OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

23701

Republic of Macedonia
Ministry of Environment and Physical Planning

Project: HCFC Management Phase out Plan
Number: MP/MCD/08/001

Implementation Agency: UNIDO

June 2009

CONTENT

SUMMARY

This document is a part of policies of Republic of Macedonia in environment protection especially designed to ozone layer protection. The HCFC Management Phase out Plan is created to enable the Government of Republic of Macedonia to meet the obligations towards Montreal Protocol and its Amendments.

The preparation of the HCFCs Management Plan is conducted by Survey on installed quantities and annual consumption of HCFCs in Republic of Macedonia as per the new Montreal Protocol accelerated phase-out schedule for HCFCs and establishing the new baseline for the country, based on the average consumption in 2009-2010 and subsequently freeze in 2013. The Plan is developed in staged approach. The first stage of the planned activities covers the period from the year 2010 to 2015 and the second stage is related to the period 2016 - 2040.

The planned activities and implementation of the HCFC Management Phase out Plan is through:

Policy instruments (Import Quota System, Mandatory reporting by importers and exporters, Environmental taxes for import of ODSs and ODS containing equipment and Bans on import).

Projects (Training of involved stakeholders, Improvement of refrigerants Recovery and Recycling scheme, Completion of the conversions of technology in manufacturing industries, establishing of Waste Disposal Center)

Institutional strengthening (Preparation and implementation of policy instruments, preparation of project proposals, implementation of approved projects, awareness raising, etc.)

The cost calculation and time frame of implementation are given as Appendix 1. The total cost of HCFCs Phase-out in Republic of Macedonia is US$ 3.970.000.

1. COUNTRY PROFILE

1.1 Population and geography

Geography

The Republic of Macedonia is located in the center of the Balkan Peninsula, in South Europe, between 40° and 42° north latitude and between 23° and 20° east longitude. Neighboring countries are Albania on the West, Serbia on the North, Bulgaria on the East and Greece on the South. The Republic of Macedonia has a total area of 25,713 km^2.

Table 1. Geographic coordinates

	Latitude North	Longitude East (Greenwich)
North	42^0 22' 21"	$22^0$18' 04"
South	40^0 51' 16"	21^0 07' 33"
East	41^0 42' 33"	23^0 02' 12"
West	41^0 31' 04"	20^0 27' 32"

The Republic of Macedonia is a mountainous country with many lowlands. The average altitude of the whole territory is 850 meters. According to the spatial plan of the country, 1.9% of the territory is covered by water (lakes), 19.1% are plains and valleys, and the largest part consists of 79% in hills and mountains.

Plains and valleys in Macedonia occupy a total area of 4,900 km^2. Their area is different, from 25 km^2 - Debarsko Pole, up to 1,200 km^2 Pelagonija, or Bitolsko-Prilepsko Pole. They are also at a different average elevation - from 80 meters of Gevgelisko-Valandovsko Pole up to 880 meters in Prespansko Pole. Other larger plains and valleys are Skopsko Pole, Kumanovsko Pole, Tikvesh, Polog, and Ovce Pole.

According to the hypsometry, the territory can be classified into three categories of high-, mid- and lowland. The highland area is the one with an absolute height over 2,000 meters, the midland area consists of land between 1,000 to 2,000 meters above sea level, and the lowland area is land below 1,000 meters in height.

The total territory of the highland in Macedonia is 354.26 km^2 or 1.38% of the territory of the country. The highest mountain is Korab (Golem Korab peak is 2,764 meters) and the lowest is Belasica (2,029 meters). Other significant high mountains include the Shar Planina, Bistra, Stogovo, Jakupica, Galichica, Pelister, Nidze, Kozhuv, and Osogovo.

The midland area covers 7,528.22 km^2 or 29.28% of the country. The highest mountain in this category is the Plakenska Planina (Plake peak is 1,998 meters) and the lowest is Konechka Planina (1,158 meters). Other important mountains in this category include Maleshevski Planini, Plachkovica, Busheva Planina, Babuna, Ograzden, Selechka Planina, and Skopska Crna Gora.

The lowland area of the country below 1,000 meters is spread over the entire territory. The total area in this category is 17,830.52 km^2, or 69.34%. Out of this territory 4,900 km^2 are plains and valleys, while the remaining are low mountains and hills.

Climatic specifics

The climate in Macedonia is diverse. In the southern part of the country it is altered Mediterranean, in the central and northern areas it is mild continental and high mountains or mountainous. The average annual temperature is 11.50 C°. The warmest month is July with an average air temperature of 22.0 C°, while the coldest is January, with an average temperature of -3.0 C°. The temperatures are higher in the southern parts of the country. Thus, moving towards the north, the average annual temperature gradually declines: Gevgelija 14.5 C°, Kavadarci 13.5 C°, Skopje 12.4 C° and Tetovo 11.3 C°.
The calendar of precipitation in Macedonia, as well as their type shows significant irregularities. Hence, although the average precipitation equals 680 mm, the mountainous region of western Macedonia gets much more precipitation – over 1,000 mm – while the middle part, especially the middle of the Povardarie (Vardar Valley) gets under 500 mm of precipitation. The most frequent winds in Macedonia are "Vardarec" and "Jugo".

Population and employment

The Republic of Macedonia has a population of 2.045.177 (as of 31.12.2007), with an average population density of 80 persons per sq km. The number of households is 564.300.
The population of Republic of Macedonia, as a result of a positive natural increase, is still keeping the positive direction of increase, but with significantly lower dynamics.
In the period 1997-2007 the population increase was 42837 persons or 2.1%.
The significant changes in direction of aging, issued changes in the age structure of the population. In the period 1997-2007, the participation of the young population (age group 0-14) in the total population decreased from 23.5% to 18.5% and the participation of the old population (age group 65 and over) increased from 9.3% to 11.4%.
The territorial distribution of the population in Republic of Macedonia expresses significant inequality. The 57.8% of the population live in the cities (there are 34 cities in Republic of Macedonia) where the biggest concentration is in the capitol Skopje (20.5%). Large part of the rural settlements (total number of settlements is 1728) are completely depopulated (141 settlement) or have extremely small number of inhabitants, and in close future, as a result of inauspicious age structure (old population), will have no population.
From the other side, in relatively small number of rural settlements (mostly located in the west and north-east part of the country), the concentration of the population is very large.
Between 1948 and 1994, the urban population grew from 28.7% to 58.4% of the total population. Some 62% of the population lives in urban areas, mainly in the five largest cities: the capital Skopje, Bitola, Prilep, Kumanovo, and Tetovo. The Republic of Macedonia has one of the most complex ethnic populations in Europe. The country is inhabited by, apart from the Macedonians (64,18%), several ethnic minorities including Albanians at 25,17%, Turks at 3, 85%, Rhomas at 2,66%, Serbs at 1,78%, Bosniacs at 0,84, Vlachos at 0,48% and others.

In the period from 1997 to 2007, the activity, employment and unemployment rates register minimal changes from year to year, in terms of increase and decrease.
The highest employment rate of 38.6% and the lowest unemployment rate of 30% are registered in 2001.
The labor force in 2007 was 907,138 persons. The employment rate was 36.2% and unemployment rate was 34.9%.

1.2 Political profile of the country

The Republic of Macedonia was admitted to the United Nations in 1993. Since December 2005 it is also candidate for joining the European Union.
The Republic of Macedonia is a country with a democratically elected head of state (President) and Parliament. It has a coalition government and the Prime Minister is elected, upon the proposal of the President, by Parliament.

The Republic of Macedonia is a uniform country, administratively divided into 84 municipalities headed by mayors and municipal councils. With the new Law on territorial organization of local authorities (OG RM 55/04), the number of local self-authorities is 84 plus the City of Skopje. State intervention in local self-government is

executed through government administrative units or branches, organized in individual municipalities or, organized as a single unit covering several small municipalities together. The administrative units deal primarily with matters concerning internal affairs, defense, health, environment and physical planning.

1.3 Economy

In the period 1997-2007 Macedonian GDP grew from 10.1 billion US$ at purchasing power parity to 19.1 billion US$. In 2007 Macedonia reached the level of 5.1% real GDP growth which is an increase compared to previous years. After the initial transition-induced recession which started in 1991, Macedonian economy started to grow again in 1996. However, between 1996 and 2003 the growth rate was rather poor, partly as a result of various external shocks. With an average annual rate of around 2 percent the country's growth performance was below that one in a large majority of other transition economies[1].

The general outlook improved in 2004 and 2007 (see Table 2), with the average annual GDP growth rate of 4,3% which is still lower than most of other EU candidate and newly accessed countries. On track to reach successful economies in transition the goal of the Government of Republic of Macedonia is to achieve economic strengthening with average increase of GDP from 6-8% annually within the next 4 years.

Table 2. General outlook of the country 2004-2008

	2004	2005	2006	2007	2008*
Real GDP growth (%)	4.1	4.1	4.0	5.9	5.3
Annual inflation (%)	-0.4	0.5	3.2	2.3	8.3
Central budget balance as % of GDP	0.0	0.2	-0.5	0.6	/
Coverage of import by export (%)	57.2	63.2	63.8	64.2	58.1
FDI (USD m)	323.0	97.0	424.2	699.1	598.5
Unemployment Rate (%)	37.2	37.3	36.0	34.9	33.0

Source: State Statistical Office, National Bank of the Republic of Macedonia
*data for Q3.2008

GDP per capita measured at current prices increased from 1.870 US$ in 1997 to 3.710 US$ in 2007. In the last 2 years the substantial real growth of gross fixed capital formation (10-15%) was achieved.

Current account balance of goods has been during the whole period negative due to the higher imports of goods. The deficit increased from 386 million US$ in 1997 up to 1627 million US$ in 2007. The terms of trade measured as unit values of exports over unit values of imports have not improved during the examined period.

Macedonian leading sectors by exports are:

- manufacturing of basic metals (33,2%),
- manufacturing of wearing apparel (23,1%) and
- manufacturing of food products and beverages (9,6%).

[1] Republic of Macedonia: National Development Plan 2007 – 2009.

Macedonian industry is positioning itself in traditional markets like basic metals, food and beverages where generally price is the primary driver of competitiveness. The fact of traditional industries in global economy is that the primary profits in the chain of production are increasingly to be found in areas outside production. Moving up the value-added chain requires differentiation of products and services which are done based on innovation, research and development capabilities.

1.4 Environmental overview

Short summary
The Ministry of Environment and Physical Planning has a legal obligation to create the policy of the Republic of Macedonia and to lead the national activities in the field of protection of the environment and careful exploitation of spatial and natural resources.
According to the Framework Law on Environment consisting of the general principles of environmental protection, the Ministry of Environment and Physical Planning is responsible for the monitoring of the state of the environment, water, soil, flora, fauna, air and ozone layer protection; protection against noise, radiation, conservation of biodiversity, geodiversity, national parks and protected areas; restoration of polluted areas; waste, spatial planning, spatial information system, survey and control; and other activities specified by the law.

1.4.1 Ozone layer protection

The Country Programme for the reduction and phase-out of ODS was completed in July 1995 and approved by the 20th Meeting of the Executive Committee of the Multilateral Fund held in Montreal on 16-18 October 1996.
The Republic of Macedonia is classified as an Article 5[2] country according the Montreal Protocol.
The two main obligations of the Parties are complying with the ODS freeze and phase-out schedules and banning trade with non-Parties to the Protocol.
The freeze and phase-out obligations for Article 5 countries (including the Republic of Macedonia), take into account that developing countries usually do not have easy access to alternative technologies, know-how and capital investment. Therefore, Article 5 countries are granted with grace period to fulfill MP obligations. This should allow sufficient time to provide smooth transition to non-ODS technologies.
Table 3 summarizes control measures and the phase-out schedule for the different ODSs, applicable to developing and developed countries.

[2] Developing countries which are Party to the Montreal Protocol with an annual calculated level of consumption less then 0,3 kg per capita of the controlled substances in Annex A, and less then 0,2 kg per capita of the controlled substances in Annex B. These countries are permitted a 10 year grace period for most substances compared with the phase-out schedule for developed countries

Table 3. Control measures and the phase-out schedule

Montreal Protocol Annex/ Group	Controlled substances (ODSs)	Obligation of the countries classified according to the Article 5 of the Montreal Protocol (developing countries)	Obligation of the countries classified according to the Article 2 of the Montreal Protocol (developed countries)
A I	CFC-11 CFC-12 CFC-113 CFC-114 CFC-115	Base level: Average of 1995-1997 Freeze : July 1, 1999 50% reduction: January 1, 2005 85% reduction : January 1, 2007 100% reduction : January 1, 2010	Base level : 1986 Freeze : July 1, 1989 75% reduction : January 1, 1994 100% reduction : January 1, 1996
A II	Halon-1211 Halon-1301 Halon-2402	Base level : Average of 1995-1997 Freeze : January 1, 2002 50% reduction : January 1, 2005 100% reduction : January 1, 2010	Base level : 1986 20% reduction : January 1, 1992 100% reduction : January 1, 1994
B I	CFC-13 CFC-111 CFC-112 CFC-211 CFC-212 CFC-213 CFC-214 CFC-215 CFC-216 CFC-217	Base level : Average of 1998-2000 20% reduction : January 1, 2003 85% reduction : January 1, 2007 100% reduction : January 1, 2010	Base level : 1989 20% reduction : January 1, 1993 75% reduction : January 1, 1994 100% reduction : January 1, 1996
B II	Carbon tetrachloride	Base level : Average of 1998-2000 85% reduction : January 1, 2005 100% reduction : January 1, 2010	Base level : 1989 85% reduction : January 1, 1995 100% reduction : January 1, 1996
B III	1,1,1,-tricloroethane (methyl chloroform)	Base level : Average of 1998-2000 Freeze : January 1, 2003 30% reduction : January 1, 2005 70% reduction : January 1, 2010 100% reduction : January 1, 2015	Base level : 1989 50% reduction : January 1, 1994 100% reduction : January 1, 1996
C I	**HCFCs**	**Base level: 2009-2010 consumption Freeze : January 1, 2013 10% reduction January 1, 2015 35% reduction January 1, 2020 67,5% reduction January 1, 2025 97.5 % reduction January 1, 2030 2,5% allowed for "servicing" purposes between 2030 to 2040**	**Base level: HCFC consumption in 1989 + 2.8% of CFC consumption in 1989 Freeze: 1996 35% reduction: January 1, 2004 75% reduction : January 1, 2010 90% reduction : January 1, 2015 99.5% reduction : January 1, 2020 0.5% allowed for "servicing" purposes between 2020-2030**
C II	HBFCs	100% reduction : January 1, 1996	100% reduction : January 1, 1996
C III	Bromochloro methane	100% reduction : January 1, 2002	100% reduction : January 1, 2002
E I	2Methyl Bromide	Base level : Average of 1995-1998 Freeze : January 1, 2002 20% reduction: January 1, 2005 100% reduction : January 1, 2015	Base level : 1991 Freeze : January 1, 1995 25% reduction: January 1, 1999 50% reduction: January 1, 2001 70% reduction: January 1, 2003 100% reduction : January 1, 2005

The first steps towards country action on ozone layer protection started upon development of the country programme for phasing-out ozone depleting substances in Macedonia in 1996. The Programme contains milestones for overall national action on ODSs reduction and elimination. The Country Programme gives excellent basis for conducting of the successful ODSs phase-out process.

The role of a coordinator of the national activities towards Country Programme implementation was given to the Ozone Unit under the Ministry of Environment and Physical Planning. The Ozone Unit, being the national focal point, was established on February 1, 1997. During the 12-years of existence the Ozone Unit in cooperation with UNIDO as an Implementing Agency and financial support provided by the Multilateral Fund realized investment projects in almost all economic branches where ODSs found application (refrigeration equipment production, rigid & flexible foams manufacturing, agriculture, SME, etc.).
Table 4 gives a list of the on-going and already completed projects realized under the NOU supervision.

Table 4. Projects realized by the NOU

Name of project	**Number of project**	**ODSs phased out (MT)**	**Remarks**
Country Programme	MP/MCD/95/034	n/a	Completed
Institutional strengthening – Phase I	MP/MCD/97/006	n/a	Completed
Institutional strengthening – Phase II	MP/MCD/00/056	n/a	Completed
Institutional strengthening – Phase III	MP/MCD/01/224	n/a	Completed
Institutional strengthening – Phase IV	MP/MCD/04/028	n/a	Completed
Institutional strengthening – Phase V	MP/MCD/06/001	n/a	Ongoing
Phasing out of CFCs at refrigeration plant of "Frinko" (replaced with HFC)	MP/MCD/96/179	104	Completed
Phasing out of CFC-11 from flexible slabstock foam manufacturing at "Sileks" (replaced with CO_2)	MP/MCD/97/083A	280	Completed
Phasing out CFC-11 from manufacturing of rigid PU sandwich panels at "Sileks" (replaced with HCFC -141b)	MP/MCD/97/123	76	Completed
Demonstration project on the alternatives to the use of methyl bromide	MP/MCD/98/084	n/a	Completed
Refrigeration Management Plan	MP/MCD/99/ 092/093/094	45	Completed
Phase out of CFC 11/12 in the aerosol sector – "Alkaloid"	MP/MCD/01/010	25	Cancelled
Phase out of methyl bromide in tobacco seedlings and horticulture	MP/MCD/00/163	45.4	Completed
Technical assistance in preparation of the national halon management plan	MP/MCD/02/090	n/a	Completed
Terminal Phase-out Management Plan for CFC	MP/MCD/05/001	43.31	Ongoing
Chiller demonstration project	MP/RER/05/010	1.3	Ongoing
Preparation of a HCFC phase-out management plan	MP/MCD/08/001	n/a	Ongoing
Total (MT of ODSs)		**575.61**	

The NOU coordinates the project activities towards reduction and elimination of ODSs in almost all economic branches applying the substances that deplete the ozone layer. All industrial installations using CFCs were considered and CFC-technology was phased-out with non-CFC alternatives. This includes production and servicing of refrigeration equipment, rigid and flexible foams, agricultural production of tobacco seedlings and vegetables.

Special attention was paid to the refrigerants recovery and recycling process (including HCFCs). Recovery and Recycling Scheme gives the opportunity for service shops to be granted with equipment and three recycling centers were established in the country. The latest data says that more then 40 tonnes of refrigerants are recovered and recycled in the period from 2001 to 2008.

Table 5. Recovered and recycled quantities in the period 2001-2008

	Recovered (kg)					Recycled (kg)	Waste (kg)
Year	**CFCs**	**HCFC-22**	**HFCs**	**Blends***	**Total**		
May 2001-Dec 2002	1.546,5	1.203,4	512,0	22,0	3.283,9	2.820,9	463,0
2003	1.188,1	1.183,0	173,0	22,0	2.566,1	2.466,1	100,0
2004	1.946,0	2.598,4	2.542,5	238,5	7.325,4	7.101,6	223,8
2005	1.775,7	2.741,5	2.863,0	254,5	7.634,7	7.191,5	443,2
2006	1.823,8	1.698,6	777,6	1.400,3	5.700,3	5.452,8	247,5
2007	1.873,0	2.226,0	1.745,0	2.332,0	8.176,0	8.089,0	87,0
2008	1.341,4	4.495,8	2.110,4	2.847,0	10.794,6	10.407,8	386,8
Total	**11.494,5**	**16.146,7**	**10.723,5**	**7.116,3**	**45.481,0**	**43.529,7**	**1.951,3**

* Reported quantities of blends are recovered and reused refrigerants without change of the composition

Institutional and legal aspects include the role of NOU in control and monitoring of the ODSs import, export and consumption. The Ministry has involved the Ozone Unit in the procedure of issuing ODS import and export permits. Actually this facilitates the control of ODSs internal and external trade. The Government of the Republic of Macedonia adopted the Ordinance on banning the import of used refrigerators, freezers or other cooling or freezing devices and import of CFCs in August 2006. According to this document the import of used equipment containing ODSs classified in Annex A Group I of the Montreal Protocol is banned as of January 1, 2007 and the import of the substances in Annex A Group I of the Montreal Protocol is banned since January 1, 2009.

Another topic treated with special consideration is the awareness of the Macedonian public regarding the protection of the ozone layer. All generations including children in the kinder gardens through the professionals familiar with the ODS issue and the public in general are involved in the national action on ozone layer protection.

1.4.2 Lessons learned concerning HCFCs

Republic of Macedonia has established a phase-out program for CFCs, methyl bromide and halons. That includes comprehensive measure including legal framework, conversion of CFC technology to non-CFC in foam production, phase out of methyl bromide in tobacco seedlings and horticulture, training and certification of customs officers and service technicians and establishing an R&R scheme.

Lessons learned from the previous projects will be used for the phase-out of HCFCs, such as:
- Legal framework - system of permits and taxes;
- Phasing out of CFC-11 from rigid PU sandwich panels - (conversion to HCFC-141b) and flexible slab stock foam - (conversion to CO_2);
- Phasing out of CFCs at refrigeration plant of "Frinko" - (production of domestic refrigerators);
- Refrigeration Management Plan and CFC Terminal Phase-out Management Plan - (training of customs officers and service technicians in "Good Practice in Refrigeration", establishing and improving of refrigerants recovery and recycling scheme);
- Chiller demonstration project (replacement of CFC-11 turbo compressor chillers with HFC water chillers on two locations).

2. Legislative framework

Immediately after the start of the country action on ODS reduction and elimination in 1997, the Ministry of Environment and Physical Planning/Ozone Unit established a legal framework for the Montreal Protocol implementation. The ODS/ODS containing equipment import restrictions have been realized according the following schedule:

- As of 12.06.1998 import of the equipment (new and used refrigerators, freezers, cooling equipment, heat pumps etc.) containing ODSs is allowed only with permit issued by the Ministry of Environment and Physical Planning.
- As of 01.03.1997 import of the Ozone Depleting Substances (ODSs) is allowed only with permit issued by the Ministry of Environment and Physical Planning.

The above mentioned subsidiaries enable reduction, control and inventory of the imported ODS quantities. The Ozone Unit prepared special database for creation of complete inventories of the annual ODS import and consumption which gives clear picture of the country situation concerning this issue.

Few years later (December 2004) the Ministry of Environment and Physical Planning prepared Instructions for Special Data to be Submitted for Issuing Permit for Goods Imported-Exported under D4 (Official Journal of the Republic of Macedonia, No. 91/2004). This act defines all necessary data and information (documents and information) that should be provided for ODSs/ODS containing equipment import/export. The Instructions are available to the public (www.ozoneunit.gov.mk) and is extremely useful for the companies-importers of the ODSs/ODS containing equipment.

Law on Environment (Official Journal of the Republic of Macedonia, No. 53/2005, 81/2005), Chapter XVIII – Financing, prescribes that every natural or legal person who imports certain used products or produces/imports hazardous products and goods or products and goods containing hazardous substances to the environment and nature is obliged to pay tax defined by the Ministry of Environment and Physical Planning of the Republic of Macedonia.

In the case of the ODSs and ODS containing equipment, the tax depends of the type (ODP value) and quantity of imported ODSs, and quantity and volume of the imported refrigerators, freezers and other used cooling devices respectively (Article 164 of the Law on Environment).
The Law on Environment (Article 21 and 22) gives possibility the Minister on Environment to ban the production, trade and use of certain products and substances or to restrict and control the export and import of certain substances and products.

Overview of existing legislative framework is given below chronologically:

1. **Law on Ratification of the Vienna Convention**, adopted by the Former SFRJ in 1990 (O.J. of the SFRJ no. 1/90). The Republic of Macedonia has accepted the ratification through succession from the SFRJ in 1994.
2. **Law on Ratification of the Montreal Protocol**, adopted by the Former SFRJ in 1990 (O.J. of the SFRJ no. 16/90). The Republic of Macedonia has accepted the ratification through succession from the SFRJ in 1994.

3. **Law on Ratification of the London Amendment to the Montreal Protocol,** adopted by the Macedonian Parliament in 1998 (O.J. of the Republic of Macedonia no. 25/98).
4. **Law on Ratification of the Copenhagen Amendment to the Montreal Protocol,** adopted by the Macedonian Parliament in 1998 (O.J. of the Republic of Macedonia no. 25/98).
5. **Law on Ratification of the Montreal Amendment to the Montreal Protocol,** adopted by the Macedonian Parliament in 1999 (O.J. of the Republic of Macedonia no. 51/99).
6. **Law on Ratification of the Beijing Amendment to the Montreal Protocol, adopted by the Macedonian Parliament in 2002** (O.J. of the Republic of Macedonia no. 13/02).
7. **Permit for ODSs import**, as of 01.03.1997 the import of ODSs is allowed only with permit issued by the Ministry of Environment and Physical Planning.
8. **Permit for import of used equipment**, as of 12.06.1998 import of used equipment (refrigerators, freezers, cooling equipment, heat pumps etc.) is allowed only with permit issued by the Ministry of Environment and Physical Planning.
9. **Permit for import of new equipment**, as of 01.01.2008 import of new equipment (refrigerators, freezers, cooling equipment, heat pumps etc.) is allowed only with permit issued by the Ministry of Environment and Physical Planning
10. **Instructions for Conditions to be Fulfilled for Issuing a Permit for Goods Imported-Exported under D4 and Certificates for Duty Free** (document prepared only for internal application), according to the Law on Organization and Work of the Administrative Organs (Official Journal of the Republic of Macedonia, No. 58/2000), and the Decision for Arrangement of the Goods in Export and Import Forms (Official Journal of the Republic of Macedonia, No. 91/2004) the Minister of Environment and Physical Planning of the Republic of Macedonia adopted the Instructions for Conditions to be Fulfilled for Issuing Permit for Goods Imported-Exported under D4* and Certificates for Duty Free.
    The Article 8 (Chapter I: General Provisions) of the above mentioned Instructions says that the application for ODS/equipment containing ODS import (after documentation check undertaken by the Legislation and Standardization Department under the Ministry of Environment and Physical Planning) must be submitted to the Ozone Unit for the final approval/refusing. The Ozone Unit has to express the opinion regarding the subjected application within 7 days after reception of the application.
    If the application does not contain sufficient evidence for the environment impact, the Chapter II: Special Provisions, Article 9, requires the Ozone Unit to organize on-site inspection within the period of 10 days.
    According to the Article 10 of the Instruction the Ozone Unit is obliged to keep records on the quantities applied for import/export and quantities that were permitted for import/export.
11. **Instructions for Special Data to be Submitted for Issuing Permit for Goods Imported-Exported under D4** (Official Journal of the Republic of Macedonia, No. 91/2004), according to the Law on Organization and Work of the Administrative Organs (Official Journal of the Republic of Macedonia, No.

---

* D4 – goods that can be imported/exported only after issuing permit by the Ministry of Environment and Physical Planning of the Republic of Macedonia [Decision for Arrangement of the Goods in Export and Import Forms (Official Journal of the Republic of Macedonia, No. 91/2004)]

58/2000), and the Decision for Arrangement of the Goods in Export and Import Forms (Official Journal of the Republic of Macedonia, No. 91/2004) the Minister of Environment and Physical Planning of the Republic of Macedonia adopted the Instructions for Conditions to be Submitted for Issuing Permit for Goods Imported-Exported under D4.

The Instructions requests, besides general data under the Decision for Arrangement of the Goods in Export and Import Forms, the application for ODS/equipment containing ODSs import/export to contain certain special data.

According to the Article 4 of the Instructions the application for import/export of ODSs has to contain:

- Raw material characteristics if it is used in certain technological processes and analysis of the possible pollution of the environment and nature and problem solutions;
- Customs code and quantity. If the goods are made of certain number of different components (for instance: refrigerators, freezers, etc.) every component has to be provided with customs code and quantity;
- Chemical formula of the good;
- Origin of the goods, full producer name and country of import;
- Data on the end-user (explanation on purpose and application of the goods);
- Evidence that posses adequate space for the goods storage and marketing;
- Evidence that posses adequate human and technical resources for servicing of the equipment;
- List of the three-month needs for import of these goods and report on the state of the previously imported goods;
- Treatment of the useless technical goods and waste material generated after servicing and methods of disposal/elimination/recycling.

According to the Article 5 of the Instructions the application for import/export of the equipment containing ODSs has to contain:

- Evidence that posses adequate space for the adequate storage and marketing;
- Evidence that posses adequate human and technical resources for servicing of the equipment;
- List of the three-month needs for import of these goods and report on the state of the previously imported goods;
- Treatment of the useless technical goods and waste material generated after servicing and methods of disposal/elimination/recycling;
- Customs code and quantity. If the goods are made of certain number of different components (for instance: refrigerators, freezers, etc.) every component has to be provided with customs code and quantity.

12. **Environmental taxes for ODSs and ODS containing equipment import,** Chapter XVIII on Financing of the Law on Environment (OJ of the RM 53/05, 81/2005, 24/2007) foresees every natural or legal person who imports certain used products or produces/imports hazardous products and goods or products and goods containing hazardous substances to the environment and nature is obliged to pay tax defined by the Ministry of Environment and Physical Planning.

    The tax amount depends on the type and quantity of the imported ODSs and type, quantity and volume of the imported refrigerators, freezers and other used cooling devices respectively (Article 164, paragraph 5, subparagraph 2 of the Law on Environment).

According to Article 179 paragraph 2 subparagraph 1, 2, 3 the tax amount for import of refrigerators, freezers and other cooling devices is as follows:

- cooling units with volume of 250 l 200 MKD/piece
- cooling units with volume of 250-340 l 300 MKD/piece
- cooling units with volume of 340-900 l 400 MKD/piece

Article 179 paragraph 4 subparagraphs 1, 2, 3 oblige the importers of the ODSs classified in Montreal Protocol Annexes to pay following taxes for import:

- Annex A Group I and II substances;
  Annex B Group I and II substances; and
  Annex C Group II substances 64 MKD/kg
- Annex C Group I substances (HCFCs) 6 MKD/kg
- Annex E Group I substances 100 MKD/kg

(1 USD ~ 48 MKD)

13. **Ordinance for banning of import of used refrigerators, freezers, and other used cooling or freezing devices and import of the ODSs,** according to article 22, paragraph 1 of the Framework Law on Environment (Official Journal of the Republic of Macedonia, No. 53/2005, 81/2005, 24/2007), the Ordinance for banning of the import of the used refrigerators, freezers, and other used cooling or freezing devices and import of the ODSs (Official Journal of the Republic of Macedonia, No. 87/2006) was adopted by the Minister of Environment and Physical Planning, Minister of Health, Minister of Agriculture, Forestry and Water Economy and Minister of Economy.
    According to the document the two concrete steps will be undertaken in the field of the ODSs and ODS containing equipment phasing-out:
    - As of 1 January 2007 the import of the used refrigerators, freezers and other cooling and freezing devices is banned;
    - As of 1 January 2009 the import of the Montreal Protocol Annex A Group I substances is banned.

As the Republic of Macedonia has a strategy to harmonise regulatory framework with EU and the industry is motivated to achieve a European standard a phase-out strategy for HCFCs can benefit from the ongoing harmonisation within Europe.

3. DATA COLLECTION AND SURVEYS

HCFCs have been in use for more then 70 years.
HCFC-141b, HCFC-142b and HCFC-22 represent more then 99 percent of total HCFC consumption.
The main uses of the HCFCs are: foam (32.5%), manufacture and service of refrigeration (66.2%), aerosols (0.2%), fire extinguishers (0.1%) and solvents (1.0%).
In 2006, the total consumption of HCFCs in A5 Countries was 396,100 Mt (28,000 ODP tonnes).
The first step in preparation of the HCFCs Management Plan is conducting of Survey on installed quantities and annual consumption of HCFCs in Republic of Macedonia as per the new Montreal Protocol accelerated phase-out schedule for HCFCs. The inventory is necessary for establishing the new baseline for the country, based on the average consumption in 2009-2010 and subsequently freeze in 2013.

3.1 Description of Survey Methodology

The Survey Methodology provides relevant information about installed quantities of HCFCs by sectors, annual consumption of HCFCs in the period 2003-2008 year and forecast for needs/consumption until the year 2012. The survey is based on the "UNIDO Data Collection Questionnaire for the Preparation of HCFC Phase-out Management Plan".
Estimation of installed quantities of HCFCs in Republic of Macedonia is based on: Collection of data from different sources - Customs Administration (import of equipment), Industry, Importers of equipment, end users, the NOU (import permits system, started 01.01.2008) and statistical annual publications.
Collection data of installed quantities of HCFCs was conducted through the direct contacts with:
Customs Administration, importers of equipment, ends users, service shops.

There is no production of ODS in the Republic of Macedonia, it means that the Import - Export is equal to the Consumption. Import of HCFCs is controlled by the import licensing system.
The data of annual consumption are provided by the NOU and Customs Administration.
Estimation of the real needs is based on collected data from importers of HCFCs, end users, service shops etc, and estimated annual leakages.

Forecast of future needs (level of consumption in 2012) is based on annual consumption, estimated needs end expected increase of installed quantities.

The data and information's collected through the Questionnaires are submitted to the NOU in order to assist in creation of database.

3.2 Installed quantities of HCFCs in Republic of Macedonia

Air Conditioning and Refrigeration Sector

The dominant use of HCFCs is in **the air conditioning and refrigeration servicing sector** which is growing due to the general economical growth resulting in more handling of chilled and frozen food, air-conditioning etc. The using of HCFCs is further increased by the recent warm summers.

The most installed quantities of refrigerants are in Air Conditioning - split/unitary systems in: households, Business premises, Public buildings and trade shops. According to the statistics approximately 80% of equipment is charged with HCFC-22.

Relevant statistical data for Republic of Macedonia:

- Number of households 564296
- Living quarters 698143
- Business subjects 148727
    - Wholesale and retail trade 78171
    - Hotels and restaurants 6578
    - Financial intermediation 287
    - Real estate agencies 6576
    - Public Administration 2098
    - Health and social work 2003
    - Others - municipal, cultural 10067

Table 6. Installed quantities and annual needs for servicing of HCFC in metric tonnes

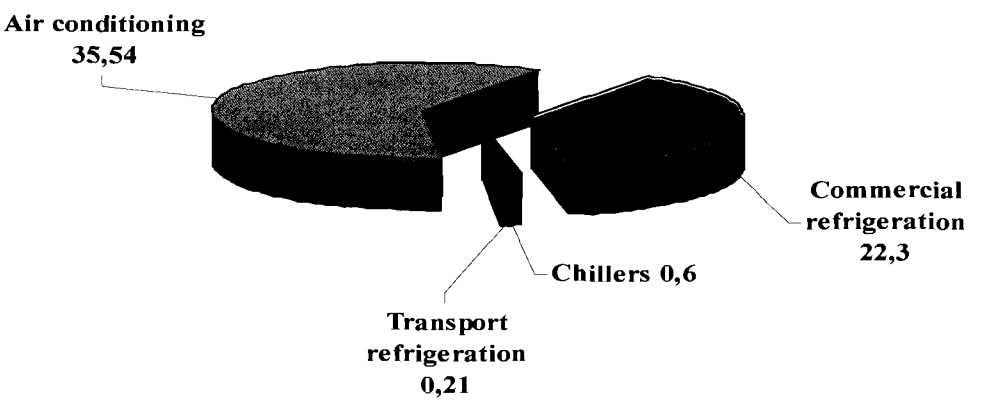
Sector	Number of units	HCFC-22 installed stock	Leakage %	Annual needs for servicing	% of the HCFC - 22
Air conditioning (unitary/split systems)					
Households	225600	0,001 x225600=225,6	10	22,56	
Wholesale and retail trade	93805	0,001x93805=93,80	10	9,38	
Hotels and restaurants	15787	0,001x15787=15,79	10	1,58	
Financial intermediation	689	0,001x689=0,69	10	0,07	
Real estate agencies	7891	0,001x7891=7,89	10	0,79	
Public Administration	1678	0,001x1678=1,68	10	0,17	
Health and social work	1923	0,001x1923=1,92	10	0,19	
Others - municipal, cultural	8054	0,001x8054=8,05	10	0,8	
Subtotal	**355545**	**355,42**	**10**	**35,54**	**60,6**

Commercial refrigeration (Display cases, cold rooms, cold stores)					
Restaurants	19734	0,0006x19734=11,84	15	1,78	
Wholesale and retail trade 1. Cold rooms 2. Display cases	 39085 39085	 0,03x39085=117,25 0,0005x39085=19,54	 15 15	 17,59 2,93	
Subtotal		**148,63**		**22,30**	**38**
Chillers (Air-conditioning and Industry)		According the Survey on chillers 2,40	 25	 **0,60**	 **1,0**
Transport refrigeration		0,70	30	**0,21**	**0,4**
Total		**507,15**		**58,65**	**100**

In the Table above the installed stock of refrigerant is calculated by:

- Charging of approximately 1 kg = 0,001 Mt refrigerant/per unit AC split and unitary systems;
- Charging of approximately 0,6 kg = 0,0006 Mt refrigerant/per unit in refrigerating equipment in restaurants;
- Charging of approximately30 kg = 0,03 Mt refrigerant/per unit in cold rooms;
- Charging of approximately 0,5 kg = 0,0005 Mt refrigerant/per unit in display cases;

Annual needs for servicing of HCFC-22 in Mt



The installed stock of HCFC-22 in split and unitary air-conditioning in the Republic of Macedonia is approximately 355,42 Mt with an annual leakage rate of 35,54 Mt of HCFC-22. This is approximately 60% of the total HCFC-22 consumption in the country.

The number of imported units has been increasing during the last years. Economical growth and warm summers have contributed to an increase of air-conditioning systems. An increasing number during the last years has been with non-ODS due to

that they are coming via Europe where there is a ban on installation of HCFC. The split and unitary air-conditioning systems are imported from Europe and Eastern Asian countries. Recently, there is trend of increasing of the split and unitary air-conditioning systems containing HCFC-22 import from the Asian Region. The reason is that Asian producers have lower prices of the HCFC-22 units.
The import of HCFC equipment from the year 2008 is under permits, issued by the Ministry of Environment and Physical Planning. In the year 2008 issued permits show the number of 91675, HCFC -22 units of Air conditioners - split systems. According data received from importers, the realization of issued permits is about 30-40%.
With an average of 1 kg per unit, it means that new 30-40 Mt of HCFC-22 are imported and installed.
With an expected life time of 8-10 years the units installed now and in the next few years could contribute significantly of the HCFC consumption after the freeze year of 2013. As these units are getting older and also larger installations that are old today, the air-conditioning and refrigeration sector is expected to increase its share of the market.

The commercial refrigeration sector is the second largest sector and use 38% of the HCFC-22 consumption. The installed stock of refrigerant is 148,63 Mt with annual leakage rate of 22,3 Mt.
The main application in this sector is smaller cold rooms and larger display cases of non plug-in type in shops and restaurants. Since the pressure to phase out CFC-12 became apparent HCFC-22 has been used in the commercial sector in particular in cold rooms and larger display cases that have been installed with condensing units connected to evaporators on site. A significant amount of second hand equipment has been imported from European countries in the past. New plug-in display cases have mainly been with non-ODS during the last years.

The industrial refrigeration sector with users in food processing industries and larger cold storages use smaller amounts of HCFC-22 since ammonia is the main refrigerant in this sector.

Chillers
The Survey on chillers in Republic of Macedonia, with cooling capacity up to 100 KW was conducted during year 2004/2005. This equipment is used in central air conditioning systems and cooling in technological processes in industry. The Survey shows installed quantities of 1915 kg of HCFC-22. On the base of these data, the total amount of installed quantities of HCFC-22 in this sector is estimated on 2,4 Mt. With the leakage rate of 25% the annual needs for servicing are 0,6 Mt.
Mostly, the old chillers, still present in the Republic of Macedonia, have to be replaced with the new equipment. The main reasons are: Their age (20 to 30 years); High costs for exploitation and maintenance; Harmful impacts on the environment.

Transport refrigeration
The installed quantities of HCFC refrigerants in this sector are 0,7 Mt. This type of refrigerant could be found only in old vehicles for food transportation. The impact of annual needs for servicing is only 0,14%.

3.3 Annual consumption of HCFCs in Republic of Macedonia

Servicing

In Table 6 data are given for annual needs of HCFC-22 for servicing. The annual needs of 58,65 Mt does not correspond to imported quantities reported from Customs Administration for each year. The average consumption (consumption=import-export) for the period 2002-2008 is 57,214 Mt of HCFC-22. In Table 7 data are given for annual consumption of HCFC-22 in the period 2002 - 2008.

Foam production

The biggest producer of PU foams in Republic of Macedonia is Sileks AD Co. located in Kratovo, approximately 100 km east from the capital Skopje. Sileks AD company is a combined trading and industrial conglomerate. The foam production division started to operate in 1975. The production programme of Sileks factory Silpen ST is flexible foam (slabstock), rigid foams (sandwich panels), pipe insulation and moulded products. The technology for production of flexible foams was converted in non-CFC technology using CO_2 as blowing agent in 1997.
Through the project "Phasing out of CFC-11 from rigid PU-sandwich panels manufacturing at Sileks", funded by the Multilateral Fund of the Montreal Protocol, 76 tonnes of CFC-11 were phased-out through technology conversion to the new one applying HCFC-141b. For this purpose Sileks imports polyol (mixture containing HCFC-141b to be used as a blowing agent). The company actually does not import polyol permanently, but according to the received purchase orders. That is the main reason for the different consumption data.

There are also several small companies, applying polyol mixtures in their production (electric water heaters, refrigerators, display cases ....). The Company LEOV from Veles produces electric water heaters and their product line for PU insulation is on the base polyol mixture using water technology (blowing agent CO_2).

The Company KOPER from Negotino is a factory for production of domestic appliances, commercial refrigerators - display cases, established 1990. The capacity of the factory is 48.000 units per year. The company exports their products in the neighbouring countries. The production line for PU insulation is on the base of polyol mixtures with HCFC-141b as a blowing agent.

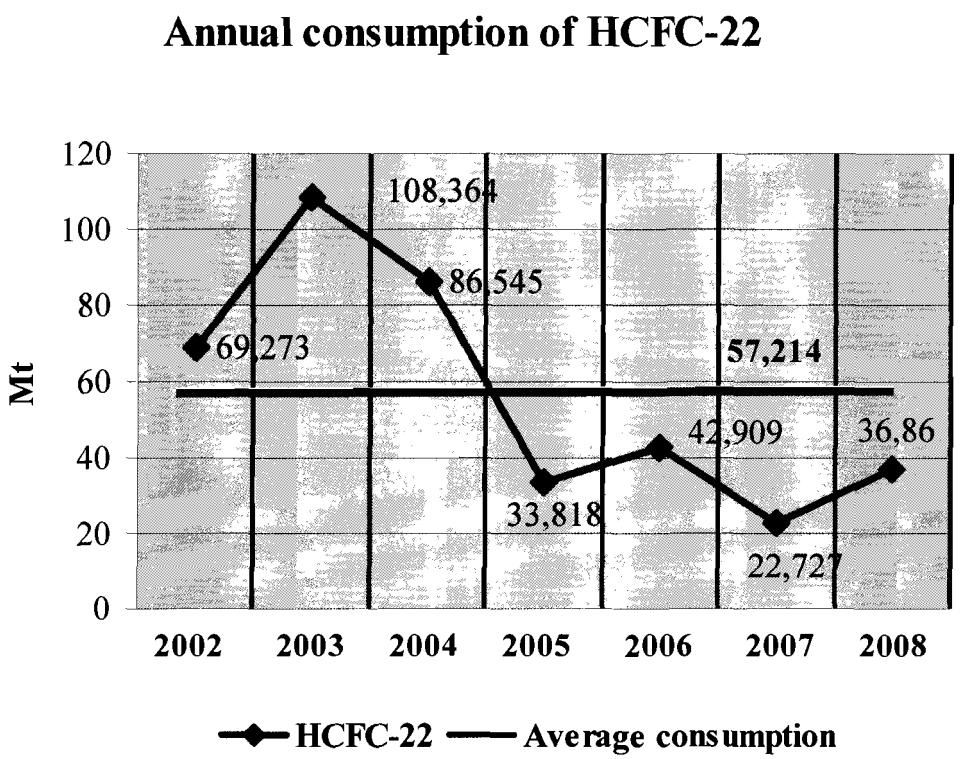
Another company near the capitol Skopje, "Zlatna Raka", established in 1970, obtains certificate ISO 9001-2000. The main part of the production is insulated segment doors. Capacity of the company is 10.000 kg/year PU insulation - mixture of polyol and isocyanate with HCFC-141b as blowing agent.

The annual consumption of HCFC-141b, given in the Table 7, varies from 11 Mt to 18 Mt in the period 2002-2008 (data received from companies through the Questionnaire for users of polyol mixture for foam production). Average consumption in this period is 14,2 Mt of HCFC-141b.

Table 7. Annual consumption of HCFCs in Mt/year

Substance	HCFCs consumption in Mt/year						
	2002	2003	2004	2005	2006	2007	2008
HCFC-22 (ODP=0,055)	69,273	108,364	86,545	33,818	42,909	22,727	36,860
HCFC-141b (ODP=0,11)	13,000	16,000	14,000	18,000	11,000	14,500	13,000

The Ozone Unit does not control the polyol import and can not report HCFC-141b quantities indirectly imported in the country.



List of importers and exporters authorized by the Government:

1. **TEHNODOM, Angel & Toni Doo**, Partizanski Odredi Str., Tc Leptokarija, section 5, 1000 Skopje, Tel: 00389 2 3070511, Manager: Angel Pavlovski;
2. **ALKALOID,** Bul. Aleksandar Makedonski 1000 Skopje;
3. **EVRO-ZAN, DOO Export-Import**, Juzen Bulevar B, Str. Blok 4, 1000 Skopje;
4. **TGS - TEHNICKI GASOVI, AD**, Proleterska Str. No.4, 1000 Skopje, Fax: 00389 2 2341470, Tel: 00389 2 2331 481;
5. **DOGAN TREJD**, Sava Kovacevic Str, 1000 Skopje, Tel: 00389 2 3114095, Manager: Faik Bektesh;
6. **FRIGOTEHNA**, Sava Kovacevic 1/13 Str. 1000 Skopje Tel: 00389 2 3217 216, Manager: Genevski Marijan;
7. **NEEL-KOMERC**, Marsal Tito Str. No.5, Negotino, Tel/fax: 00389 43 360 215, Manager: Aleksandar Ivancev;

8. **D-N, DOOEL,** Ilo Kostov Str, Kavadarci, Tel: 00389 43 414-196, Manager: Jordan Petrezanov;
9. **FRIGOTEKNIKA**, Bogovinje;
10. **INTER VAT, DOO**, JNA Str. No. 181, 1230 Gostivar;
11. **TEHNOINSPEKT, DOO,** 1000 Skopje, Tel: 00389 70 260268, Manager: Dragan Stoevski;
12. **ARIAZONE INTERNATIONAL EUROPE, DOOEL,** 4600 Ohrid, Tel: 00389 70 307 490, Manager: Vlatko Martinoski;
13. **TUSH DOOEL,** 1000 Skopje.

List of distributors authorized by the Government:

1. TEHNODOM, Skopje;
2. EVRO-ZAN, Skopje;
3. TEHNICKI GASOVI, Skopje;
4. DOGAN TREJD, Skopje;
5. AT SIMENS, Skopje;
6. NEEL-KOMERC, Negotino;
7. D-N, Kavadarci;
8. ASPERA, Prilep;
9. ELEKTROTEHNIKA, Strumica;
10. ELMA, Ohrid.

End users: According the NOU database in the Republic of Macedonia there are about 220 active repair shops servicing the refrigeration and air-conditioning appliances.

3.4 Forecast for HCFCs use

The air-conditioning and refrigeration sector is growing and it is expected to increase the consumption of HCFC-22 with 15 to 20% during the coming years. There are several factors that will affect the future HCFC consumption as the selection of refrigerants are done on the bases of cost as well as expectations of the future availability of HCFC.

The forecast of demand of HCFC (increasing 5% per year) is based on growing in air-conditioning and refrigeration sector and expected phase out of the old equipment.

During the last 3-4 years there has been an introduction of alternatives in many traditional HCFC-22 applications, not mainly due to end-user demand for alternative refrigerants but also due to that most of the importers have had access to the units sold on the European market. With the ban on HCFC in EU the supply of products in the Republic of Macedonia has also changed with the trends in Europe. There is a risk that this could change if importers bring in low price HCFC-22 units from Asia as the awareness/concern for the environmental difference among many end-users are lower then the desire to get the lowest price.

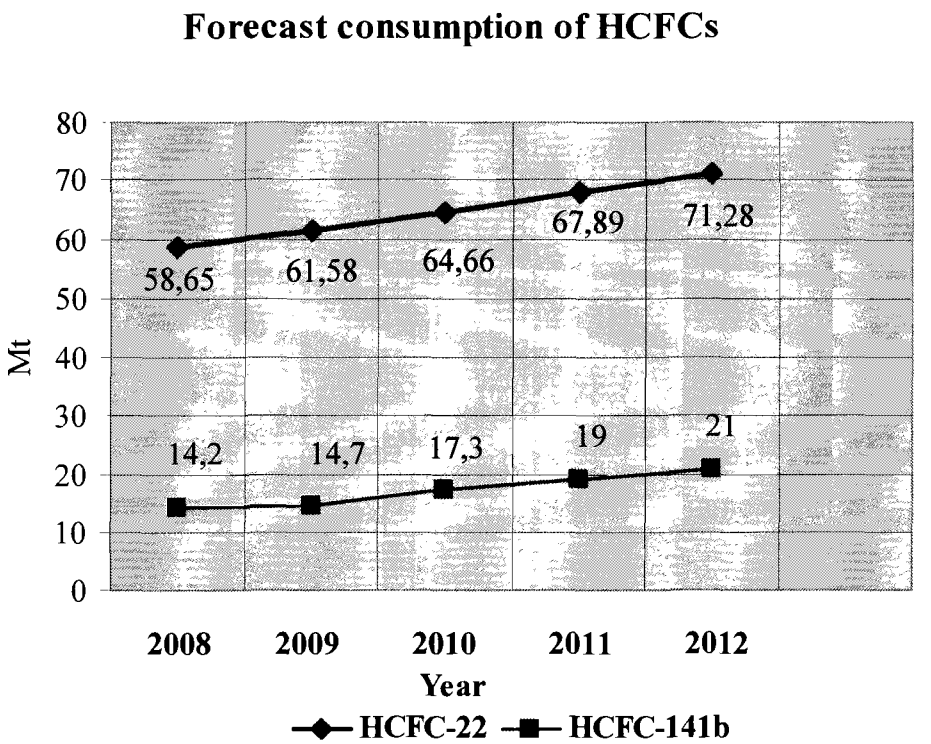
A further increase of the installed HCFC-22 stock will be a challenge to achieve the freeze level in 2013. The implementation of HPMP during the next five years will be important to avoid that this stock grows.

Table 8. Forecast consumption of HCFC-22 for 2009-2012 in Mt

HCFC - 22	Base	2009	2010	2011	2012
Increasing %		+5%	+5%	+5%	+5%
Consumption Mt	58,65	61,58	64,66	67,89	71,28

Table 9. Forecast consumption of HCFC-141b for 2009-2012 in Mt

HCFC-141b	Base	2009	2010	2011	2012
Increasing %		+10%	+10%	+10%	+10%
Consumption Mt	14,20	15,70	17,30	19,00	21,00



3. 5 Availability of alternatives to HCFCs and prices

3.5.1 Alternatives to HCFCs

The HCFC-22 consumption is expected to grow in the coming years unless measures are introduced to prevent this scenario. Alternatives are available (see Table 10) but at a higher initial cost and the industry are not in all sectors familiar with the use of these alternatives. The alternatives (in particular to HCFC-22) require specific competencies as they have technical differences that must be understood for successful use.

Table 10. Refrigerants alternatives in various refrigeration sectors

	Sector	HCFC alternatives
1	Industrial Refrigeration	Ammonia, R-404A
2	Commercial Refrigeration	HFC-134a, R-404A, R-507, CO_2, Propane, Propylene
3	Air conditioning	R-407C, R-410A, HFC-134a
4	Household	Isobutane, (HFC-134a)
5	Transport Refrigeration	R-404A, HFC-134a

This table indicates the dominating trend of alternatives for new installations on the European market today. There is a strong focus on development of solutions with low Total Equivalent Warming Impact (TEWI) which include the Global Warming Potential (GWP) of the refrigerant as well as the indirect effect caused by energy consumption of the system. Tests of many different solutions are on-going sector by sector as well as efforts from refrigerant manufacturers to develop new low GWP alternatives.

HCFC-22 alternatives are available for all applications and a replacement is possible in new systems at relatively low cost. But there are significant challenges to phase out HCFCs in existing systems without interruption of the economical recovery which is focused on areas that are today dependent on the use of HCFCs.

In the short term a continued use in existing equipment is cost effective and the first focus should be replacement in new installation to avoid an increase of the installed stock. On the European market HCFC-22 is most often replaced with – HFCs (R-407C and R-410A) - in unitary/split air conditioners, with HFC-134a/R-404A/R-507 in transport refrigeration and commercial equipment, in large-scale industrial refrigeration ammonia and R-404A are used and central air conditioning often use HFC-134a/R-407C/R-410A and sometimes ammonia. HFCs are available for all applications. In larger installation ammonia has always had a strong position and is expected to be even more competitive in the future. For some supermarkets and low temperature industrial applications carbon dioxide has been used with good experience.

There is a strong focus on development of low GWP and energy efficient systems for more segments and the market shares of ammonia, carbon dioxide and hydrocarbons is expected to increase as these technologies mature. The challenge is to ensure that energy efficiency and cost is acceptable on a system level when necessary precautions for safety and design have been taken. The development is on-going internationally and it is important that government and industry in the Republic of Macedonia follow this development so alternatives with a minimal impact on environment is introduced when they can be used cost effectively in a safe and energy efficient way.

There are also a range of products developed to be used as retrofit solutions for HCFC-22 but these are not listed/discussed here as retrofit of existing systems will not be the focus at the beginning of the phase-out period for HCFCs when a stop of new installation should be given higher priority. HCFC-22 systems can be retrofitted but there are technical issues with all retrofit alternatives and appropriate skills must be

transferred to select the best option and execute the retrofit based on each type of system.

The rigid foam marketplace has undergone many transitions in its existence. One of the most challenging has been the transition through the myriad of foam blowing agents to find suitable products that meet the increasingly stringent environmental constraints placed in the industry. What makes a blowing agent suitable for one industry may make it entirely unsuitable for another. For example, frothing characteristics of gaseous BAs (Blowing Agents) (CFC-11 to HCFC-22 to HFC -134a transitions) are fine for frothing foams, but less desirable for spray foams. Thus, the PU market has been fragmented by the blowing agent requirements of specific products.

Those markets which in the past have used liquid blowing agents (CFC-11 to HCFC-141b transitions) generally prefer to use liquids in the future. The current choices available in the market as liquids all seem to have some major constrains: Water is an obvious choice, but as a drop-in replacement it has shrinkage problems, the need for very low viscosity polyols, and is disadvantageous for thermal conductivity over not-in-kind insulations.

HFC-245fa, when mixed into a polyol blend, behaves like a liquid, but needs to be handled like a gas prior to mixing and has added constrains in handling (mixing) in the plant and laboratory. While it offers excellent thermal conductivity, has minimal effect on formulation flammability, and meets ODP requirements, HFC-245fa has issues in having relatively high GWP and very high row material cost.

Hydrocarbon blowing agents have flammability issues, as well as VOC limitations. These tend to preclude use in non-containment areas as well as certain market segments as spray foam.

Because of all this constrains (Liquid vs. gas, VOC, ODP, GWP, flammability, solubility, and cost), the formulator has been both harried and hard-pressed transforming product lines into the best possible solution to utilize current BA offerings.

Overview of possible alternatives to HCFC-141b for Rigid Foam

	HFC	Hydrocarbons	Water
Appliances			
Water heaters			
Reefer containers			
Sandwich panels			
Pipes			
Spray			
Structural foam			

Being tested
Being tested/ Commercialized
Not an option

Environmental properties and Safety classifications

BA	ODP	GWP	Toxicity	Flammability
HFC-245fa	**0**	**560**	**B**	**1**
Hydrocarbons	**0**	**1**	**A**	**3**
Water (CO_2)	**0**	**1**	**A**	**1**

Toxicity/flammability - According standard ANSI/ASHRAE 34a -1993

3.5.2 Import of alternative refrigerants in Republic of Macedonia

The consumption of alternative refrigerants in the Republic of Macedonia is increasing each year. The Table 11 below shows import in the year 2008 (data from the NOU- database).

Table 11. Import of alternative refrigerants in 2008 (issued permits)

Refrigerant	HFC-134a	R-404A	R-407C	R-410A	R-507
Import (Mt)	51,610	71,699	10,193	11,704	15,297

3.5.3 Price level of refrigerants

HCFCs are readily available and are from the short term perspective often the most familiar and lowest cost alternative to CFCs. The prices of refrigerants, according data received from importers, are given in the Table 12.

Table 12. Wholesale import prices of refrigerants (Year 2008)

Refrigerant	HCFC -22	R-507	R-404A	R-407C	R-410A	HFC-134a
Price (US$/kg)	2,27 - 2,87	5,32 - 6,0	5,3 - 6,7	5,5 - 6,0	5,6 - 6,0	4,27 - 5,6

The refrigerants are offered on the market with prices higher then presented in the Table 12 (approximately more then 2 times).

4. STRATEGY AND PLAN FOR IMPLEMENTATION OF HCFC PHASE-OUT

4.1 Overall strategy

New phase-out schedule for HCFCs for A5 countries agreed at the XIX MOP:

- **Baseline: Average 2009-2010 consumption**
- **Freeze at baseline level: 2013**
- **10 % reduction: 2015**
- 35% reduction: 2020
- 67.5 % reduction: 2025
- 97.5 % reduction: 2030
- 100 % reduction: 2040

The achievement of targets to meet complete phase-out of HCFCs will be through:

Policy instruments: Import quotas and permits, price control through environmental taxes for HCFCs and HCFC containing equipment, ban on import of HCFCs containing equipment and new HCFCs installations.

Plan for gradually reduction of HCFC consumption: Completion of the conversion in manufacturing industries; Decreasing of the needs of HCFCs in refrigeration and air-conditioning servicing sector through recovery and recycling, economic measures (import quotas, permits, environmental taxes), raising awareness and control measures (ban of import).

The first stage of the strategy covers the freeze of HCFCs consumption in 2013 (base level - annual consumption in 2009-2010) and 10% reduction of HCFCs consumption in 2015.

Cost of the HCFC phase-out

The estimated costs are split in operating costs and investment costs and staged annually till 2015 and beyond. All subprojects and activities are calculated as well as the total funding required.

Time frame for implementation of planed activities

Time schedule of planned activities and time frame of implementation are in the Table - Appendix 1. The First stage is elaborated in details. The Second stage will cover the period 2016-2040.

Coordination and management

The Ministry of Environment and Physical Planning - National Ozone Unit (NOU) is assigned for coordination and management. The NOU is the central national body responsible for coordination the country action with respect to ozone protection and facilitation of ODS phase-out. This Office is in charge of implementing the Country-Programs under the Montreal Protocol.

4.2 HCFC Management plan

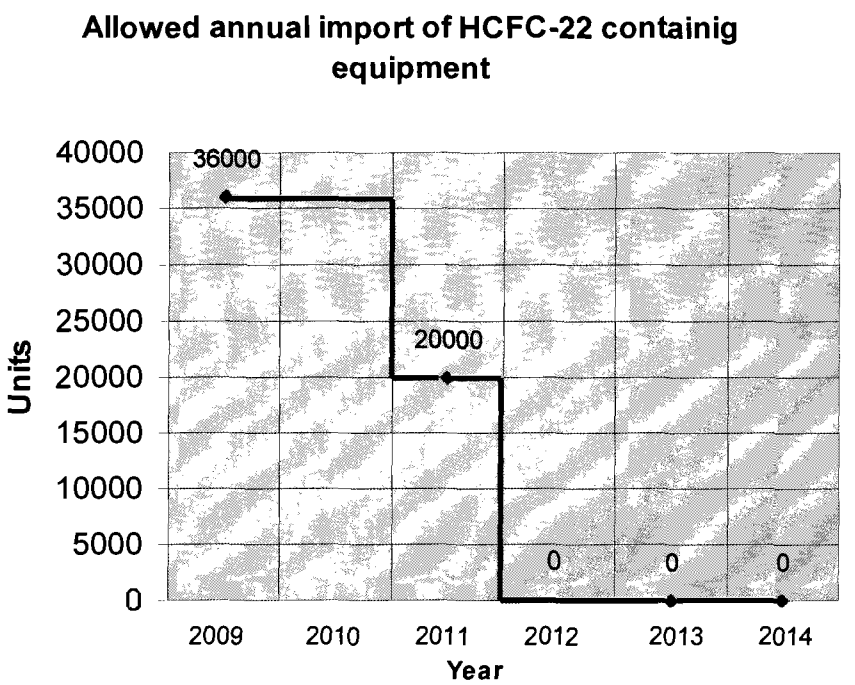
The first stage of the strategy covers the freeze of HCFCs consumption in 2013 (base level- annual consumption in 2009-2010) and 10% reduction of HCFCs consumption in 2015. Developed activities are based on the previous experience in implementation of similar ODS Phase-out projects: Phasing out of CFCs at refrigeration plant of "Frinko" (1996); Phasing out of CFC-11 from flexible foam and rigid PU sandwich panels manufacturing at "Sileks" (1997); Refrigerant Management Plan (RMP-1999), Halon Management Plan (HMP-2003); Terminal Phase-out Management Plan for CFC (TPMP - 2005).

The second stage of the HCFC Phase-out Plan covers the period from 2016 to 2040.

4.2.1 Policy instruments

Import quotas

Annual import quota for new Air-conditioning equipment containing HCFC
Dominant use of HCFCs (R-22) in Republic of Macedonia is in refrigeration and air-conditioning sector - more then 60% of the consumption. According to the last Survey, there is trend of increasing of import of the split and unitary air-conditioning systems containing HCFC-22. This import increases the installed quantities of HCFC-22 in the country. The Ministry of Environment and Physical Planning will establish Import Quota System to avoid build up of "stock". The base line for limitation of import of new air-conditioning equipment (split and unitary) will be the number of imported units in the year 2008 which is ~36.000.



The allowed annual import of HCFC-22 air-conditioning equipment will be as follows:

- 36.000 units - Base line
- 20.000 units - from 1 January 2011 to 31 December 2011
- Zero units - from 1 January 2012.

The importers/exporters could apply for import/export permits for each shipment to the Ministry of Environment and Physical Planning during the current year, until the quota will be reached.

The Import Quota System will decrease build up of installed quantities of HCFC-22 in the country and will generate lower consumption in the future (recharge after leaks and service). This measure will help to meet the 2013 freeze and following gradual phase out.

Annual import quota for HCFCs consumption

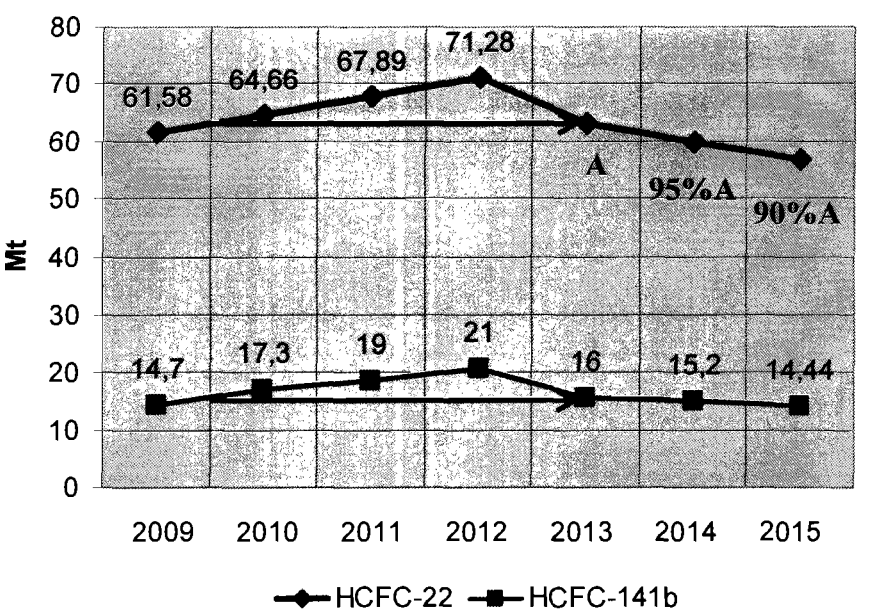
The measures to phase out HCFCs should be a further development of the measures implemented to phase-out CFCs, as there are many similarities. The plan for the reduction and phase-out of HCFCs is developed to a large extent based on the experiences from the TPMP taking into account the specifics of the different HCFC applications on the market as well as the international development of alternative technologies.

According the prepared Survey and foreseen consumption in 2012 of HCFCs in Republic of Macedonia, the needs in servicing sector are estimated at 71.28 Mt HCFC-22 and 21 Mt HCFC-141b in foam production.

By limiting installation of new equipment at appropriate time, it is expected that the Republic of Macedonia will achieve the target: Freeze at baseline level 2013 (Baseline=Average 2009-2010 consumption).

The Ministry of Environment and Physical Planning will establish Import Quota for allowed annual import of HCFC-22, to meet needs of servicing sector from the year 2011. The allowed annual quota for the years 2011 - 2012 will be according foreseen consumption.

Allowed annual HCFCs consumption



Allowed annual HCFC-22 consumption is as follows:

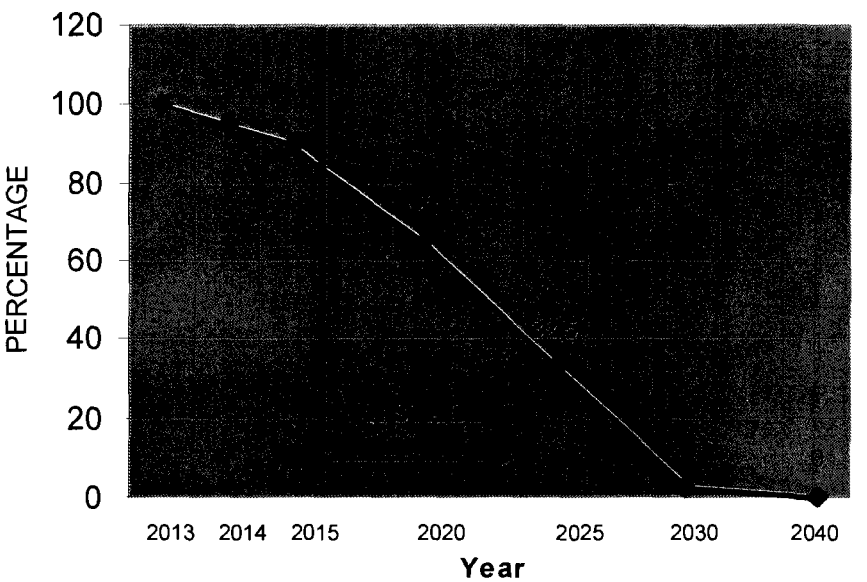
- 67.890 kg. from 1 January 2011 to 31 December 2011;
- 71.280 kg. from 1 January 2012 to 31 December 2012;

- **A** kg. from 1 January 2013 to 31 December 2013;
- **(95% of A)** kg. from 1 January 2014 to 31 December 2014;
- **(90% of A)** kg. from 1 January 2015 to 31 December 2015;

The value "**A**" is the real average consumption 2009-2010 (consumption=import-export). This value will be established after receiving data for the years 2009 and 2010 and the quota will be announced not later then the end of the year 2011.

Implementation of this Quota System will enable compliance of Republic of Macedonia with new phase-out schedule for HCFCs for A5 countries agreed at the XIX MOP. The start of the Quota System will facilitate achievement of the freeze level without negative effects to the servicing sector. The establishing of the Quota System will not allow stock of HCFC-22 during the period 2010-2012.
The Quota system of allowed annual consumption will continue after 2015 in the Second stage of HPMP implementation.

ALLOWED ANNUAL CONSUMPTION - SECOND STAGE



100%= A (HCFC-22, Mt)

The importers/exporters of refrigerants have to apply for import/export permits for each HCFCs shipment to the Ministry of Environment and Physical Planning during the current year, until the quota will be reached. Since 01.01.2009 an electronic system was introduced. Namely all importers have to apply for permit through internet on a specially designed web page from the Customs (www.exim.gov.mk). For those who have no access to internet the Ozone Unit is assisting them for the application. After that the NOU is reviewing the application and approves the import/export if applicable.

The consumption of HCFC-141b in the Republic of Macedonia is only in the foam production sector, as a component in polyol mixtures. Polyol is not among the controlled substances under the Montreal Protocol. This HCFC Management Plan foresees phase-out of HCFC-141b through conversion of technology in foam production by using non-ODSs blowing agents.

Mandatory reporting by importers/exporters

It will be mandatory for the importers/exporters of HCFCs and HCFCs containing equipment to report to the NOU the total annual quantities of imported/exported goods under the issued permits. The deadline will be 28 February for submission of annual report for the previous year.

Mandatory reporting by importers/exporters will provide data of actual import/export of HCFCs and HCFCs containing equipment. The NOU will be able to cross-check the quantities reported by the individual importers/exporters with the data provided by Customs.

Environmental taxes for import of ODSs and ODS containing equipment

Chapter XVIII on Financing of the Law on Environment (OJ of the RM 53/05, 81/2005, 24/2007) foresees every natural or legal person who imports certain used products or produces/imports hazardous products and goods or products and goods containing hazardous substances to the environment and nature is obliged to pay tax defined by the Ministry of Environment and Physical Planning.

In accordance with Article 179 paragraph 2 subparagraph 1, 2, 3 the tax amount for import of refrigerators, freezers and other cooling devices will include payment of tax per imported HCFC air-conditioning units. The amount of tax will be 250 MKD/KW-cooling capacity.

In accordance with Article 179 paragraph 4 subparagraphs 1, 2, 3 the importers of the ODSs classified in Montreal Protocol Annex C Group I substances (HCFCs) will pay tax for import of 62 MKD/kg. (1US$ ~ 48 MKD).

The adjustment of the import tax system will start from 1 January 2011.

Intention of environmental tax system is to discourage the importers of ODSs and ODSs containing equipment.

Bans on import

- The import of HCFCs containing equipment and new HCFCs installations will be banned from 1 January 2012. It will facilitate the implementation of HCFC terminal phase-out plan. Since Republic of Macedonia intends to join the EU, designs the relevant legislation according to the provisions contained in the EC (2037/2000) regulation for ODS.
- The import of non-refillable HCFCs containers will be banned from 1 January 2015. The ban on placing on the market of non-refillable HCFC containers will assist a faster phase-out of HCFCs, because without such containers the illegal trade that leads to sustaining the demand for HCFCs would be more difficult. From environmental perspective, the benefit of including a ban on non-refillable containers in legislation is that there will be no more emission into the atmosphere of the HCFCs remaining in the used non-refillable container.

4.2.2 Plan for gradually reduction

Planned policy instruments will limit the consumption of HCFCs in the country and meet the new phase-out schedule of Montreal Protocol provisions. Gradually reduction will be achieved through investment and non-investment activities.

Planned activities and projects
The Strategy of phase-out of HCFCs in the Republic of Macedonia will be implemented through different activities. The activities for the First stage of implementation (2011-2015) are described in details.

1. Implementation of policy instruments
The policy instruments described in Item 4.2.1 will be implemented as follows:

- Limitation of import of HCFC containing equipment - Annual import quota for HCFC new AC equipment (20.000 units for the year 2011 and ban from the year 2012) will be announced until the mid of 2010.

- Annual import quota for HCFCs for the year 2011-2012, will be adopted until the mid of 2010. During the year 2011, the baseline **A (Mt)** =average consumption 2009-2010, will be assessed and announced as a quota from the year 2013. At the same time the quota for 2014 **(95% of A)** and 2015 **(90% of A)** will be announced.

- Annual import quota for HCFCs after 2015 will be gradually reduced 5% each year to achieve value (65% of A) in the year 2020. After 2020 the allowed import quota will be gradually reduced to (32,5% of A) in the year 2025. The remaining 30% of the consumption will be reduced until 2030. Gradually reduction of HCFC-22 consumption is shown above on the Chart - quotas for second stage of the HPMP.

- Decision for introducing of environmental taxes for import of ODSs and ODS containing equipment will be implemented in the same time with annual import quota systems.

- The Ministry of Environment and Physical Planning will introduce the Mandatory reporting by importers/exporters as from 1 January 2011.

- The Ministry of Environment and Physical Planning will introduce the Mandatory logbooks for users of equipment containing more then 3 kg of HCFCs refrigerant. The main purpose of equipment logbooks is to collect data on HCFCs emission from the larger equipment related to leakage checking. This measure will be implemented during the year 2012.

Bans
- Import of HCFCs containing equipment and new HCFCs installations will be banned from 1 January 2012.

- Import of non-refillable HCFCs containers will be banned from 1 January 2015.

- Import of HCFCs substances will be banned from 1 January 2040.

2. Projects

Training of involved stakeholders in implementation of phase-out schedule for HCFCs:
- *Users and Service technicians* - Non-HCFCs refrigeration technologies; Recovery and Recycling of HCFCs refrigerants, minimizing the need of virgin refrigerant; Implementation of logbooks for the HCFC equipment charged with more then 3 kg of refrigerant.
- *Customs officers* - Enforcement of new HCFCs legislation for new phase-out schedules, monitoring and control of HCFCs including detection of HCFC consignments at the border checkpoints.

Improvement of Recovery and Recycling scheme (R&R)
The R&R scheme was implemented by the previous RMP and TPMP projects. The service shops granted with R&R equipment report to the NOU recycled quantities of refrigerants. The recycled quantities of refrigerants in the previous years are significant. This scheme could be improved with new R&R equipment. It is estimated that additional 40 sets will decrease the consumption of virgin refrigerants. This project will enable the country to implement the HCFC Phase-out Plan without any obstacles (lack of refrigerant in servicing sector).

Completion of the conversions in manufacturing industries
- Company SILEKS, Kratovo - 76 tonnes of CFC-11 were phased-out through technology conversion to the new one applying HCFC-141b. The Company needs new (second) conversion with non-HCFC technology. The capacity of production line is 800 Mt rigid foams per year. This conversion will enable elimination of 8,8 ODPt/year of blowing agent HCFC-141b. Recommended conversion is in technology using CO_2 as blowing agent;
- Company KOPER, Negotino - producer of commercial refrigerators, based on HFC-134a. The capacity of the production line of the Company is 48000 units per year. The total weight of rigid foam in the products is 250 Mt/year. The consumption of blowing agent HCFC-141b is ~ 10%. Through conversion with non-HCFC technology 25 Mt (2,75 ODPt/year) will be eliminated. Recommended conversion is in technology using hydrocarbons as blowing agent;
- Company ZLATNA RAKA, Skopje - producer of insulated segment doors. The conversion of the technology will eliminate 1 Mt/year of HCFC-141b. Recommended conversion is in technology using CO_2 as blowing agent;

The proposed conversions in foam production are under the criteria considered in Item 3.5.1 . Detailed costs breakdown are given in Appendix 2.

Waste disposal
The phase-out of HCFCs substances will result with waste of old equipment and unwanted ODS substances. The refrigerant from the equipment out of service has to be discharged and stored for further destruction by environmental sound manner. This process needs establishment of appropriate disposal facilities. Because the Republic of Macedonia does not have destruction facility, the project foresees establishment of Waste Disposal Center for dismantling of equipment and discharging and storing of refrigerants.

The justification of establishing of this Center is the data of installed quantities of refrigerants in existing equipment (507 Mt - HCFCs, according the Survey). Establishing of disposal facility will prevent releasing of significant amount of refrigerants into the atmosphere.
The establishing of Waste Disposal facility has to be as soon as possible in the first stage of implementation of HPMP. The Waste Disposal Center during the second stage of HPMP will need financial support to operate properly.

3. Awareness raising
Awareness raising of stakeholder groups (importers, exporters, users, service shops, producers, academia, NGO etc.) is a part of HPMP Phase-out strategy. These groups should be aware of the advanced HCFC phase-out schedule and up-coming legislative policies in the country and the planned implementation schedule as well as the available and emerging alternative technologies. The awareness raising includes:
- Issue of brochures with summary of HPMP, HCFC phase-out schedule and up-coming legislative;
- Organization of technical seminars and workshops to promote planned activities and Projects;
- Public awareness: Press releases; TV spots; Radio broadcasts; Distribution of leaflets, posters and movies.

4. Institutional strengthening
The institutional structure was established from 1997 with start of "Country-Programme for Phasing out Ozone Depleting Substances in Macedonia". The National Ozone Unit in the Ministry of Environment and Physical Planning is nominated as a national focal point for implementation and coordination of Programmes related the Montreal Protocol. Government Institutions are responsible for development of the HCFC phase-out management plan. Besides coordination of the planned activities and projects, the Institutions in charge have to implement the instruments directly addressed to them. In view of this fact the Ministry of Environment and Physical Planning has to be financially supported.
Planned activities addressed to the Government Institutions are:
- ***Policy instruments*** (Item 1 in Chapter 4.2.2) - Preparation, decision making, implementation;
- ***Awareness raising*** (Item 3 in Chapter 4.2.2) - Organization of seminars, Workshops, Public awareness...

4.2.3 Project coordination and management

The Republic of Macedonia has experience in coordination and management in successful implementation of projects on ozone layer protection.

The National Ozone Unit (NOU) is the central national body under the Ministry of Environment and Physical Planning, responsible for coordination the country action with respect to ozone layer protection and facilitation of ODS phase-out. This Office is in charge of implementing the Country-Programmes under the Montreal Protocol. During the 12-years of existence of the Ozone Unit in cooperation with UNIDO as an Implementing Agency and financial support provided by the Multilateral Fund realized investment projects in almost all economic branches.

The role of a coordinator of the national activities towards HPMP Phase-out Plan implementation will be given to the Ozone Unit under the Ministry of Environment and Physical Planning.

Management of implementation of the planned project activities will be allocated to the NOU in cooperation with UNIDO as an Implementing Agency. The NOU as a management body has responsibility to the Ministry of Environment and Physical Planning as a decision-making body.
According the planned activities, the stakeholders in implementation will be:
- UNIDO - Implementing Agency (Preparation of Projects, Project officers);
- Government Administration;
- International and national consultants;
- Companies - suppliers of equipment and services;
- Beneficiaries (Industry, Importers/exporters, Companies ...)

The role of UNIDO is to assist Republic of Macedonia in preparation of separate projects proposals addressed to MLF for financial support and implementation of approved projects.

Reports and verification
The NOU will submit annual progress reports of status of implementation of the HPMP to UNIDO. Separately, participants in implementation of the Projects will submit reports defined in the TOR of the Projects.
Monitoring of development of HPMP and verification of the achievement of the performance targets, specified in the Plan, will be assigned to independent local company/consultants. Annual report of Monitoring and Verification Audit will be submitted to the NOU and UNIDO.

5. Republic of Macedonia and EU

The Republic of Macedonia has strategies to gradually harmonise the economy with EU. The European Union has stringent regulations for ODS as well as all alternative refrigerants either due to HFCs Global Warming Potential or other alternatives safety aspects (flammable, toxic or high pressures).

The HCFCs consumption phase-out schedule in the EU goes ahead of the Montreal Protocol requirements and starting from 1 January 2010 consumption of HCFCs in the EU will be near to zero. Until 31 December 2014 recycled and reclaimed HCFCs would be allowed for use (with certain restrictions) in refrigeration and air-conditioning equipment.

As the Republic of Macedonia has a strategy to harmonise regulatory framework with EU and the industry is motivated to achieve a European standard a phase out strategy for HCFCs can benefit from the ongoing harmonisation within Europe.
The whole European industry faces new and clear regulations with requirements on technicians as well as enterprises active in the refrigeration and air-conditioning sector. As the ODS's phase out is coming to the final stages the new requirements are focused on the use of HFCs due to their global warming potential. As the requirements are similar, the F-gas regulations are based on experiences from the ODS phase-out.
Republic of Macedonia is expecting formal invitation for negotiation to join EU in 2009. In the process of harmonizing all legislation related to ODSs will be adjusted to the EU legislation.

Appendix 1

Cost of the HCFC phase-out and time frame for implementation

The cost of planned activities and projects are estimated on the basis of previously implemented projects and information from producers of equipment.
Name of project/activities, Period of implementation and estimated cost are given in the Table below:

Activities /project	Time frame	HCFC to be phased-out (Mt)	Estimated costs US $
I STAGE			
1. Institutional strengthening	2012 to 2015	n/a	300.000
Policy instruments			
- Annual import quota for HCFC new AC equipment;	from 1 January 2011		
- Annual import quota for HCFCs;	2011-2015		
- Environmental taxes for import of ODSs and ODS containing equipment;	from 1 January 2011		
- Mandatory reporting by importers/exporters;	from 1 January 2011		
- Mandatory logbooks for users of equipment containing 3 kg and more of HCFCs;	2012		
- Ban of import of HCFCs containing equipment and new HCFCs installations;	1 January 2012		
- Ban of import of non-refillable HCFCs containers;	1 January 2015		
Awareness raising	2010 -2015		
- Issue of brochures			
- Organization of technical seminars and workshops			
- Public awareness			
2. Training	2011-2012	n/a	
- Users and Service technicians			40.000
- Customs officers			20.000
3. Improvement of Recovery and Recycling scheme	2012-2015	30	200.000
4. Conversions in manufacturing industries			
- Company SILEKS, Kratovo	2015	80/year	248.000
- Company KOPER, Negotino	2015	25/year	252.000
- Company ZLATNA RAKA, Sk	2015	1/year	50.000
5. Establishment of Waste Disposal Center and collection of ODSs	2012-2015		400.000
6. Monitoring and verification	2012 to 2015	n/a	60.000
Total I STAGE			**1.570.000**

Activities /project	Time frame	HCFC to be phase-out (Mt)	Estimated costs US $
II STAGE			
1. Institutional support **Policy instruments** - Annual import quota for HCFCs - Ban of import of HCFC substances; **Awareness raising** - Issue of brochures - Organization of technical seminars and workshops - Public awareness	from 2016 to 2030 from 2016 to 2030 1 January 2040 2016-2039		750.000
2. Waste Disposal Center – collection and destruction	2016-2040	500	1.500.000
3. Monitoring and verification	from 2016 to 2040	n/a	150.000
Total II STAGE			**2.400.000**
Total cost for the HCFC phase-out			**3.970.000**

Annual costs of implementation of the HPMP - I STAGE in US$

Year	Investment costs	Running costs	Total
2011	30.000		30.000
2012	380.000	90.000	470.000
2013	100.000	140.000	240.000
2014		140.000	140.000
2015	550.000	140.000	690.000
Total - I Stage	1.060.000	510.000	1.570.000

Appendix 2

Project costs calculation

1. Conversion in manufacturing industries - Foam production

	BA Technology $H_2O \rightarrow$ Chemical CO_2	Company **SILEKS**
	Investment costs calculation	**US$**
1	**General machine check -up and refurbishing** Technical features Output range (Ratio 1:1).....min 65 max 270 (gr/s) Absorbed power .....20 (KW) Air consumption .....80 (nl/shot)	**168.000**
2	**Redesign of moulding tools**	**20.000**
3	**Start-up materials**	**50.000**
4	**Training of operating staff**	**10.000**
5	**Total**	**248.000**
6	**Operating costs comparison** **HCFC141b** REF=1,00 **CO_2-water** - Raw material 1,00 1,00 - Energy consumption (KWh/kg) 1,00 1,0007 - Labour 1,00 1,00	
7	Increasing of operating costs	**0,07%**

	BA Technology $H_2O \rightarrow$ Chemical CO_2	Company **Zlatna Raka**
	Investment costs calculation	**US$**
1	**General machine check -up and refurbishing** Technical features Output range (Ratio 1:1).....max 35 (gr/s)	**35.000**
2	**Redesign of moulding tools**	**8.000**
3	**Start-up materials**	**2.000**
4	**Training of operating staff**	**5.000**
5	**Total**	**50.000**
6	**Operating costs analysis increasing/decreasing**	**1/1**

	BA Technology HC → Pentane, Isobutane, ...		Company **Koper**
	Investment costs calculation		**US$**
1	**1a. Dosing unit update** - Replacement with High Pressure; - Adding new Polyol side; - New premix unit; Technical features Output range .....min 35 max 130 (gr/s) **1.b BA storage system** - Storage capacity 9 m^3 **1.c Safety system** - Ventilation system - Gas sensors - Safety control cabinet		**112.000** **28.000** **17.000**
2	**Redesign of moulding tools**		**64.000**
3	**Start-up materials**		**16.000**
4	**Training of operating staff**		**15.000**
5	**Total**		**252.000**
6	**Operating costs comparison**	**HCFC-141b** REF=1,00	**HC**
	- Raw material	1,00	0,955
	- Energy consumption (KWh/kg	1,00	1,0015
	- Labour	1,00	1,00
7	Decreasing of operating costs		**4,35%**

2. Waste disposal center

Investment costs	US$
Equipment - Refrigerant identifiers - Refrigerants evacuation station - Storage tanks - Scale - Pressure testing - Safety system	250.000
Operating costs per year - Rental of premises - Materials - Energy - Staff (salary)	50.000

Appendix 3

Same Key Acronyms

HCFCs	- Hydrochloroflourocarbons
CFCs	- Chlorofluorocarbons
HFCs	- Hydrofluorocarbons
MP	- Montreal Protocol
ODS	- Ozone Depleting Substances
BA	- Blowing Agent
RMP	- Refrigerant Management Plan
TPMP	- Terminal Phase-out Management Plan (of CFC substances)
HPMP	- HCFC Phase-out Management Plan
VOC	- Volatile Organic Compounds
ODP	- Ozone Depleting Potential
GWP	- Global Warming Potential
MLF	- Multilateral Fund
MOP	- Meeting of the Parties
R&R	- Recovery & Recycle
UNIDO	- United Nations Industrial Development Organization
D4	- Goods that can be imported/exported only after issuing permit by the Ministry of Environment and Physical Planning of the Republic of Macedonia [Decision for Arrangement of the Goods in Export and Import Forms (Official Journal of the Republic of Macedonia, No. 91/2004)]
ODPt	- Ozone Depleting Potential tonnes
Mt	- Metric tonnes
EU	- European Union

Republic of Macedonia

Ministry of Environment and Physical Planning
Ozone Unit

Drezdenska 52, Str.
1000 Skopje- Republic of Macedonia
Tel/fax: ++ 389 2 3119 622
E-mail: ozonunit@unet.com.mk
www.ozoneunit.gov.mk