitable alternatives are available.

3. Improving energy efficiency

- Energy efficiency labels for refrigerators and air-conditioners exist in several countries and target the energy performance of appliances through a rating system or a maximum allowed energy consumption target. The rating system can be based on the overall system efficiency of the appliance or on several distinct criteria and provide a tool for comparison for the customer. Setting sector-wide benchmarks for emissions and energy consumption can be used to promote the uptake of more energy-efficient technology. As per the front-runner principle, future technology might only become applicable when meeting certain minimum efficiency benchmarks.
- Ban of equipment non-compliant with national targets and benchmarks: An energy efficiency scheme may set a maximum allowable energy consumption target for a certain appliance and prohibit all equipment not complying with the target. Such an approach is currently being introduced in the EU for commercial refrigeration cabinets and other product groups such as light bulbs etc.

The following step-by-step guide shows how to assess and select policy options to achieve reduction of emissions and consumption of HFCs most effectively and efficiently.

Steps for assessing and selecting policy options:



Step 1: Identify the target sectors with large reduction potential for HFC emissions and consumption.

The following information sources can be used to identify sectors with large emission reduction potential:

- Monitoring data on leakages or refilling (from companies, if your industry requires such reporting) and other background information from companies or industry associations
- Data collected in the HPMP
- National inventory and national communication
- Authorities related to the RAC&F sectors with experiences on fillings, refilling and end-of-life treatment of RAC&F appliances

Step 2: Assess the existing national policies regarding energy efficiency and the use of refrigerants in the RAC&F sectors, and the institutional framework

List relevant policies for identified target sectors (HPMP, climate policies, legislation on energy, waste etc.) and identify the stakeholders responsible or addressed through the policies.

The following questions could guide such assessment:

- **Training:** Is a certification scheme in place for servicing technicians? Is training infrastructure in place? Are additional resources available?
- **Monitoring and reporting:** Do operators and owners of equipment need to keep equipment logbooks?
- **Labeling:** Does a labeling scheme for refrigeration and air conditioning equipment exist? Is it a governmental scheme or a scheme introduced (voluntarily) by industry?
- **Economic incentives:** Are economic incentives for the introduction of alternatives to HCFCs in place and could they be extended?
- **Bans:** Are bans or quotas for HCFC equipment established? What about HFCs?
- **Licensing system:** Licensing system: Is a licensing system for HCFCs in place? What about HFCs?

Step 3: Identify possible policy options for the relevant sectors and structure the options according to sectors and emission sources

The range of possible policy options follows the analysis presented in this module. Relevant policy options include restrictions on the allowed refrigerant and restrictions and reporting on the use of certain refrigerants.
Proklima recommends carrying out an impact analysis for each of the policy options, including an estimate on the emission reduction potential of the options.

Step 4: Undertake a screening of the identified options and narrow down the list

After having considered the impact of all possible policy options in step 3, you can narrow down the list. You may also want to group different policy options, if overlaps exist. For example, if a ban on refrigerants prohibits the use of high-GWP refrigerants, then certain reporting and monitoring requirements will no longer be needed in the future.

Step 5: Undertake a ranking of the remaining list of policy instruments according to their emission reduction potential within a given time frame

The following questions could guide such assessment:

- What is the technically possible and targeted emission reduction potential in the subsector?
- What are the technical constraints and barriers; can they be removed through the NAMA?
- What are the institutional and political barriers; can the NAMA realistically remove these barriers?
- Can emission reductions be clearly accounted and realistically achieved in the chosen time frame?

Step 6: Combine highly-ranked policy options into a policy-package that complements the existing policy framework

As a last step, package the policy options that ranked highest and develop the strategy to implement this package.

The European F-gas regulation can be taken as an example: Of the RAC&F sectors, the mobile air conditioning (MAC) subsector was chosen as a priority subsector. The most stringent policy measures were first introduced for the MAC sector where the currently dominant refrigerant HFC-134a was effectively banned (all refrigerants with a GWP above 150 will be banned from 2017). Next, the EU reviews the remaining subsectors for possible, more stringent policy measures. Some of the other subsectors were already addressed with the current F-gas regulation: Sectors with higher emissions, such as chillers with large refrigerant filling amounts, have to follow more stringent reporting and monitoring requirements.

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