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Resource Mobilization for HCFC Phase-out and Climate Mitigation Co-benefits

**A Study Prepared for the Executive Committee
of the Multilateral Fund**

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GCCMP

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KEY MESSAGES

This study seeks to identify potential investment opportunities and sources of co-financing to meet the additional costs of energy efficiency and climate mitigation benefits associated with HCFC phase-out projects supported by the Multilateral Fund of the Montreal Protocol. As it stands, the Multilateral Fund only supports eligible incremental costs related to ozone depleting substances, and does not fund the additional costs of additional energy efficiency related improvements. Currently therefore, the Multilateral Fund does not directly incentivize the uptake of the most energy efficient technology, leading to missed opportunities to enhance support to ozone depleting substances phase-out projects which would have maximized associated climate mitigation outcomes, and risking technology lock-in. The paper explores strategies that can maximize synergies with climate financing in general and in combination with the World Bank's energy efficiency and climate mitigation portfolios.

An analysis of impacts and benefits shows that savings related to electricity, whether at the individual consumer level or from avoided generation capacity, dominate. When comparing the direct climate benefit arising from reductions in emissions associated with the replacement of HCFCs (given the intrinsic global warming potential of the refrigerant) with the indirect benefit associated with energy savings from the newer equipment (from the lower electricity consumption), the value of the indirect benefit is larger. In any event however, from a country perspective, it is more often energy security benefits that drive policymaking directed at the Ref/AC sector, with climate mitigation and ODS phase-out as secondary objectives only.

There are, in principle, a number of sources of financing that address energy efficiency in developing countries that could, potentially, be leveraged to finance the additional climate benefits associated with HCFC phase-out. Challenges arise however with respect to timing, approach, and implementation:

- No sources of funds were identified that could provide the type of predictable funding that would allow countries to plan on securing funds in accordance with the timeframe of their compliance obligations under the Montreal Protocol.
- Climate financing traditionally takes a demand-side approach offering incentives to end-users to reduce their energy use, while the Montreal Protocol typically works with equipment manufacturers to replace ODS in production processes.
- Multisource financing can add to transaction costs and elevate governance and decision risks in interdependent financing operations.

A dedicated funding window for financing ozone-climate co-benefits, including HFC avoidance, could be explored. Existing funds such as the Climate Investment Funds could be used or modified so that resources could be earmarked to ensure predictability and accountability of funding and timing so as to blend with Multilateral Fund funding as seamlessly as possible. In parallel and additionally, seed money could be made available through the Multilateral Fund or others to offer incentives for Parties to pursue energy efficiency / climate

mitigation linkages; for example to support energy audits in cases where there are good prospects for follow-up climate finance.

Generally, bringing together various sources of financing increases transaction costs. Any effort to promote multi-source financing should acknowledge the same and strive to streamline implementation and management procedures of such a blended operation in order to eliminate, or strongly limit, additional project and financial management and reporting requirements and keep transaction costs low.

Good strategic planning and inter-sectoral coordination at the country level are crucial to ensure that policies are aligned and possibilities to leverage financing are optimized. Parties should be encouraged to ensure that their second phase HCFC Phase-out Management Plans include a broad and strategic overview of on-going and planned investments for climate mitigation and energy efficiency so that the Montreal Protocol interventions can be mainstreamed within these larger on-going programs. The overall domestic climate change and energy policy and regulatory environment, including Nationally Appropriate Mitigation Actions (NAMAs) and Intended Nationally Determined Contributions (INDCs) where relevant, should be providing the framework for the mainstreaming of HCFC phase-out. Linkages should be made with potential new sources of climate finance and greenhouse gas mitigation instruments, including the Green Climate Fund and potentially new carbon market-based instruments which the Partnership for Market Readiness supports. In many countries, this would require strong coordination and collaboration across sectors and ministries, as well as careful consideration of Agencies' comparative advantage.

World Bank investments for clean energy are growing, and offer scope for inclusion of Montreal Protocol objectives in energy-related activities. World Bank Group commitments to finance energy efficiency have stood at approximately \$1.5 billion per year for the past five years. In addition, a review of the overall World Bank portfolio reveals that projects that could represent up to \$3.5 billion, or 8.7% of the Bank's portfolio, across a variety of sectors could offer opportunities for linkages with the Montreal Protocol agenda. Further analysis of these opportunities would allow key sectors with strong potential for synergies, such as energy but also health and agriculture, to be targeted and alerted of opportunities, including through appropriate information and guidelines. Sustainable (green) procurement practices could also actively be promoted in these sectors. A principal challenge here that goes beyond mere alignment of procedures would lie in aligning Multilateral Fund financing with Bank lending, given the different business models at play. Additional Montreal Protocol "integration" funds could be set aside to blend in with World Bank or other IFI funds as a way to magnify impact and help countries meet compliance targets.

A review of financial flows related to climate change underlines the preponderance of domestic private sector investment. Indeed, in some key countries, this is the largest source of climate finance, pointing to the importance of interventions that target the domestic private sector. The World Bank could therefore explore with its client countries opportunities for synergies between the Montreal Protocol agenda and Development Policy Lending operations,

which could help set the enabling policy environment in the country with interventions targeting standards setting and regulatory framework for example. There may also be further scope for synergies with investments by the International Finance Corporation which should be explored.

The study provides an overview of the use of carbon finance in the past and outlines potential future opportunities for its use. The Kyoto Protocol's Clean Development Mechanism has had limited success in reducing investment barriers related to less mature technologies and large scale, long-term, investments and, in its current form, imposes significant transaction costs and risks on project developers. On the other hand, the CDM has been successful in dissemination of mature technologies and projects that offered short-term large greenhouse gas reductions. In the near term in any event, carbon finance is not available to support energy efficiency or other types of financing at the nexus of the Montreal Protocol/climate change agenda given the severe downturn of the global carbon market associated with the economic downturn in countries that had been the engines of demand for carbon credits: carbon market mechanisms and systems as currently configured do not present a reliable financing option to support the phase out of HCFCs, especially in middle-income countries.

The outlook nonetheless is promising with respect to the development of domestic carbon markets and frameworks that could support this agenda. We expect that market-based instruments will play a role in future GHG mitigation efforts at the international and domestic levels and that new climate finance instruments such as the Green Climate Fund will become accessible more broadly and, in pursuing green growth, could be tapped to support a broader co-benefits agenda. The international community and countries around the globe are looking at the next generation of carbon markets. The emergence of new climate finance instruments which could better support energy efficiency and related ODS phase-out efforts can be an opportunity for the Montreal Protocol community to align objectives and instruments and plan synergies in future operations. For example, Mexico's plan to develop and implement Nationally Appropriate Mitigation Actions targeted at the refrigeration sector may offer a useful model for others. Other domestic instruments, some supported by the World Bank's Partnership for Market Readiness, may become available over time, and, once mature, financial engineering tools and approaches outlined in this study should be applicable.

In conclusion, the current development of new GHG mitigation and financing instruments can be seen as an opportunity for early discussion and engagement towards more tailored tools that will make co-financing for co-benefits easier to achieve in the future.

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LIST OF ACRONYMS

A5:	[Parties] Operating Under Article 5 Paragraph 1 of the Montreal Protocol
AC:	Air Conditioning
AR4:	Fourth Assessment Report of the Intergovernmental Panel on Climate Change
BAU:	Business As Usual [scenario]
BFI:	Bilateral Finance Institutions
CAR:	Climate Action Reserve
CCAC:	Climate and Clean Air Coalition
CCX:	Chicago Climate Exchange
CDM:	Clean Development Mechanism
CERs:	Certified Emission Reductions
CF:	Carbon Finance
CFCs:	Chlorofluorocarbons
CFLs:	Compact Fluorescent Lamps
CIF:	Climate Investment Funds
COP:	Conference of the Parties [to the Kyoto Protocol]
CPI:	Climate Policy Initiative
CTF:	Clean Technology Fund
DFIs:	Development Finance Institutions
DPL:	Development Policy Lending
DSM:	Demand Side Management
EE:	Energy Efficiency
ESCO:	Energy Services Companies
ESMAP:	World Bank Energy Sector Management Assistance Program
ERPA:	Emission Reductions Purchase Agreement
ETS:	Emission Trading Scheme
EU:	European Union
GCF:	Green Climate Fund
GEF:	Global Environment Facility
GHG:	Greenhouse Gas
GPP:	Green Public Purchasing
GWP:	Global Warming Potential
HCFCs:	Hydrochlorofluorocarbons
HFCs:	Hydrofluorocarbons
IBRD:	International Bank for Reconstruction and Development
IDA:	International Development Association
IEA:	International Energy Agency
IFC:	International Finance Corporation
IFIs:	International Financial Institutions
INDCs:	Intended Nationally Determined Contributions
IPCC:	Intergovernmental Panel on Climate Change
ISO:	International Organization for Standardization

Jl:	Joint Implementation
KP:	Kyoto Protocol
LDCs:	Least Developed Countries
MDBs:	Multilateral Development Banks
MEPs:	Minimum Energy Performance Standards
MICs:	Middle Income Countries
MFIs:	Multilateral Finance Institutions
MLF:	Multilateral Fund for the Implementation of the Montreal Protocol
MP:	Montreal Protocol
NAMA:	Nationally Appropriate Mitigation Action
NFIs:	National Finance Institutions
NMM:	New Market Mechanism
ODS:	Ozone Depleting Substance(s)
ODP:	Ozone Depleting Potential
OECD:	The Organization for Economic Co-operation and Development
PAD:	Project Appraisal Document
PID:	Project Information Document
PMR:	Partnership for Market Readiness
PPP:	Public-Private Partnership
RECs:	Renewable Emission Certificates
Ref:	Refrigeration
RTOC:	Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee
SLCPs:	Short-Lived Climate Pollutants
SMEs:	Small and Medium-Size Enterprises
tCO ₂ eq:	Tonnes of Carbon Dioxide Equivalent
TEAP:	Technology and Economic Assessment Panel
UNFCCC:	United Nations Framework Convention on Climate Change
VCM:	Voluntary Carbon Market
VCS:	Verified Carbon Standard
VER:	Verified Emission Reduction
WMO:	World Meteorological Organization

1. INTRODUCTION

1. This study¹ seeks to identify potential sources of co-financing to meet the additional costs of energy efficiency (EE) and climate mitigation benefits associated with the HCFC phase-out supported by the Multilateral Fund of the Montreal Protocol (MLF). As it stands, the policy of the Multilateral Fund is to support only the eligible incremental costs related to the phase-out of ozone depleting substances, and not to support the additional costs of additional energy efficiency related improvements of the equipment. Currently therefore, while the Multilateral Fund encourages exploring co-financing opportunities for improving energy efficiency, the Fund does not directly support the uptake of the most energy efficient technology. This can lead to missed opportunities to enhance support to ozone depleting substances phase-out projects and therefore missed opportunities to maximize the associated climate mitigation outcomes from these projects, as well as risking technology lock-in. Strategies to maximize synergies with climate financing in general, and in combination with the World Bank's energy efficiency and climate mitigation portfolios, are explored with the aim to outline how finance may best be leveraged in support of climate co-benefits generation in MLF-funded operations.

2. The Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer (MP) decided in 2007 to accelerate the phase-out of hydrochlorofluorocarbons (HCFCs) in accordance with the schedule shown in the Table 1, below. The decision XIX/6 also required that Parties take into account potential climate benefits associated with HCFC phase-out, which are influenced, in the case of refrigeration and air conditioning (Ref/AC), by the selection of the refrigerant alternative to HCFCs and the energy efficiency of the equipment that is being upgraded ("converted").

3. HCFC phase-out management plans (HPMPs) approved by the MLF seek to facilitate the conversion of Ref/AC manufacturing and foam manufacturing away from the use of HCFCs to non-ODS alternatives. These processes entail structural redesign of equipment that allows for enhanced energy efficiency with certification testing of equipment. Specifically in the Ref/AC sector, this provides an opportunity to build upon MLF funding to upgrade equipment energy efficiency performance as part of the HCFC phase out. However the process is not cost neutral given that the components required for energy efficient Ref/AC equipment and refrigerants with low global warming potential (GWP) tend, at present, to be more costly. Conversely, there is a risk of lock-in with less than optimum technology if financing towards the cost of energy efficiency upgrades cannot be made available in a timely manner.

4. While blending of financial resources is applied in many World Bank operations, it is also a source of added complexity, transaction costs and risk in project preparation and

¹ The "Study for Resource Mobilization Activities Related to the Phase-out of HCFCs" was approved by the Executive Committee of the MLF by Decision 63/24 and the Study report submitted to the 71st meeting of the Committee. The original concept proposed by the World Bank envisaged addressing the resource mobilization question from two complementary perspectives: harnessing market mechanisms to accelerate donor commitment and overall resources available to the MLF; and, using market mechanisms at the project level. Ultimately, the Committee agreed to proceed by focusing solely on the second approach.

implementation, to an extent which often discourages project teams and clients from seeking out opportunities for blended finance. The World Bank has recognized this and repeatedly attempted to harmonize project cycle and approval requirements, most recently through ongoing efforts to streamline GEF and Bank lending project preparation milestones. Yet it is still difficult to overcome the rules and governance interests of the source funds and financing mechanisms. This is problematic as it can lead to suboptimal project (re)design or even halting project preparation entirely.

Table 1. Montreal Protocol HCFC consumption control measures

Non-Article 5 Parties: Consumption		Article 5 Parties (developing countries): Consumption	
Base level:	1989 HCFC consumption + 2.8 per cent of 1989 CFC consumption.	Base level:	Average 2009–10.
Freeze:	1996.	Freeze:	January 1, 2013.
35 per cent: reduction	January 1, 2004.	10 per cent: reduction	January 1, 2015.
75 per cent: reduction	January 1, 2010.	35 per cent: reduction	January 1, 2020.
90 per cent: reduction	January 1, 2015.	67.5 per cent: reduction	January 1, 2025.
99.5 per cent: reduction	January 1, 2020, and thereafter, consumption restricted to the servicing of refrigeration and air-conditioning equipment existing at that date.	97.5 per cent: reduction (averaged over ten years 2030–40)	January 1, 2030, and thereafter, consumption restricted to the servicing of refrigeration and air-conditioning equipment existing at that date.
100 per cent: reduction	January 1, 2030.	100 per cent: reduction	January 1, 2040.

Source: Montreal Protocol Handbook, UNEP (2012)

5. Whilst this aspect is not addressed here, it should be noted that the study is nested in the broader public policy challenge of the compartmentalization in addressing (global) environmental issues and consequently of funding sources. Given increasing interdependency of environmental concerns and solutions and the resulting scope for synergies and savings, such compartmentalization can be seen as a failure of public policy coordination. Addressing this failure appears a particular challenge in the international context with its complex negotiated governance arrangements. Yet, alternatives could be considered such as addressing sound environmental conduct holistically, perhaps on a sector or industry basis, and aligning financial support mechanisms accordingly.

6. This study explores pathways that may encourage the uptake of ozone- and climate-friendly technologies through synergies between the MP, policies to promote energy efficiency, and climate finance instruments; thereby leading also to cost-effectiveness of public financing and economic efficiency where synergies exist and can be exploited. The study underscores, based on practical examples, that opportunities can be strategically engineered to encourage

harmonization between the phase-out of the HCFCs and HCFC-using technologies with efforts to promote energy efficiency and reduce greenhouse gas emissions (GHG).

7. The study recognizes that carbon markets and carbon finance, in general, are in a state of flux and will likely remain so in the mid-term, and carbon prices are at present highly depressed. Regardless of the specific design of any mechanism, a current problem is lack of demand – associated with the economic downturn in many countries (especially in Europe), leading to historical (too) low prices that make the mechanism ineffective, and insufficient visibility on sources of future demand and the regulatory context. Consideration of carbon finance as an option for financing of climate co-benefits will require a more robust market with greater clarity and predictability of demand. The recent strong momentum towards domestic carbon pricing initiatives is a welcome development in that direction - essentially, this study assumes this will happen and thus seeks to extrapolate the lessons from the Clean Development Mechanism (CDM) experience to be ready.

8. Therefore, the avenues explored present options for consideration, irrespective of the exact future configuration of the climate financing landscape, and of how the scope and roles of the various climate financing instruments may evolve. The study is also relevant² to the work of the Climate and Clean Air Coalition to address Short Lived Climate Pollutants, as the paradigms that are explored are broadly applicable to efforts to minimize HFCs.

2. SECTOR BACKGROUND

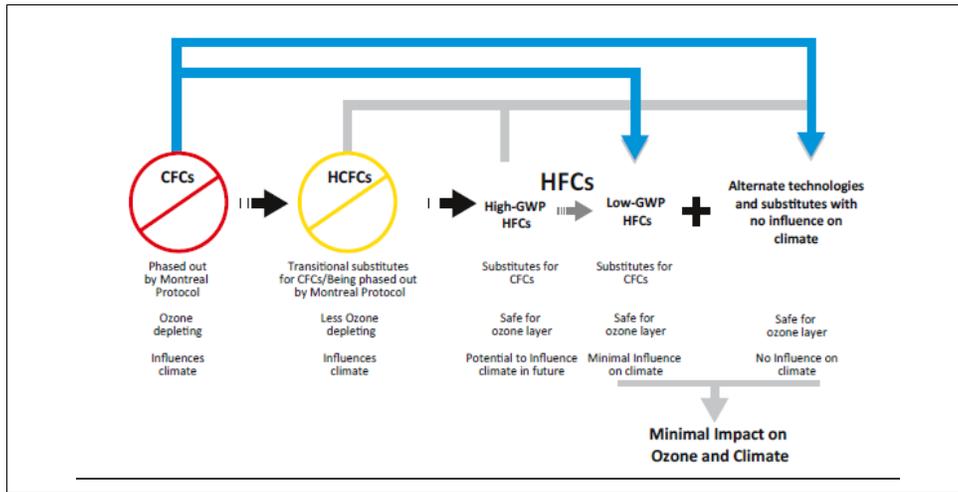
9. The objective of the MP is to eliminate the consumption and production of substances that deplete the ozone layer. The MP has achieved recognized success in phasing out the consumption and production of chlorofluorocarbons (CFCs) and other ODS through adoption of lower ozone depleting potential (ODP)³ alternatives, including HCFCs (see Annex I, Table 1 for the range of lifetimes, ODP and GWP of principal ODS and alternatives). The agreement to accelerate phase-out of HCFCs has generated a further shift towards other alternatives, including an upswing in the use of hydrofluorocarbons (HFCs), which have no ODP but do, however, have high global warming potential (GWP). Although the MP does not regulate or have a formal role in control of HFCs, its decision XIX/6 establishes a clear desire to minimize climate impacts. Where feasible therefore, conversion to substances with no ODP and low GWP such as ammonia, CO₂, or hydrocarbons is promoted. New HFCs with low to very low GWP are

² The growth of HFCs which are increasingly replacing ODS phased out by the MP, and also increasing with rising demand for air conditioning, is cause for concern. The threat from HFCs stems not from their current global contribution to climate forcing which is relatively limited, but from the potential for exponential growth if left unabated, particularly in developing countries, and the risk to cancel the climate benefits that accrued from CFC and now HCFC phase-out (see UNEP's HFCs Synthesis Report). Whilst this report is not primarily concerned with HFCs, some of the tools and lessons learned can apply to efforts to minimize HFC growth, notably the section that seeks to map out opportunities for linkages with the Bank's portfolio.

³ ODP is the ratio of the impact on ozone of a chemical compared to the impact of a similar mass of CFC-11. The ODP of CFC-11 is defined to be 1.0. Other ODS have ODPs that range from 0.01 to 12.0.

under development⁴ but at present, viable low- and no-GWP alternatives are not commercially available for all applications and/or circumstances (see Figure 1 for a depiction of ODS and related GHG control measures over time).

Figure 1. ODS and related GHG control measures and policies



Source: HFCs Synthesis Report, UNEP (2011)

10. While HCFCs are used in both the foam manufacturing and Refrigeration/Air Conditioning sectors, the greatest potential energy efficiency gains through HCFC conversion and technology upgrade can be achieved in the latter due to recent technological advances. One sub-sector which offers interesting potential climate benefits is the residential AC sector which currently uses HCFC-22⁵. This section provides some broad estimates of the climate benefits and energy savings that are associated with the sector. Table 2 provides a rough “back-of-the-envelope” analysis of the relative benefits that could drive a technology upgrade program linked to room air conditioning equipment.

11. These analyses provide rough estimates of the potential climate benefits and energy savings associated with the HCFC transition, and point to where these savings can be found. The Montreal Protocol’s TEAP estimates⁶ that, in 2008, there were 553 million units of HCFC-22 air conditioners in service, containing 1 million tons of HCFC-22. Therefore, it can be estimated that each year at least 50 million new units reach the market, containing roughly 100,000 tons of HCFC-22.

⁴ At least one producer has announced commercial production and market availability in early 2013, for HFO blends for air conditioning and heat pumps application, while HFO-1234yf is being adopted for mobile air conditioning (in cars) in Europe and North America.

⁵ HFC-23, a by-product in the manufacture of HCFC-22, is a potent greenhouse gas regulated under the United Nations Framework Convention on Climate Change (UNFCCC). Therefore, the harmonization of efforts to phase out HCFC-22 and eliminate HFC-23 is critical for both protecting the ozone layer and for climate change mitigation efforts.

⁶ TEAP, RTOC (2010)

12. Based on a hypothetical conversion/replacement scheme targeting 1 million of these units, one can see that the main drivers related to co-benefits would be, by far, energy savings for the individual consumer and avoided economic cost of building new power generation capacity. Based on the analysis in Table 2 below, a scheme could be developed for example to provide a rebate on any working air conditioner that is scrapped and replaced for a new energy efficient one. Such a rebate, if it were to include the first year of energy savings and avoided cost of constructing a new power plant, could amount to at least \$126 per unit. The analysis also indicates that, should a viable carbon market be available, carbon finance revenues would more than cover the cost of managing such a scheme through intermediation of retailers and manufacturers or with energy services companies (ESCO) as driving agents.

Table 2. Back-of-the-envelope estimate of the energy efficiency and climate mitigation related impacts of a program addressing 1 million energy efficient room air conditioners.

<p>Personal savings from one room AC</p> <ul style="list-style-type: none">• Electricity savings = \$117 per year• Carbon “value” equivalent = \$3.4 per air conditioner per year <p>Impact on power generation</p> <ul style="list-style-type: none">• Avoided cost of new power plant construction: \$95- \$216 million• Equivalent to \$9.5- \$21.6 per air conditioner, excluding operating costs <p>Program carbon finance income</p> <ul style="list-style-type: none">• Net income from carbon finance: \$3.2 - \$3.3 per air conditioner per year (assuming \$5 per ton CO₂ - which is not supported by the market today) <p>Possible (theoretical) impact from high GWP refrigerant replacement</p> <ul style="list-style-type: none">• \$0.6 per air conditioner per year <p>→ Main impact / driver is energy savings for the individual consumer and avoided investment in generation capacity. In contrast the savings from displacement of HCFCs, even if eligible for earning carbon credits (which it is not), is much smaller.</p>

Source: this report – see Annex I, Table 2, for assumptions and details

13. This pro-forma example demonstrates that climate benefits stemming from the refrigerant control is often only a small fraction of the potential for GHG reduction (15% in our example). On the other hand, climate benefits from energy efficiency improvement, generally leading to reduced GHG emissions depending on the source of power, are more critical from a climate change perspective. These rough estimates are for illustration purposes only, and different equipment and situations would lead to different results, including with possibly less energy efficiency gains.

14. It should be noted that while reliance on the CDM in the energy efficiency sector has been problematic in part because of complex and high transaction-cost monitoring and

verification requirements, by contrast the baseline assessments and monitoring and verification tasks associated with MP compliance should be less onerous since, contrary to energy efficiency aspects, there are fewer opportunities for the baseline or the target to deviate from a theoretical value (that is, whether a particular ODS or non-ODS refrigerant is being used).

15. Finally, with economic growth and rapid urbanization trends, increase in refrigeration and air-conditioning energy use has become one of the largest and fastest growing contributors of energy (electricity) demand in developing countries. Air-conditioning, in particular, also coincides with electricity peak loads in most countries, and therefore energy efficiency in air-conditioning also provides a significant opportunity to address electricity sector supply-demand gaps which many countries face resulting in power system blackouts and brownouts. In this context, the main public driver behind replacing the existing stock of Ref/AC or shifting the new stock of Ref/AC to new technologies is energy security, with climate change mitigation as a co-benefit and reduction of ODS even further down the line.

3. FINANCING INSTRUMENTS FOR CLIMATE CHANGE MITIGATION, ENERGY SAVINGS, AND EMISSIONS REDUCTION

3.1 Overview of Climate Finance Instruments

16. Climate finance refers to public or private sector finance that supports climate adaptation and mitigation activities. This includes a number of policy and finance instruments that may be used to incentivize mitigation actions and influence change in behavior amongst stakeholders.

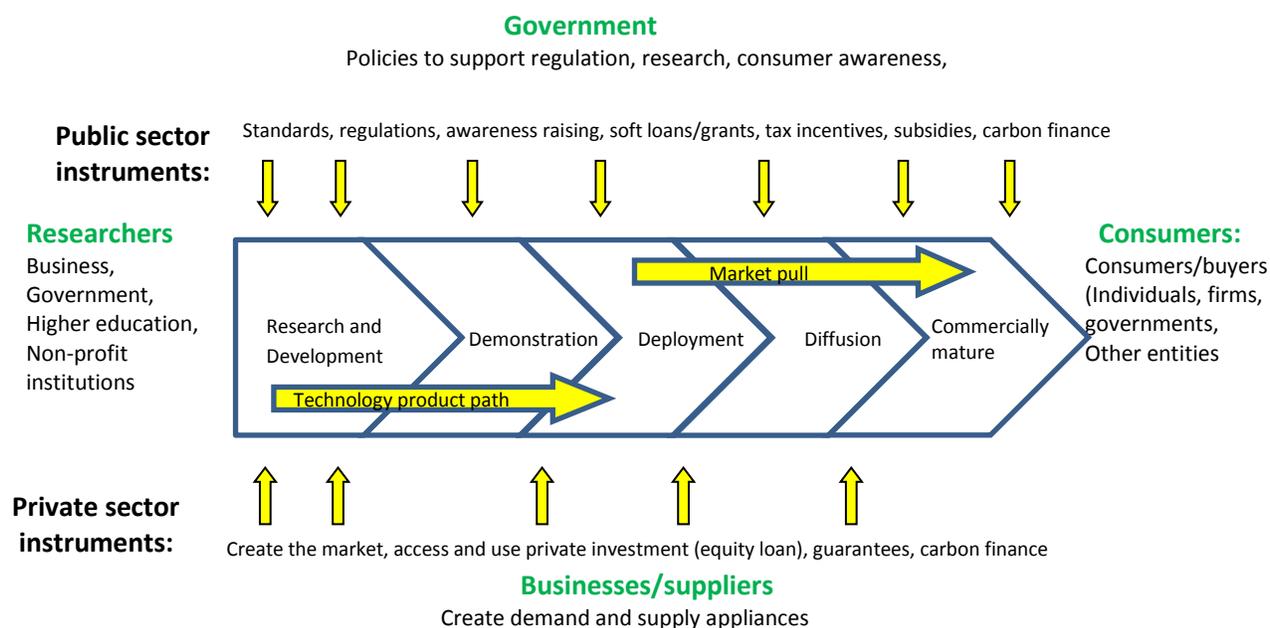
17. Four broad categories of stakeholders are involved in the energy efficiency process and product life cycle continuum (see Figure 2):

- Governments, economic unions and global treaties, such as the MP and Kyoto Protocol that use a variety of tools – of which regulation, fiscal and financing instruments, and capacity development are key - to drive behavioral change in the product development cycle, involving product design researchers, manufacturers, and consumers of energy efficient appliances and services;
- Businesses, including suppliers, retailers and energy services companies (ESCOs) who sell products/appliances and services to enhance energy efficiency and maximize profits and returns for investors;
- Consumers, who purchase energy efficient appliances and services depending on their needs, income level, level of awareness, and exposure to marketing; and
- Researchers and innovators, looking to develop new appliances and services in response to changes in the regulatory environment and business and consumer demand.

18. Numerous financing instruments are available from a variety of potential partners to address policy, fiscal, and financing needs related to energy efficient product and services

development and uptake. A non-exhaustive list of various financing partners who may support such efforts is presented in Table 3, with a more detailed overview of specific source of funding outlined in Annex II. Table 4 then maps the types of perceived public and private sector energy efficiency financing needs against available financing instruments and the agents from whom support may be solicited.

Figure 2. Product development cycle showing role of key stakeholders and available instruments to support energy efficiency



Source: "Beyond the sum of the parts", WB (2010).

3.2. Overview of Climate Finance Flows

19. The Climate Policy Initiative's (CPI) Landscape of Climate Finance 2012⁷ estimates that annual global climate finance flows reached approximately \$364 billion in 2010/2011, approximately half of which went to investments in developing countries (\$171 billion). Figure 3 presents CPI's graphical depiction of these overall flows. Additional complex interactions exist that are not depicted, for example households' behavior (private) reacting to government incentives (public).

20. Mapping climate finance to date has proven challenging with no precise internationally agreed definition. Current efforts to track such financial flows struggle with issues regarding specificity (e.g., tagging of adaptation or mitigation investments), consistency (e.g.,

⁷ See <http://climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2012>

This is the most comprehensive treatment of the subject and is the source for all the figures in this section.

comparability across existing reporting systems), and comprehensiveness (e.g., extensive data gaps).⁸ It is worth noting that estimating financing for energy efficiency, which is most relevant to both ODS and climate change benefits, in general is further complicated by underreporting, given a tendency to classify investments by the sector targeted versus the energy efficiency or climate benefits sought: investment for equipment upgrade is more likely to be recorded, if at all, under the specific equipment category (e.g., AC, refrigerator, appliance, etc.) than under energy efficient action. This may partially explain why energy efficiency accounts for only 4% of global flows in the finance landscape.

21. Given the current shortcomings in reporting of climate-related flows it remains difficult to identify, beyond dedicated instruments like the MLF or carbon finance, which flows fall at the intersection of ODS mitigation and low emissions development. The World Bank is actively working on systems, as are others, to improve such reporting and increase the reliability of data in this domain. Based on information available at this time, this section outlines evidence of flows, as yet largely untapped for HCFC projects, that could be used to support opportunities for synergistic ODS and climate co-benefits. Realizing this potential will require targeted outreach, awareness-raising, and capacity building.

22. Governments and public financial intermediaries have invested slightly more than \$80 billion in mitigation activities, with energy efficiency representing 18% of this amount. A significant percentage of mitigation finance comes from development finance institutions, including bi-, multi-, and national development banks that together have provided \$32.3 billion in climate finance, or about 30% of North-South climate-related flows, highlighting the pivotal role that these institutions play in leveraging and mobilizing finance for climate-smart development.

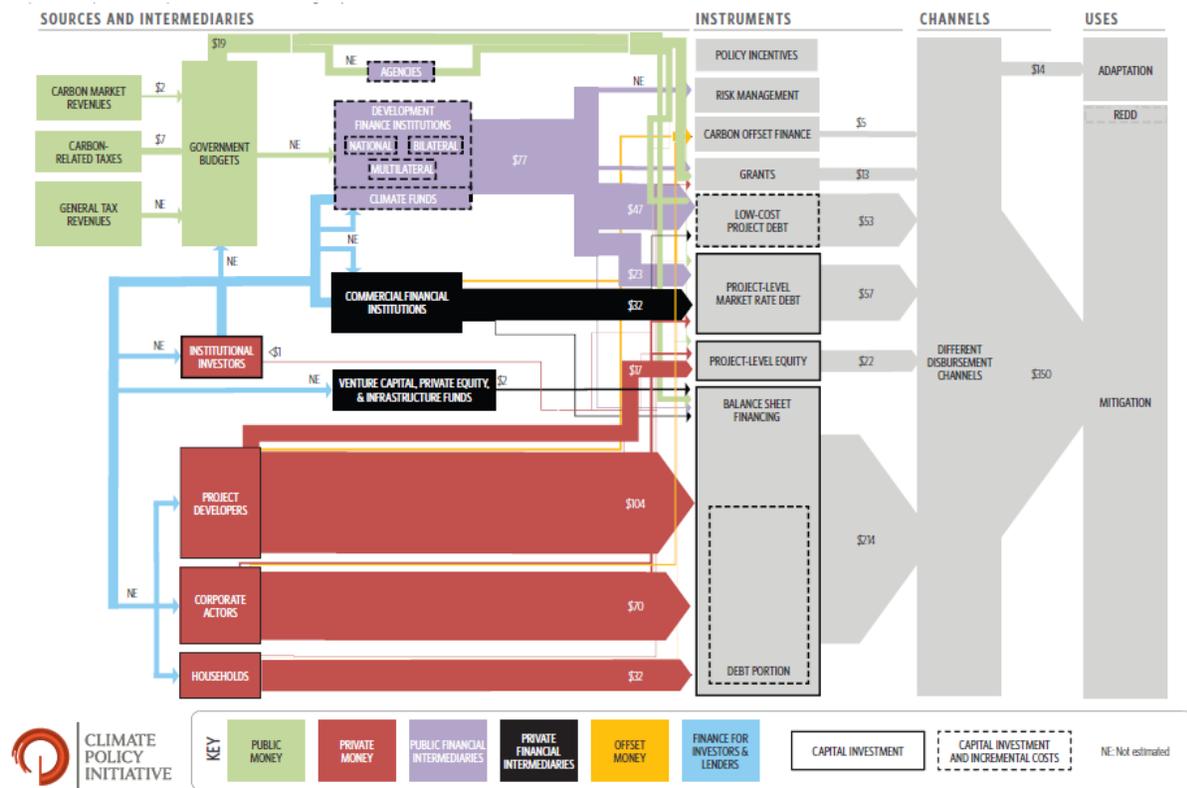
23. Development Finance Institutions (DFIs)⁹ support energy efficiency for energy security, climate change priorities, or other purposes, and this financing is on the rise. DFI energy efficiency portfolios include a wide range of activities including technical assistance and policy incentives, financial intermediation, direct investment in projects and programs, as well as piloting new financing models and combining and leveraging various streams of finance. According to the Climate Policy Initiative, governments and public financial intermediaries provided the following amounts in support of renewable energy and energy efficiency in 2010/11:

- National Finance Institutions (NFI): \$28.9 billion (67.7% of NFI climate financing), with strong concentration in two countries, Brazil and China;
- Bilateral Finance Institutions (BFI): \$3.6 billion (29.2% of BFI climate financing for renewable energy and 13% for energy efficiency);
- Multilateral Finance Institutions (MFI): \$13 billion (61.45% of MFI climate financing).

⁸ For a more detailed discussion see Buchner, Barbara, Jessica Brown and Jan Corfee-Morlot. (2011). *Monitoring and Tracking Long-Term Finance to Support Climate Action*. May 2011. OECD/IEA Project for the Climate Change Expert Group on the UNFCCC.

⁹ DFIs are defined in the CPI report as comprising 4 Bilateral Finance Organizations, 9 Multilateral Finance Organizations including the World Bank, and 19 National Finance Organizations.

Figure 3. Climate flows 2012



Source: Climate Policy Initiative (2012)

24. Overall, as outlined in Table 4, a number of financing tools exist that can address the various needs related to EE financing, from the policy/regulatory enabling environment, to investments and risk guaranties.

25. In 2012, multilateral development banks (MDBs) collectively committed more than \$25 billion for climate action, of which approximately 80% was dedicated to mitigation activities. In the order of \$12 billion is considered to have been allocated to sustainable energy, which includes energy efficiency, but the exact collective amount for energy efficiency has not yet been calculated.

Table 3. Possible financing partners – a non-exhaustive list

SOURCE OF FINANCING	DESCRIPTION
Investor capital formation	Investor capital is generated by bank, private and corporate investors responding to perceived investment opportunities offered by the market for an expanding range of EE appliances driven by technology improvement, growing consumer demand, increasing costs of energy, and increasing EE standards.
Multilateral Development Banks (MDBs)	MDBs and donors manage various loan facilities that seek to help developing countries eradicate poverty and achieve global development targets, under which EE is gaining importance as a financing/development priority.
Global Climate Change Alliance (GCCA)	Initiative of the European Union to build a new climate change alliance with developing countries, working through established channels for cooperation.
Global Energy Efficiency and Renewable Energy Fund (GEEREF)	A Public-Private Partnership designed to maximize private finance leveraged through European Commission public funds, managed by the European Investment Bank with a focus on financing SMEs.
Clean Technology Fund (CTF)	The CTF is one of the funding windows under the Climate Investment Funds (CIF), partnership of the MDBs that provides incentives to middle income and developing countries to scale up the demonstration, deployment, and transfer of technologies with a high potential for long-term GHG emissions savings, including EE.
Global Environment Facility (GEF)	The financial mechanism for a number of Multilateral Environmental Agreements (MEAs), including the United Nations Framework Convention on Climate Change (UNFCCC) and for CEITs under the MP. The GEF finances the incremental costs of project activities, i.e. only those that are being undertaken to meet the objectives of the MEA (global benefits). By 2011, GEF funding had supported over US \$140 million for EE projects.
German International Climate Initiative (ICI)	The ICI finances climate projects focused on, inter alia, promotion of a climate-friendly economy.
Indonesia Climate Change Trust Fund (ICCTF)	A national funding entity established by the Government of Indonesia, the ICCTF acts as a catalyst to attract investment and implement a range of alternative financing mechanisms for climate change mitigation and adaptation programs.
UK International Climate Fund (ICF)	Operational since 2011, the ICF is the primary channel for UK climate change finance, through which developing countries may receive funding to embark on low carbon growth.
Japanese Fast-Start Financing	Fast-Start Financing (or Hatoyama Initiative) makes available up to USD\$15 billion in public and private financial assistance to help developing countries address climate change.
Green Climate Fund (GCF)	Mandated by the parties to the UNFCCC, once operational the GCF is intended to provide funds to developing countries to finance climate change adaptation and mitigation activities, including for EE.
World Bank Carbon Finance Unit (WB CFU)	The WB CFU enters into transactions as Trustee of various carbon funds. Whilst originally the focus was on “project-based” transaction, using financing contributed by public and private sector entities from OECD countries to purchase project-based GHG emission reductions in developing countries and CEITs, the scope of its activities now includes programs as well broader considerations.

Source: Research undertaken for this report

Table 4. Energy efficiency financing needs, tools and examples; financing instruments available

Financing needs, tools, and examples	Available financing instruments
<p>Creation of enabling environment, including capacity building</p> <ul style="list-style-type: none"> • <i>EE regulations:</i> energy efficiency appliance standards and labeling, building codes, industry performance targets, fuel efficiency standards • <i>Regulatory reforms:</i> removal of subsidies (power and heating pricing reform), decoupling sales from revenues • <i>Technical assistance:</i> to ESCOs and other EE project developers to build an ESCO industry and prepare financing deals; to financial institutions to develop financial products; to government agencies on public procurement rules; to utilities on EE/DSM program; programs for cooling and heating design • <i>Government tax reform and incentives</i> 	<p>MDB resources are available to meet these costs.</p> <p>Grants from the GEF, Bank Trust Funds (ESMAP, ASTAE, PPIAF, PHRD, etc.), foundations, or other donors</p>
<p>Investment resources</p> <p><i>Private financing:</i> EE projects may be profitable and have short payback periods, but they suffer from other barriers such as inertia, principal-agent problems, or managerial challenges</p> <p><i>Long-term financing</i> can be provided to governments on a sovereign guarantee basis for the following:</p> <ul style="list-style-type: none"> • <i>Lending for energy efficiency:</i> Lending to municipalities or power utilities • <i>Lending to local financial institutions:</i> Lending stimulates on-lending for EE investments • <i>Public procurement:</i> Bulk procurement of energy-efficient retrofits for government buildings • <i>Green/Climate bonds:</i> support low carbon development/finance energy efficiency <p><i>Concessional element in financing:</i></p> <ul style="list-style-type: none"> • <i>Financial incentives:</i> Providing consumer rebates • <i>ESCOs:</i> Providing initial capital to set up ESCO industry • <i>Dedicated revolving EE fund:</i> Operating like a dedicated investment fund • <i>Utility EE/DSM fund:</i> Paying costs of utility-based efficiency programs 	<p>International or national investment capital may be used if investment meets risk-reward requirements</p> <p>Government resources and development banks may also be used</p> <p>Mobilized from private sector</p> <p>CTF, IDA (in low-income countries) Concessional financing from other donors (AFD, KfW, or JBIC) or GEF resources (for piloting or demonstration only), Govt may also provide this</p> <p>Carbon finance may assist with energy efficiency programs and provide additional revenue based on project generating emission reductions</p>
<p>Risk mitigation</p> <p>Partial risk guarantees for investments or technology (can also be supported with concessional finance)</p>	<p>The Multilateral Investment Guarantee Agency (MIGA), part of the World Bank Group, provides partial guarantees;</p> <p>The Global Environment Facility (GEF) has, in the past, provided limited risk guarantees on first-loss positions; Commercial bank & other risk guarantees are also available</p>

Source: Research undertaken for this report

26. *Private flows*, which are broadly defined as financial institutions and investors, corporate actors, and households represent the lion’s share of climate investment. In 2010/11, private flow investments amounted to approximately \$217-243 billion globally, or 63% of the total. Contributions from private intermediaries, commercial banks, and infrastructure funds

are considered to be in the order of \$33.1-42.8 billion. Here, even more so than for public sources, the information behind private flows for climate action is tenuous. Important data gaps exist and assumptions are often required given the multiplicity of sources and endpoints, confidentiality issues, and lack of data. It is difficult not only to quantify flows, but also to estimate to what extent they may have been stimulated by specific policy and regulatory actions.

27. Overall, without differentiating between mitigation and adaptation inputs, private actors contributed approximately \$85 billion to financing in developing countries, with 80% financed from their balance sheet. CPI (2012) further estimates that this contribution is largely internal to developing countries; that is, domestic private actors contributed up to 83% of the private investments in developing countries – making them a critical target for awareness raising and capacity building. In China for example, 79% of energy efficiency financing is estimated to stem from domestic private sources.

3.3. Carbon Finance

28. There are several types of carbon market instruments which developing countries could use to help finance the introduction of low GHG, ozone friendly, equipment:

- The Clean Development Mechanism (CDM);
- International and domestic voluntary carbon markets;
- Emerging domestic cap and trade systems; and
- New Market Mechanisms currently under development (NAMAs¹⁰, sectoral crediting, new types of offset instruments, e.g. the Japanese “Joint Crediting Mechanism”).

Carbon finance concepts

29. The United Nations Framework Convention on Climate Change (UNFCCC) governs climate change negotiations. The UNFCCC’s Kyoto Protocol (KP) in turn contains the targets and timeline to which so-called Annex I Parties¹¹ agreed to reduce their GHG emissions as well as the flexible mechanisms they may use in meeting their targets. Parties who ratified the Protocol can either meet their emission cap through domestic action, or they may purchase

¹⁰ Nationally Appropriate Mitigation Action (NAMA) refers to a set of policies and actions a country commits to undertake to address its climate change challenges and low carbon development goal. These may include scaling up of renewable energy development, energy efficiency measures, forest management, solid waste management, public transportation etc. As of September 2012, about 50 countries had submitted information regarding their NAMA to the UNFCCC and one of the mechanisms to support the framing and implementation of NAMAs is through the Partnership for Market Readiness. Resources from both public and private sectors at domestic and international levels need to be mobilized for countries to take actions.

¹¹ Countries with legally binding emissions objectives under the KP include those that were members of the OECD in 1997 (when the Protocol was negotiated and adopted) and the countries with economies in transition. While most Annex I Parties observed the Protocol’s first Commitment Period (2008-12), the USA never ratified the Protocol and Canada withdrew after having ratified it. The Protocol’s agreed second Commitment Period is supported by even fewer countries (essentially only the European Union). A new climate treaty with broader participation is currently being negotiated and planned to come into force in 2020.

emission quotas (“Assigned Amount Units”) from other Annex I Parties or project-based carbon offsets (“Certified Emission Reductions”) from developing countries through the Protocol’s Clean Development Mechanism (CDM). Outside the Kyoto Protocol and the demand generated by Parties needing to meet legally-binding emissions targets, a (smaller) voluntary carbon market has also emerged consisting of voluntary demand for emissions offsets not required for regulatory compliance.

30. CDM projects are activities that can demonstrate that they will reduce GHG emissions (measured in tons of CO₂ equivalent - tCO₂-eq) compared to a baseline, usually the business-as-usual (BAU) scenario. For example, a project which proposes to install energy efficient air conditioners compared to the baseline equipment and which can demonstrate that this activity results in reduced consumption of energy and hence lowered CO₂ emissions (from power generation, based on the GHG intensity of the power grid) may qualify as a CDM project¹². CDM projects must also contribute to meeting the sustainable development objectives of the host country. The same principle is typically applied by standards and emission registries that facilitate carbon offset projects and the generation of carbon credits for the voluntary market. Carbon finance concepts are described in detail in Annex III.

31. Carbon finance projects and the emission reductions they generate are normally registered, either with the UNFCCC (for CDM projects) or with a registry in the voluntary market, after they have been verified to meet the required standards. Registration will usually enable the project developer to sell the expected or the verified and registered actual emission reductions (certified emission reductions - CERs - under the CDM) to another party wishing to offset its own CO₂ emissions. The sale of emission reductions from a carbon offset project will usually generate an income stream that will support the project over time, but which may also be used to raise project finance. That is, at least initially, the CDM – and carbon finance in general – were also thought of as a financing mechanism for investments in energy efficiency and cleaner technologies in developing countries. However, carbon finance was not in fact designed to address investment barriers in underlying projects as most carbon purchasing contracts (e.g., emission reductions purchase agreements - ERPAs) consider payments for credits upon delivery. Therefore, project developers have found this form of project finance difficult to access, since commercial banks were reluctant to accept ERPAs as collateral for their loans. It should be noted, however, that this touches on a more general issue of financing of demand-side energy efficiency with future energy savings, and that this difficulty is not inherent to the CDM only.

32. Project-based carbon finance instruments are structured as performance-based payment schemes with internationally defined overarching principles and methodologies for assessing project eligibility and quantifying, monitoring, reporting, and verifying GHG impacts of project activities. Project-based carbon finance has been instrumental in reducing emissions of

¹² A similar Kyoto Protocol mechanism, known as “Joint Implementation,” exists for emission reduction projects in Annex I countries.

short-lived climate pollutants (SLCPs), such as methane, from waste management operations, and HFCs, from chemical plants, which are covered by the mandate of the Kyoto Protocol.

Targeting HFC-23 incineration with the Kyoto project-based mechanisms

33. Some CDM projects were developed to support the incineration of HFC-23, which is generated as a by-product in the production of HCFC-22, a Montreal Protocol-regulated chemical, either for refrigerant or as input ('feedstock') for the further production of synthetic polymers. This is described in more detail in Annex IV. Given the high GWP of HFC-23, plant operators were, until recently, able to earn significant revenue through the carbon offset market, far exceeding the cost of purchasing, installing and operating HFC-23 incinerators and the transaction costs linked to the carbon market. However, concerns over the abundance of HFC-23 credits and with the risk/perception for perverse incentives, and questions regarding their additionality and contribution of these activities to host country sustainable development, all led to a decision in 2012 by the EU to no longer allow the use of carbon credits from such projects for compliance within the EU Trading Scheme (ETS), thereby effectively halting most carbon finance flows to HFC-23 destruction projects.

34. Therefore, while carbon finance proved extremely effective in early years at catalyzing investments for mitigation of HFC-23 releases, eligibility restrictions on CERs associated with GHG reductions from the destruction of HFC-23 in the EU-ETS is having a big impact and raises doubts that this mechanism could be expanded to help finance future ODS mitigation efforts.

Destroying ODS Banks with the voluntary carbon markets

35. At a much smaller scale, voluntary carbon markets are creating incentives for the recovery and destruction of ODS, as described in more detail in Annex IV. While the MP regulates the production and consumption of ODS, a significant amount of ODS still remains contained in equipment, products, and stockpiles, and risks being released into the atmosphere in the absence of appropriate regulatory or financial incentives. Activity has, thus far, been limited, except in California where transactions have increased in number and volume from 2010 to 2012. The level of interest expressed remains low however in comparison to the volume of ODS potentially eligible for destruction, as provided by some estimates.¹³ Moreover, the voluntary markets today are suffering from the same uncertainties and depressed prices as the CDM, though they appear less affected.

Assessment of carbon market experience and risks based on 12 years of operation

36. The main suppliers of CERs have been China, India, Brazil and Mexico, accounting for over 95% of all CERs issued to date. Over 62% of CERs issued derive from industrial gases projects including HFC-23, N₂O, and perfluorocarbon (PFC) projects which have been attractive

¹³ See "Study on Financing the Destruction of Unwanted Ozone-Depleting Substances through the Voluntary Carbon Market," ICF International (2010).

targets for CDM projects in the early stages of the carbon market, taking into account their high GWP, high concentration, and the relatively robust financial and technical nature of their industrial emission sources. Conversely end use energy efficiency projects, including those in the Ref/AC and chiller replacement sectors, have made negligible progress, with fewer than 10 projects issuing CERs, each in small amounts.

37. Overall, while carbon finance instruments have established very detailed procedures for accounting of, and banking on, GHG emission reductions, they are not without risk, for the following reasons:

- (i) carbon finance instruments pose risk for both project developers and buyers of carbon credits. For the former, carbon finance procedures are burdensome, projects are time consuming to develop, and they present risk with regard to the possibility of non-registration, or, if registered, with regard to the possibility that expected volumes of emission reductions may not be issued – the CDM board is looking at measures to improve the efficiency and effectiveness of the CDM. From the perspective of the buyer, if the expected income from a carbon finance project is critical to the success of a project (related to the additionality criteria), such risks may be perceived to be too high to proceed with carbon financing;
- (ii) program design and successful delivery: there are transaction costs associated not only with dealing with multiple dispersed sources of financing, but also associated with programs involving smaller interventions; how to bundle these and coordinate activities to generate an attractive package has been a key challenge. In this regard, significant progress has been made under the CDM’s programmatic approach;¹⁴
- (iii) carbon finance rules do change from time to time and while some simplifications have been introduced, revisions of rules and modalities often lead to greater stringency;
- (iv) the recent severe downturn in prices of emission reductions resulting from a lower demand associated with economic downturn does not encourage the use of carbon finance at this time. Nonetheless, a number of actors, including the European Union and the World Bank, are exploring measures and means to revitalize the market; a new round of carbon finance is expected to emerge, linked to a new climate treaty entering into force – none of this in the short term.

38. Despite its complexity, the CDM was quite successful in terms of number of projects and capacity built in developing countries, upon which the new generation of carbon finance instruments builds. Carbon finance programs however can take anywhere from 3 – 6 years to deliver an actual revenue stream associated with the value of the carbon credits, and given the current market situation, they do so at very low rates of return. As a result, this serves as a disincentive for any project that would be dependent on carbon finance income.

¹⁴ Small-scale methodologies, programs of activities and micro-projects have been promoted, leading to several CDM projects addressing efficient lighting, micro-hydro etc.

3.4. Current Status of Carbon Markets

39. Glut of carbon assets from CDM at time of severely contracted demand. In the order of 2.4 billion tons of CO₂eq carbon credits were contracted during the 2002-2011 period from both developing countries and countries with economies in transition. These contracts reached a cumulative total worth of US\$28 billion in carbon credits and supported underlying investments of more than US\$150 billion in developing countries, principally from the private sector.¹⁵ Since 2011, the market has contracted in reaction to the end of the first Kyoto Commitment Period and EU restrictions on the use of CDM credits from new projects (except in LDCs) in the third phase of the EU ETS. Whereas in 2007 636 million primary¹⁶ CERs were traded for \$8.2 billion, by 2011 this had declined to just 263 million primary CERs at a value of \$2.9 billion.¹⁷ And though November 2012 saw the registration of the 5000th¹⁸ project by the CDM Executive Board, at the same time the price of primary CERs dropped to under \$1 compared to the \$20+ value they commanded in 2008. The voluntary market has been somewhat less impacted, but has also seen a drop in prices.

40. Carbon market outlook for 2013 to 2020: It is projected that approximately 2.5 to 3 billion CERs¹⁹ will be issued from projects registered before the end of 2012 against a demand of no more than 1.5 billion CERs, largely due to restrictions following the economic downturn in the world's largest market, the EU ETS, which has historically driven demand for CERs. The voluntary carbon market, which is smaller, may face similar difficulties. Therefore, CER prices are expected to remain depressed, which provides little incentive to the market to develop new CDM projects.

41. Decisions emanating from UNFCCC Conference of the Parties, Doha post 2012: The flexible mechanisms of the Kyoto Protocol (CDM, Joint Implementation and emissions trading through Assigned Amount Units) continue to exist as compliance instruments for the Parties²⁰ to the second commitment period from 2013-2020. However, no additional compliance demand for carbon assets will result, given that a review of commitments will not take place until 2014, and no significant actions were taken to address the current position of the carbon market as outlined above.²¹

¹⁵ Bloomberg New Energy Finance, 2012. Reference to investments in 2010 and 2011.

¹⁶ "Primary" CERs are purchased from the original party that makes the reduction.

¹⁷ This represents a 2011 monetary value of forward (primary) project-based transactions for generation of pre-2012 and post-2012 CERs, ERUs and voluntary market (see State and trends of the carbon market, 2012, WB).

¹⁸ As of May 13, 2013, 6,830 projects have been registered. <http://cdm.unfccc.int/>

¹⁹ Undiscounted and risk adjusted values are over double this figure.

²⁰ Excluding Japan, New Zealand and Russia, but including Belarus and Kazakhstan with emission caps.

²¹ The following actions which are expected to provide results in the medium term were agreed to : The Green Climate Fund, intended to be operational in 2014 – though progress has been slow in setting this up; Germany, the UK, France, Denmark, Sweden and the European Commission announced concrete finance pledges in Doha for the period up to 2015, totaling approximately 6 billion USD; a work program to further elaborate the new market-based mechanism under the UNFCCC, and set out possible elements for its operation; and a work program to develop a framework for recognizing mechanisms established outside the UNFCCC, such as nationally-administered or bilateral offset programs, and to consider their role in helping countries to meet their mitigation targets.

42. The European Union (EU) policy changes: Carbon credits which are generated from projects in non-LDCs registered before end of 2012 will remain eligible under the European Emissions Trading Scheme, while those registered after 2012, or from industrial gasses projects, including from HCFC-22/HFC-23 projects, have become ineligible under the EU ETS post-2012.

43. Implications of current CDM and joint implementation²² (JI) market for phasing out HCFCs: Given the lack of demand for emission reductions, which is projected to last through the mid-term, coupled with the continued projected low price of emission reductions and the EU position, carbon finance as currently configured does not present a reliable financing option to support the phase out of HCFCs, especially for MICs.

44. In the post-Kyoto area, the CDM will likely lose its dominant role and be supplemented by new generations of international and domestic carbon market instruments (e.g. NAMAs, Bilateral Crediting Mechanism (Japan), policy and sector-based crediting). This is relevant since the concept of synergies may most effectively be introduced at the formative stage of these new mechanisms. Examples exist in the international and increasingly domestic voluntary carbon markets, where for instance the “Gold Standard”²³ enhances its carbon credit offerings by certifying and monetizing additional sustainable development benefits. It should, for instance, be possible to define a carbon asset class that certifies energy efficiency and GHG reductions, or ozone and climate benefits.

45. The focus in climate finance circles is now turning towards developing a new and wider array of climate finance instruments which could, amongst other things, better support energy efficiency and related ODS phase-out efforts.

3.5. Emerging Domestic and International Schemes

46. Despite the challenges facing the global CDM-based market, many countries have learned from the experience and now are exploring innovative and cost-effective ways to scale up emissions reductions and foster financial flows, including through carbon market instruments. Much of the current focus of the international community is towards the next generation of carbon mechanisms that aim to target “broad segments of the economy” and towards the linking of emerging domestic carbon markets. Under the Partnership for Market Readiness (PMR), a grant-based, global partnership, the World Bank is working with a number of developed and developing partners, representing some of the world’s largest economies, to build readiness for market-based instruments for GHG emissions reduction. To date, nearly \$30 million in grant funding has been allocated to 16 nations to support the design and

²² The “joint implementation” mechanism defined in the Kyoto Protocol allows a so-called Annex B Party (industrialized countries, roughly equivalent to non-A5 countries under the MP) to earn emission reduction units from a project in another Annex B Party. This is therefore relevant for the Countries in Economies in Transition, and not directly relevant to MLF supported activities.

²³ The Gold Standard is a certification standard for carbon mitigation projects, recognized internationally for its quality and rigor in both the compliance and voluntary carbon markets - <http://www.cdmgoldstandard.org/>.

development of market approaches to greenhouse gas emission reductions. This includes development of monitoring, reporting, and verification systems and consideration of scaled-up crediting mechanisms and domestic cap and trade schemes to cost effectively meet given emissions caps and national mitigation objectives, and to promote energy efficiency in response to rising power costs and demand, growing supply bottlenecks, and energy security issues. Some examples, including support for developing Nationally Appropriate Mitigation Actions (NAMAs),²⁴ are outlined in Table 5 below. Moreover, PMR participants have recently agreed to explore opportunities to pilot emission reductions transactions in connection with a payment facility to purchase emissions credits generated as part of the Partnership's activities.²⁵

Pay-for-Performance mechanisms

47. Pay-for-performance mechanisms (also known as results-based finance) are also being developed that build on the experiences of the international community with carbon finance, and with output-based aid. Such schemes disburse cash on the delivery of pre-determined and independently verified results. Compared to traditional funding mechanisms, pay-for-performance provides increased transparency and accountability along with greater scope for innovation that can also be a powerful catalyst for private investment and maximize public value for money. Pay-for-performance mechanisms present opportunities for short-term climate mitigation interventions and can serve as stop-gap measures to breathe new life into carbon markets.

48. At the request of the G8, the World Bank convened a group of experts, the Methane Finance Study Group, which released its report in April 2013 evaluating new approaches to financing methane reduction activities. An innovative recommendation from the Group is to establish a climate finance facility that would use payment for performance against independently verified emission reductions to provide incentives for methane abatement projects, and rely on an auction mechanism to ensure the lowest possible cost to the funder. There is a great deal of interest in this initiative, and the partners in the Climate and Clean Air Coalition subsequently agreed in September 2013 to establish a similar Study Group to review potential strategies for supporting financial flows towards projects that can significantly reduce black carbon emissions.

²⁴ Nationally appropriate mitigation actions (NAMAs) are domestically developed voluntary initiatives adopted by developing countries to mitigate their GHG emissions. Countries develop NAMAs for those sectors which most interest them, for example renewable energy (e.g., geothermal) or energy efficiency (e.g., energy efficient buildings or equipment). The financing of NAMAs will use domestic resources or resources provided by donor countries ("supported NAMAs") including through carbon markets ("credited NAMAs"). The UNFCCC has established a website for the submission of information on NAMAs and for donors to review and decide if they wish to support a particular NAMA.

²⁵ Strategic orientation for the future of the Partnership for Market Readiness, PMR Secretariat, October 2013
http://www.thepmr.org/system/files/documents/PMR_Draft_Strategic%20Note_October2013.pdf

Table 5. Examples of relevant country undertakings under the Partnership for Market Readiness

COUNTRY	PMR ACTIVITIES
Brazil	Brazil has a voluntary commitment to reduce emissions by 36.1%-38.9% below business-as-usual by 2020. The country is currently considering mitigation plans that cover the forestry, agriculture, energy, iron, steel, transportation, mining and building sectors. As part of its proposed PMR activities, Brazil is analyzing different carbon pricing instruments suitable for given sectors.
China *	China aims to reduce emissions intensity by 40-45% compared with 2005 levels by 2020. In order to achieve this objective—and as included in its 12th Five-Year Plan—China looks to create statistical and verification systems for GHG emissions and to pursue pilot emissions trading schemes (ETS) in five cities and two provinces. The country aims to set up a national scheme by 2015. China’s market readiness plan, supported by financing from the PMR focuses on the design of China’s national emissions trading scheme, including (i) core technical, institutional and regulatory market readiness components; (ii) design elements of main ETS components; and (iii) specific consideration and research on issues facing State-owned enterprises and the power sector in a carbon emissions trading scheme.
India *	India aims to reduce its GHG carbon intensity by 20-25% compared with 2005 levels by 2020 as a voluntary commitment. Energy efficiency measures are being promoted and scaled up to permit these significant reductions in energy intensity. India’s Perform Achieve and Trade Scheme (PAT) is an existing market-based mechanism that covers 8 industrial sectors; it was developed to enhance the cost effectiveness of improving energy efficiency through certification of energy savings that may be traded using energy savings certificates (ESCerts). The PAT aims to accelerate a shift to energy efficient appliances in designated sectors through the use of innovative measures to make products more affordable, and creating mechanisms that would help finance demand side management programs in all sectors by capturing future energy savings. To further intensify these efforts, India is working through the PMR to develop reporting guidelines for EE and expand sectoral coverage of the PAT. This scheme is particularly interesting due to its innovative nature and potential for replication in other countries.
Indonesia*	Indonesia plans to reduce its national GHG emissions by 26 percent from its BAU scenario by 2020 and by an additional 15 percent with international support. With assistance from the PMR, Indonesia plans to build MRV systems for the power sector and its cement industry as well as conduct research and consensus building activities on the future use of market-based instruments.
Jordan *	The PMR is helping Jordan explore the potential for scale-up of crediting for NAMAs in renewable energy, water (energy efficiency in pumping, waste water treatment) and/or solid waste management sectors.
Mexico	Mexico pledges to reduce up to 30% of its emissions by 2020 compared to its baseline scenario, dependent on international support and participation in external markets. As part of its PMR Activities, Mexico is focusing on the development of three crediting NAMAs in the following target areas: (i) urban services; (ii) appliance/refrigerators; and (iii) urban transport, as well as on the elaboration of a national registry/tracking tool for emissions data collection, and a management and reporting system.
Thailand *	Thailand seeks to lay the groundwork for a low carbon society, as outlined in its 11th National Economic, Social, and Development Plan, and to reduce energy intensity by 25% by 2030 as compared to 2005 levels and to increase the share of alternative energy to 25% of final energy consumption by 2021. PMR support in Thailand will help create an Energy Performance Certificate scheme (EPC) and a pilot Low Carbon City Program (LCC).
Vietnam *	PMR support in Vietnam will, inter alia, help design and pilot market instruments in the steel, solid waste, and power (energy efficiency) sectors. Vietnam's emissions reduction strategy focuses on energy efficiency and large-scale renewable energy production. The country aims to reduce energy consumption per unit of GDP by 2.5-3% per year by 2020 and to reduce greenhouse gas emissions relative to its BAU scenario by 2-3% per year from 2020 to 2030. Vietnam is also developing a Green Growth Strategy that envisions emission reductions from the energy sector by 10% relative to BAU (and 20% with international support) by 2020.

* Indicates countries with whom the World Bank is working on HCFC consumption and production projects.

Source: this report, based on <http://www.thepmr.org/>

4. OPPORTUNITIES FOR SYNERGY: BUILDING ON EXPERIENCE

4.1. Experience with Multi-Source Financing: the “Chiller Replacement” Cohort of Projects

49. A cluster of projects targeting the conversion of building chillers with the explicit intent to address servicing uses of CFCs, potential climate co-benefits, and identification of additional financing from other sources offers useful insight and lessons learned regarding securing and implementing multi-source financing .

50. The analysis reviews the achievements and on-going challenges associated with five projects: India, Indonesia, the Philippines, Thailand, and Turkey. This analysis does not constitute a formal evaluation, nor is it comprehensive. Rather, it provides a qualitative overview of some of the difficulties encountered at the various stages of implementation, and reflects upon the lessons that may be extracted and serve as possible guidance for such future work. The details for each project are presented under Annex V.

51. Overall experience with this cohort of projects has been mixed, and this even though chiller replacement allowed unusually large energy efficiency gains (30% and more), thereby providing a rapid return on investment. While they represent a clear effort to acknowledge synergies inherent amongst the different global environmental conventions and their financing mechanisms, they also speak to the complexities that can arise as additional financing partners become involved, as well as when a “blended” approach applies in name only. Such challenges have ranged from an inability to synchronize the timing of financing approvals, the collapse of the carbon market, the impact of the 2008 financial crisis, competing institutional, governance, and implementation arrangements (e.g. dual reporting), namely under the MLF and GEF, and issues regarding the acceptability, suitability, and commercial availability of alternatives.

52. In general and as noted earlier in the report, the difficulty of truly leveraging underlying investment with carbon finance revenues has been a challenge for the carbon finance experience thus far. Here, carbon finance in and of itself has not driven the financing of chiller projects largely due to doubts associated with the status of the CDM in light of the political uncertainty regarding the post-Kyoto timeframe, as well as the current depleted state of the carbon market. Where the integration of carbon finance has been tested, it has tended to overburden projects with heavy monitoring procedures and, in general, higher transaction costs. Moreover, within the context of chiller replacement, one barrier lies in the opportunity cost of access to up-front financing for the investment, a challenge that can also be compounded by low energy tariffs. The India experience, in particular, shows that as a result of this barrier (and a lack of trust in carbon markets), participants will choose up-front compensation over greater compensation in future – the CER price level being a factor of course.

53. Lessons drawn from an extensive study on chiller replacement in India formed the basis of the World Bank's design to secure MLF financing for the global chiller demonstration program. Based on the recognition that carbon finance would not address the opportunity cost barriers, the strategy adopted was for MLF and GEF funding to cover the upfront costs for the first round of chiller replacement and, once carbon finance returns started to flow, these could in turn be utilized for upfront financing to bring additional chiller owners onboard. Unfortunately, this premise could never be effectively tested given the global economic downturn and subsequent collapse of the carbon market.

54. Experience with these projects has also demonstrated that multi-source financing tends to lead to heavy implementation structures and procedures. There is a need to simplify procedures and processes not only to streamline obtaining financing from multiple sources, but also with respect to reporting requirements imposed during implementation. At present, for example, it is a requirement to maintain strictly separate progress reporting and accounting of relatively small amounts of MLF and GEF financing for 'blended' projects, despite the similarities between the instruments and their quasi identical shareholder base. The design of similar future projects should strive to substantially simplify procedures and minimize additional administrative requirements, and should consider exploring the potential for joint project design, approval and oversight functions in order to enhance efficiency and reduce transaction costs.

55. Turkey's experience demonstrates how positive results derived through application of a simple and targeted project design can rapidly deliver the desired market transformation. Here, non-grant instruments were used to overcome the opportunity cost, low energy tariffs and lack of fiscal incentive barriers that were faced. The Turkish counterparts who managed the project on the ground offered an attractive financing package (zero interest loans with three year payback periods) and also actively promoted chiller replacement, which ultimately led to the project achieving a high success rate.

56. One broad lesson that can be drawn from this suite of projects is that concessional financing is important for this type of project, and is particularly relevant as it also benefits and can leverage funds for climate mitigation. It is especially important where, as in this instance, there are multiple barriers to be addressed: operational complexity, with multiple project cycles of different institutions and funding mechanisms (including GEF and MLF); regulatory/policy uncertainty (state of the CDM); and technical difficulties (choice of refrigerant).

57. As noted above, the market for primary CDM interventions has dropped to its lowest level since 2004, linked to declining demand for offsets resulting from economic turbulence, a growing long-term oversupply of carbon offsets in the EU ETS, and plummeting carbon prices. This has impacted the vision behind the strategy governing the more recent group of projects, requiring that they be restructured to adapt to the new context in order to deliver the best possible outcomes in terms of chiller replacement.

Box 1. *The “chiller replacement” cohort of projects – Key lessons*

- Five “chiller” projects were implemented or prepared by the World Bank; four envisaged multi-source financing with GEF co-financing, of which three also envisaged a carbon finance (CDM) revenue stream.
- The most successful of the five projects, based on the number of chillers replaced, is the oldest one (for Turkey) which, whilst it promoted an innovative revolving fund for chiller replacement, relied on a single source (MLF) of international financing.
- The projects that had envisaged relying on a CDM revenue stream had to drop that component. It is difficult however to tease out intrinsic project design /CDM delivery issues from the overall collapse of the CDM – in other words, these projects might have been fully successful had the CDM not collapsed (and more countries ratified the Kyoto Protocol).
- There is some evidence however that carbon finance led to overburdening the projects with monitoring and verification procedures which were unattractive to chiller owners.
- Technical issues (i.e. choice of refrigerant) were the source of irreconcilable differences, ultimately leading to the cancellation of one of the projects (Indonesia).
- Blending MLF and GEF resources has been a source of delay related to different project cycles and approval procedures, despite similarities in instruments and quasi identical shareholder base.
- Blending MLF and GEF resources has also lead to heavy implementation structures and procedures, with requirements for separate progress reporting and accounting of relatively small amounts of grant financing – these procedures should be streamlined and simplified.

These lessons derive from a qualitative and non-exhaustive analysis of experiences with the cohort of “chiller” projects implemented by the World Bank, rather than from a formal evaluation. These lessons in general are relatively nuanced; the more detailed overview provided in Annex 5 of this report provides a more thorough description of the challenges and opportunities.

58. Taking this experience into account and looking more broadly, some options might be explored to avoid compartmentalization and facilitate multi-benefit or synergetic approaches. Financial resources could be pooled upfront from different sources and funds (e.g. GEF and MLF) and under a specific mandate to address synergies more systematically to effectively create a seamless single-window for project proponents and implementers. In the longer term, a single funding mechanism that would address environmental benefits on a broad basis (e.g. including national and local benefits) could also be envisaged. With a more robust carbon market, benefits generated could be converted into assets to be monetized in emerging environmental markets (such as the carbon market) and/or sold to (or reimbursed by) specialized funds or interested parties. Although such an approach is not without governance and administrative complexities and risks (political and market related), the Green Infrastructure Investment Fund²⁶ (GIIF) that is being developed in the East Asia Pacific Region, for example, is exploring comparable avenues.

²⁶ The recent World Bank study on a Green Infrastructure Investment Finance framework to stimulate greater flow of funds for green investments in EAP countries is primarily oriented toward promoting private investments, but can also serve to accelerate public-private partnerships as well as purely public engagements. The framework consists of an analytical methodology to assist policy makers in deriving the financial “viability gap” of green investments, and a country assessment

4.2. Some Relevant Models for Phasing out HCFC-22 in the Residential Sector

59. Two main approaches have been adopted by developing countries in promoting new Ref/AC technologies from the energy standpoint. First is the set of policy-based approaches using appliance energy efficiency standards (along with appliance energy efficiency labeling systems), and often in conjunction with building energy efficiency codes. This approach is primarily focused on new stock and works well in countries where energy (electricity) pricing is rational and where the compliance regime is robust, with infrastructure available (testing laboratories, etc.). However, as a short-term measure, often the second approach of financial incentives is adopted, especially where there are limited incentives for consumers to adopt new energy efficient appliances or replace existing appliances with new ones as these are both more expensive and manufacturers are unwilling to promote these into the market in the absence of binding regulations and consumer demand. The choice among mandatory regulation (efficiency standards), incentives (subsidies in various forms), and purely voluntary programs (e.g., labeling and disclosure of efficiency ratings) is of relevance to appliances and therefore refrigerants. Most of the World Bank's interventions in the areas of appliances, including refrigeration and air-conditioning, are in the second category – that is based on financial incentives - as governments often find it difficult to rely solely on standards and labeling enforcement.

60. The following section explores examples that have been developed recently or that are under development, and that offer promising models for addressing climate co-benefits, particularly in the residential sector.

The Mexico Efficient Lighting and Appliances Project (ELAP)

61. The Mexico ELAP paradigm highlights a number of key characteristics that can serve to inform the design of a cross-cutting ozone-climate co-benefits model. The project was approved in November 2010, with a development objective to promote Mexico's efficient use of energy and mitigate climate change through the increased use of energy efficient technologies at the residential level. The vehicle by which to achieve these objectives is to promote the development of a sustainable market for energy efficient equipment among the large and fast growing energy end-use sectors for lighting and Ref/AC.

62. The project has three components, including the replacement of 45 million incandescent bulbs with compact fluorescent lamps (CFLs) in the low to medium-income residential sector, targeted technical assistance, and institutional strengthening. Of particular relevance are the incentives designed to encourage the replacement of old and inefficient appliances, namely refrigerators and air-conditioners in the residential sector.

framework to allow a better understanding of a country's investment climate in general and green investments climate specifically. (<http://documents.worldbank.org/curated/en/2012/04/16253049/green-infrastructure-finance-framework-report>)

63. The value of the project is estimated to be \$714 million and its financing structure includes a blending of World Bank financing, composed of loans from the IBRD and the CTF, as well as a GEF grant. This is complemented by financing from the Government of Mexico, the National Development Bank (NAFIN), and Mexican consumers (see Figure 1 in Annex VI).

64. The project is of particular interest to this study, given a focus on phasing out CFC-12 based appliances in the residential sector, and its support for the Appliances Replacement Program under the Government's national program on energy efficiency, which targets the replacement, including collection and scrapping, of approximately 1.7 million old (more than 10 years) and inefficient REF/AC appliances over a four-year period.

65. Two types of incentives are being proposed: 1) the provision of vouchers as instant discounts to low-income consumers, and 2) the provision by NAFIN of credits, at favorable interest rates, to middle-income and other qualifying consumers. Resources from the IBRD loan to the Government co-finance the vouchers, those from the CTF loan to NAFIN support the credits, and resources from the GEF grant capitalize the guarantee facility that protects NAFIN from credit defaults by consumers.

66. Carbon finance is also considered in connection with the appliance replacement program and Ref/AC disposal activities under Component 2, where MLF resources have supported an assessment of opportunities for financing the destruction of ODS through the voluntary carbon markets.²⁷

67. *Qualification of Efficient Appliances by Consumption Level.* In order to qualify as an eligible appliance under the program, refrigerators and air conditioners must meet specific EE requirements above the Minimum Efficiency Performance Standards approved by the Government. In addition, appliances must also meet certain size requirements, which vary by consumption level, reflecting limitations on size for consumers who benefit from the larger subsidies provided by the vouchers as compared to the credits.

68. *Integration with Mexico's Domestic Refrigerator Nationally Appropriate Mitigation Action.* This proposal is being developed as a potential crediting NAMA and will be elaborated during the implementation of Mexico's Market Readiness Proposal with funding from the Partnership for Market Readiness. A description²⁸ is included on the PMR website. The Domestic Refrigerator NAMA is an initiative driven by the National Association of Home Appliance Manufacturers (ANFAD), whose intention it is to introduce, on a nationwide scale, more EE technologies that use refrigerants with significantly lower or zero GWP. The domestic refrigeration technology currently sold in Mexico is based on HFCs, predominantly R-134a which has a high GWP of 1300. The move away from the use of HFCs, combined with enhanced energy savings, will contribute doubly to the country's climate change mitigation efforts.

²⁷ "Disposal of ODS in Mexico", World Bank (2012)

²⁸ http://www.thepmr.org/system/files/documents/Mexico_MRP_Final_Refg_19-02-2013.pdf

69. The NAMA proposal scales up the World Bank efficient appliances project described above. Although older, inefficient refrigerators and air-conditioners are still in use, the market has been steadily moving towards adoption of HFC-134a appliances. Based on imports and domestic production capacity data, the Mexican market share for refrigerant fluid currently shows 98 % HFC-134a and 2 % hydrocarbon.²⁹

70. The NAMA aims to phase in HFC-free energy efficient technology to cover 100% of the domestic market in Mexico (2.4 million units per year in 2012) within a 5-year timeframe. The estimated mitigation potential from the electricity to be saved is in the order of 4.6 million tCO₂-eq accumulated over a 15 year period. Piloting the NAMA with the introduction of 100,000 new refrigerators is estimated to cost around \$770,000 for operational costs and \$3,250,000 for the coverage of the incremental cost of the new technology (\$30/unit), plus \$21,160,000 for loans to the end users, which will be paid back through household electricity bills. A visual representation of the NAMA's implementation arrangement is presented in Annex VI, Figure 2.

71. The design of this initiative still needs to be elaborated and operationalized, along with identifying funding sources. While a number of key elements will need to be in place to ensure success, financing will be key. If successful, the design of both initiatives - vouchers and low-interest loans for consumers, and financial incentives for manufacturers - could be adapted and replicated to HCFC appliance phase-out in other developing countries. This would demonstrate that energy saved in the Ref/AC sector can be associated to quantifiable emission reductions, and that carbon finance holds the potential to play an important role in harnessing additional resources to incentivize consumers and/or appliances manufacturers.

Directly Improving Equipment Efficiency

72. In addition to the more traditional demand-side management approach typically followed by energy efficiency programs, World Bank Energy teams have been working with clients to design interventions that directly target manufacturers and seek to improve the efficiency of equipment. Innovative mechanisms are being developed to provide financial incentives to manufacturers to create price parity for the more efficient product without creating market distortions. Strong monitoring and verification elements are introduced to test quality and conformity of the product with the agreed specifications. In principle, such innovative design could be envisaged and would be potentially applicable to support climate co-benefits in parallel with MP funding towards an ODS-free transition. This model is particularly relevant and attractive because such relatively rare example of supply-side intervention in the climate change/ energy efficiency domain can readily match the types of conversions that are typical of MP interventions, and apply to Ref/AC equipment, including with MLF funding targeting the refrigerant.

²⁹ World Bank Project Appraisal Document

Model Scenario for the Residential Sector

73. Many residential energy efficiency equipment programs have been developed and implemented in developed and developing countries; ODS phase-out activities can be included in the design of these activities. Based on this experience, some complementary features of an energy efficiency equipment transformation programs could be as follows: (i) strong regulation and enforcement including inspection at import points, manufacturers, retailers or the installation points for larger equipment to ensure compliance with standards; (ii) standards and labeling to demonstrate to inspectors and consumers compliance with regulations; and (iii) financial incentives to overcome initial financial barriers/higher costs until the new standards become common practice. Incentives can take the form of loans, grants, tax incentives, or initial subsidies to the power sector, suppliers/retailers, or consumers depending on where the financial barrier is found and can be most efficiently overcome. The Mexico example which may serve as a model addresses these key points by providing the consumer with information about the efficiency of the new technology against the minimum energy performance standards, supported by a labeling program and financial incentives for manufacturers and/or consumers.

74. In the case of regulatory approaches/policy tools to promote energy efficiency of Ref/AC equipment such as appliance Minimum Energy Performance Standards (MEPs) and appliance energy efficiency labeling, elements related to MP requirements (that is, if the refrigerant used is ODS free or not) could be integrated into the standard MEPs and also provided as information through the EE label design. For example the California Appliance Efficiency Regulations³⁰ refer to ODS. In the case of financial incentive-based approaches to promote energy efficient appliances through traditional utility demand-side management or innovative market mechanisms like ESCOs, it would be important to establish the relative additional (incremental) purchase cost of complying with MP requirements over the BAU cost of appliances with regular efficiency levels, and over the cost of appliances with higher efficiency – with additional incentives to target the most environmentally friendly refrigerant.

75. A typical household level equipment energy efficiency program may target air-conditioning units (windows or split systems) used in the residential sector or small buildings (split systems or rooftop units) that are currently using HCFC-22 as the coolant. Depending on the country concerned, the key stakeholders to involve in an energy efficiency program are therefore: (i) the power sector, whose interests are to reduce the gap between power demand and supply (including reducing peak load), promote energy security and independence and, in some instances, to mitigate climate change; (ii) consumers (commercial, public, households) for whom energy efficient equipment provides energy savings and thus monetary savings; (iii) manufacturers and retailers, who must comply with regulations and respond to demand from consumers.

76. Compelling this set of stakeholders to test and label equipment correctly, both with regard to EE standards and the ODS potential of equipment, allows consumers to make more

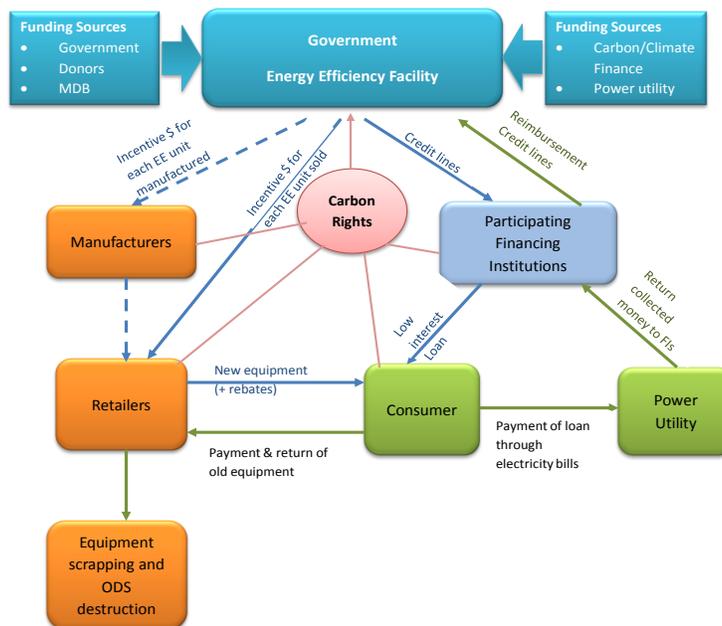
³⁰ <http://www.energy.ca.gov/2012publications/CEC-400-2012-019/CEC-400-2012-019-CMF.pdf>

informed decisions. However, the higher upfront costs of upgrades are often strong barriers to the deployment of EE technologies. Therefore, market transformation may only be achieved when adequate financial incentives are offered to the parties facing the financial barriers, usually the consumers or suppliers. Based on the Mexico ELA project example, a potential HCFC-free energy efficient air-conditioning program could be structured as per Figure 4 below.

4.3. Driving ODS Phase-out Through Energy Efficiency in the Non-residential Sector

77. The non-residential sector includes buildings (public and commercial: air-conditioning, chillers, rooftop units) and industrial facilities where refrigeration plays a key role in the process (textile, foods and beverages, chemicals, etc.).

Figure 4. Model structure for a potential HCFC-free energy efficient AC program



Source: this report

78. Many of the points discussed above under residential models also apply to the non-residential sector including approaches to regulation and enforcement, standards and labeling and financing mechanisms to support phase-in. A key difference in the non-residential sector as compared to the residential sector is the size and cost of the equipment, and the volume of

ODS involved. It therefore needs to align with corporate and public sector financing models, some of which are as follows:

- Leasing and loan facilities need to be available through equipment suppliers/commercial banks (i.e. where corporate loan financing schemes are required);
- Innovative financing approaches, such as those involving third party ESCOs where, for example, a utility or supplier finances and installs the new equipment and recovers the cost from the corporate consumers electricity based on the value of actual or averaged projected energy savings as managed by the ESCO;
- Public sector financing of energy efficiency projects in public buildings, which has become increasingly favored as a means to reduce operating costs; and
- The use of official development assistance (ODA) can also play an important part in demonstrating pilot programs in either corporate or public settings.

The GEF – Supporting Energy Efficiency Finance

79. GEF concessional funding has been a strong catalyst for introducing innovative ideas and supporting institutional development to build successful energy efficiency programs. A number of World Bank Group GEF-supported energy efficiency projects in different regions have successfully institutionalized ways to achieve energy efficiency gains that promise strong returns on investment. The most sustainable uses of GEF resources have been achieved when the GEF contribution formed part of broader, longer-term energy efficiency initiatives - such as blended packages of concessional and non-concessional energy efficiency finance (including helping local financing institutions develop their own EE lending products and business lines). Other good examples include projects focused on market transformation, heating reform and building EE, industry/utility level EE, or ESCO development — supported by strong government commitment and program financing from other sources.

80. For example, the Bank's International Finance Corporation (IFC)-implemented *China Utility-Based Energy Efficiency Finance Program (CHUEE)* used the GEF contribution to provide credit enhancement tools and technical assistance to local banks to develop their energy efficiency and renewable energy financing business. Financial institutions, utility companies, and suppliers of energy efficient equipment were brought together to establish new financing models for energy efficiency, with a focus on expanding lending to small and medium enterprises. The concessional element focus on provision of public training, green credit, international standards such as the Equator Principles, and completion of five industrial and regional energy efficiency opportunity studies all helped the China Banking Regulatory Commission, the Chinese banking sector, other potential investors, and ESCOs and equipment suppliers better understand the Chinese national EE market. A \$16.5 million GEF investment in CHUEE helped three partner banks disburse \$540 million in energy efficiency loans to 107 projects, mobilizing nearly \$1 billion of additional financing and resulting in a global reduction of millions of tons of CO₂ equivalent.

Building Energy Efficiency Codes

81. Building energy efficiency codes and standards offer a powerful tool to promote energy efficiency measures, including consideration of the substances used as refrigerant. A recent World Bank ESMAP publication “Mainstreaming Building Energy Efficiency Codes in Developing Countries” (2010) asserts that mandatory and enforced building EE codes are an essential and effective tool to promote energy savings related to heating and cooling that may otherwise be overlooked.³¹ The report also notes that no country, industrialized or developing, has reaped the benefits of energy conservation measures in buildings without enforcing compliance with such mandatory codes.

82. The report also finds that promotion and enforcement of building energy efficiency codes in a country can both complement and promote the technical and engineering capacity of the national supply chain, such that local materials and equipment become available and compatible. In other words, building codes promote and facilitate the availability and uptake of ODS-free low-GWP/GHG solutions.

83. With respect to financing, in medium-income countries building energy efficiency codes can be mainstreamed such that compliance becomes the norm and additional costs are effectively internalized in regular building costs. For lower income countries, however, external financing to meet the up-front additional costs of energy conservation measures must be addressed, which could include participation in carbon markets to encourage market-driven energy efficiency innovations.

4.4. Using Carbon Assets to Enhance Investments in Montreal Protocol Projects

84. The possibility of using future carbon assets generated through MP projects to increase their level and/or lower their cost of financing remains worthy of consideration, given that the general economic principles behind the global carbon market are broadly applicable to market-based mechanisms in the medium term.

85. If MP projects that aim to reduce ODS in refrigeration applications through the replacement of older HCFC-using cooling units with more modern and efficient technology are able to generate significant energy saving benefits, and such projects are also registered under one of the various Carbon Finance mechanisms, then any energy savings achieved could be converted into carbon assets (taking into account the power grid emission factor).

³¹ Pierre Langlois and Shirley J. Hansen, PhD., authors of ‘The World ESCO Outlook, 2012’, further cite energy performance contracting (EPC) and shared savings contracting (SSC) models, adapted to local needs, as key tools for self-funding energy efficiency, based on their practical experiences gained working with developed and developing countries around the world.

86. In principle, monetization of future carbon assets can offer two main benefits in addition to the immediate energy savings to consumers, provided carbon markets are solid. From an environmental perspective, monetization could accelerate the implementation of HCFC-reducing projects. From a financial perspective, providing more capital and/or lowering its cost at the onset of a project, rather than relying on an additional future revenue stream from carbon finance, could improve a project's overall financial viability and encourage more rapid scale-up of ODS-reducing projects.

Carbon Assets as a Credit Enhancement Tool for Lending

87. Carbon assets generated by MP projects could further potentially be used as collateral against lending.³² For most sponsors, the collateral would be used to reduce the risk profile of the borrower, which would enable the lender to decrease the cost of funding for collateralized operations. Alternatively, for borrowers facing credit exposure headroom limitations, the credit enhancing effect of such collateral could be used to increase exposure limits, resulting in the release of additional funding sources. This proposal could utilize a range of carbon assets, such as CERs and verified, voluntary emission reductions (VERs).

88. Depending on the type of asset to be utilized, MP projects generating energy efficiency gains would need to register under the CDM or JI schemes. Post registration, carbon assets would be transferred by means of an Emissions Reduction Purchase Agreement (ERPA) or other arrangement into the custody of a third party, which could use these assets as collateral to extend a loan to the country/project originating the assets at the project design phase. The collateral could be held on the balance sheets of the lender or in a separate facility that could be set up as a debt service facility with binding instructions to pay off pre-determined debts. Note however that this would require a mature and sophisticated market.

89. The introduction of carbon assets to the MLF financial structure would necessarily induce the management of additional risk. Determining which parties bear what risks and how these risks can be mitigated are crucial elements of this proposal (see Figure 5):

- *Project Company*: holds the delivery risk, or the risk of generating fewer carbon assets than expected;
- *Carbon Credit Trustee*: holds (and manages) carbon asset price risk once an ERPA is signed. Otherwise, it would remain with the Project Company.
- *Lender*: holds the Borrower's credit risk in case of default by the project companies, though this risk would be reduced by the collateral. The Lender would also assume carbon asset delivery risk indirectly, as the quality of the collateral is linked to the ability of the project company to deliver as planned. Of all the risks, delivery risk remains the most difficult to mitigate or transfer.

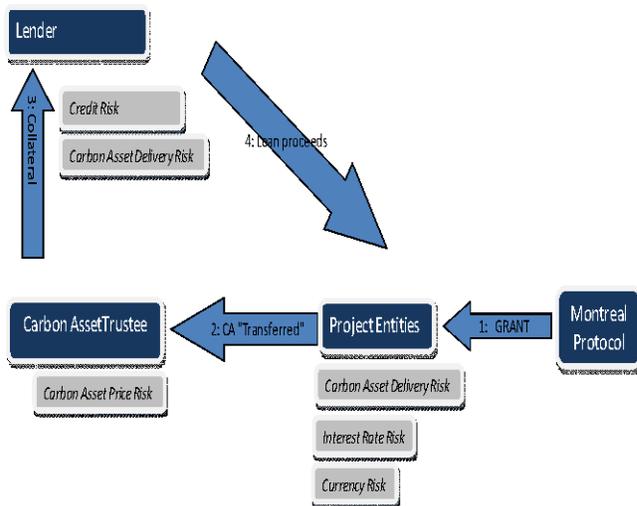
³² The lending could be done by multilateral agencies, banks, or other financial institutions.

90. Once carbon assets are verified, they may be sold at spot market prices or settled through the ERPA at a pre-agreed price. Depending on the arrangement, proceeds may be paid to the lender as debt service or to the project entity. The host government may stand as a guarantor and/or consolidator (see Figure 6).

91. To enhance the collateralized lending concept, guarantee mechanisms could be used to mitigate certain risks. For instance, it may be possible to strip out the credit and delivery risk components of the carbon assets by using new or existing mechanisms (i.e., IFC’s Carbon Delivery Guarantee Mechanism³³), thereby enhancing the monetization potential of the assets.³⁴

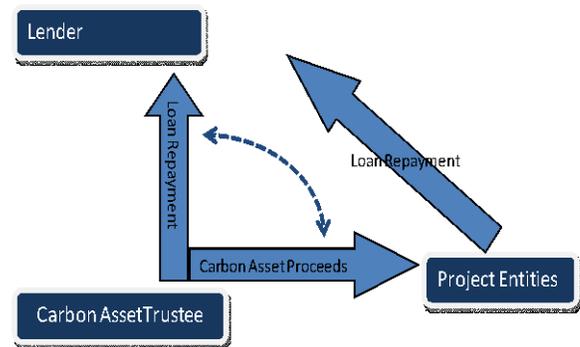
92. Effectively, such an approach allows a buyer of carbon credits to provide an advance, or lend money, against the projected value of the emission reductions to be purchased. This necessitates that a guarantee be established to allow the lender to recover its advance should the emission reductions not be delivered. In the past the World Bank carbon funds have offered such advances to some projects in their portfolio; other lenders could do so if they felt their risks were reduced by the existence of an ERPA with an institution such as the World Bank.

Figure 5. Project’s process flow



Source: this report

Figure 6. Illustration of flows as carbon assets are verified



Source: this report

³³ The IFC has two conditions for offering this financial product: the carbon market must be mature and it must present a clear and long-term price signal.

³⁴ See IFC Carbon Finance information page: <http://ifcnet.ifc.org/intranet/carbonfinance.nsf/>.

5. ADDITIONALITY AND OPTIONS FOR PROFIT SHARING

93. When approving the terms of this study, the Executive Committee highlighted a number of elements important for consideration, including the “additionality of the projects proposed” and “assurance that these projects would avoid perverse incentives for countries”. Within the context of the MLF, “additionality” can be understood as assurance that the set of activities to be promoted would generate environmental benefits beyond the baseline of MLF-supported interventions, which would not happen without the additional effort.

94. This can also be understood, together with the reference to perverse incentives, as a desire to see that any grant or concessional element that is introduced with private sector beneficiaries does not distort existing markets. This is particularly important today when, contrary to the early days of CFC phase-out, the market is much more fragmented, with large volumes of chemicals of interest produced in developing (Article 5) countries in either wholly domestic, foreign owned, or joint venture-types of enterprises. The World Bank, including the IFC, possesses rich experience in project economic analysis to ensure that any grant element or concessional loan is set to an appropriate level for barrier removal but does not interfere with the market.

95. The Executive Committee, in approving this study, also requested that it “explore possibilities of profit-sharing, including return of funds to the MLF.” This is in part an issue of how proceeds may be distributed and can be challenging to analyze in the absence of concrete parameters. Conceptually, “profit sharing” with the Executive Committee can take three forms: (i) a lower MLF contribution (grant) to projects with synergies (and other funding sources), (ii) a greater scope or faster HCFC phase-out, or (iii) monetary reflows to the MLF. Participation of the MLF in any monetary returns (e.g. from carbon credits) seems difficult to justify, unless a specific service was provided that may enhance the carbon market instruments. To create value, such services would best address weaknesses in carbon markets and related instruments, for instance upfront investment funding, financial risk management (through insurance or guarantees), or funding/grant flexibility to fill unexpected funding gaps.

96. The concept of carbon or related revenues flowing back to the MLF could be explored through a model in which, for example, MLF support is provided to manufacturers of HCFC-using Ref/AC equipment to convert to alternatives, as well as to introduce energy efficient and low GHG equipment which would generate energy and/or GHG savings. In return for the MLF providing funds³⁵ to manufacturers, the MLF could share in the income earned from the sale of the energy or GHG savings. From a theoretical perspective, the concept is feasible. Some generic design features of such a program could include:

³⁵ As noted, this assumes that the MLF is also providing support directly for EE related improvements or other valuable services to the carbon market, such as price risk management, some form of guarantee or insurance, as otherwise it would be difficult to justify reflows to the Fund, since the “profits” that would involve private sector actors would then derive from energy savings and reduced GHG emissions, rather than being directly linked to the ODS reduction or financing arrangement that is supported by the MLF.

- MLF funds would be provided as a grant to Ref/AC manufacturers to change production lines to produce low ODS, low GHG and more energy efficient appliances;
- All manufacturers benefitting from the MLF funds would be required to also take part in a program which would recognize or register the projected reduction in energy or GHG emissions – through more energy efficient appliances and appliances making use of low GHG coolants;
- A legal agreement spelling out what percentage the MLF would receive would be required between the Implementing Agency of the MLF, equipment manufacturers, and the overall entity managing the energy savings and GHG reduction program to apportion the income derived from the program;
- Once the program was registered or recognized, each year an annual audit would need to be undertaken to determine the amount of equipment sold and the resulting energy or GHG savings, and verify the resulting emission reductions; and
- Once the energy or GHG savings were sold, the income derived from the sales would then be apportioned between manufacturers and the Implementing Agency/MLF as per the legal agreement.

97. Some key factors related to the applicability of such a concept would include:

- When this concept was first considered, a robust carbon market existed with the price of emission reductions trading at over \$10 per tonne. The current price is much lower. Until the price of carbon recovers, such schemes will not be viable.
- The main target for such a program would be the larger manufacturers of AC and refrigeration equipment. However, they are typically located in middle-income countries which are excluded from selling emission reductions to the European Union market from 2013.
- Although domestic carbon and energy efficiency markets are developing in many of the large equipment manufacturing countries, Mexico is the first one (and only one so far) to have demonstrated interest in AC and refrigeration fitting into the thinking and elaboration of its new generation of carbon finance architecture. In the years to come, other countries could be inspired by the Mexico example.
- Would large manufacturers find participation sufficiently attractive in a scheme as described above if they are required to share the income with the MLF? A recognized barrier to multiple-source financing generally is that this comes often with an increase in transaction costs, decreasing the attractiveness of participation to investors. As noted above, even with the robust carbon price of the past, there was only limited use of the potential of a carbon finance program to generate energy savings.

98. The idea that the MLF could benefit from the reflows of a market mechanism/climate finance scheme tied to conversion to low ODS, low GHG and higher EE equipment manufacturing production lines is theoretically possible, and experience with the operation of similar funds is that reflows can be managed transparently when this is planned from the start. Although, as discussed, no such profitable opportunities exist in the short-term, the Bank is

working with clients to monitor this space. The design and piloting of domestic climate finance markets that include energy efficiency improvements in the Ref/AC sector may provide an option in future.

6. INVESTMENT OPPORTUNITIES

6.1 Energy Efficiency Financing at the World Bank

99. World Bank investments for clean energy are growing at a rapid pace. World Bank Group commitments³⁶ for EE have been around \$1.5 billion per year for the past five years. This offers opportunity to explore the possible linkages between Bank clean energy operations and the MP agenda, and to understand the potential scope and scale of energy sector activities that could be tapped into if incentives were aligned and transaction costs kept to a minimum.

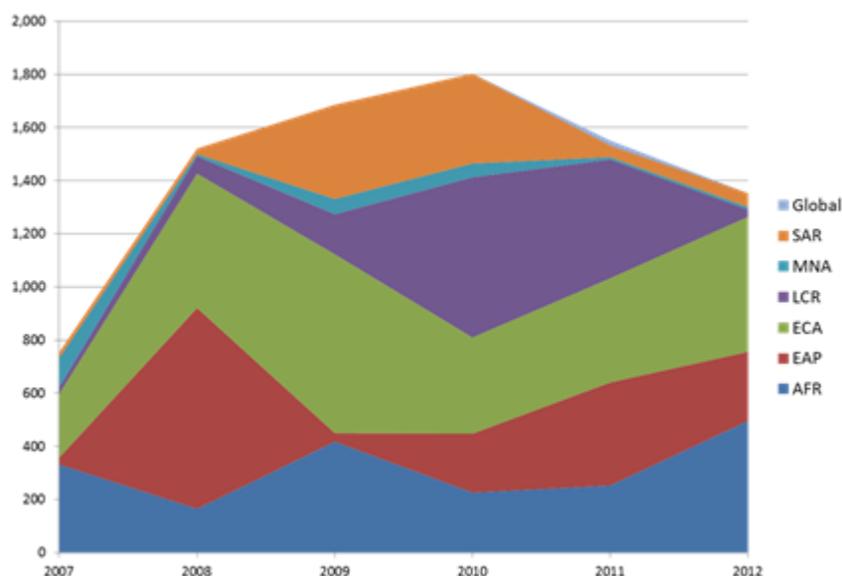
100. Energy efficiency³⁷ has emerged as a growing investment focus of the WBG given the recognition that it is one of the most effective means to enhance energy security and achieve better supply/demand balance in the face of mounting power shortages, as well as to mitigate climate change. Energy efficiency can offer an interesting point of entry as it taps the least-cost domestic source of energy while reducing the need for investment in energy generation infrastructure required to power economic growth. In so doing, it can enhance private and macro competitiveness and creates fiscal space for other development priorities, while avoiding negative environmental impacts associated with energy generation including, but not limited to, global climate change.

101. Nevertheless, energy efficiency improvements, particularly on the demand side, are complex to implement as the opportunities are diverse, dispersed, and spread across a range of different end-use sectors that face various technical, institutional, financial, market and regulatory barriers (see Table 6). In addition, converting potential opportunities into investments in order to scale up energy efficiency implementation requires working across sector boundaries – for instance, energy savings in the water, agriculture, or transport sectors. Furthermore, transfer of knowledge in the areas of energy efficiency policy and finance – key to effective replication and scale-up – is more complex than the transfer of technology, and the transferability of the relatively successful energy efficiency policy and finance approaches from OECD countries is not direct, requiring significant adaptation prior to replication in developing countries, given the different barriers and institutional contexts. World Bank GEF co-financed energy efficiency financing projects, such as CHUEE for example, referenced earlier, have worked precisely to address these obstacles.

³⁶ Energy Anchor Database, data as of September 7, 2012; personal communication, Ashok Sarkar, 5 Oct 2012.

³⁷ This section “Energy Efficiency Community of Practice Progress Report for Fiscal Year 2012,” SEGEN, World Bank, June 2012, and “Delivery Mechanisms for Energy Efficiency in Bank Operations” presentation by Jas Singh, Energy & Extractive Industries Learning Days, March 8, 2013.

Figure 7. World Bank energy efficiency investments by region, 2007 – 2012



Source: Jas Singh, ECA Energy Unit, WB (2013)

Table 6. Main barriers to investments in energy efficiency

Policy / Regulatory	Equipment/ Service Providers	End Users	Financiers
<ul style="list-style-type: none"> - Energy pricing and collection - Procurement policies favor lower cost - Import duties on EE equipment - Unclear or underdeveloped EE institutional framework - Lack of appliance standards and building EE codes, lack of testing, poor enforcement - Limited and poor data 	<ul style="list-style-type: none"> - High project development costs - Limited demand for EE goods/services - Diffuse/diverse markets - New contractual mechanisms (ESCOs) - Limited technical, business, risk mgmt. skills - Limited financing/ equity 	<ul style="list-style-type: none"> - Lack of awareness, high discount rates - High upfront and project development costs - Ability/willingness to pay incremental costs - Low EE benefits relative to other costs - Perceived risks of new technologies/ systems - Concept of EE is “virtual” – cannot see - Mixed incentives - Behavioral biases - Lack of credible data 	<ul style="list-style-type: none"> - New technologies and contractual mechanisms - Small sizes/widely dispersed → high transaction costs - High perceived risks – not traditional asset-based financing - Other higher return, lower risk projects - Over-collateralization - Behavioral biases

Source: Jas Singh, ECA Energy Unit, WB (2013)

102. Energy efficiency projects can generate interesting and multiple benefits but it must be acknowledged that they are work intensive at the design and implementation stages, given the

barriers noted above. Their lending volumes are, in general, much lower than renewable energy projects, and they offer less visibility than projects in the renewable energy sector. The Bank therefore works with client countries to build the capacity necessary to ensure that energy efficiency projects are not systematically down-graded when compared to large infrastructure projects (i.e., in the case of the energy, transport, and water sectors), and/or to sector-specific strategies and guidelines failing to account for efficiency as a viable path to achieve development objectives (i.e., in the case of the agriculture, sanitation, and urban sectors).

103. In addressing energy efficiency, the Bank uses a number of delivery models that target the industrial, commercial, public, or residential sectors, including development policy lending (DPLs), utility demand side management (DSM) programs, ESCOs, commercial energy efficiency financing, public EE financing, actions to stimulate market transformation, incentives subsidies and grants, and capacity building, awareness-raising, and education (see Table 7). The experience³⁸ with these various mechanisms is described below, including pointers to existing or potential linkages and synergies with Montreal Protocol issues.

Table 7. Delivery models for energy efficiency financing that have been used in World Bank projects

Model / Sector	Industrial	Commercial	Public	Residential
DPLs	✓	✓	✓	✓
Utility DSM	✓	✓	✓	✓
ESCOs	✓	✓	✓	
Commercial EE financing	✓	✓	✓	✓
Public EE financing			✓	
Market transformation				✓
Incentives, subsidies, grants			✓	✓
Capacity building, awareness raising, education	✓	✓	✓	✓

Source: Jas Singh, ECA Energy Unit, WB (2013)

104. Climate/energy DPLs with energy efficiency policy conditions. The demand from governments for DPL support has grown in recent years and several of these have targeted energy efficiency directly through: support to development of EE laws/acts, secondary legislation/decrees, national climate change/EE strategies, and EE Action Plans; changes in tariff structures to incentivize EE; upgrading or adoption of regulations to support white

³⁸ From “Delivery Mechanisms for Energy Efficiency in Bank Operations,” presentation by Jas Singh, Energy & Extractive Industries Learning Days, World Bank, March 8, 2013.

certificates,³⁹ smart metering, codes and standards, and auditor/energy manager certifications; initiation/funding of appropriate EE programs; and enactment of favorable tolls, taxes, and incentives. Key success factors identified for this delivery model include proper regulatory and financial incentives; adequate and dedicated funding sources; utility management commitment; strong program planning, implementation, and evaluation functions; and strong customer outreach.

105. Utility demand side management (DSM). On the demand side, the Bank has worked directly with electric utilities on their DSM approaches, addressing lighting or EE appliances, as in the case of the Mexico ELAP. There are many advantages for utilities to pursue DSM, but also mixed incentives which require careful alignment. Recent examples include a number of utility-run CFL programs, as well as “post DSM” models such as DSM bidding, standard offer, EE power plant, and white certificates.

106. Energy service companies (ESCOs). ESCOs represent an approach that was developed in the industrialized world and adapted, with some success, to developing country circumstances. ESCO configurations vary widely, including bundling projects, mobilizing financing, offering turn-key services, and assuming performance risks. ESCOs are complex mechanisms that require strong legal, financial, accounting, and business infrastructure; experience has shown that often the ESCO structure must be vastly simplified to be launched in Bank client countries. In these situations, “public” ESCOs are utilized to develop the market, which itself necessitates the development of a sustainable exit strategy for transition to a fully market-based structure.

107. Key success factors that have been identified include supportive policies and enabling environment; the introduction of simpler business models; appropriate financing schemes; early market development through public sector projects; and development of PPP models (e.g. public ESCO, super ESCO, ESCO agents, ESCO financing windows) to build capacity and develop the business model to kick-start the market.

108. Energy efficiency financing through financial intermediaries. A number of these delivery models have involved investments through “financial intermediaries” that then on-lend to others. Financial intermediaries can be commercial banks, ESCOs, or dedicated investment funds, and a variety of tools can be involved including, credit lines, revolving funds, special purpose funds, credit guarantees, special purpose vehicles, or equity funds. This type of intervention is commonly used to support energy efficiency with building owners, small industries, etc. It is therefore highly likely that such projects offer synergies related to the phase-out of HCFCs or HFCs, yet at the initial stage their design does not offer sufficient portfolio composition breakdown, or detailed activity lists. To maximize ozone-climate co-benefits using this modality, specific, up-front criteria would need to be integrated into investment support documents.

³⁹ An instrument awarded by an authorizing body to guarantee that a specific amount of energy savings has been achieved; usually tradable.

109. One of the on-going challenges of this work is to bring commercial banks into the market. Key success factors have included: conducting a holistic upfront market assessment; careful design of financing schemes and products; careful selection of financing partners with relevant prior experience and interest; intensive marketing to ensure a strong project pipeline; and flexible schemes that can evolve with markets. Special incentives potentially supported with concessional finance may be necessary to steer end-user refrigerant choice, where the lowest ODP/GWP option might incur additional costs not balanced by additional energy efficiency savings.

110. Direct public energy efficiency financing. This modality is typically used by public/municipal clients whose investments have a strong social dimension (e.g., schools, hospitals), and where commercial financing is not a viable option due to factors such as reliance on a central budget for maintenance and operations. In some cases, some repayment and/or co-financing obligations have resulted. In the interest of sustainability and scalability, this modality can only be applied where funds are available on an ongoing basis. There are a number of examples of successful operations using this modality in Central and Eastern Europe.

111. Key success factors have included strong political commitment, transparent building selection criteria, realistic project performance indicators, use of bundled procurements to reduce administrative costs, strong technical baseline data, and competent contractors/suppliers. Introducing concomitant pricing reforms has also helped ensure sustainability of savings and proper operations and maintenance.

112. “Market transformation,” referring to targeting the products rather than the end users. Many tools have been used, including utility DSM, standards & labeling, market aggregation, public procurement, marketing, technology transfer, financing, rebates, and manufacturer negotiations. Challenges include overcoming higher costs and changing purchasing behaviors, while in some projects, still under preparation, the Bank and its clients are also developing approaches to provide incentives directly to manufacturers.

113. Key success factors that have been identified include strong upfront market research, effective public campaigns, incentive schemes that have preceded introduction of mandatory requirements, careful selection of financing partners, judicious use of subsidies, effective and efficient enforcement, and use of economies of scale to help incentivize suppliers and bring down costs.

114. Incentives, subsidies and grants. The use of public funds has been justified to demonstrate new technologies or models, overcome initial high costs, lower perceived risks, and jumpstart nascent markets. These can be used where credit barriers are too high or banks are unwilling to lend, and to help address low priority of energy efficiency among consumers. Care has to be taken to design initiatives such that subsidies can be used alongside market-based approaches without undermining them. Key success factors include effective administration, targeted use, sunset provisions, and intensive dissemination.

115. Most recently, “green” procurement has been used to support energy efficiency at the municipal level, in schools and hospitals. In this case, an incentive is provided to encourage purchase decisions based not only on least cost considerations, but also on life cycle benefit considerations. Where alternatives are readily available, this can be a powerful instrument (see below).

6.2. Identification of Opportunities for Linkages with the Montreal Protocol Agenda and Points of Entry in the World Bank Program

Background

116. The World Bank’s portfolio of projects in various sectors, including but not limited to energy efficiency, has the potential to strongly overlap with the MP agenda through the procurement of appliances, equipment, and/or insulation materials, as well as through elaboration of policy and regulatory frameworks affecting the choice of chemicals used. Overlap between these kinds of projects and the MP agenda can be made more explicit in order to maximize synergies and the MP related impact of Bank activities overall. Such opportunities for linkages are not however readily apparent from basic project documentation used in Bank operations. Table 8 lists the World Bank sectors/activities with potential MP linkages.

117. A portfolio review has highlighted areas of opportunities for linkages and identified points of entry in the portfolio where communication of recommended practices regarding the choice of more desirable low-GWP and zero-ODP technologies could be targeted. This preliminary review, which has not been fine-tuned, nevertheless comprises all World Bank projects approved in fiscal years 2011 and 2012, including IBRD/IDA, GEF, and CIF projects, and serves as a first step to uncover the common patterns and trends in the Bank’s regular programming where HCFC/HFC-related issues may be pinpointed.

Methodology

118. Within these two fiscal years, 447 projects were World Bank Board approved in FY11 and 327 projects in FY12, with an overall commitment of more than \$80 billion from IBRD/IDA funding and trust funds. The review involved screening of project concept notes and project appraisal documents (PADs), based on the development of a typology to identify sectors and key activities that could impact the consumption/emission of HCFCs or HFCs. The broad approach followed cannot attribute funding specifically to directly relevant MP issues, but rather attributes funding for the full component if there is an overlap between that component and MP issues.

119. The 774 projects were rated based on the strength of their relational links to the HCFC agenda. A list of keywords was used to search project documents for overlap, excluding the

Montreal Protocol projects, and each project was then classified according to one of four categories: full, strong, potential, or nil. Of the 774 projects, 16 projects qualified as ‘full’ based on the following selection of relational keywords: cold chain/ equipment/ room/ storage/ box, cooling, freezer, refrigerator/ refrigeration, HVAC, AC, MAC (mobile air conditioning system), air con(ditioner).

120. The limited number of projects with ‘full’ explicit overlap does not signify that there are no additional relevant projects. Many activities have strong potential relevance to the MP agenda, particularly given that Ref/AC systems are used virtually everywhere, and span many sectors. A further 62 projects were identified as having ‘strong’ overlap when the project documentation described activities strongly suggesting links with the HCFC agenda, in the following sectors: i) agriculture: food storage, milk and meat preservation, packaging, distribution; ii) aquaculture; iii) development policy lending: energy efficiency, renewable energy, green growth, infrastructure, housing, low carbon, urban transport; iv) energy efficiency; v) health: medical supplies, distribution, vaccines, health care facilities; vi) transport: green freight/truck, train; and vii) urban: green building (space heating and cooling). Together, projects with ‘full’ and ‘strong’ relational overlap, where targeted interventions could support MP objectives, represent 8.7% of the total FY11/FY12 portfolio of projects and have a cumulative committed value of \$7 billion for these 2 years.

121. Furthermore, additional projects can be characterized as having ‘potential’ overlap, where the overlap could not be readily inferred from project documentation but where the type of activities/sectors might in principle involve relevant aspects related to Ref/AC. Identifying which among these projects really overlap with the HCFC agenda would require a much more detailed analysis, including interview with the project teams. An additional 53 ‘potential’ projects, worth another \$7 billion in World Bank commitments have been identified associated in sectors and activities covering: i) agriculture: productivity/technologies, food safety; ii) aquaculture: alliance for responsible fisheries, capacity building; iii) development policy lending: health and education sectors, health reform; education: school construction, basic education services, early child education; iv) emergency recovery: housing construction, health, education, transport; v) health: maternal and child health services, capacity building, nutrition/ school meals, health care system; vi) rural: basic infrastructure, transitional housing, vulnerability reduction, food security/ nutrition; vii) transport: transport efficiency, smart/ intelligent transport management system, construction of railways, public transport; and, viii) urban: municipal development, historical building/cultural heritage, informal settlement, infrastructure investment, low income housing development.

Potential Points of Entry

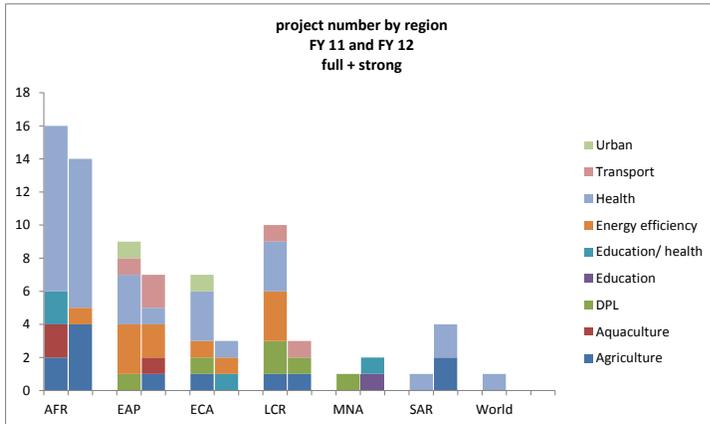
122. Analysis of the 181 projects classified as having full, strong or potential overlap with the MP agenda shows that consideration of the ‘potential’ category did not appear to drastically alter the data trends that emerge, and therefore only those projects with ‘full’ and ‘strong’ overlap were identified as the first tier of projects/sectors that would be analyzed in greater detail.

Table 8. Examples of sectors and World Bank interventions potentially relevant to the Montreal Protocol agenda

SECTORS	MP- RELEVANT WORLD BANK INTERVENTIONS	MAIN MP SECTORS
Agriculture	food banks/ storage and preservation packaging and distribution livestock, meat, milk productivity and technology climate smart agriculture	Residential/commercial and industrial air conditioning Commercial refrigeration
Aquaculture	handling practices, hygiene capacity building, alliance for responsible fisheries	Industrial refrigeration
Development policy lending	energy efficiency and renewable energy green/ low carbon growth infrastructure and housing urban transport	Car/truck/train (mobile) AC Foam manufacturing (blowing agent)
Education	construction of schools, classrooms and kindergarten	Solvent use
Energy Efficiency	lighting and appliances financing, investment, scaling up regulation	Firefighting (fire extinguishers)
Emergency recovery	construction of housing and roads health and education services	
Health	medical supplies and vaccines incl. distribution construction of health centers, health care facilities, hospitals, ambulatories and laboratories	
Rural	basic infrastructure transitional housing	
Transport	green freight, truck and train public transport smart/ intelligent transport management system transport efficiency	
Urban	green building municipal development informal settlement, low income housing development infrastructure investment	

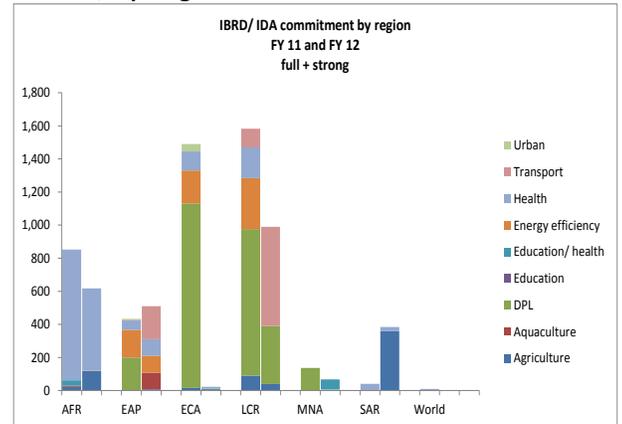
123. *Regional trends and opportunities.* The distribution of the number of projects (Figure 8) reflects the high volume of activities in the Africa region, of which the majority are in the health sector. In East Asia and the Latin American regions, EE and transport projects compose a larger share. Overall, the regional distribution pattern is consistent from one year to the next. From a dollar commitment by region perspective (Figure 9), the trend is skewed by a few large DPL operations in the Europe and Central Asia and the Latin America and Caribbean regions.

Figure 8. Number of projects with full or strong overlap with the MP agenda, by region



Source: this report

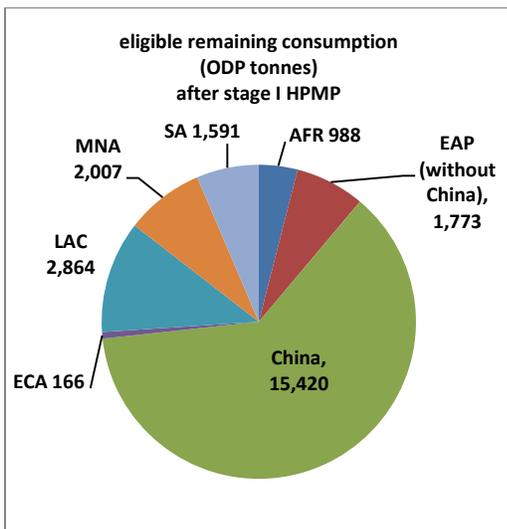
Figure 9. \$ commitment for projects with full or strong overlap with the MP agenda, US \$ million, by region



Source: this report

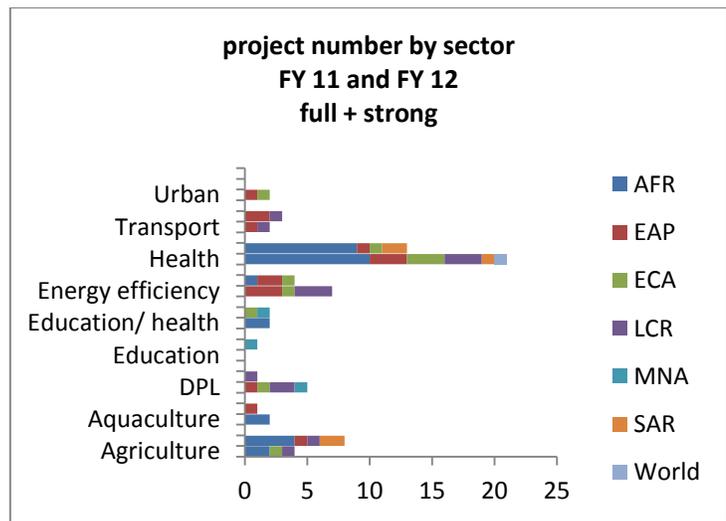
124. “Needs.” Figure 10 highlights remaining eligible consumption of HCFCs, by region, following approval and implementation of the stage I HCFC Phase-out Management Plans in all eligible developing countries. A few things stand out, China’s consumption notwithstanding. When compared to the types and volumes of World Bank investments by sector and region, with overlap to the MP agenda highlighted in Figures 10 and 11, in general it may be surmised that the LAC region appears to be the one where the greatest opportunities exist that are matched with the greatest “need” in terms of HCFC phase-out.

Figure 10. Eligible HCFC consumption remaining after HPMP phase I implementation in eligible Article 5 countries (ODP tonnes)



Source: this report

Figure 11. Number of projects with full or strong overlap with the MP agenda, by sector



Source: this report

125. *Sectoral trends and opportunities.* Health sector projects make up the majority of the “full” and “strong” overlap pool, which is not surprising given the use of cold storage equipment in the medical supply and vaccine distribution chains (see Figure 11). Energy efficiency and agriculture come second. Air conditioning and refrigeration equipment are major consumers of energy, and therefore must be targeted for energy efficiency improvement. For the agriculture and aquaculture sector, food preservation and distribution, where cold storage and freezers are needed, are key concerns. Emergency recovery, transport, and education take a greater importance when looking also at the “potential” projects.

Due Diligence - Green Public Purchasing (GPP)

126. One key tool that may be used in World Bank projects to promote energy efficient equipment and/or technology that uses low GWP/low ODP is by “greening” procurement. A recent internal guidance note⁴⁰ from the World Bank’s Operations Procurement Unit outlines how Bank operational procurement policies and practices can have significant environmental and social impact through the goods and services that countries procure under Bank-financed projects and through those the Bank itself procures. Procurement is considered “environmentally responsible” when environmental aspects are incorporated into purchasing choices, along with economic factors such as price, quality, and performance. The note clarifies that Bank Clients have the option to incorporate environmental requirements in the technical specifications of the goods and equipment procured under Bank Guidelines, and as part of bid evaluation.

127. In particular, the guidelines state that, “for goods and equipment, other factors may be taken into consideration including, among others, payment schedule, delivery time, operating costs, efficiency and compatibility of the equipment, availability of service and spare parts, and related training, safety and environmental benefits.” This makes it possible to refer to “internationally accepted standards such as those issued by the International Standards Organization with which the equipment or materials or workmanship shall comply. When such international standards are unavailable or are inappropriate, national standards may be specified.”

128. In addition, the Standard Bidding Document for Procurement of Goods (May 2004, revised May 2010) provides the possibility for introducing environmental aspects into the process of evaluation and comparison of bids through “projected operating and maintenance cost” and “performance and productivity of the equipment.” The evaluation criteria in the bidding documents would specify a component of the good’s operating and maintenance costs, which represent the corresponding environmental concern, such as energy consumption, emissions, or waste management and disposal cost at end of useful life. The bidding documents would also specify a satisfactory method for calculating these costs over the operational life of the good in question. This “life cycle cost” becomes part of the bid-evaluated costs, and is

⁴⁰ “Green public purchasing (GPP): An introduction and methods to include environmental aspects in technical specifications and bid evaluation criteria”, OPCPR, WB, June 2007, updated November 2011.

defined as such in the Bid Data Sheet. For example, bidding documents could require bidders to demonstrate the annual electricity consumption cost for a computer or office photocopier over its useful life, using a standard formula that specifies units for calculation, the number of operating hours per day and/or other relevant operational characteristics.

129. The note also provides that a price advantage could be given to bidders demonstrating that environmental benefits are taken into consideration, as this could be clearly stated in the technical specifications in a manner similar to the Bank's current domestic preference allowance.

130. While "green procurement" is presented as an option open to Bank clients, it is a tool that is available for immediate use within the context of existing guidelines and procedures, and it allows Bank clients to express preferences for goods or companies with desirable environmental qualities. If GPP were to be more effectively used to address MP considerations, clients and Bank task teams would require up-to-date technical guidance in order to effectively conduct bid specification and evaluation processes.

131. The portfolio review for FY11 and FY12, although preliminary in nature, raises a number of interesting trends and yields interesting opportunities for further analysis, as follows:

- Each year projects that could amount to up to \$3.5 billion, equivalent to 8.7% of the Bank's portfolio, appears to have overlap with the MP agenda.
- Taking into account regional distribution of potential and needs, good complementarity exists to explore MP-investment synergies across most regions, with the LAC region standing out as a region with particularly high potential.
- Taking into account sectoral distribution potential, priority sectors that could be targeted include EE, health, and agriculture.
- If consumption of ODS (HCFCs) can be seen as a proxy of needs, the EAP region, in particular, is one where efforts related to EE could be increased.

6.3 Potential Linkages with the International Finance Corporation (IFC)

132. IFC, a member of the World Bank Group, is the largest global development institution focused exclusively on the private sector in developing countries. Through investment services, IFC provides a broad suite of financial products and services—including loans, equity, trade finance, structured finance, and syndications—designed to promote development in emerging economies and help reduce poverty. Through advisory services, IFC offers advice, problem solving, and training to companies, industries, and governments, all aimed at helping private sector enterprises overcome obstacles to growth. Advisory services do not rely upon IFC capital for funding but are supported by donor trust funds.

133. IFC has helped develop and deploy tools for estimating project GHG emissions. The Carbon Emissions Estimator Tool (CEET) builds upon a tool developed by the Agence Française de Développement (AFD) and expanded to cover IFC investment sectors. The CEET provides investment departments with a simple way to estimate actual project emissions based on information commonly collected during project appraisal, as well as enabling the calculation of changes in GHG emissions by comparing project emissions to a no-project or reference scenario.

134. In FY13, IFC invested over \$2.5 billion in climate related investments, or 14% of total FY13 net commitments. A corporate goal is to commit \$3 billion to climate-related investments by FY15. Climate related investment volumes have been tracked since 2005 and, going forward, IFC intends to also report on the impact of its climate-related investments in terms of GHG emissions reduction. All new investment projects (excluding through financial intermediaries) are required to report GHG emissions prior to project approval as an additional form of business risk analysis.

135. Aligned with goals to scale up climate-related activities, IFC's guiding principles and typology for climate-related investment and advisory projects include various project types that are directly related to Montreal Protocol sectors: 1) energy efficiency, including green buildings, 2) cleaner production, 3) retrofits or replacement of existing heating and cooling systems with reduced global warming potential refrigerants, and 4) decrease in fugitive GHG emissions in existing operations. There are however currently no projects explicitly addressing HCFCs. More information on IFC climate-related investments are described in IFC Definitions and Metrics for Climate-Related Activities.

136. IFC Advisory Services works with companies to adopt beneficial environmental, social, and governance practices and technologies, as well as to seek broad adoption of these practices to transform markets and scale up climate change solutions. This work represented 16% of total client-advisory spending in FY2012, with the goal to increase this to 23% in FY15.

137. Financial intermediaries represent nearly half of IFC's climate-related investments: IFC has supported 125 financial partners through 135 sustainability and climate projects in 35 countries since 1997. Engaging financial intermediary partners to overcome investment barriers and share IFC experience and standards also presents opportunities to engage a broader range of stakeholders around Montreal Protocol related issues.

138. The building sector is one area which holds great potential for enhancing linkages of relevance to the Montreal Protocol. Continued growth in the green building sector is expected to scale up improvements in energy efficiency in residential and commercial cooling and refrigeration. IFC's investments in new green buildings grew from \$2 million in FY09 to over \$400 million in FY13, representing 16% of IFC's climate commitments. For example, IFC is providing \$10 million in financing to complete construction of an energy-efficient 50-bed hospital in Mexico's Monterrey City that will improve access to health services for low and middle-income communities. IFC is also supporting the buildings sector in emerging markets

through its EDGE Green Building Market Transformation Program. Buildings certified by EDGE will have lower emissions than their peers and also require less energy, water, and building materials. IFC is engaging with builders, developers and financial institutions to make these buildings more accessible to households and commercial enterprises.⁴¹

7. OVERALL CONCLUSIONS AND RECOMMENDATIONS

139. **This study highlights that, in principle, many sources of financing available to address energy efficiency considerations in developing countries could potentially be used to finance the additional climate benefits associated with HCFC phase out.** The status of the global carbon market in the short-term, however, limits the availability of funding sources that could provide predictable resource mobilization options against which developing country Parties to the MP could plan for compliance purposes. The report recognizes therefore that there are at present no silver bullets in light of the current uncertainty surrounding climate negotiations and climate finance: new ideas are being explored and promoted but have not yet been widely tested and adopted. The report notes however that there are numerous efforts currently underway to shape the future of climate finance, including efforts under the Partnership for Market Readiness supported by the World Bank. There is, internationally, a strong recognition that it is vital for climate change mitigation efforts to utilize market-based approaches including carbon markets, and that this requires that there be a “right” price set for Carbon in order to generate investments.

140. **A number of opportunities for linkages exist between MP activities and the World Bank’s portfolio.** Every year, multi-billion dollar investments are sourced by the World Bank towards energy efficiency. Although not all these investments overlap with Montreal Protocol sectors, it is a safe assumption that a significant portion of these investments are in fact relevant. The initial analysis conducted has shown that a variety of sectors, across several regions, offer strong potential for synergy. It is recommended that in order to increase mainstreaming of ozone layer depletion activities in World Bank programming, outreach efforts should be targeted to Bank teams and clients in relevant sectors through the development and dissemination of guidance notes and examples of good practices, including related to sustainable “green” procurement. In this context, efforts could be focused in regions where energy efficiency financing efforts are being pursued and where MP phase-out obligations (from an ODP perspective) remain high. In particular the LAC region stands out as one with strong potential for synergies, with significant remaining HCFC phase out needs and strong Bank activities in related sectors. On the other hand, the EAP region appears one where there would be potential for increased energy efficiency-related Bank activities to match the significant size of the related sectors, as evidenced by the size of the remaining HCFC phase-out needs. IFC, the private sector arm of the World Bank, is also supporting a range of climate-

⁴¹ For more information, please visit <http://www.ifc.org/greenbuildings>.

smart investments and activities that support the MP agenda and there are many potential opportunities for more direct linkages in this area.

141. Alignment of MLF funding with Bank lending may prove challenging however, even when directly related to energy efficiency financing, given the different business models at play. The MLF applies a systematic approach in its provision of support, in order to ensure that all developing country Parties have access to the financing necessary to allow them to meet their compliance obligations. A World Bank lending project, in contrast, develops organically, from the ground up, with a focus on its emergence as a priority issue of national concern within a fixed lending envelope. This raises issues of timing with respect to matching opportunities to leverage relevant energy efficiency operations with the MLF funding and development timeline, which is guided by global compliance targets. Furthermore, additional constraints may arise from the fact that, often, different national line ministries or departments would be involved, requiring good management of dialogue amongst government stakeholders. In view of the significant opportunities for climate co-benefits financing, it is recommended that the Parties to the Montreal Protocol promote strong inter-sectoral discussions within Government, and that the Executive Committee take into consideration Agencies' comparative advantage and relevant energy efficiency financing country programs in the context of pipeline and funding decision-making.

142. Innovative financing schemes nevertheless are being developed that could be adapted to support energy efficiency benefits linked to HCFC transition. In some Bank supported interventions, for example, teams are designing projects to work with industry to improve equipment energy efficiency performance. Such an approach could be followed under circumstances directly relevant to the Montreal Protocol; for example, for manufacturers of fridges and room AC, the MLF could finance some of the conversion and Bank financing would support the manufacturers in developing more efficient equipment. It is recommended that the Bank's Montreal Protocol team keep abreast of developments under these projects with a view to sharing relevant lessons learned with the Parties to the Montreal Protocol and the Executive Committee as appropriate.

143. The global carbon markets do not, at present, offer viable financing options. In the near term, CDM related schemes will not be available to support energy efficiency or other financing needs at the nexus of the ozone/climate agenda, due to, amongst other things, the severe downturn in the CDM. Moreover, to date, the CDM has had limited success in contributing to overcome investment barriers and channeling financing for GHG mitigation interventions for less mature technologies or targeting large scale, long-term investments, and in addressing sectors or countries with weak investment climates.⁴² This is due in part to the CDM's cumbersome procedures that resulted in a long and unpredictable project cycle (it takes an average of four years for a project to reach the issuance of certified carbon credits). In addition, regulatory risks limit the CDM's capacity to facilitate access to advance payments

⁴² It is important to understand that carbon finance was not designed to address investment barriers in underlying projects as most carbon purchasing contracts (e.g., emission reductions purchase agreements – ERPAs) consider payments for credits upon delivery.

critical for projects, in particular in least developing countries (LDCs). Reducing such risks is indispensable in order to direct climate finance and result-based developmental finance into CDM projects, as well as attract private sector investment. The issues of efficiency and outreach under the CDM are at the center of the on-going CDM reform and figure in recommendations formulated by the High-level Panel on the CDM Policy Dialogue that took place in 2012. The World Bank is actively contributing to the dialogue on ways to make the CDM more efficient, flexible, and better adapted to the needs of different countries to contribute to net global emission reductions and sustainable development, and is also engaged in discussions and support to the development of new generation carbon market instruments - both nationally and internationally.

144. **One of the premises for this report is that in any event carbon revenues are usually only paid once a project is fully commissioned, while project developers invariably need finance to reach financial closure.** To overcome these problems, approaches to develop financial products to frontload future carbon credits continue to be explored. Instruments such as green bonds, designed to deliver financing to developing countries through the sale of bonds that return both interest and carbon credits, have been under discussion to leverage and scale up investment, provided that the price of carbon is sufficiently high. Insurance and guarantee products can underwrite risks and enable the development of existing and new low-carbon technologies that may, on their own, not be commercially attractive. It is recommended that these approaches be kept under review so that they can be applied to Montreal Protocol-related activities when the second generation of carbon markets is up and going.

145. **The severe downturn in the CDM market and the widespread ban on carbon credits from HFC-23 projects present another challenge since, for the foreseeable future, HCFC production for feedstock results in HFC-23 being released to the atmosphere if it is not captured and destroyed.** It may require that governments address the issue through regulation, with technical assistance provided as appropriate. It is recommended that, if incorporated in a domestic trading scheme, the allocation of such credits would have to be carefully prescribed and limited to avoid domestic markets being flooded with cheap credits, as happened with the CDM.

146. **However, the outlook with respect to development of domestic carbon markets in a number of developing countries remains promising.** A number of pilots underway or planned by countries participating in the Partnership for Market Readiness are being launched with the support of the Bank. A case in point is the development of several regional cap-and-trade schemes in China. The Partnership for Market Readiness is working to build readiness for market-based instruments and may support piloting schemes in selected countries in the future. It is possible that these will evolve into new markets which may eventually be able to support financing of activities to which HCFC phase-out projects could link. Within a 3-5 year timeframe, it is envisaged that these markets may be able to support financing. At that stage, financial engineering tools and approaches that were conceptualized and developed to facilitate the upfront financing of investments under the CDM should be applicable. It is

recommended that the Executive Committee and the Parties to the Montreal Protocol be kept abreast of these developments, and that countries engaged with the PMR explore Montreal Protocol-related activities as part of their readiness efforts.

147. Following the request of the Executive Committee, the report considers reflows back to the MLF and concludes that these are theoretically possible, provided robust domestic carbon markets exist with high enough carbon prices to justify the additional effort. It is recommended that should such approach be followed, very careful consideration should be taken to not unduly increase transaction costs and create new barriers to investments which would inevitably reduce attractiveness to private sector investments.

148. The on-going phase-out of HCFCs will create stocks of used HCFCs (so-called “banks”). It is recommended that Parties to the Montreal Protocol and members of the Executive Committee work with the Implementing Agencies and the international community to ensure that these banks do not accumulate and add to the existing CFC banks. Proactive approaches could include support to manufacturers and others to develop buy-back schemes that address the final disposal of the ODS.

149. In conclusion, the strong commitment by World Bank senior management to put climate change at the core of the Bank’s fight for poverty eradication and shared prosperity offers a framework for enhanced engagement throughout the World Bank upon which to build linkages among Montreal Protocol activities, energy efficiency, and climate mitigation.

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ANNEX I – Sector Background

1. This Annex provides background material for the analyses presented in Section 2 on Sector Background. The ODP and GWP of the main chemical substances relevant to this study are provided in Table 1. Table 2 gives the assumptions behind the model and the details of the calculations presented in Table 2 of the main text of the report.

Table 1. Range of lifetimes, ODPs, and GWPs (20-yr and 100-yr) of some relevant ODS and HFCs

Substance	Lifetime (years)	ODP	GWP (20-yr)	GWP (100-yr)
Chlorofluorocarbons (CFCs)				
CFC-11	45	1	6,730	4,750
CFC-12	100	1	11,000	10,900
Hydrochlorofluorocarbons (HCFCs)				
HCFC-22	12	0.055	5,160	1,810
HCFC-141b	9.3	0.11	2,250	725
HCFC-142b	17.9	0.065	5,490	2,310
Hydrofluorocarbons (saturated HFCs)				
HFC-23	270	-	12,000	14,800
HFC-32	4.9	-	2,330	675
HFC-125	29	-	6,350	3,500
HFC-134a	14	-	3,830	1,430
HFC-161	0.3	-	43	12
HFC-245fa	7.6	-	3,380	1,030
Hydrofluorocarbons (unsaturated HFCs)				
HFC-1234yf	10.5 days	-		4
trans-HFC-1234ze	16.4 days	-		7

Source: Handbook for the Montreal Protocol, UNEP (2012); IPCC AR4 (2007); WMO/ UNEP (2010)

Table 2. Detailed back-of-the-envelope estimate of the energy efficiency and climate mitigation related impacts of a program addressing 1 million⁴³ energy efficient room air conditioners; summarized in main text Table 3.

<p>Personal savings from one room AC</p> <ul style="list-style-type: none"> • Assume average size room air conditioner: 1,500 W / 18,000 BTU • Air conditioner cost: \$700 • Assume new unit is 20% more energy efficient (300W) • Use varies per region: assume 12 hours for 270 days for (sub)-tropical climate • Energy savings: 300 W x 12 hours X 270 days = 972 kWh per annum • Energy savings @\$0.12 per kWh = 972 x 0,12 = \$117 per annum. Over 10 years = \$1,170 • Potential “Carbon value” per annum @ \$5 per ton of carbon and grid emission factor of 0,7 tCO₂eq per MWh = 0.972 X 0.7 x \$5 = \$3,40 per air conditioner per annum
<p>Impact on power generation</p> <ul style="list-style-type: none"> • Program saves 972,000 MWh of electricity per year • Avoided cost of new power plant: 111 MW of installed power. Capital cost in order of \$95- \$216 million depending on source of power • Saving per air conditioner is in order of \$9.5- \$21.6 (excluding operating costs)
<p>Program carbon finance income</p> <ul style="list-style-type: none"> • Annual income from sale of emission reductions for 1 million air conditioners = \$3.4 million • Carbon finance income over 10 years is \$34 million • Carbon finance program costs: <ul style="list-style-type: none"> ○ One-off costs: Carbon finance program preparation: \$200,000 - \$400,000 ○ Program validation: \$15,000 - \$50,000 ○ Program registration: \$50,000 ○ Annual monitoring: \$20,000 - \$60,000 ○ Annual verification: \$15,000 - \$30,000 ○ Annual issuance fees: \$50,000 <p>Program cost over 10 years: \$265,000 - \$500,000 + 10 X (\$85,000 - \$140,000) = \$1.15 million - 1.9 million</p> <ul style="list-style-type: none"> • Net income from carbon finance: \$32.1 - \$32.75 million
<p>Possible (theoretical) impact from refrigerant</p> <ul style="list-style-type: none"> • Average size window air conditioner might contain 0.7 kg of refrigerant • HCFC-22 GWP of 1,810; substituted with a gas with 0 GWP • would result in reduction of 126,700 tCO₂eq if assuming 10% leakage rate, or • @ \$5 per ton, a revenue of \$633,500 per annum; representing only \$0.6 per unit ➔ In contrast the savings from displacement of HCFCs even if it were eligible for earning carbon credits (it is not), is much smaller.

Source: this report

⁴³ 553 million units of HCFC-22 air conditioners were estimated to be operating worldwide in 2008; in the order of 50 million new units might therefore reach the market yearly (TEAP, RTOC, 2010).

ANNEX II – Climate Finance Instruments

2. This Annex expands on Section 3.1, Overview of Climate Finance Instruments. A number of policy and fiscal instruments are available that could be used to target various sets of stakeholders at different stages of the product development cycle, which may be summarized as follows:

- Financing the enabling, regulatory and fiscal/tax environment. Financing of energy efficiency (EE) and ODS standards and labels are usually undertaken by governments in MICs and in the case of LDCs, through concessional sources of finance and technical support from MDBs and bilateral and donor agencies. Financing needs are relatively low but the correct design of the enabling environment is critical for program success. A range of existing instruments to more innovative instruments can be used. Criteria for selecting the correct instruments include: effectiveness in changing behavior, cost effectiveness of administration, economic efficiency, financial sustainability and predictability of results. For instance, taxes are often a highly effective and predictable instrument for changing behavior. In contrast, carbon finance as a means of financing new products and services in order to change behavior carries a high administrative burden, provides low financial rewards and is highly unpredictable in terms of delivering financial rewards.
- The most obvious and relatively easier fiscal instruments that may be used to incentivize a change in retailer and consumer behavior include:
 - Reducing or eliminating import duties and or sales taxes on energy efficiency and low ODS appliances;
 - Providing tax rebates to suppliers who reconfigure manufacturing lines to support EE and low ODS appliances. Given that new business investments are usually tax deductible, this is not a new instrument as such unless further tax deductible benefits are created;
 - Providing rebates to consumers who submit receipts demonstrating that they have replaced old energy inefficient and high ODS appliances with new EE and low ODS appliances. Though such programs exist in many developed countries they need to be expanded to cover low ODS equipment in developing countries together with the development of ODS bank facilities;
 - Investment level support to manufacturers of equipment and ESCOs may take the form of grants, or soft loans to manufacturers to ramp up production and sales of more EE appliances until such time as they become the new market norm/baseline technology. Regulation may simultaneously be tightened to support higher standards in order to support the phase-in;
 - ESCOs play an important role in many countries in providing new EE appliances to consumers who in turn, recover the costs of the investment in the appliances through savings on energy bills. Utilities, equipment suppliers, municipalities or private agents may provide such a service to consumers. ESCOs often require upfront soft finance from government or a utility in order to make the upfront purchase of appliances on behalf of the consumer. That is, the ESCO effectively

leases the appliance or extends credit to the consumer until it is paid off from energy savings on the electricity bill. Various donor and MDB programs have also supported such initiatives;

- National revolving energy efficiency funds may be established to support the above activities. Such funds may be established through government budget, MDB loans or through green bonds;
- Green bonds may be structured in the same way as regular government or bank bonds but provide the principal amount to the financing of energy efficiency activities. Prior to the decline in carbon markets, green bonds were being developed which would allow the bond holder to opt for receipt of a fixed coupon (interest) or to be paid in certified emission reductions (CERs) or income derived from the sale of CERs. While green bonds are likely to continue to be used, it will be difficult to pay the coupon in emission reductions or from the income derived from the sale of emission reductions until carbon prices stabilize.

3. Specific instruments are varied and include the following list, by no means comprehensive:

4. Capital formation through investors. The most important source of finance remains banks and private/corporate investors responding to the perceived investment opportunities offered by the market in the expanding range of energy efficient appliances driven by technology improvements, consumer demand, the increasing costs of energy and increasing energy efficiency standards imposed by governments.

5. MDB and donor related programs to support developing countries. A large number of loan facilities are managed by MDBs and donors to support developing countries to eradicate poverty and to achieve their development targets. Though energy access is more commonly stated as a development goal in donor/development partner country program documents than EE, the latter is gaining increasing importance as a financing/development priority. This is due to the fact that countries recognize that EE programs can deliver results more quickly and at lower cost than building new power plants. The main financing instruments include market related interest rate loans associated with technical assistance, low interest rate loans, and grants. Various guarantee instruments are also provided.

6. The Global Climate Change Alliance (GCCA) is an initiative of the European Union (EU). Its overall objective is to build a new alliance on climate change between the EU and developing countries that a) are most affected and, b) have the least capacity to deal with climate change. The GCCA does not intend to set up a new fund or governance structure, but will work through the European Commission's established channels for political dialogue and cooperation at both the national and international levels.

7. The Global Energy Efficiency and Renewable Energy Fund (GEEREF) is a Public-Private Partnership designed to maximize the private finance leveraged through public funding made available by the European Commission and managed by the European Investment Bank.

GEEREF is structured as a fund of funds and invests in private equity sub-funds that specialize in financing small and medium-sized project developers and enterprises (SMEs) to implement EE and renewable energy projects in developing countries and economies in transition.

8. The Climate Investment Funds (CIF) are a \$7.6 billion partnership to scale up both financing and knowledge for climate solutions in 49 countries. The CIFs are demonstrating scaled-up support to transformative adaptation and mitigation planning, leveraging investment finance and deployment of technologies. Current demand for CIF assistance outweighs available resources indicating a need for additional financing to cover the gap before the Green Climate Fund (GCF) is fully operational. CIF contributors agreed that "the CIF should play its part in ensuring the continuity of climate finance provided to recipient countries while the GCF's structures are put in place." Of the four CIF windows, two are focusing on sustainable energy, the Clean Technology Fund (CTF) and the Program for Scaling-up Renewable Energy in low-income countries (SREP).

9. With \$5.2 billion in pledges, the Clean Technology Fund (CTF) provides middle-income countries with resources to trigger investments for scaling up demonstration, deployment and transfer of low-carbon technologies. Investment Plans for 15 pilot countries and one region have been endorsed, as well as \$2.3 billion in funding for 41 projects under 14 investment plans. The amount is expected to leverage \$18.8 billion in co-financing from governments, MDBs, and other sources, with nearly one third funded by the private sector. Virtually all of the CTF's Investment Plans have a component to finance EE improvement (mostly through financial intermediaries, coupling credit lines/risk facilities and capacity building). While not all may target sectors linked to ODS, these investment plans offer opportunities. The World Bank is the Trustee of the CTF, as well as an implementing agency together with the regional development banks (Asian Development Bank, African Development bank, Inter-American Development Bank and European Bank for Reconstruction and Development).

10. The Global Environment Facility (GEF). The GEF is the financial mechanism for a number of Multilateral Environmental Agreements, including the United Nations Framework Convention on Climate Change, and also supports the Montreal Protocol in countries with economies in transition. As of 2011, the GEF EE window had allocated \$80 million to ESCOs and \$61 million to appliances projects⁴⁴. It finances the incremental costs of project activities, i.e. those activities which are only being undertaken to broadly meet the objectives of the Convention/ to create global benefits. The GEF, in principle, should be well suited to support the funding of climate co-benefits associated with the Montreal Protocol, but in practice this has not always been the case, in part due to the constraints that arise from the GEF's resource allocation system.

11. The Indonesia Climate Change Trust Fund (ICCTF) is a national funding entity which aims to develop innovative ways to link international finance sources with national investment strategies. Created by the Government of Indonesia, it acts as a catalyst to attract investment

⁴⁴ <http://www.thegef.org/gef/whatisgef>

and to implement a range of alternative financing mechanisms for climate change mitigation and adaptation programs. The ICCTF receives non-refundable contributions from bilateral and multilateral donors. The main funding mechanism of the ICCTF is the “Innovation Fund” which provides grants to line ministries to support climate change related projects.

12. The UK International Climate Fund (ICF) is the primary channel of UK climate change finance. It became operational in 2011 emanating from the Spending Review 2010 and replacing the Environmental Transformation Fund. The ICF is designed to help developing countries adapt to climate change, embark on low carbon growth and tackle deforestation.

13. The German International Climate Initiative (ICI) finances climate projects in developing and newly industrialized countries, as well as in countries with economies in transition. The ICI focuses on promoting a climate-friendly economy, measures for climate change adaptation and for the preservation or sustainable use of carbon reservoirs/reducing emissions from deforestation and forest degradation (REDD).

14. The Japan Fast-Start Financing. In December 2009, Japan announced the Hatoyama Initiative (now commonly referred to as the Fast-Start Financing), which pledged \$15 billion in public and private financial assistance to help developing countries address climate change. Consisting of \$11 billion in public finance and \$4 billion in private finance, this Fast-Start Financing replaced the government's previous financing mechanism known as the “Cool Earth Partnership” (2008 - 2010).

15. The Green Climate Fund (GCF). The decision to establish the Green Climate Fund was taken by the Conference of the Parties to UNFCCC in December 2010. The GCF is intended to provide funds to developing countries to finance climate change adaptation and mitigation activities, including for energy efficiency⁴⁵. The Green Climate Fund was designated as an operating entity of the financial mechanism of the UNFCCC. As per the UNFCCC, the Fund is to operate in a transparent and accountable manner guided by efficiency and effectiveness. The Fund is to play a key role in channeling new, additional, adequate and predictable financial resources to developing countries and is to catalyze climate finance, both public and private, and at the international and national levels. The Fund will pursue a country-driven approach and promote and strengthen engagement at the country level through effective involvement of relevant institutions and stakeholders. The Fund which is to be scalable and flexible is to seek a balance between adaptation and mitigation, while promoting environmental, social, economic and development co-benefits and taking a gender-sensitive approach. The target of GCF is to raise Climate Finance to US\$100 billion for low carbon investment by 2020.

⁴⁵ <http://gcfund.net/about-the-fund/mandate-and-governance.html>. At this point it is unclear what level of funding will materialize given the current global economic climate. No commitment of funds to the GCF has been fixed. The Copenhagen Accord contains a pledge from developed countries of 100 billion by 2020, which can come from "a wide variety of sources, public and private, bilateral and multilateral, including alternative sources of finance."

16. De-risking instruments. De-risking instruments may be useful where loan guarantees or Letters of Credit are required by banks to lend to firms seeking to expand production of new appliances; that is, for firms that are less credit worthy and do not have strong balance sheets or assets and are therefore, less able to access bank credit, or only at significantly higher interest rates. Facilities which partially cover the default by the borrower help to reduce the risks which lenders face in lending to firms.

17. Carbon Finance. The carbon offset market exists through regulation or voluntary action. Signatory countries to the Kyoto Protocol have agreed to reduce their GHG emissions. They pass this obligation onto firms in the form of legally binding GHG emission caps or targets that are measured in tons of carbon dioxide equivalent (tCO₂-eq). Firms in turn, are required to reduce their emissions accordingly to meet their targets or caps. The voluntary carbon market, in contrast, caters to the needs of entities that voluntarily decide to reduce their carbon footprint as part of a corporate social responsibility framework. In addition, some voluntary carbon market schemes cater to consumers who are attracted to buy carbon neutral products or services. The anticipation of legislation on GHG emissions also motivates some pre-compliance activity. Carbon offset markets did catalyze investment in ODS-mitigation projects with pre-compliance and/or voluntary markets with projects focusing on destruction of ODS banks under the Climate Action Reserve (CAR).

ANNEX III – Carbon Finance Concepts

1. This Annex expands on the overview provided in Section 3.3 of the Report. The United Nations Framework Convention on Climate Change (UNFCCC) governs climate change negotiations. The UNFCCC’s Kyoto Protocol (KP) in turn contains the targets and timeline to which so-called Annex I Parties agreed⁴⁶ to reduce their GHG emissions as well as the flexible mechanisms they may use in meeting their targets. Parties who ratified the Protocol can either meet their emission cap through domestic action, or they may purchase emission quotas (“Assigned Amount Units”) from other Annex I Parties or project-based carbon offsets (“Certified Emission Reductions”) from developing countries through the Protocol’s Clean Development Mechanism (CDM). Outside the Kyoto Protocol and the demand generated by Parties needing to meet legally-binding emissions targets, a (smaller) voluntary carbon market has also emerged consisting of voluntary demand for emissions offsets not required for regulatory compliance.

2. Carbon finance projects are defined as activities that can demonstrate that they have reduced GHG emissions measured in tons of CO₂ equivalent (tCO₂-eq) compared to a baseline (often a business-as-usual (BAU) activity or scenario. For example, a project which proposes to install more costly energy efficient air conditioners compared to the existing baseline equipment, and which demonstrates reduced consumption of energy and hence lowered CO₂ emissions from the power grid, may qualify as a carbon finance project.

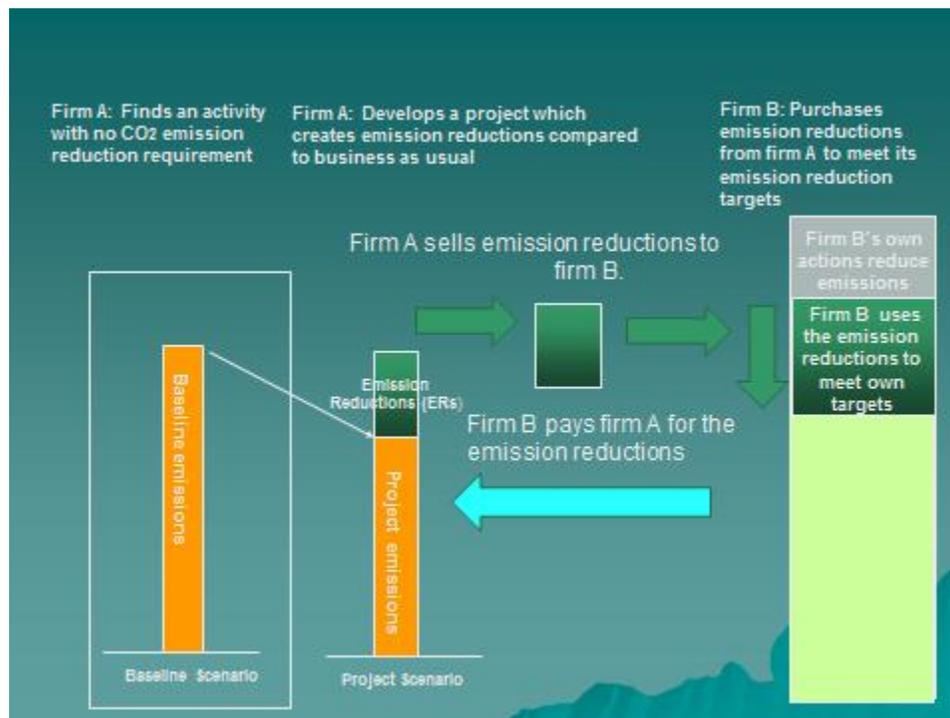
3. A project and the resulting emission reductions will usually be registered with a carbon trading clearinghouse (the UNFCCC for the CDM or one of several voluntary registries). This will assist the project developer to sell the expected or actual emission reductions to another party wishing to offset its CO₂ emissions. While carbon finance projects target, in the first instance, GHG emission reductions or CO₂ reductions which can be purchased by another party, the sale of the emission reductions can also be intended to be a key mechanism through which the project developer may raise project finance. That is, carbon finance projects are also intended as a mechanism for financing the introduction of energy efficient and cleaner technologies to developing countries.

4. Project-based carbon finance instruments are structured as performance-based payment schemes with internationally defined overarching principles and methodologies for assessing project eligibility and quantifying, monitoring, reporting and verifying GHG impacts of project activities. Project-based carbon finance has been instrumental in reducing emissions of short-lived climate pollutants (SLCPs), such as methane and HFCs that are covered by the mandate of the Kyoto Protocol.

⁴⁶ Countries with legally binding emissions objectives under the KP those that were member of the OECD in 1997 (when the Protocol was negotiated and adopted) and the countries with economies in transition. While most Annex I Parties observed the Protocol’s first Commitment Period (2008-12), the USA never ratified the Protocol and Canada withdrew after having ratified it. The Protocol’s agreed second Commitment Period is supported by even fewer countries (essentially only the European Union). A new climate treaty with broader participation is currently being negotiated and planned to come into force in 2020.

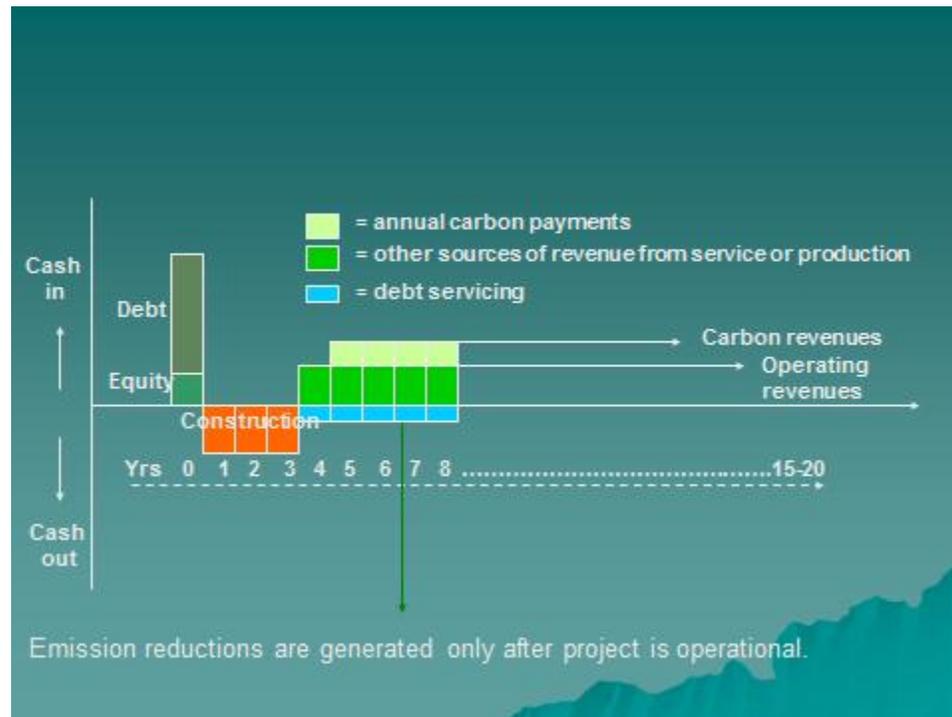
5. Carbon finance is a market mechanism regarded by most as being a more efficient mechanism than either imposing taxes on emissions of CO₂ or fixing strict targets that each firm would have to meet. In principle it allows firms to more efficiently plan new investments and how best to allocate capital in order to meet targets. Carbon finance projects are also referred to as emission reduction projects and they have given rise to the carbon market in which emission reductions are traded. Hence we also refer to emission reductions as “carbon credits” and to the carbon trade which is the trade in carbon credits and which has given rise to the carbon finance business.

Figure 1. Concept of emission reductions and carbon finance



Source: this report

Figure 2. Carbon finance income is generally earned once a project is operational and emission reductions have been issued by a registry



Source: this report

Key Carbon Finance Activities

6. The key carbon finance activities which need to be understood include: (i) demonstrating that project emission reductions will be generated and the estimated volume; (ii) the carbon finance project cycle and institutional and implementation arrangements; and (iii) negotiating an agreement to sell emission reductions – emission reductions purchase agreement.

Demonstrate that emission reductions will be generated and the estimated volume

- Decide which mechanism the project will be registered under: Several different mechanisms or registries exist for registering emission reduction projects each with their own unique rules. The general concepts as described below are broadly similar.
- Identify and use an approved methodology⁴⁷: Methodologies provide the general guidance for determining whether a project is eligible to claim carbon credits and the method which it needs to comply with to calculate the emission reductions and

⁴⁷

http://cdm.unfccc.int/filestorage/C/D/M/CDMWF_AM_NUYR4LTAJWFFEKSTJRJDZ8YDRKJB3T/AMS_II.C.Efficiency_Demand_side_ver09.pdf?t=dXJ8bWxpajE1fDCC7AaNc8w7GdGoGPbwCKLP

demonstrate that the project is additional (see below). For instance under the Clean Development Mechanism (CDM), a number of methodologies can be used to claim emission reductions from energy efficiency projects. As HCFCs are not included in the Kyoto Protocol “basket” of gases, no methodologies exist for claiming emission reductions from projects which destroy or do not use HCFCs. While it is conceivable that methodologies could be developed under the voluntary carbon market now that there are stricter control measures for HCFCs, the key issue is that this would probably not be worth the effort financially: An average size window air conditioner not using HCFCs would only displace 0.09 t equivalent of CO₂ which at \$5 per t of CO₂-eq would be worth \$0.45 per annum. This compares to income of approx. \$3.40 which would be earned from energy efficiency measures.

- Project must be additional/not business as usual: In order to demonstrate that the project will generate emission reductions the project developer has to demonstrate that the project would not take place under business as usual. The project developer usually needs to demonstrate that: (i) they considered that the project would be eligible to earn carbon revenues at the time of investment decision such as a company board meeting; (ii) that the project will face significant barriers in being implemented such as financial barriers (cannot raise funds); technological barriers (technology is first of its kind/new/risky/ lacks suppliers and maintenance providers); implementation barriers (roll out requirements are new and untested), etc. or (iii) the project faces investment barriers, i.e. the project is more costly than business as usual and does not generate the required company rates of return, or consumers would not buy the more expensive appliance.
- Establish the baseline and project emissions: In the case of an energy efficient air conditioner project for example, the project developer needs to establish the energy consumption of the type of air conditioner which the project will replace. He also needs to establish the energy consumption of the proposed project equipment. The projected difference in energy consumption will constitute the projected energy savings per piece of equipment and for all of the air conditioners for the program as a whole. The energy savings are then converted into GHG emission reductions by applying the power grid GHG emission factor.
- Clear monitoring parameters: All methodologies specify the parameters which need to be determined during project design and the parameters which will be monitored annually. These general parameters are typically as follows:
 - the power consumption of the baseline or pre-project equipment (measured in kW);
 - the power of the project equipment to achieve the same level of performance (kW);
 - estimated operating hours of the equipment (hours);
 - Number of pieces of equipment;

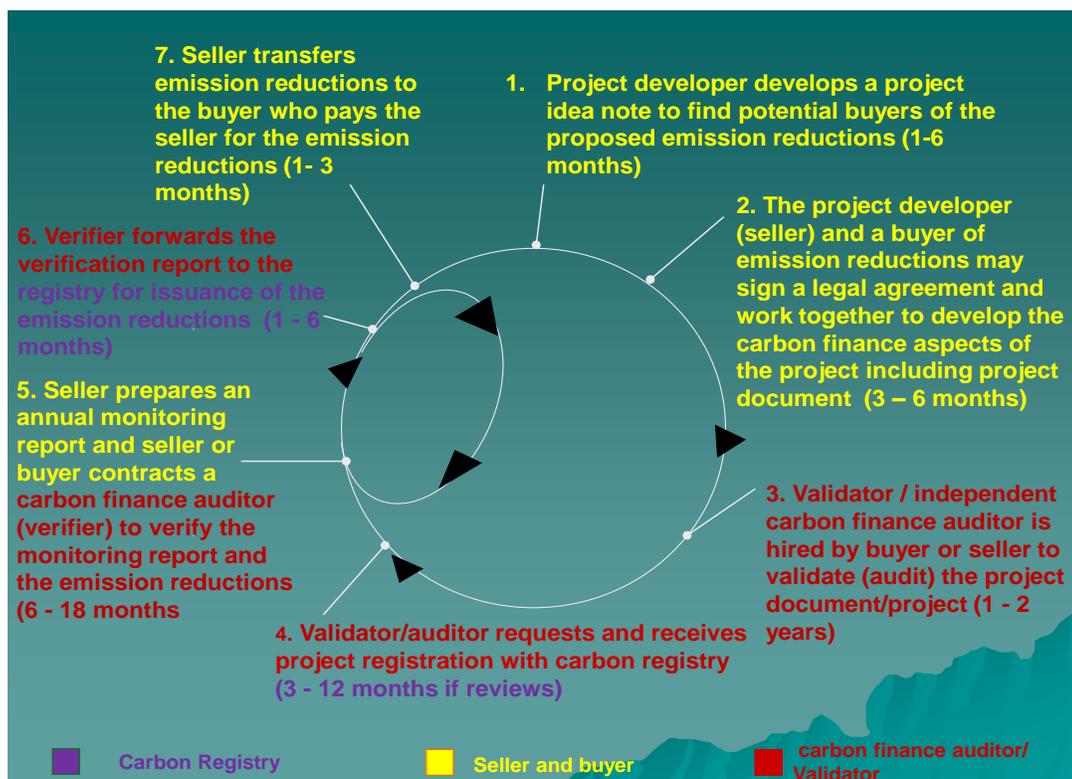
- Scrapping of old equipment: it may be needed to demonstrate that old equipment is scrapped and does not continue to be used – otherwise emissions have not gone down – but baselines that allow for growth are possible as well;
- Projected emission reductions: The baseline energy consumption – the project energy consumption x the grid emissions factor for the power grid provides the overall projected CO₂ savings/ emission reductions;
- Clearly defined monitoring requirements and arrangements: The institutional responsibilities for monitoring arrangements including data capture and storage must be described and the frequency of monitoring and type of monitoring must be specified. The actual number of pieces of equipment which will form part of the project together with the date of installation, the power of the equipment, the place of installation etc. must be recorded in the project database. Where a very large numbers of pieces of equipment are installed, annual sample surveys are usually allowed to demonstrate that the equipment remains installed and in working condition. Depending on the methodology, it may be necessary to demonstrate through actual continuous monitoring of a sample of equipment for how many hours it operates per annum. In other instances it may be possible to adopt conservative default values.

Carbon finance project cycle and institutional/ implementation arrangements

7. The carbon finance project cycle involves several routine key steps which are indicated in Figure 3 below. There are four key players:

- The project developer who develops the underlying project also referred to as the seller of the emission reductions.
- The buyer of the emission reductions who will often support the seller technically or financially through advances to get the project registered. They will usually also be assisted by their own consultants given the highly specialised content of the project documents which must be prepared.
- Third party independent auditors who validate the project document (validators) and verifiers who verify the annual monitoring report prepared by the seller each year to demonstrate the volume of emission reductions which have been generated.
- Carbon Registries are the technical extension of the regulator – the key stakeholder in establishing a market. There are various registries serving different types of carbon assets and different markets. The best known is the CDM serving the Kyoto Protocol. Until recently it was the main registry serving MICs and LDCs. The transaction costs associated with administrative requirements vary significantly between registries. The procedures for the CDM are considered by many to place excessive burden on project stakeholders, creating barriers for investors. The voluntary Verified Carbon Standard while ensuring a similar high level of integrity is considered less burdensome on project developers, but is unable to issue emission reductions for CDM purposes which rest solely with the CDM Executive Board.

Figure 3. General steps forming part of the carbon finance project cycle



Source: this report

Negotiating emission reduction purchase agreements (ERPAs)

8. Negotiating an emission reductions purchase agreement between seller and buyer involves several key issues with the identification of risk mitigation measures being a most critical one. The most obvious aspects to be negotiated include: overall emission reduction volume/size of the contract, volume of emission reductions to be delivered each year, the type of emission reduction (whether for instance based on a monitoring report or an actual issued emission reduction).

9. With Europe having decided to restrict emission reductions into its trading scheme from projects registered post December 31, 2012 to LDCs, MICs are effectively shut out of the European market, and hence the origin of the emission reductions is key.

10. On pricing, approaches have shifted from fixed price contracts to variable pricing contracts as well as a mixture of both. Currently, with the decline in carbon markets, the few sovereign (government buyers) recognize the need to offer prices which are partially delinked from the market and which offer a price required to make it attractive to project developers to undertake a carbon finance project. However, the volume of funds available for such activities are insignificant compared to the needs.

11. Risk mitigation measures aim to create certainty for both buyers and seller especially to insulate against under-delivery of emission reductions and damaging price fluctuations. The most common risk mitigation measures include using milestone dates by when projects should be registered, commissioned and generating emission reductions and what emission reduction volumes would constitute under-delivery and allow the buyer to renegotiate the emission reduction purchase agreement or to cancel it.

Assessment of carbon market risks based on the 12 years of carbon markets

12. Overall, while carbon finance instruments have established very detailed procedures for accounting of, and banking on, GHG emission reductions, they are not without risk for the reasons that follow:

- (i) carbon finance instruments pose risk for both project developers and buyers of carbon credits. For the former, carbon finance procedures are burdensome, projects are time consuming to develop, and they present risk with regard to the possibility of non-registration, or if registered to the possibility that expected volumes of emission reductions may not be issued. From the perspective of the buyer, if the expected income from a carbon finance project is critical to the success of a project, such risks may be perceived to be too high to proceed with carbon financing;
- (ii) carbon finance rules, especially under the CDM and in the European market, change frequently and while some minor simplifications are introduced, often the revisions lead to greater stringency;
- (iii) recent severe downturn in prices of emission reductions which does not encourage the use of carbon finance at this time. Nonetheless, a number of actors, including the European Union and the World Bank⁴⁸ are exploring measures and means to revitalize the market.

13. In conclusion, carbon finance programs can take anywhere from 3 – 6 years to deliver actual financing, and they currently, given the market situation, do so at very low returns. As a result, this presents a disincentive for any project that would be dependent on carbon finance income. Results based schemes funded by sovereign donors could offer a stop gap solution however.

⁴⁸ For example work of the World Bank's Carbon Finance Unit under the Partnership for Market Readiness.

ANNEX IV – Experiences with Carbon Finance Related to the Montreal Protocol

1. This Annex expands on section 3.3 of the Report by providing additional information regarding experiences with using carbon finance to finance the mitigation of releases of relevant substances in two key areas: the destruction of HFC-23 by-products (not an ODS) and the destruction of ODS “banks”.

Targeting HFC-23 incineration with the Kyoto project-based mechanisms

2. One sector that has seen the development of a number of projects for support through the Kyoto project⁴⁹-based mechanisms is the incineration of HFC-23. The bulk of HFC-23 generation comes as a by-product in the production of HCFC-22, either for refrigerant or as input (“feedstock”) for the further production of synthetic polymers. HFCs are part of the Kyoto basket of gases but, having no ODP, are not regulated by the Montreal Protocol, while HCFCs that have both ODP and GWP are regulated by the Montreal Protocol only. . Given the high GWP of HFC-23, plant operators were, until recently, able to earn significant revenue through the carbon offset market, far exceeding the cost of purchasing, installing and operating HFC-23 incinerators and the transaction costs linked to the carbon market. However, concerns over the abundance of HFC-23 credits and with the risk/perception for perverse incentives, and questions regarding their additionality and contribution of these activities to host country sustainable development, all led to a decision in 2012 by the EU to no longer allow the use of carbon credits from such projects for compliance within the EU Trading Scheme (ETS), thereby effectively halting most carbon finance flows to HFC-23 destruction projects.

3. There are currently 23 such CDM projects⁵⁰ in existence, all but one registered, and 19 are active and have issued CERs. Virtually all are in East Asia and the Pacific, with 11 projects in China, nine in India (including one not registered) and one in South Korea. Though they represent only a tiny fraction of CDM projects registered (0.3%) or with issuance (0.9%) globally, ‘HFC’ projects nevertheless account for the top category in terms of issuance, with 40% of certified emission reductions (CERs) issued to date, or approximately 483 MMtCO₂-eq.⁵¹

4. ‘HFC’ projects also represent the top category in terms of CDM transactions by project type, or about 20% of CERs transacted in the primary pre-2013 CDM market, reflecting the preference of buyers and intermediaries for asset types with large potential and predictable issuance. Together, these forward transactions account for \$4.9 billion in potential flows to “HFC” projects (or 17% of global estimated value of CDM transactions in the primary pre-2013

⁴⁹ When covered by carbon market regulation, HFC sources have been so far addressed through the project market and not included under the cap. New Zealand is the only exception, where HFCs (and PFCs and SF₆) are regulated by the New Zealand ETS since January 2013, and California (where compliance started in 2013).

⁵⁰ There are, in addition, four 4 CDM projects in India that substitute HFC-134a as a blowing agent for polyurethane foam. All but one are registered, but with no issuance so far.

⁵¹ Source: *UNEP Risoe CDM/JI Pipeline Analysis and Database*, March 1st 2013.

CDM market, with already \$4 billion in realized⁵² financial flows (or 34% of estimated payments for issued CERs globally).⁵³

5. This by far outweighs the estimated \$59 million in underlying investment behind these projects.⁵⁴ To capture part of this rent and mobilize public revenues for domestic climate action, China (the largest host of such HFC-23 projects) has set up a revenue sharing arrangement for the sale of carbon credits from these projects. Regulation requires that project owners share 65% of revenue generated from HFC-23 CDM projects with the China CDM Fund⁵⁵. There are also different percentages for other types of projects. The CDM Executive board repeatedly reviewed these projects and made adjustments to the applicable rules. In 2012, the EU decided to no longer accept carbon credits from such projects under the EU Trading Scheme (ETS).

6. As a result of this ban, carbon market flows to HFC-23 destruction projects have almost halted. In the absence of government regulations or creation of domestic carbon markets, the venting of HFC-23 might resume. Moreover, and in any event, a large fraction of the developing countries HCFC-22 production is not covered by CDM projects, in part because the HFC-23 incineration methodology prevented any new HFC-23 incineration projects from being added because there was a requirement that the maximum production of HCFC-22 needed to be established with three consecutive years between 2000-2004. Total annual production of HCFC-22 in developing countries continues to increase however mainly due to the increasing demand for feedstock production (e.g., use for production of Teflon). Production for feedstock is not covered under the Montreal Protocol and thus not covered under the scheduled phase-out for HCFCs⁵⁶.

7. While carbon finance proved extremely effective at catalyzing investments for mitigation of HFCs, eligibility restrictions on HFC assets in the compliance market raises doubts that this mechanism could be expanded to finance related future ODS mitigation efforts. Overall, the HFC-23 issue presents a paradox. HFC CDM projects were desirable because they required low capital investment, and generated a very large and predictable volume of carbon credits. However, if a domestic or international pricing scheme were to be developed such that no moral hazard was associated with the generation of the credits, it is conceivable that the low capital cost, size and predictability of these projects could again prove attractive to investors and project developers in the future. But, unless carefully designed, such schemes could again

⁵² Actual financial flows to developing countries through the CDM are likely of a smaller magnitude as a vast majority of transactions are forward purchase agreements with payment on delivery. Depending on project financing, registration, and performance as well as delays in the regulatory process, the amount and schedule of payments may prove different.

⁵³ As transactions and their contractual terms are confidential, it is extremely difficult to estimate actual payments. One assumes here that a project registered in year Y has been contracted in the previous year (Y-1) and that all payments occur on delivery. Actual financial flows through the CDM primary market are thus estimated as the sum, for all projects with issuance, of volume of CERs issued times contract price. Source: for CER issuance, *UNEP Risoe CDM/JI Pipeline Analysis and Database*, March 1st 2013; for market price, World Bank (2012). *State and Trends of the Carbon Market*.

⁵⁴ Source: *UNEP Risoe CDM/JI Pipeline Analysis and Database*, March 1st 2013 (applies only to registered projects).

⁵⁵ See www.cdmdfund.org

⁵⁶ Source: Stephen A. Montzka, Lambert Kuijpers, Mark O. Battle, Murat Aydin, Kristal Verhulst, Eric S. Saltzman, and David W. Fahey (2010). "Recent increases in global HFC-23 emissions", *Geophysical Research Letters*.

flood the market with cheap carbon credits, thereby undermining the overall intent of such schemes which is to provide a sufficiently high carbon price to incentivize investment in low carbon technologies.

Destroying ODS Banks with the voluntary carbon markets

8. At a much smaller scale, the voluntary carbon market is creating incentives for the recovery and destruction of ODS even though much of the potential remains to be tapped and the voluntary markets today are suffering from the same uncertainties and depressed prices as the CDM. While the MP regulates the production and consumption of ODS, a significant amount of ODS still remains contained in equipment, products, and stockpiles, and risks being released into the atmosphere in the absence of appropriate regulatory or financial incentives.

9. To date, there are three programs or standards that have approved methodologies to regulate such ODS destruction projects (see Table 7). Activity has, thus far, been limited, except in California where transactions have increased in number and volume since 2010, at least to 2012, given that Climate Action Reserve (CAR) early action ODS credits could be used for compliance under the U.S. Global Warming Solutions Act of 2006. Though volumes (6 million tCO₂-eq) over the period 2010-11 remain moderate, prices currently fetch US \$8/ton. While this demonstrates that interest from buyers exists, the level of interest expressed remains low in comparison to the volume of ODS potentially eligible for destruction, as provided by some estimates⁵⁷. The recent severe downturn in the CDM is also affecting the voluntary markets, though these appear comparatively less affected.

Table 1. ODS destruction projects registered with the voluntary market

Standard/Program	Geographical eligibility	Number of registered projects	Volume issued (MMtCO ₂ -eq)	Activity
Chicago Climate Exchange⁵⁸ (closed 2010)	Destruction must occur within U.S. territory with import possible	13	NA	No transaction publicly disclosed on the ICE
Climate Action Reserve (CAR)⁵⁹	ODS must be destroyed within U.S. territory but can be sourced in Art. 5 countries ⁶⁰	31 (incl. 3 from India and Mexico)	9.9 (39% from Art. 5 countries)	2.4 MMtCO ₂ -eq transacted at \$8.2/tCO ₂ -eq in 2011 (CAR-eligible only) ⁶¹
Verified Carbon Standard (VCS)	Destruction can occur in any MP country (allowing for import).	0 ⁶²	0	NA

Source: this report; from various sources

⁵⁷ See "Study on Financing the Destruction of Unwanted Ozone-Depleting Substances through the Voluntary Carbon Market", ICF International, Feb 2010.

⁵⁸ Source: the Intercontinental Exchange (the ICE) <https://www.theice.com/ccx.jhtml>

⁵⁹ Source: <http://www.climateactionreserve.org/>

⁶⁰ Only offset from the destruction of ODS sourced and destroyed in the US are eligible under the California ETS.

⁶¹ Molly Peters-Stanley and Katherine Hamilton (2012). *Developing Dimension: State of the Voluntary Carbon Markets 2012*. Ecosystem Marketplace & Bloomberg New Energy Finance.

⁶² There are 3 registered F-gas projects: 2 HFCs from the CDM and 1 for refrigerant leak detection (US-based).

ANNEX V - Review of Experiences with Multi-Source Financing: the “Chiller Replacement” Cohort of Projects

1. A cluster of projects that targeted the conversion of building chillers, with the explicit intent to address servicing uses of CFCs, potential climate co-benefits and identification of additional financing from other sources offers useful insight and lessons learned regarding securing and implementing multi-source financing .

2. The analysis reviews the achievements and on-going challenges associated with five projects: India, Indonesia, the Philippines, Thailand and Turkey. This analysis does not constitute a formal evaluation, nor is it comprehensive. Rather, it provides a qualitative overview of some of the difficulties encountered at the various stages of implementation, and reflects upon the lessons that may be extracted and serve as possible guidance for future such work.

Table 1. Status of World Bank implemented chiller projects with multi-source financing

Project name ⁶³	Start date (effectiveness)	Funding	Status
Turkey	1995	MLF \$4.1m	Completed and closed Dec 2007
Thailand - Building Chiller Replacement Project	Oct 2001	MLF \$2.5m (\$1.3m cancelled) GEF \$2.5m (\$1.3m cancelled)	Completed and closed 30 Sep 2005
India - Chiller Energy Efficiency Project	Nov 2009	MLF \$1m GEF \$6.3m + CF component estimated \$15.5m	Under implementation CF component being dropped
Philippines - Chiller Energy Efficiency Project	Jan 2011	MLF \$1m GEF \$2.5m + CF component estimated at \$7.3m (KfW) Private (chiller owner) \$37m	Under implementation CF component being dropped
Indonesia- Chiller Energy Efficiency Project	NA – appraisal completed Dec 2012	MLF \$1m GEF \$3.7m Private (chiller owner) \$21m	Cancelled CEO endorsement was not achieved due to GEF Council members concerns with private sector’s choice of refrigerant alternatives.

Source: this report; based on project documentation as of November 2013

⁶³ The World Bank is also implementing chiller replacement projects with MLF support in Argentina, Jordan, and Mexico, but these did not involve co-financing/blending from different multilateral sources of financing and therefore are not treated in this section. Turkey is included because of its reliance on an innovative revolving fund.

3. Overall experience with this cohort of projects has been mixed. While they represent a clear effort to acknowledge synergies inherent amongst the different global environmental conventions and their financing mechanisms, they also speak to the complexities that can arise as additional financing partners become involved, as well as when a “blended” approach applies in name only. Such challenges have ranged from an inability to synchronize the timing of financing approvals, the collapse of the carbon market, the impact of the 2008 financial crisis, competing institutional and implementation arrangements (e.g. dual reporting), namely under the MLF and GEF, and issues regarding the suitability and commercial availability of alternatives.

4. The market for primary CDM has dropped to its lowest level since 2004, linked to declining demand for offsets resulting from economic turbulence, a growing long-term oversupply of carbon offsets in the EU ETS and plummeting carbon prices. This has impacted the vision behind the strategy governing the more recent group of projects, requiring that they be restructured to adapt to the new context, and deliver the best possible outcomes in terms of chiller replacement in that context.

Turkey Chiller

5. The project was developed not as a stand-alone “chiller” project, but as part of the refrigeration sector phase out, the Turkey ODS II project, which was approved in 1995 and closed in December 2007 having disbursed \$18.7 million in total (with \$12 million under the Refrigeration Sector Plan overall, and \$4.1 million for the chiller component⁶⁴). Through this project, Turkey was the first to establish a Revolving Fund to ensure sustainable actions on phase out of ODS. Private sector enterprises were the principal beneficiaries of the project.

6. The Turkish Technology Development Foundation (TTGV), the financial intermediary and implementing agency, provided technical support and funds to large companies and SMEs on a loan and grant basis. Specifically for the chiller component, support was a combination of grant (25%) and soft loan (75%) provided by TTGV. Payback for the loan was over three years, with zero interest. The combination of grant and soft loan under a revolving fund scheme proved to be an effective tool motivating hotel owners to replace their old chillers with more energy efficient systems. In effect in this instance, the MLF grant allowed for the capitalization of the Revolving Fund that would serve to finance the energy efficiency / climate mitigation benefits. The high gains in energy efficiency that accrued on replacement coupled by the active marketing conducted by TTGV enabled nearly 40 chillers to be replaced across the country, compared with only four as originally contemplated.

7. Internally, staff continuity⁶⁵ contributed to the success of the project. Rather unusually, from project approval in 1995 until completion in 2007, the World Bank Task Manager and the

⁶⁴ MLF Project Completion Report

⁶⁵ World Bank, Implementation Completion and Results Report (ICR)

TTGV Project Manager remained on the project. This resulted in substantial continuity of project knowledge, helped consensus building with officials of pertinent government agencies, and an enhanced ability to streamline project procedures and allowed TTGV to overcome a number of implementation related issues, including the noted lack of flexibility in funding.

Thai chiller

8. The overarching objectives of the proposed project were to assist Thailand to (i) improve energy efficiency and reduce greenhouse gas emissions in the building chiller sector, and (ii) reduce consumption of ozone depleting substances (ODS) as required under the Montreal Protocol on Substances that Deplete the Ozone Layer (MP). Specifically, the project was designed to work through EGAT (state-owned electric utility) to demonstrate the potential energy and environmental benefits that could be achieved through early replacement of low-energy efficient chillers using chlorofluorocarbons (CFCs) with newer, more energy-efficient non-CFC chillers. The project design was originally meant to demonstrate the benefits of the approach by replacing 24 old CFC chillers. This demonstration activity was meant to lay the foundation for a follow-on project that would replace about 444 chillers, estimated to be approximately 30% of the entire Thai chiller market in 1999 (estimated at about 1500 units). It was anticipated that this initial push to the sector would result in a “market transformation” that would lead to the accelerated replacement of all CFC-based chillers in the country.

9. The project was prepared in 1996 and 1997 and was approved by the MLF Executive Committee and the GEF Council during the fourth quarter of 1998. The project was originally to be implemented by EGAT, but in the fall-out after the 1997 financial crisis, the Government decided to privatize EGAT, making it no longer interested in demand-side management activities, including chiller replacement. The project was finally approved and became effective in October 2001, but in the re-design, the executing agency was changed to the Industrial Finance Corporation of Thailand (IFCT) who operated as a financial intermediary utilizing the project’s funding (drawing \$2.5 million from GEF and \$2.5 million from MLF) as the basis for softening chiller replacement loans.

10. Because of the market corrections following the crisis, the commercially available interest rate dropped so low that the preferential rate provided through GEF and MLF grants was not competitive. Moreover, at the same period, the Ministry of Energy offered successfully several financial subsidy schemes to promote energy efficiency that were more attractive for the private sector as the interest rates were lower, with longer repayment periods and because there was no requirement to dismantle the old CFC chiller and install a data logger for the new chiller. The project therefore closed one year earlier than anticipated due to the limited uptake of loans by chiller owners. By that time, 17 out of the targeted 24 chillers had been replaced, but there was significant funding remaining with \$1.3 million being returned to the GEF and \$1.27 million to the MLF. Nevertheless, the Implementation Completion Report for the project notes that the project was considered to have achieved Satisfactory results as the 17 chillers replaced had resulted in the project exceeding its stated targets (CFCs phased out; kWh energy

saved; and CO₂ abated) and, as a demonstration, had stimulated the market transformation resulting in a much larger replacement of chillers via local financing.

11. A number of lessons have been drawn from the Thailand experience. The project was deemed successful in achieving its stated goals even though it did not directly replace as many chillers through the demonstration program as expected. However, some participants noted the complex and at times seemingly unnecessary complications arising from the conditions placed upon participants through the financing agreement. The monitoring and evaluation procedures and cost of participation in general did place an extra cost burden on project participants (estimated at 15% of chiller cost as documented by one supplier). Additional complications were created by the somewhat duplicative and unsynchronized approval procedures required for GEF and MLF programming.

12. The Thai chiller project demonstrated that synergistic initiatives blending funds from different sources could be used to achieve complementary global environmental benefits. In this instance, benefits from CFC phase-out and reduced GHG emissions were stimulated by focusing on a unitary approach to chiller replacement. This idea provided the basis for the next generation of chiller-replacement projects in India, Philippines, and Indonesia.

India Chiller

13. Conceived as part of a programmatic effort to catalyze further synergies between ODS Phase-out and GHG emission reduction through energy efficiency, the India Chiller Energy Efficiency project was allocated \$1 million by the MLF Executive Committee in 2007. The GEF Council approved an allocation of \$6.3 million for the project in May 2008. But in order to upscale the project and mobilize the maximum amount of funding possible for chiller phase-out in India, it was decided to also tap resources available under the CDM. The original potential for CDM funding was estimated at \$15.5 million, a sum which would be made available to proponents not at the beginning of the project, but only after the replacement of their chillers had been completed, they had generated and verified CO₂ savings, and certified emission reductions had been issued. The GEF and MLF clearances to begin project implementation were granted to allow the project to become effective in November 2009.

14. Because of the need to combine resources from three funding sources, each with different mechanisms with slightly different priorities and requirements, the project assumed a complex structure with strict requirements for eligibility. A “slot” window was developed to eliminate chillers from the eligibility of support if they were either too old as it is not possible to claim carbon credits for equipment which needs to be replaced in any event, or for those which are new and would have little to offer in way of reduced ODS or improved energy efficiency. Chiller owners had two choices. They could choose to obtain a one-time, up-front subsidy, signing over any potential carbon-linked payments to the project’s revolving fund. Or they could choose to receive all of their subsidy payments in the form of carbon-payments over the initial years of the chillers lifespan so long as that period was covered by the first commitment period of the Kyoto protocol.

15. The project faced various challenges in the early stages of implementation linked to its inherent complexity, the preference for shorter-term paybacks on the part of chiller owners, and the lag in getting the project registered. The initial financial intermediary which was meant to support the project withdrew from the project, and the new financial intermediary which took over decided to sign an ERPA with another buyer. Once the new buyer became fully acquainted with the project risks to registration and issuance of CERs as well as the slow implementation progress, they chose to terminate the ERPA.

16. Because of the initial over-ambitious project design, various project delays, and uncertainty with the carbon market, at the time of World Bank Board Approval (June 2009), the amount of funding expected from carbon financing streams was reduced to \$5.85 million from the initial estimate of \$15.5 million. The project was expected to support the replacement of 370 of the estimated 12,500 chillers in the Indian market. These demonstrations were intended to show how profitable the investments would be both to the financial intermediary serving as executing agency and to the chiller owners. This business model demonstrating mutually beneficial activities was expected to be sustainable and to lead to the eventual transformation of the market. The economic rate of return for the project was estimated at between 68 and 71%, depending upon the assumptions employed regarding the value of carbon purchased by 2013. These economic benefits included both the value of the energy savings and the overall reduction in demand resulting in capacity savings to the electric utility. From a typical chiller owner's perspective, the investment would demonstrate a financial rate of return of between 30% and 36% and a payback of 3.3 years. Clearly, the analysis undertaken during project appraisal showed that this project would be a "win" for the chiller owner; a "win" for the electricity supply companies; and a "win" for the global environment in terms of both a reduction in ODS and in GHG emissions.

17. However, implementation has not proceeded apace. As of early 2013, this project is in the midst of a restructuring. Several lessons can be drawn from these challenges. The first is linked to the overly complex project design (three instruments and complex financing and institutional arrangements); the second to the change in financial intermediaries, and the third to the time consuming process for registering a project with the CDM Executive Board. In the meantime the opportunity to tap carbon resources has effectively disappeared. In addition, the GoI became reluctant to see public resources under this project channeled to support private sector chiller owners. Further, during the short period of project implementation, no chiller owners consulted expressed an interest in utilizing the second approach to obtaining the subsidy through reliance upon carbon payments even though it was designed to be more lucrative than the up-front subsidy. Most chiller owners considered it to be too complex and fraught with risk of non-payment (which now appears to have been true). Finally, the complexity of the institutional set up is no doubt leading also to ownership issues, and might explain, in part, the reluctance of the Government of India noted above.

Philippines Chiller

18. The structure of the chillers project for the Philippines is very similar to that of India, and consequently the story of the implementation of the project and of the problems faced is very similar. The project is currently in the process of being restructured to remove the carbon finance aspects of the project. The Emissions Reduction Purchase Agreement between the buyer (KfW) and the Department of Environment and Natural Resources (DENR) has been terminated and, as a result, the performance targets of the project will be scaled down to what is achievable with MLF and GEF funding only, targeting 50 chillers only in lieu of the 195 as originally intended.

19. The project provides financial incentives on a grant basis to support 15% of chiller replacement costs, in exchange for chiller owners surrendering potential carbon credits to the overall program. Alternatively, the project would have coordinated the redistribution of carbon finance revenues from energy savings to the individual chiller owners, minus a 20% fee to cover program administration, marketing, and various CDM-related costs. Based on discussions with stakeholders during preparation, it was established that no more than 20% of the chiller owners would prefer that option – even if it potentially meant less financial returns (with hindsight, however, and as noted above in the India case, the chiller owners were justified to take a cautious approach and preferring an immediate cash benefit).

20. Based on lessons learned with the previous projects, and in order to be more attractive for chiller owners, project funds are dedicated to covering the costs of data loggers connected to a centralized management information system. Whilst this addresses the issue of cost, it still leaves the door open to reluctance from participants to provide centralized data regarding their operations. The project also explicitly allows the replacement of all “inefficient” chillers, including HCFC chillers, rather than only CFC-based chillers. Whilst this evolution in the eligibility criteria was largely driven by the chiller replacement methodology which emphasizes the age of the equipment to be replaced, it also brings a welcome element of flexibility. (Eligible chillers must not be so old that they should have been replaced already due to having reached their full expected lifetime).

21. As with other similar projects, the fate of the recovered refrigerant is not directly addressed, in line with the funding policies of the Multilateral Fund. Chiller owners can either keep the recovered refrigerant for their later servicing needs, or they can hand it over to the Ozone Desk at the DENR’s Environmental Management Bureau. However, the country lacks access to appropriate destruction technology. To address the lack of funding through the MLF for the destruction of unwanted ODS, the World Bank is engaged in a separate technical assistance effort with MLF funding to work with the Governments of the Philippines and Indonesia to facilitate the destruction of unwanted ODS. This effort will hopefully lead to providing a solution for the ODS recovered through the project, even though it is not designed to directly address the project.

Indonesia chiller

22. The project as designed will offer a financial incentive for the replacement of old inefficient chillers with CFC/HCFC-free energy efficient chillers. A grant incentive payment will be about 15% of the cost of a new energy efficient chiller. GEF grant in the amount of \$3.66 million is available to fund the incentive. The grant amount is estimated to be sufficient for the replacement of approximately 160 chillers of average cooling capacity of 350 TR (ton of refrigeration).

23. In order to simplify and provide clarity to stakeholders regarding the financial incentive to be paid by the Project, the payment is to be calculated on the basis of a normative price – assumed to be approximately \$400/TR – multiplied by the rated cooling capacity of the new chiller (but not to exceed the rated cooling capacity of the old chiller), and multiplied by 15%. At the start of project implementation, the Project Management Unit will conduct a chiller price survey to confirm the normative price or propose adjustments.

24. The incentive payment to chiller owners will be disbursed as a lump sum after confirmation that the chiller replacement activity has been completed in compliance with all relevant provisions in the agreements. It will be the chiller owner’s responsibility to pre-finance the chiller replacement and provide adequate co-financing from own resources or financing arrangement to cover the costs of new chiller(s), and any ancillary costs of chiller replacement activities (except certain measurement and monitoring services provided by the project). The ancillary costs are estimated at 10% of the cost of a new chiller.

25. Similar to the Philippines project, the project documentation acknowledges the issue of destruction of unwanted ODS, but cannot directly address the issue since this cannot be covered by MLF funding. As noted above, this is addressed through related efforts, and the project documentation notes that “the World Bank will assist the Government of Indonesia to explore funding opportunities for the disposal of unwanted ODS”.

26. As in the other related projects in this portfolio, and due to donor requirements although this was already highlighted as detrimental in the Implementation Completion Report for the first, the Thailand project, the Project must track and report separately for each source (MLF and GEF) of funds. This also is adding rigidity and complexity to both project design and implementation, for no apparent benefit.

27. Finally, in spite of considerable efforts and resources spent in the preparation of this project by the Bank team and Indonesia counterparts, and of the significant energy savings and CO₂ emissions reduction that would accrue, the project was not approved at final Endorsement stage by the GEF CEO responding to issues raised by a number of GEF Council members regarding the global warming potential of refrigerant in replacement chillers the private sector are most likely to select, and a desire to fund only replacement chillers using “natural” low GWP refrigerants in the circumstances. The Bank and Indonesia concluded the project would be non-viable under these circumstances given the specifics of the application.

Choice of refrigerant (R134)

28. HFC-134a is considered a good alternative refrigerant, but it has a high GWP of 1300. At concept approval stage, one GEF Council member had therefore requested exploring alternatives to HFC-134a use in new chillers and recommended the use of ammonia, which has a GWP of zero, in order to tap the full climate mitigation potential of the project. In the case of roof-top chillers, the Council member considered hydrocarbons a viable alternative for HFC-134a, and maintained that these cooling agents and technologies are already available at reasonable costs for new chillers in the international market and are in use in some developing countries. However, the UNEP Technical and Economic Assessment Panel of the Montreal Protocol endorses the use of HFC-134a in new chillers.

29. Ammonia and hydrocarbons have significant safety issues as their use can conflict with building safety requirements and would for example trigger additional World Bank safeguard policies. In particular, ammonia is a strong poison and hydrocarbons are explosive and flammable. Their application in chillers in commercial and residential buildings such as in office towers, hospitals, malls and other places frequented by large numbers of people, the focus of the Indonesia chillers project, therefore poses significant safety considerations within the prevailing building safety requirements which limits its attractiveness with the private sector.

30. An analysis of the GWP of HFCs and their alternatives – if conducted on a life cycle basis – and of the climate benefits of the proposed chiller replacement program shows that the claimed advantage of zero and low GWP refrigerants is not clear in practical applications. The life-cycle analysis accounts for the high leakage rate (up to 30%) of high GWP refrigerants in existing chillers and considers that modern chillers have a leakage rate of only about 1% and reduce GHG emissions due to their much higher energy efficiency. Given the practical difficulties with predicted low uptake and implementation delays of introducing ammonia and hydrocarbon based chillers, the net climate benefits of a replacement strategy that permits the use of HFC-134a in new chillers is positive.

Elements of lessons learned

31. In general, carbon finance in and of itself has not driven the financing of chiller projects largely due to doubts associated with the status of the Clean Development Mechanism in light of the political uncertainty regarding the post-Kyoto timeframe, as well as the current depleted state of the carbon market. Where the integration of carbon finance has been tested, it has tended to overburden projects with heavy monitoring procedures and, in general, higher transaction costs. Moreover, within the context of chiller replacement, the principal barrier lies in the opportunity cost of access to up-front financing for the investment, a challenge that can also be compounded by low energy tariffs. The India experience, in particular, shows that as a result of this barrier, participants will choose up-front compensation over greater compensation in future.

32. Analyses drawn from an extensive study on chiller replacement in India formed the basis of the World Bank's design to secure MLF financing for the global chiller demonstration program. Based on the recognition that carbon finance would not address the opportunity cost barriers, the strategy adopted was for MLF and GEF funding to cover the upfront costs for the first round of chiller replacement and, once carbon finance returns started to flow, these could in turn be utilized for upfront financing to bring additional chiller owners onboard. Unfortunately, this premise could never be effectively tested given the global economic downturn and subsequent collapse of the carbon market.

33. Nevertheless, a number of important lessons have been generated. For one, project boundaries must be clearly thought out, balanced against goals and purposes at the time of project design, then carefully monitored throughout implementation. The emphasis on chillers in the Thailand project, for example, was considered ultimately to have been too narrowly defined in view of the fact that greater EE outcomes might have been generated if a broader "cooling system"-oriented approach had been followed. Nonetheless, the project's results did compel the Thai government to establish an Energy Conservation Fund that went on to support the replacement of an additional 500 chillers, allowing for both the MLF and GEF financing to be reimbursed.

34. Another lesson involves the choice of refrigerant. The more recent projects are hindered by uncertainty regarding what constitutes the most appropriate alternative refrigerant to use. Fairly significant differences in perception exist at present with respect to commercial availability, cost effectiveness, and suitability, including safety considerations, of alternatives for use in different circumstances: for example between a resort hotel complex with outside space to locate their chillers safely, and a large urban area where chillers are located inside buildings, which poses greater safety challenges. Experience demonstrates that independent external reviews are not sufficient to bridge the view held by different stakeholders involved. This issue is further exacerbated by the fact that the views and policies espoused by the different funding mechanisms are not always fully coordinated, nor are their expressions of opinion or oversight restricted to their areas of comparative advantage. This has manifested itself in pressure being applied to promote adoption of specific alternatives which, while of interest given their low or no-ODP/GWP properties, pose concerns with respect to commercial availability, costs and safe use. A consideration might be to make available additional funding to compensate – where possible – for the additional barriers associated with the use of less proven alternatives.

35. Experience with these projects has also demonstrated that multi-source financing tends to lead to heavy implementation structures and procedures. There is a need to simplify procedures and processes not only to streamline obtaining financing from multiple sources, but also with respect to reporting requirements imposed during implementation. At present, for example, it is a requirement to maintain strictly separate progress reporting and accounting of relatively small amounts of MLF and GEF financing for 'blended' projects, despite the similarities between the instruments and their quasi identical shareholder base. The design of similar future projects should strive to simplify procedures and minimize additional

administrative requirements, and may consider exploring the potential for joint project design, approval and oversight functions in order to enhance efficiency and reduce transaction costs.

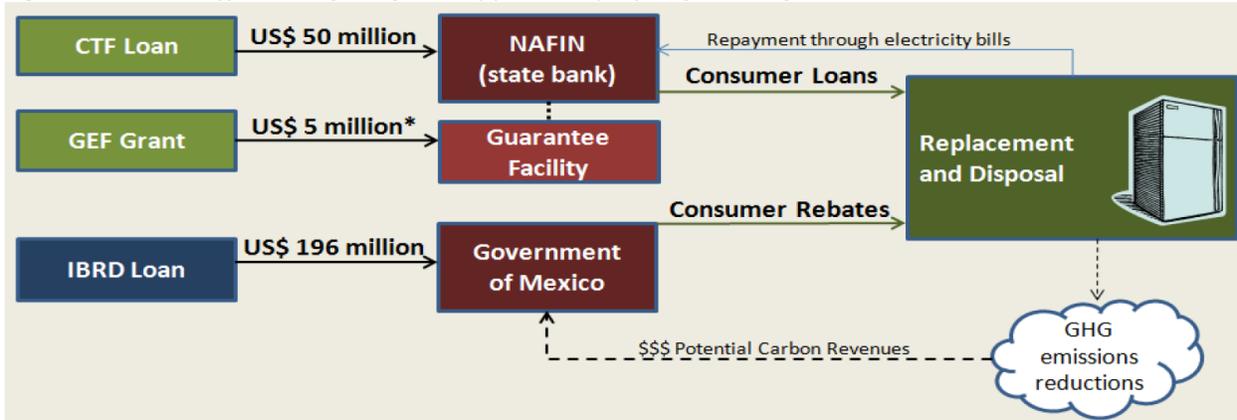
36. The experience gained in Turkey on the other hand demonstrates how positive results may be derived through application of a simple and targeted project design, which can rapidly deliver the desired market transformation. Here, non-grant instruments were used to overcome the opportunity cost, low energy tariffs and lack of fiscal incentive barriers that were faced. The Turkish counterparts who managed the project on the ground offered an interesting financing package and also actively promoted chiller replacement, which ultimately led to the project achieving a high success rate.

37. Finally, another salient feature of this cohort of projects has been the relatively small level of grant financing, which limits impact and visibility in the middle income large countries in which the projects are being implemented. Had a larger sum of funds been made available, it is likely that greater impact would have been manifested, due in part to the convening power that larger sums of upfront funding generate. Large-scale World Bank lending projects, for example, build synergies in support of full market transformation.

ANNEX VI – Opportunities for Synergies – Models and Examples

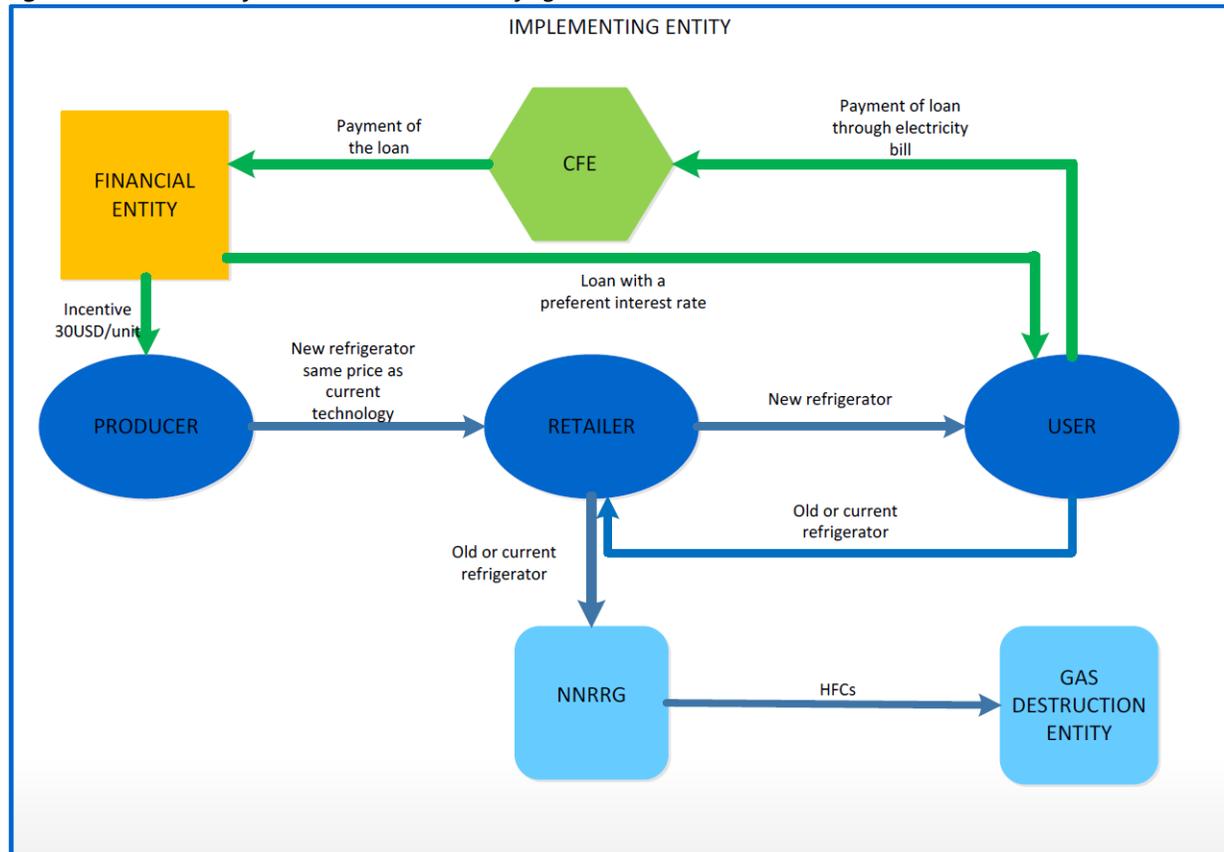
This Annex provides additional illustration for the model examples described in Section 4.2 of the Report. Figure 1 provides an overview of the financing structure of the Mexico Efficient Lighting and Appliances project, while Figure 2 gives a graphic description of the Mexico NAMA.

Figure 1. Mexico Efficient Lighting and Appliances project financing



Source: Mexico Efficient Lighting and Appliances Project Fact Sheet, World Bank (2011)

Figure 2. Structure of Mexico’s Domestic Refrigerator NAMA



Source: Mexico Refrigerators NAMA, DNV KEMA (2013)