Text and production coordination: Alejandro Ramirez-Pabon, Ruy de Goes Leite de Barros, Anderson Moreira de Vale Alves

Contributors: Suely Machado Carvalho, Paul Ashford, Jason Yapp, Miguel Quintero

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For Further Information:

Montreal Protocol and Chemicals Unit
Environment and Energy Group
Bureau for Development Policy
United Nations Development Programme
www.undp.org/chemicals

EARLY RETIREMENT OF REFRIGERATORS AND ODS BANKS MANAGEMENT/ DESTRUCTION IN BRAZIL

OZONE PROTECTION & CHEMICALS SERIES

Brazil achieved total phase out of CFCs in all major consumer sectors on 1 January 2007[1]. UNDP, as a partner in this process, mobilized US $63.4 million from the Multilateral Fund for the Implementation of the Montreal Protocol (MLF) to develop national capacity and to provide technical assistance to sectors consuming Ozone Depleting Substances (ODS) (such as foams, refrigeration, solvents, process agents and others). As a direct result of these efforts 10,603 ODP (ozone depleting potential) tonnes have been phased out in Brazil. In addition, through the CFC National Phase-Out Plan (NPP), UNDP helped establish the infrastructure for the recovery and reclamation of CFCs in order to contain and reuse the refrigerant recovered during servicing of refrigeration equipment.

Although the production and consumption of CFCs in Brazil have been successfully phased out under the Montreal Protocol, there is a significant residual amount of CFCs still found in equipment currently in operation. In the domestic refrigeration sector it is estimated that there are 50 million units in Brazil, of which 11 million units contain CFCs. Due to their high Global Warming Potential, the CFCs contained in these refrigerators are equivalent to 33 million tonnes of CO_2 that threaten to leak into the atmosphere if appropriate disposal measures are not taken.

Public and private sectors in Brazil are joining forces with UNDP to tackle this challenge. UNDP is currently developing a pilot project that will help address ODS destruction in Brazil and thereby contribute to a comprehensive scheme being established for the early retirement of refrigerators and ODS banks management/destruction. Progress on the overall program is presented below.

FIRST STEPS

The first program to replace old domestic refrigerators by new ones was developed by COELBA and CELPE (Electric Power Utilities from Bahia and

Pernambuco States). Driven by the Energy Efficiency Law[2] the program facilitates the donation of new energy efficient refrigerators to low income families, in exchange for their old refrigerators. The main incentive for the electric utilities to establish this program comes from the high energy efficiency gains achieved from installing new refrigerators in low-income households, given that a high proportion of their electricity bill comes from running the refrigerator.

In order to ensure the recovery and the secure management of the refrigerant fluids (mostly CFC-12) contained in the old refrigerators collected, a Technical Cooperation Agreement was signed in 2006 between the Ministry of Environment (MMA) and COELBA, as part of the NPP activities being implemented in Brazil with UNDP[3]. This Agreement was subsequently amended to include another four electric utilities. Recovery Machines were donated and technical support for the recovery and delivery of contaminated ODS was provided to the involved electric utilities. The recovered CFCs went into the recovery and reclamation network established by the NPP. As a result of these Cooperation Agreements, all the electric utilities – including those that did not sign the Agreement – started to recover the refrigerants and recycle the materials from the dismantled refrigerators.

Despite the costs involved, the replacement is justified by a set of positive effects achieved, as described below.

- **Social benefits:** Reducing the energy consumption among the low income population generates savings in their electricity bill. These savings represent an additional income of US $25 per year for the families involved and generate savings to the Federal Government that subsidizes part of the energy cost to low income families.

- **Increase in energy efficiency:** On average, an old CFC- based refrigerator, with capacity of 280 liters, consumes about 65 kWh/month, while a refrigerator certified by INMETRO as "A" Standard (the most efficient in the market) consumes about 29 kWh/month. Replacing the old refrigerator with a new one therefore allows a saving of 55 % (reduction of 432 kWh/year) in the consumption of electricity.

- **Ozone layer protection:** Today, all the refrigerant fluids (CFC-12 and, in some cases, HFC-134a) are recovered; and the conditions for safe CFC-11 recovery from the insulation foam are being established.

- **Global warming mitigation:** One tonne of CFC - 12 is equivalent to 10,900 tonnes of CO_2 while one tonne of CFC - 11 is equivalent to 4,750 tonnes

[1]. A small amount of CFC used in Metered Dose Inhalers is still to be phased out on 1 January 2010.
[2]. Law 9991/00 provides that 0.5% of the net operational revenue of the electric utilities should be used in energy efficiency projects. Of that amount, 50% should be devoted to projects oriented towards the low-income population.
[3].The Brazilian NPP is coordinated by the Ministry of Environment, on behalf of the Federal Government, with assistance from UNDP as Lead Agency and Germany (GTZ) as Cooperating Agency.

of CO_2. Only one refrigerator manufactured before the year 2000 contains, on average, CFCs with global warming effect equivalent to about 3 tonnes of CO_2. The recovery and appropriate management of CFCs would therefore have an additional and higher impact on the climate than the impact achieved through energy efficiency.

- **Recycling of components:** In addition to the recovery of ODS from the compressor and the insulation foam, stringent and systematic refrigerator disassembly ensures that toxic chemicals like mercury and lubricating oils are not released into the environment. It also allows the recycling and resale of many other materials such as metals, aluminum, glass and plastics.

- **Reduction of illegal connections:** The high cost of the electricity bills has historically created an incentive for low income families to arrange clandestine connections to the electricity grid. The reduction in energy consumption with the new refrigerator would enable the family to pay their electricity bill, avoid the need for illegal connections and lead to system stability and user safety.

The environmentally safe disassembly of refrigerators containing ODS is not just an issue in Brazil. It is an issue for both developed and developing countries. Many countries under Article 5 paragraph 1 of the Protocol (developing countries) are facing similar problems related to equipment replacement and disposal. In this context, UNDP organized a Regional Seminar to facilitate discussion on these issues and foster south-south cooperation in June 2008, under the coordination of the National Ozone Unit (NOU) of Brazil. Five Latin American NOUs, representatives of European Disassembling Companies and almost 100 Brazilian companies and stakeholders attended the seminar, which resulted in a vibrant exchange of ideas on the challenges faced and solutions found by different countries.

A NEW NATION-WIDE PROGRAM

Even though the ongoing electric utilities programs are clearly expanding with successful results, the growth is limited by the amount of resources generated by the Energy Efficiency Law, which only allows for the replacement of 150,000 refrigerators[4] per year. This is only a fraction of the current replacement potential in the country, bearing in mind

that Brazil has 50 million units, out of which over 11 million are more than ten years old (i.e. contain CFCs), and 4.5 million new units are annually produced for the domestic market.

With this in mind, the Federal Government is establishing a program to collect/disassemble and replace one million refrigerators a year[5]. The program will include the maintenance and expansion of the ongoing electric utilities' initiatives. It will also introduce new incentives to expand it beyond the electric utilities. By engaging manufacturers, retailers, and waste management enterprises, it will use existing structures that are logistically efficient, familiar and easy to understand for the consumer. It is expected that to join the program, manufacturers would be required to sell INMETRO Standard "A" refrigerators, containing isobutene (or another non-ODS and low GWP substance) as refrigerant. Figure 1 shows the components of the program and Table 1 describes the expected benefits of replacing 10 million refrigerators within a 10-year period.

However, in order to have a comprehensive program for the early retirement of refrigerators and ODS banks management system, additional financing will be needed to cover costs such as incentives for the consumer, transportation, stocking, tracking and disassembling of the recovered refrigerators, recycling of materials and recovery and proper disposal or destruction of hazardous gases and residues. Different types of financing are being identified to cover these costs. UNDP is a key player in this process and is already assisting several stakeholders to determine these costs, identify the most suitable financing sources and bring the interested partners together as appropriate. Potential source of funding identified by the different actors involved in the Brazilian scheme for the early retirement of refrigerators and ODS banks management system (some of which are already in use), include but are not limited to (also shown in Figure 1):

- **Federal Banks loans:** Preferential interest rates by Federal Banks to the consumer who adheres to the program in voluntarily and to retailers participating in the program.

[4]. Estimated value based on information provided by the electric utilities.

[5]. Program constructed under the coordination of the Ministry of Mines and Energy, with the participation of the Ministries of Environment, Development, Industry and Foreign Trade, Social Development and Economy. Other participants include Banco do Brasil; BNDES; Inmet; Eletros (Association of manufacturers); Abras (Brazilian Association of Supermarkets); IDV (Institute of the Retail Leaders); CNDL (National Confederation of Store Owners); Abradee (Brazilian Association of the Electric Power Distributor Companies) and recycling companies. External institutions assisting in different areas include UNDP and GTZ.

- **Tax incentives:** Potential tax exemptions for manufacturers are under consideration at Federal and/or at State levels.

- **Donor Assistance:** The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety is providing technical and financial support for the introduction of full scale refrigerator recycling scheme (disassembling including CFC 11 recovery) in Brazil. The funds originate from auctioning CO_2 emission rights to German industries and are used to invest in emission reductions that are in addition or in support of existing carbon trading activities.

- **Multilateral Fund:** Part of the infrastructure used to handle the gases, such as the recovery/reclamation network established by UNDP/MMA, is already in place with funding by the Multilateral Fund. Four reclamation centers have been established. In addition, the Montreal Protocol discussion on how to address the destruction of ODS banks, could potentially benefit the program. UNDP has received approval for the preparation of a pilot project that will analyze all the elements involved in the emerging ODS banks management system in Brazil (including collection, transport, storage and destruction of ODS) to identify gaps, and propose solutions to ensure an economically feasible model. This pilot would serve as seed funding to make the system operational.

- **Carbon finance/others:** UNDP is exploring with our partners the various financial options to monetize the emission reduction accrued from energy efficiency and the destruction of CFC, HCFC and HFC recovered from refrigerant and foam. Other sources of funds, including from private sector partnerships in the country, are also being explored.

NEXT STEPS AND CHALLENGES

One problem still to be addressed is the destruction of the recovered CFC fluids. During recent years, the ongoing operation of the existing reclamation centers created a new market for the reclaimed CFC-12. Due to the total phase out in 2007 and the increasing use of drop-in blends to service CFC equipment during their last years of life, the use of CFC-12 is quickly decreasing and the need to destroy it is imminent. With regards to CFC-11, there is virtually no market in Brazil and the establishment of proper conditions to destroy it is already required. The decisions to

Table 1: Estimated benefits of replacing 10 million refrigerators within a 10-year period

Electric power saved by month/residence	36 kWh/month
Monthly average reduction in the electric power bill	R$ 10.56
Monthly reduction in the Low Income subsidy	R$ 6.56/residence
Total electric power saved by year	4,320GWh
Equivalent hydroelectric power plant avoided	865 MW
CFC-12 recovered	1,000 tonnes
CFC-11 recovered	4,000 tonnes
CFCs recovered in CO_2 eq	30 million tonnes
Electric power savings in CO_2 eq (avg emission of 0.4 tCO_2 / MWh)	1,72 million tonnes

Source: Ministry of Mines and Energy

be made by the Parties to the Montreal Protocol regarding the recovery and destruction of those gases are core elements to cover program costs, to expand it and replicate it in other developing countries. Seed funds, such as those provided by the MLF for the "pilot destruction projects," are critical to assist countries with finding the solutions needed and in identifying other potential sources of funding.

The development of business and financing plans for the activities involved in the overall system remains a major challenge. In the Brazilian case, the catalyst to the electric utilities' programs was a mandatory use of resources for energy efficiency, and the government is studying possible tax exemptions or subsidies for its expansion. In both situations, the public resources would allow for implementing the early retirement part of the equation, but there are still costs involved in the manufacturing of climate friendly energy efficient refrigerators, removal of CFC-11 during disassembling and final disposal of all CFCs that need to be analyzed in more depth. There are multitudes of technical, financial, regulatory and institutional barriers that could hinder the rapid adoption of energy efficient and low GWP appliances. Funding, such as that available under the GEF (climate change mitigation) could provide a timely 'learning by doing' opportunity for the removal of these barriers to mainstreaming energy efficient and low GWP appliances. GEF funding under this climate change focal area fall within the Resource Allocation Framework and countries must decide if these kinds of project are a priority compared to others to be submitted, which may cause delays. Carbon finance opportunities also exist, as described above.

Proper combination and sequencing of these financial sources require expertise on environmental financing, and understanding of the local markets and legal frameworks to ensure the operation of a scheme that is economically feasible in the long term.

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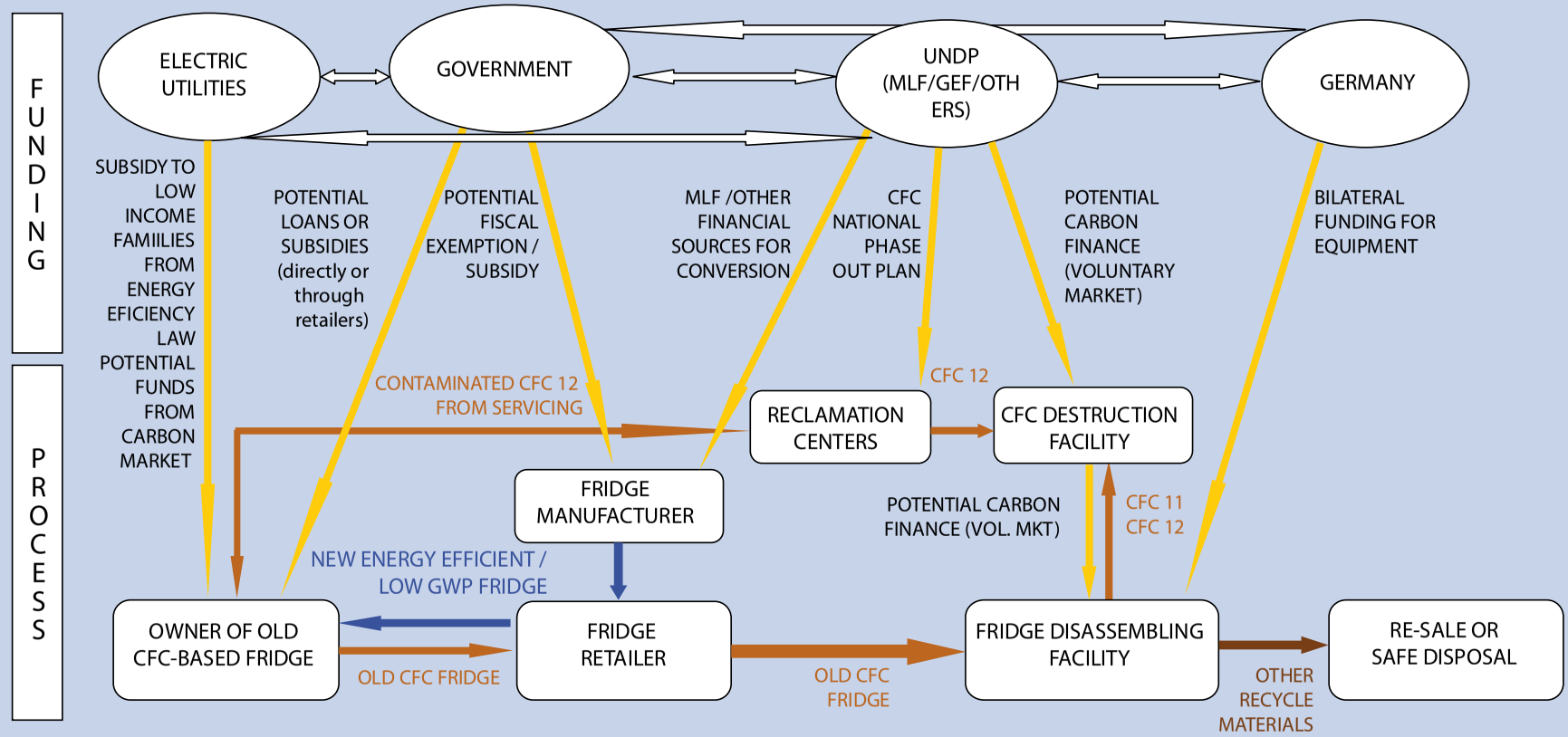

DEFINITIONS:

- FACILITATORS
- COOPERATION AMONG ALL THE FACILITATORS
- FUNDING
- PARTICIPANTS IN THE PROCESS
- FLOWS OF CFC OR REFRIGERATORS CONTAINING CFC
- FLOWS OF ENERGY EFFICIENT LOW GWP REFRIGERATORS
- FLOWS OF RECYCLED MATERIALS