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EXECUTIVE COMMITTEE OF  
THE MULTILATERAL FUND FOR THE  
IMPLEMENTATION OF THE MONTREAL PROTOCOL  
Sixty-sixth Meeting  
Montreal, 16-20 April 2012

**PROJECT PROPOSAL: TURKEY**

This document consists of the comments and recommendations of the Fund Secretariat on the following project proposal:

Destruction

- Pilot demonstration project on ODS waste management and disposal

UNIDO

**PROJECT EVALUATION SHEET – NON-MULTI-YEAR PROJECT**

**TURKEY**

**PROJECT TITLE**

**IMPLEMENTING AGENCY**

Pilot demonstration project on ODS waste management and disposal

UNIDO

**NATIONAL CO-ORDINATING AGENCY:** Ministry of Environment and Urbanisation of Environmental Management (NOU)

**LATEST REPORTED CONSUMPTION DATA FOR ODS ADDRESSED IN PROJECT**

**A: ARTICLE-7 DATA (ODP TONNES in 2010)**

Annex I, CFC	0		

**B: COUNTRY PROGRAMME SECTORAL DATA (ODP TONNES, 2010)**

ODS	Subsector/quantity	Subsector/quantity	Totals
CFC			0

**CURRENT YEAR BUSINESS PLAN:** Total funding US \$ 1,844,700      Total phase-out 130 ODP tonnes

**PROJECT TITLE**

ODS USE AT ENTERPRISE		n/a
ODS TO BE PHASE-OUT		n/a
ODS PHASED IN		n/a
PROJECT IN CURRENT BUSINESS PLAN		Yes
SECTOR		ODS Waste
SUB-SECTOR		Refrigeration servicing sector
PROJECT IMPACT		103.72 metric tonnes of CFC-12
PROJECT DURATION		24 months
LOCAL OWNERSHIP		100%
EXPORT COMPONENT		%
REQUESTED MLF GRANT	US \$	1,076,250
IMPLEMENTING AGENCY SUPPORT COST (7.5%)	US \$	80,719
TOTAL COST OF PROJECT TO MLF	US \$	1,156,969
COST-EFFECTIVENESS	US \$/kg	10.37 ODS(metric)
PROJECT MONITORING MILESTONES		Included

**SECRETARIAT'S RECOMMENDATION:** Individual Consideration

## **PROJECT DESCRIPTION**

### Introduction

1. UNIDO, on behalf of the Government of Turkey, submitted to the 66<sup>th</sup> Meeting a proposal for a pilot demonstration project on ozone depleting substances (ODS) waste management and disposal at a cost, as originally submitted, of US \$1,583,500. This project is submitted in line with decision 58/19 and will address the destruction of 130 metric tonnes (mt) of waste ODS in the country.

2. At the 57<sup>th</sup> meeting, the Executive Committee provided funds for UNIDO to prepare a pilot ODS demonstration project for Turkey. At that Meeting, the decision was taken to look at pilot ODS disposal projects that would respond to decision XX/7 of the Twentieth Meeting of the Parties, which provided that pilot projects could cover the collection, transportation, storage and destruction of ODS, with a focus on assembled stocks with high net global warming potential (GWP), and in a representative sample of regionally diverse Article 5 countries. Members also stressed that ODS disposal demonstration projects should be feasible, and should include methods of leveraging co-funding. Turkey was one of the countries selected based on these criteria.

### Background

3. At the 58<sup>th</sup> Meeting of the Executive Committee, criteria and guidelines for the selection of ODS disposal projects were discussed, and led to decision 58/19. This decision established the basis for the review and approval of ODS disposal demonstration projects. The Secretariat carried out a review of this proposal based on the principles established through this decision. The Secretariat also applied sub-paragraph (a)(ii) of the decision, which specified that no funding would be available for the collection of waste ODS in the pilot project. The definition for the collection of ODS was included in Annex VIII to the Report of the 58<sup>th</sup> Meeting, called "Definitions of activities included in the interim guidelines for the funding of demonstration projects for the disposal of ODS". This pilot project for Turkey will cover already collected ODS waste as well as additional amounts to be collected through a number of recovery and collection systems in place at the local level.

4. Turkey's pilot demonstration project seeks to demonstrate a sustainable business model for ODS waste management from collection to disposal using Multilateral Fund assistance as seed money to destroy unwanted ODS and generate carbon credits. These credits would be subsequently used to sustain the current recovery and collection system for ODS with the view to later incorporating other refrigerants. It is envisaged that after the pilot demonstration project, this system should be fully self-sustaining and create incentives for further ODS waste management and destruction activities in future years. It is intended that future ODS waste destruction will be undertaken through local incineration facilities.

5. The project also provides an opportunity to achieve synergies with a Global Environmental Facility (GEF) project addressing the destruction of persistent organic pollutants (POPs) particularly polychlorinated biphenyls (PCB) waste stockpiles, which could be implemented in parallel and under coordinated institutional supervision. The local incineration facility being considered for ODS waste destruction in Phase II of this project (without Multilateral Fund funding) is currently being certified as a regional POPs disposal hub. A detailed project proposal is attached as Annex I to this document.

### Project description

6. The pilot project submitted by UNIDO will address the disposal of 83.72 tonnes of CFC-12 and 50 tonnes of halon, for a total amount of 133.72 tonnes of unwanted ODS. In Turkey, there are government-authorized recovery and reclamation centres established in three cities, Ankara (TUHAB), Istanbul (ISISO) and Izmir (ESSIAD). There are also numerous smaller recovery and collection

industries, which feed into these larger centres. One objective of the project is therefore to put in place institutional measures that will organise the existing recovery and collection systems in the country into an integrated and efficient collection validation and valuation system, which will support sustainability of the project in the future. Private and public sector cooperation had already been sought for this initiative through consultation workshops held during the project preparation process.

7. This collection network will also be supported by a number of national regulations, one of which is on waste electrical and electronic equipment (WEEE), which was partially adopted by the end of 2006 after finalization of technical studies. This will be implemented under the coordination of the Ministry of Environment and Urbanization (MoEnU), in cooperation with the relevant sector institutions. This legislation is expected to come into force by mid-2012. The project will also be supported through government policies that promote advanced environmental policies (such as a ban on venting of ODS, defining responsibility for financing recycling programmes), that will support the sustainability of the business model for ODS waste management.

8. The overall approach that will be undertaken to destroy waste ODS in Turkey will be through export for destruction, is to be carried out through a project developer (Pan Gulf) identified by the Government. Pan Gulf will also provide co-financing for the project. The lessons of this pilot project will encourage local waste recyclers/collectors to gather ODS waste from equipment that is already being processed for recycling, for the potential revenues it will generate for destruction. The ODS waste that will be exported will be destroyed in a destruction facility compliant with the international standards as specified both in the Technology and Economic Assessment Panel (TEAP) Report of the Task Force on Destruction Technologies and Code of Good Housekeeping. A local incineration facility (IZAYDAS) will be used for future destruction in Turkey. This facility will need to be certified to meet the required 99.99 per cent Destruction Removal Efficiency (DRE) indicated by the TEAP.

9. The ODS destruction demonstration project is envisaged to be implemented in two years.

#### Estimation of the ODS to be disposed

10. As submitted, the amount of ODS to be handled by the pilot project will be 133.72 tonnes. Out of these, 83.72 tonnes are CFC-12 while 50 tonnes are halon 1301. These quantities are stored with individual recovery and recycling facilities and are ready for destruction. The source of the estimated ODS wastes are shown in Table 1 below:

Table 1: Estimated quantities of ODS-waste that will be disposed in the project

Source of collection	Quantity (CFC-12 and halon) (MT)
ASO Recovery Centre (TUHAB)	0.62
Metal Goods Craftsmen Federation (MESF)	5.1
Dispersed Service Shops (reported by MESF)	3
Other sources (reported by servicing companies for refrigeration and air-conditioning equipment, responsibility programmes, etc.)	75
Turkey Halon Bank	50 (halon)
<b>TOTAL</b>	<b>133.72</b>

#### Financial management of the project

11. The proposal envisaged that funding from the Multilateral Fund will cover the costs of destruction of the currently available ODS waste by exporting it to an accredited destruction facility in the United States of America through an agreement with the project developer, Pan Gulf. The agreement between Pan Gulf and the Government of Turkey will be based on cost sharing with the credits belonging to the Government, or the institution authorized by the Government. The credits can only be issued with

the MoEnU's letter of approval for a specific period. This carbon project shall be registered to the National Carbon Registry, operated by the MoEnU.

12. The proposal also foresaw the design of a system that will monetize carbon credits resulting from the ODS to be destroyed, which will be used to scale up the project, depending on the results of the pilot activity.

#### Monitoring and verification of the destruction

13. In order to ensure that all ODS waste is properly accounted for, the process will be closely monitored and data will be recorded through an electronic database system to be set up for this purpose. The project developer, Pan Gulf, will develop a monitoring plan which will cover all operations and report on all activities associated with the project. The plan will stipulate the frequency of data collection, define a recording system, and the role of each individual involved in monitoring. The plan will also develop quality control provisions to ensure that the overall operations, data collection and ODS analyses are carried out consistently throughout the project. These will be integrated into an overall data management system that will ensure coordination of data between ODS aggregators, project developers, and destruction facilities. This system will be closely linked to the National Carbon Registry managed by the climate unit of the MoEnU. This unit will work closely with the national ozone unit. There is no risk of inflated volumes and ineligible stocks given that there are no production facilities in Turkey.

#### Cost of the project

14. The total funding requested for the project has been estimated at US \$1,583,500. Details are shown in the table below.

Table 2: Proposed cost of the project

	<b>Activity</b>	<b>MLF Funding (US\$)</b>	<b>Co-Financing Pan Gulf</b>
1	Stage I CFC-12 recovery units with separation of oil and gas	185,000	
2	Three ISO containers (10000 litres)	60,000	
3	Carbon market project management (Documentation, Sale etc.)	125,000	
4	Health, safety, environment training (Technical workshop with international expert)	65,000	In kind contribution (workshops, trainers, experts): USD 150,000
5	Awareness raising	50,000	
6	Destruction of CFC-12 already collected by existing energy efficient appliances replacement programs in Turkey	440,000	Incentive program for CFC-11 & CFC-12
7	Incineration of halons	225,000	Incentive program for halons
8	Monitoring and verification of ODS destruction	100,000	

	<b>Activity</b>	<b>MLF Funding (US\$)</b>	<b>Co-Financing Pan Gulf</b>
9	Transportation of dispersed ODS within Turkey to centralized facility to aggregate in ISO containers for transport to the US	50,000	
10	Transportation of aggregated CFC-12 to US destruction facility (RemTec)	150,000	
	<b>SUBTOTAL</b>	<b>1,450,000</b>	
	Contingencies (10% all items except items 4 and 5)	133,500	
	<b>TOTAL</b>	<b>1,583,500</b>	

## **SECRETARIAT'S COMMENTS AND RECOMMENDATION**

### **COMMENTS**

15. The Secretariat provided a number of comments and observations on the submitted project based on the review following the criteria set out in decision 58/19. It noted that the basis for the collection system for waste ODS will be undertaken by already established recovery and recycling facilities throughout the country, yet a system still needs to be established to organise a more centralised collection. It drew UNIDO's attention to the fact that collection activities are not eligible for funding under the guidelines. UNIDO responded that while this system will be one of the main outputs of the pilot project, this will be done without any funding from the Multilateral Fund. An incentive programme which would provide a small financial motivation to collect ODS waste is currently being set up through the initiative of the project developer, and is believed, will be a catalyst for a broader collection system in future. Further, UNIDO informed the Secretariat that Turkey's current regulations on recovery, recycling and destruction are being aligned with the European Commission regulations due to their consideration of being a future member of the European Union.

16. The issue of the inclusion of halons was also brought up with UNIDO, drawing its attention to decision 58/19(a)(ii)d., and the fact that this component does not have any additional demonstration value as required by the decision. UNIDO agreed to exclude the amount of halons indicated in the proposal. It subsequently informed the Secretariat that an additional 20 mt of CFC-12 had just been recorded with one of the government-authorized recovery and reclamation centres, which would be added to the amount that will be covered by the demonstration project. The total amount of ODS waste to be handled in the pilot project was therefore finalised at 103.72 mt of CFC-12 that had already been collected.

17. The Secretariat also sought clarification on why the destruction of the ODS waste cannot be done in a facility in Europe where transport costs may be more cost-effective, and where there is more stringent monitoring of carbon credits. It also brought UNIDO's attention to a similar issue raised by the Executive Committee with regards to the Mexico ODS destruction project, about which some members had expressed concern on how carbon credits are calculated and determined using voluntary markets. It sought UNIDO's justification for this choice of approach. UNIDO clarified that the export to destruction facilities in Europe was also explored. However, the process of finding a buyer for credits in Europe was considered to be more challenging than in the United States of America and could therefore cause delays. In addition, the co-financing offered by Pan Gulf included the entity's responsibility to undertake all necessary activities to generate income through carbon credits. The value of Pan Gulf is its experience and direct connection to Climate Action Reserve (CAR) through its long lasting agreement with RemTec

which is a CAR-certified incineration facility. The Government of Turkey therefore came to the conclusion that the option to export to a facility in the United States of America through Pan Gulf would generate the best sustainable results for both the project and the country.

18. The Secretariat also sought clarification on Phase II of the project, to have an understanding about its future sustainability, and its consideration of IZADAS, the local waste incineration facility. UNIDO confirmed that IZAYDAS will be the main player in the second step of the process. The facility is authorised and currently operates the incineration of chemical and dangerous waste, including ODS in line with the existing national waste disposal regulations. However, this facility has no link to carbon trading programmes nor to the integrated collection system proposed in the project. The pilot project will therefore establish this link during the pilot phase, to ensure that the company will be included in the carbon-trading programme for further funding and capacity enhancement for collection, verification and destruction. The adjustments necessary for the facility's capacity to handle ODS wastes are proposed to be covered from its own resources, from local/regional funding agencies, or from the income generated from carbon trading activities once the facility is linked to this programme. The facility will then take over the domestic incineration of ODS waste in the second phase. UNIDO also emphasised that no capital investment is being sought by IZAYDAS in the pilot project from the Multilateral Fund.

19. In further discussions with UNIDO on the budget, the Secretariat noted some items that were not eligible because they were for collection activities and/or halons, therefore they were adjusted accordingly. In view of these adjustments, the final cost of the project was agreed at the level of US \$1,076,250 plus support costs of US \$80,719 calculated at US \$10.37/kg which is lower than the threshold of US \$13.2/kg provided for in decision 58/19. This is summarized in the table below:

Table 3: Agreed costs of the project

Item	Activity	MLF Funding (US\$)	Co-Financing Pan Gulf (US\$)
1	Three ISO containers (10000 litres)	60,000	
2	Carbon market project management (Documentation, Sale etc.)	100,000	
3	Health, safety, environment training (Technical workshop with international expert)	30,000	150,000
4	Destruction of CFC-12 already collected by existing energy efficient appliances replacement programs in Turkey	550,000	Incentive program for CFC-11 & CFC-12
5	Monitoring and verification of ODS destruction	85,000	
6	Transportation of dispersed ODS within Turkey to centralized facility to aggregate in ISO containers for transport to the US	50,000	
7	Transportation of aggregated CFC-12 to US destruction facility (RemTec)	150,000	
	<b>SUBTOTAL</b>	<b>1,025,000</b>	
	Contingency (5% all items except item 3)	51,250	
	<b>TOTAL</b>	<b>1,076,250</b>	

## RECOMMENDATION

20. The Executive Committee might wish to consider:
- (a) Noting with appreciation the submission of the Government of Turkey of a pilot ODS waste management and disposal project to destroy a total of 103.72 metric tonnes of ODS waste; and
  - (b) Whether to approve the implementation of a pilot project for ODS waste management and destruction in Turkey at the amount of US \$1,076,250, plus agency support cost of US \$80,719 for UNIDO, on the understanding that no further funds will be available for Turkey for any ODS disposal projects in future.

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MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEplete THE OZONE LAYER			
PROJECT COVER SHEET			
<b>COUNTRY</b>	Turkey	<b>IMPLEMENTING AGENCY</b>	UNIDO
<b>PROJECT TITLE</b>	Demonstration project for disposal of unwanted ODS in Turkey		
<b>PROJECT IN CURRENT BUSINESS PROJECT</b>	Yes		
<b>SECTOR</b>	ODS Destruction		
<b>SUB-SECTORS</b>	Refrigeration and Air-conditioners (CFCs) sub-sector; Fire fighting (halons) sub-sector		
<b>ODS DESTROYED</b>	2 years of project (MLF funded)	80	mt of CFCs
	2 years of project (MLF funded)	50	mt of halons
	Carbon Trading Offset Programme, (expected average per year)	30	mt of CFCs
<b>PROJECT IMPACT</b>	ODS reduction per annum		
	2 years of project (MLF funded)	40	mt of CFCs
		25	mt of halons
	Reflecting annual emissions in CO <sub>2</sub> equivalent in refrigerating sector	324,000	t CO <sub>2</sub> e
	Reflecting annual emissions in CO <sub>2</sub> equivalent in fire fighting sector	140,000	t CO <sub>2</sub> e
	Carbon Trading Offset Programme (expected average per year)	27	mt of CFC-12
		3	mt of CFC-11
		218,700	tCO <sub>2</sub> e
		11,400	tCO <sub>2</sub> e
<b>PROJECT DURATION</b>	2 Years (MLF funded phase)		
<b>PROJECT COSTS</b>			
	Incremental Capital Costs	US\$	1,335,000
	Contingencies	US\$	133,500
	Incremental Operating Costs	US\$	
	Policy & Management Support	US\$	115,000
	Total Project Costs	US\$	1,583,500
<b>LOCAL OWNERSHIP</b>		100%	
<b>EXPORT COMPONENT</b>		0%	
<b>REQUESTED GRANT</b>	US\$	<b>1,583,500</b>	
<b>COST EFFECTIVENESS</b>	US\$/kg	12.2	
<b>IMPLEMENTING AGENCY SUPPORT COSTS</b>	US\$	118,762	
<b>TOTAL COST OF PROJECT TO MULTILATERAL FUND</b>	US\$	1,702,262	
<b>STATUS OF COUNTERPART FUNDING</b>	Committed - provided by Pan Gulf (in kind contribution for the training workshops USD 150,000 and incentive programme for substances)		
<b>PROJECT MONITORING MILESTONES</b>	Included		
<b>NATIONAL COORDINATING BODY</b>	TR Ministry of Environment and Urbanisation G.D. of Environmental Management (NOU)		

## Project summary

UNIDO is submitting a demonstration project for disposal of unwanted ozone depleting substances (ODS) in Turkey to the 66<sup>th</sup> Meeting of the Executive Committee. This project will cover the disposal of 80 ODP tons of CFC-12 and CFC-11 in the domestic refrigerator sector of Turkey and 50 ODP tons of halons from the Halon Bank of Turkey in the next 2 years. **This quantity of CFCs has already been collected** from various sources in the country. The collected CFC-12 will be incinerated in an eligible destruction facility in the United States as required by the CAR Protocol *Article 5 Ozone Depleting Substances Project Protocol Destruction of Article 5 Ozone Depleting Substances Banks Version 1.0* (see <http://www.climateactionreserve.org/>). As supporting measures during the initial period the collection and recovery system will be improved and, if required, the legislative system will be adapted. (The MLF shall fund the transportation/storage and destruction activities of these 2 years, costs for improving the collection system and changing legislation will be covered by income from sale of carbon credits.)

Assuming a price of USD 3 per ton of CO<sub>2</sub>e and emission reductions of approximately 300,000 CO<sub>2</sub>e, the activities of the first two years will generate a financial value of around 900,000 Mio USD through utilization of the carbon market. This financial benefit will be used to implement a sustainable recovery and collection system for ODSs with the view to later incorporate other refrigerants. This system should be fully self-sustaining without further need for financial support. It should create incentives for further ODS waste management and destruction activities **in future years which will lead to an estimated additional destruction of 30 ODP tons of CFC-11 and CFC-12 per year – Carbon Trading Offset Programme** (Please NOTE: there is no funding requested from the MLF beyond the first two years of the project). This latter part of the programme consists of the recovery and collection of ODS from various sources in Turkey, in particular end of life treatment refrigerators, air-conditioning equipment and servicing activities.

This project is **unique and innovative** in its approach because it demonstrates for the first time:

- That funds from MLF may not only be used for a one time destruction of ODS but will provide a type of “seed money” for implementing a sustainable, comprehensive ODS waste management and destruction system in Turkey for the future,
- the sourcing of co-funding from the carbon market as proposed by the *Report by the Secretariat on funding opportunities for the management and destruction of banks of ozone-depleting substances (UNEP 2009)*,
- fund raising in the private sector by involving companies specialized in RAC manufacturing, waste management and incineration activities, and
- the implementation and operation of state of the art recovery and collection technologies in an Article 5 country enabling an improvement of ODS collection and recovery activities and thereby significantly reducing the impact on the ozone layer as well as on the global climate.

**PREPARED BY**  
**REVIEWED BY**

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**DATE** 18 February 2012  
**DATE** 20 February 2012

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## PROJECT OF THE GOVERNMENT OF TURKEY

### DEMONSTRATION PROJECT FOR DISPOSAL OF UNWANTED ODS IN REPUBLIC OF TURKEY

#### 1. Project objectives and strategy

*UNIDO submits a Demonstration Project for Disposal of Unwanted ODS in Turkey to the 66<sup>th</sup> Meeting of Executive Committee of the Multilateral Fund for the implementation of the Montreal Protocol.*

*The project aims to develop a sustainable business model for ODS waste management from collection to disposal, in a way that shows how "seed money" from the MLF can be used within a country to take the banked ODS and destroy it so that it can generate carbon credits. This will create income to those who participate. Thus, the demonstration project will show how this financial mechanism can be used as an incentive to enterprises in A5 countries, such as India, China, Brazil, and Mexico, to participate in carbon trading programs for profit or for lower cost destruction.*

Therefore the objective of the project is to implement a sustainable and integrated business model for an efficient ODS waste management system (including the establishment of an effective recovery system for CFC-11 in insulation foam used in refrigerators, as well as CFC-12 in refrigeration equipment) and to destroy 80 metric tons of CFC-12 and CFC-11 in the refrigerator sector in Turkey and 50 metric tons of halons (halon-1301);

1. Destroying already collected/accessible 80 ODP tons of CFC-12 and 50 ODP tons of halon-1301 located in the Halon Bank of Turkey (in the first two years of the project is considered as the demonstration phase- to be funded by the MLF);
2. Investing the financial benefits created through the use of the carbon market (*by selling the emission reductions generated through destruction activities in the first 2 years*) in modifying and/or improving national legislation with regard to a producer/distributor responsibility program for ODS containing equipment and improving the collection and recovery system in Turkey.

This will result in annual destruction of additional 27 ODP tons of CFC-12 and 3 ODP tons of CFC-11 adding up to 30 ODP tons in future years (to be sustainably funded through the annual sale of carbon credits, as well as other national incentive systems to be implemented in parallel).<sup>1</sup>

The proposed implementation mechanism, partially funded by MLF with the in-kind contributions to be provided by Pan-Gulf Co. as well as the beneficiaries listed in Section 6; will recover CFC-12 and CFC-11 from domestic refrigerators and other refrigeration systems to be considered within the implementation process.

The current legislation on ODS and waste management gives the authority of the regulating certification and monitoring of waste recycling and recovery activities to the Ministry of

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<sup>1</sup> The consumption of CFC-11 in the past years has been very low.

Environment and Urbanization (MoEnU, G.D. of Environmental Management). Work is ongoing to adapt the system to the requirements of the 2002/96/EC-Directive (WEEE-Directive), under the coordination of MoEnU and in close cooperation with the relevant institutions. The proposed entry into force of this legislation is mid 2012.

Besides this ongoing work of the Ministry, companies have been licensed for the destruction of electric and electronic waste; including licenses for the destruction of the dangerous waste/chemicals (one company also got a license to store such goods). 1 company (İZAYDAŞ) is authorized to conduct waste incineration. 17 companies of different size have been declared as eligible to de-manufacture electronic equipment for recycling. Nine of these facilities recycle air-conditioning and refrigeration equipment. All facilities are capable to recycle materials such as iron, aluminum, copper, chrome, plastics, paper, etc. In 2011, the number of the recycled electronic waste was reported approximately 6,000 tons.

The Turkish Halon Bank (TUHAB) is the only authorized institution for the collection and verification of halons as well as other ODSs. It was established under the Ankara Chamber of Industry in 2007, and carry out its activities in cooperation with the other recovery and reclamation centers established in Istanbul (ISISO) and Izmir (ESSIAD) during the phase-out activities funded by MLF. Implementation will be done under the overall coordination of a Coordination/Implementation Board to be established by the National Ozone Unit in collaboration with these Centers and active participation of relevant institutions such as the RAC Sector Association, private sector and government institutions such as the Waste Management Department of the Ministry of Environment and Urbanization.

İZAYDAŞ Co. as the only authorized incineration plant of the country and other public and private sector companies will also be included in the implementation of the project (chapter 6).

The project complies with the criteria established by Decision 58/19 including focus on specific aspects not addressed by other pilot projects. This project is unique and innovative in its approach, because it demonstrates for the first time in the country/region:

- a. Funds from MLF may not only be used for a one time destruction of ODS but will provide a type of “seed money” for implementing a sustainable, integrated and comprehensive ODS waste management and destruction system in Turkey for the future years. If the business model is proven to be viable any lessons learned regarding the application of carbon markets and the introduction of producer responsibility programs could likely be modified and transferred to other countries where collection activities have already been carried out,
- b. Resource mobilization from the Turkish private sector, chambers, associations, unions and development agencies,
- c. Co-funding from Pan Gulf Industrial Company,
- d. The sourcing of co-funding from the carbon market as proposed by the Report by the Secretariat on funding opportunities for the management and destruction of banks of ozone-depleting substances (UNEP 2009),
- e. The implementation of advanced environmental policies (such as ban on venting of ODS, defining responsibility for financing recycling programs) which support the establishment of the business model for ODS waste management,

- f. The implementation and operation of state of the art recovery and collection technologies in an Article 5 country enabling an increase of ODS collection and destruction efficiency and thereby significantly reducing the impact on the ozone layer as well as on the global climate.
- g. The extraction and destruction of CFC-11 from insulation foams would be the next step for setting up an advanced waste management system for ODS. There are ongoing and pipelined R&D activities and projects by research institutions in cooperation with the private sector companies, on the recovery of CFC-11 from insulation foams. The Project will cooperate and include such contributions by the institutions to provide extremely valuable “real life” data about the amount of CFC-11 contained in insulation foams of refrigerators and scientific methodologies, etc. to improve and further develop the system.
- h. The project can build upon a well established energy efficiency strategy in Turkey through which around 2 million domestic refrigerators and air conditioners will be collected by the end of 2025 and from which over 100 tons of ODS have been collected for destruction. By providing a clear strategy for the beneficial destruction of ODS, further energy efficient programs will provide incentive opportunities.

UNIDO strongly believes that this project proposal is a real opportunity to demonstrate to Article 5 countries, that ODS destruction could be self-sustained and moreover self-financed through the commercialization of carbon credits, as well as national or self-funding/incentive mechanisms and the results of this demonstration project can be replicated in other Article 5 countries.

## 2. Justification for the ODS disposal pilot project

The Executive Committee, at its 58th Meeting, approved a set of interim guidelines for the funding of demonstration projects for the disposal of ODS in accordance with paragraph 2 of decision XX/7 of the Meeting of the Parties. The following information is provided to comply with all the requirements as set out by the above mentioned Decision 58/19.

### **i. An indication of the category or categories of activities for the disposal of ODS (collection, transport, storage, destruction), which will be included in the project proposal:**

The project includes all categories of activities for the disposal of ODS namely collection, transport, storage and destruction, however it only seeks funding from the MLF for the later three activities in relation to the existing stock of 80 tons of ODS (CFC-12 and CFC-11) as described in (iv) in line with the interim guidelines for the funding of demonstration projects for the disposal of ODS.

All collection activities will be financed through the innovative use of carbon markets and other national incentive programmes to be mobilized by the relevant national bodies involved in the implementation.

**ii. An indication of whether disposal programmes for chemicals related to other multilateral environmental agreements are presently ongoing in the country or planned for the near future, and whether synergies would be possible:**

The potential synergies with relevant programmes in the country can be listed as follows:

- The ongoing projects on energy efficiency and POPs, under implementation by UNDP in cooperation with UNIDO and relevant ministries (e.g. Ministry of Industry, Ministry of Energy and Natural Resources, Ministry of Environment and Urbanization), as well as national institutions in the country, funded by GEF and co-financed by partnering Ministries and private sector companies. These efforts are linked with relevant EU and international legislations such as Stockholm Convention, Energy Efficiency and Labeling regulations of EU.
- Improvement of Turkish legislation on environment and chemicals, by the MoEnU, e.g. adaptation of RoHS and WEEE directives of EU, as by-laws,
- Ongoing R&D activities by universities in cooperation with private sector institutions and national research funds.

**iii. An estimate of the amount of each ODS that is meant to be handled within the project:**

The project activities aim to handle a total estimated amount of 80 MT of CFC-12 within the first two years of the project, based on the official data provided by the authorized institutions to the National Ozone Unit on the already collected and accessible amounts, and the calculation of the potential amount to be covered with the relevant equipment collection or recycling activities together, which is in a very advanced stage of the collection. Details are given below (see item iv.).

**iv. The basis for the estimate of the amount of ODS; this estimate should be based on known existing stocks already collected, or collection efforts already at a very advanced and well-documented stage of being set up**

The expected amount of CFC-12 for incineration for the first two years of the project is estimated to be 80 MT, based on the data on the already collected and recorded quantities provided in the below table.

**Table 1: Overview of the reported and accessible amounts of CFC stocks in Turkey by January 2012**

Source of collection	Quantity CFCs
ASO Recovery Center (Turkish Halon Bank-TUHAB)	0,62 MT
Metal Goods Craftsmen Federation (MESF)	5,1 MT
Dispersed Service Shops (reported by MESF)	3 MT (minimum)
Other sources (reported by servicing companies for refrigeration and air-conditioning equipment, responsibility programmes, etc.)	75 MT (minimum)

Source: TUHAB, MESF

**v. For collection activities, information regarding existing or near-future, credible collection efforts and programmes that are at an advanced stage of being set up and to which activities under this project would relate.**

According to the By-law on Phase out of Ozone Depleting Substances and Montreal Protocol, the Government developed a licensing program for individuals and companies involved in the repair and maintenance of refrigerators and other products, which require ozone depleting substance for their continued functioning. This program ensures that the recovery, recycling and recharge of ozone depleting substances will be consistent with the overall goal of ozone depleting substance phase out. Three centers have been established for the recovery, recycling and reclamation of ODS. Those form the basis for the refrigeration management system which already started in 2005.

As a supportive action energy efficiency related collection campaigns for refrigerators and white goods have been launched. The activities aim to replace old equipment by new machinery with a better environmental profile. Within the project the close co-operation with the RAC sector associations, leading manufacturing companies, service shop associations and networks enhanced.

The NOU officially requested the relevant institutions to provide data and update the NOU on their activities on this collection programs on a regular basis. Also NOU declared intention to include this request as a reporting obligation to the relevant legislation, in cooperation with the relevant departments of the Ministry (e.g. Climate Change and Waste Management Departments).

**vi. For activities that focus at least partially on CTC or halon, an explanation of how this project might have an important demonstration value**

As already mentioned in table 1, 50 metric tons of halon-1301 currently stored in the Turkish Halon Bank will also be destroyed. The destruction of this quantity equals an incineration of 500 tons of CFC, thus adding a high environmental benefit to the project. Together with the incineration services provided by Pan Gulf Company (chapter 4) is gives an example on how excess quantities of such substances can be handled on a region level.

### **3. Background on ODS and waste related legislation in Turkey**

#### **List of legislations relevant to the project**

Main legislations with respect to the ozone depleting substances are the Law on Environment No.2872 (Official Gazette: 11 August 1983, no 18132) as amended by the Law No.5491 (Official Gazette: 13 May 2006, no 26167) and the By-law on Phase-out of the Ozone Depleting Substances (Official Gazette: 25 July 1999, no 23766) which regulate controlled substances, control of use and placing on the market, trade controls and reporting requirements.

The development of the national legislation reflects Turkey's intention to join the EU and its effort to transpose EU regulations into national laws. Following acts are important for this project:



1. The main laws are the Law No. 2872 on Environment as amended by Law No. 5491 and the Law No 4856 on the Establishment and Duties of MoEnU.
2. Since 2004, Turkey is party to the UN Framework Convention on Climate Change (UNFCCC) and since 2009 to the **Kyoto Protocol**. Therefore Turkey has been considering how Directive 2003/87/EC on **emissions trading** is applicable in the country. The current rate of greenhouse gas emissions per capita in Turkey is lower than the average for the OECD countries or economies in transition.<sup>2</sup> The statistical office, TURKSTAT is responsible for the collection and processing of relevant data.
3. All provisions (the only exception being Article 8 on the establishment of a reporting and data recording system) of Directive 91/689/EEC on **hazardous waste** have been transposed into the 2005 By-Law on Hazardous Waste Control. MoEnU and its Provincial Directorates have been designated as competent authorities for:
  - a. Provisional storage, disposal and recovery of hazardous waste;
  - b. Inspection of disposal/recovery facilities and preparing plans and programmes for waste management.
4. MoEnU and the Ministry of Transport are responsible for the issuing of licenses for transport. For reporting purposes, waste producers and operators of waste disposal/recovery facilities are obliged to keep the records on type, amount and other characteristics of waste (e.g. mode of transport, method of treatment) and to submit them to MoEnU. Turkey indicated the need to establish an inventory of data on hazardous waste, to strengthen the administrative capacity (notably in the monitoring), to enhance industry awareness with regard to the management of hazardous waste and to build new disposal/recovery facilities.
5. There is an ongoing work on the adaptation of the Directive 2002/96/EC on **waste electrical and electronic equipment** (WEEE), which was partially adopted by the end of 2006 after finalization of technical studies, as the national WEEE by-law, under the coordination of MoEnU, in cooperation with the relevant sector institutions. The proposed period for the entry into force of the draft legislation mentioned to be mid 2012, by the MoEnU Officers.
6. As regards Directive 2001/80/EC on **Large Combustion Plants (LCP)**, Turkish legislation (notably the By-Law on Air Pollution Control) provides for definitions of LCPs, sets emission limit values, designates MoEnU, Provincial Governors and local authorities as competent bodies, lays down requirements concerning monitoring of emissions (e.g. methods and frequency of measurements) and reporting. According to the estimations there are around 70 installations<sup>13</sup> falling within the scope of the directive, the majority of which meet the emission targets set in the directive. Difficulties in the implementation of the Directive may be expected due to high costs of investment needed (in some cases the modernization of existing installations will be initiated only after completion of privatization process). The administrative capacity, in particular with regard to enforcement and inspection should be strengthened.
7. The Directive 2000/76/EC on **incineration of waste** (incl. definitions, procedure of application, principles of operation, issuance of permits, emission limit values, monitoring

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<sup>2</sup> Green House Gas emission per capita in Turkey: 4.17 tonnes

mechanism, methods and frequency of measurements) has been transposed as well as the remaining provisions in 2007. In 2011, there were 18 facilities (1 incineration and 17 co-incineration plants) operating on the basis of a license issued by the MoEnU. These facilities are suitable to destruct the electrical waste and recycle the materials such as iron, aluminum, copper, chrome, plastics, paper, etc. By 2010 the number of the recycled electrical waste recorded by the MoEnU to be around 6,000 tons.

Institutions authorized by the relevant regulations for ODS collection, validation and destruction in the country can be summarized as follows:

**The Turkish Halon Bank (TUHAB)**, established under the Ankara Chamber of Industry in 2007, is the only authorized institution for collection and validation of halons and other ODSs, with a ministerial circular (MoEF -No.200/4). TUHAB also designated as the coordinating institution within the CFC & Halon phase-out activities under Turkey National Programme for ODS Phase-out, as one of the recovery and reclamation centers.

**Recovery and Reclamation Centers ISISO and ESSİAD**, in cooperation with the other centers established in Istanbul (ISISO) and Izmir (ESSİAD) within the CFC phase-out activities funded by MLF.

**IZAYDAŞ (Izmit Waste and Residue Treatment, Incineration and Valuation Co.Inc.)**, a company of the Kocaeli Metropolitan Municipality, is the only authorized institution for the waste incineration processes in the country.

**Metal Craftsmen Federation (MESF)**, authorized for the in-site collection, validation and recovery of the ODSs, via their member organizations, service technicians, by using the ODS recovery equipments provided within the previous CFC phase-out programme.

The improvement of Turkish legislation is considered as another important element of the proposed demonstration project, to ensure the creation of a sustainable, integrated and transparent ODS waste management system.

The proposed changes shall include:

1. Ban on venting of ODS and on deposition of ODS containing products/equipments (wastes) in landfills
2. Defining and assigning the responsibility for financing recycling programs (e.g. local authorities, producer responsibility programs).
3. Requirements that the applied recycling technology achieves an acceptable amount of ODS recovery.

Implementation will be done under the overall coordination of a Coordination/Implementation Board to be established by the National Ozone Unit with the active participation of relevant institutions including Waste Management Department of the MoEnU, IZAYDAŞ Co, etc.

## **4. Co-financing component: Pan Gulf Industrial Company**

### **4.1 Background of Pan Gulf Company**

Pan Gulf Industrial Company is a wholly owned subsidiary of Pan Gulf Holdings. The enterprise is active in the business world in the Middle East for over 30 years and is listed in the top 50 companies in Saudi Arabia.

Pan Gulf can be regarded as a leading company offering solutions for environmental problems. As a principal approach the company follows global environmental organizations, which set out strict guidelines for safe recycling and destruction of halons and ODS and global warming gases. It also offers training and educating to individuals as well as organization to improve their environmental profile.

The enterprise offers state of the art processing for halon and ozone depleting substance (ODS) in the Middle East and Asia, meet international standards for recycling and adhere to the most up to date specifications. It also uses the latest in halon and ODS recycling equipment, sophisticated laboratory equipment, performing series of test and by utilizing our internationally trained technicians.

The halon and ODS recovery and recycling provided meets current standards set out by the Montreal Protocol, ASTM – D7673-10, ISO – 7201-1 (1989) Mil Spec – DTL – 38741A for Halon 1211, ASTM D 5632 – 8 Type 1, ASTM D 5632 – 08 Type 2, ISO -7201 (1989) for halon 1301, and GOST standard for halon 2402. Pan Gulf provides our customers with full laboratory certificates.

Pan Gulf has formed a partnership with Reclamation Technologies International Company, RemTec. RemTec provides technical support to Pan Gulf.

### **4.2 Objective of activities undertaken by Pan Gulf**

1. Destroy all Ozone Depleting Substances (ODS), meeting highest standards of the Montreal Protocol
2. Fulfill a United Nations Industrial Development Organization (UNIDO) objective of providing ODS destruction services to Turkey and Western Asia and potentially the Western Asian Region and Africa.
3. Provide an incentive towards the collection of ODS
4. Provide co-financing to the overall project to enhance components such as training, certification and verification.
5. Provide technical assistance to the Government of Turkey.

Through the direct involvement and experience of the company in the area of ODS destruction, the following items will be undertaken to assist the Government of Turkey and UNIDO:

- Destruction of ODS collected through this project.
- Monitoring and Verification of ODS Destruction.
- Provide Carbon Market project management, including handling documentation, sales and other administrative as well as technical assistance.
- Transportation of aggregated CFC to RemTec for destruction.

- Provide technical assistance, including providing training workshops to be held in both facilities located in the USA and Saudi Arabia; the workshops will also cover health and environmental issues.

- **Technical Support Component**

The project will address not only the destruction as the only subject, because the environmental and economic benefit mainly depends on successful marketing of the recovered construction materials (steel, plastics, rubber, aluminum, glass, etc.). These activities will need to be supported through provision of a technical support component for ensuring that the collection of the high quantities of recovered material could be sold. This coincides with the priorities to develop recycling activities in Turkey.

Under the technical support component the following actions are planned:

a) Establish quality standards for the recovered construction materials using data and information from the de-manufacturing equipment supplier.

b) Conduct four workshops to ensure a high level of professional technical assistance in the fields of health and safety and for protection of the environment for technicians who are working in the collection of end-of-life refrigerator. The workshop goal is to ensure a high level of assistance in the fields of health and safety and for protection of the environment.

- **Monitoring and verification of the destruction**

In order to ensure that all the ODS are properly monitored and accounted for, Pan Gulf will develop a monitoring plan capturing all operations and reporting activities associated with this ODS destruction project. It will stipulate the frequency of data collection; a record keeping plan; the role of each individual involved in monitoring; quality control provisions to ensure that operations, data acquisition and ODS analyses are carried out consistently and with precision; and will develop data management systems and coordination of data between ODS aggregators, project developers, and destruction facilities.

### 4.3 Project Financing & Pan Gulf Co-Financing

The proposal envisaged that funding from the Multilateral Fund will cover the costs of destruction of the currently available ODS waste by exporting it for destruction to an accredited destruction facility in the United States. The demonstration project also foresees co-financing, to which Pan Gulf will undertake the following components and offer co-financing.

- **ODS Collection Incentive – Co-Financing**

Pan Gulf will provide an incentive for the collection of the ODS as described below.

**Table 2: Financial incentives provided by Pan Gulf**

Substance	UNITS	Incentive amount in US\$	
		Pure	Non-Pure
CFC 11*	kg	\$ 1.5	\$ 1
CFC 12	kg	\$ 2.5	\$ 2
Halon 1301		\$ 1.5	

## 5. Destruction of ODS

RemTec International's processing systems and plasma arc technology provides the highest levels of Destruction and Removal Efficiency (DRE) levels of any of the technologies available. Dioxins and Furans are almost non detectable. The process can be regarded as safe, environmentally preferred and accepts 100% waste streams of all ODS including halons.

### 5.1 Facility Requirements

- RemTec International's state of the art processing and tracking systems for ODS
- Plasma Arc Destruction Equipment and Technology
- ARI Standards Certified Laboratory
- Complete Tracking of the recovery, processing, testing, and destruction of the ODS
- Aggregation to qualify for Carbon Offsets
- Protocol to meet Third Party Verification

#### • RemTec International – Supporting Information

RemTec International has proven capability to develop and operate ODS processing and destruction systems and facilities. In the following the capabilities for processing and destroying ODS are documented:

RemTec International is headquartered in Bowling Green, Ohio, USA. The company designed and processed ODS for the National Halon Bank (NHB) in Australia. It was the original contractor chosen to recover and reclaim ODS at the NHB. RemTec also designed the Tank Management software and control system. It also completed the Make Safe Halon 1301 Program from 1996-2002 for the Commonwealth of Australia.

#### Facility, Storage Tank



The National Halon Bank in Australia was designed to recover, process and destroy ODS using RemTec's proprietary Cylinder Piercing Technology (CPT) and the Modular Automated Reclamation System (MARS) to recover and prepare the ODS for destruction.

RemTec specifically developed Cylinder Piercing Technology (CPT) for this project.

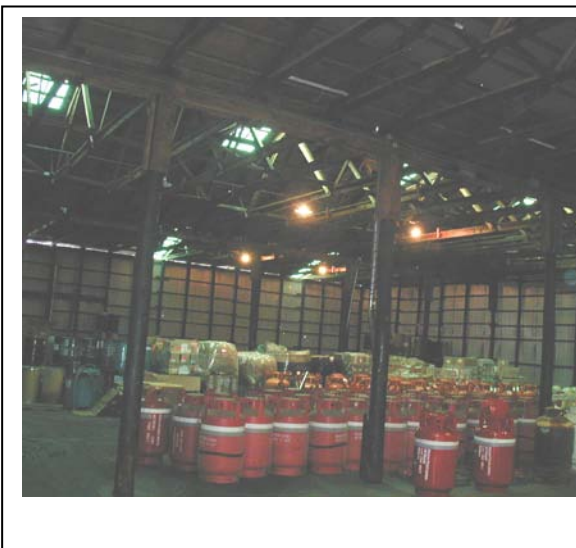


The RemTec Defender Halon Recovery systems were used to collect ODS from larger cylinders.



RemTec utilizes a special forklift clamp attachment that will lift, rotate and invert ton and ½ ton size cylinders. This will facilitate the safe handling of cylinders within the factory.

Inside views of RemTec International facility in Bowling Green, OH



RemTec International is an industry leader in the recovery, reclaiming, separation and destruction of Ozone Depleting Substances (ODS) for several important reasons.

First, the company is committed to developing systems, which are efficient at processing ODSs with minimal loss to the atmosphere. Secondly, the processing systems are flexible. The equipment is designed to operate in stand-alone mode or together as part of our integrated ODS processing and destruction facility. The recovery and processing equipment also meets highest standards.



NHB Laboratory 1996-2002



Tank Farm Management – NHB Australia

In the following the steps RemTec takes in processing ODS are described. Additional information can be found under the following web-address: [www.remtec.net](http://www.remtec.net)



- **Receiving and Inspection**

Each cylinder containing ODS is immediately leak tested to ensure it does not emit any product to the atmosphere. It is weighed and a scale weight is recorded on a tag and this tag is also placed on the pallet. Each cylinder receives a tag to identify the source of the material with the receiving weight and other particulars of the cylinder. A log sheet is then prepared to list all cylinders received by serial number and total weight received.



- **Recovery**

Cylinder Piercing Technology (CPT) equipment is used to efficiently recover the ODS by piercing a hole in the cylinder and collecting the ODS without release of any material to the atmosphere. The ODS is collected into batches of approximately 2,000 pounds. After the cylinder reaches a vacuum, the weight of the empty cylinders is recorded to determine the amount of ODS collected from that cylinder. This information is logged and made part of the report of accountability.





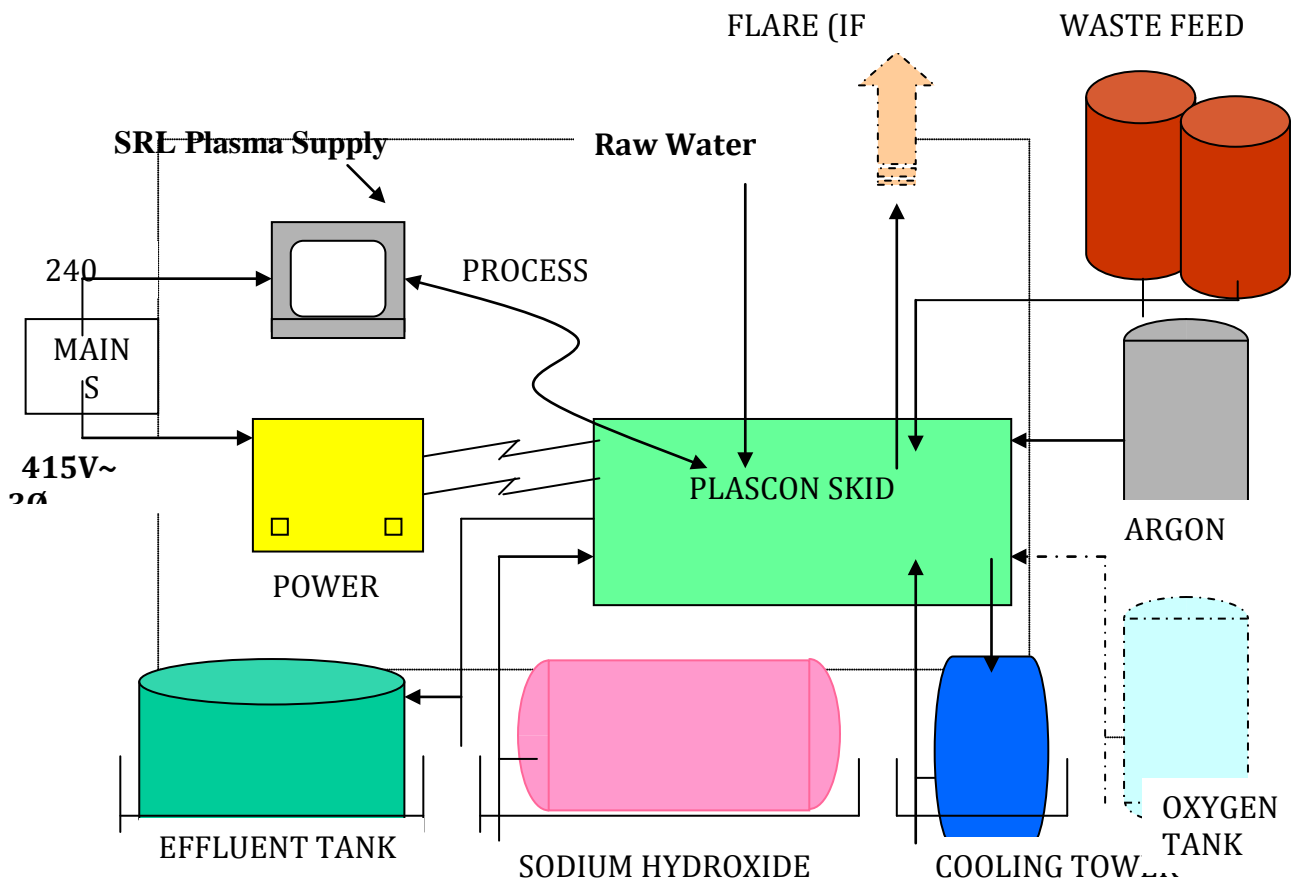
- **Analytical Testing**

Each batch is tested. A sample is drawn from each cylinder and analyzed by the ARI Certified testing laboratory.



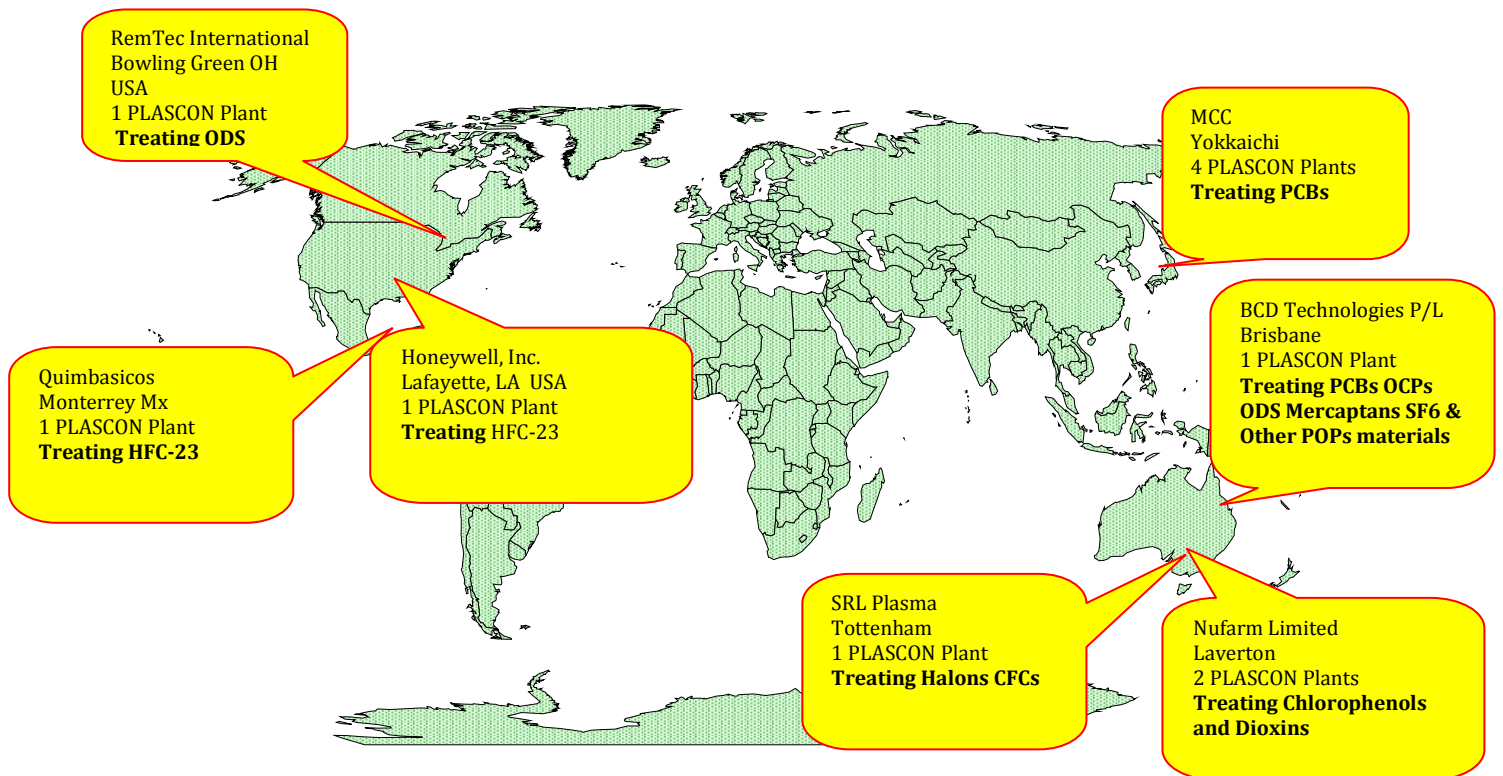
- **PLASCON Services and Scope of Supply**

A block diagram showing SRL Plasma's scope of supply is shown below:



- **Worldwide Application of PLASCON**

The PLASCON in-flight plasma-arc system was developed by the Australian Commonwealth Scientific Industrial Research Organisation (CSIRO) in association with SRL Plasma. The technology was designed to treat chemical manufacturing process wastes. The technology has been adapted to treat a wide range of halogenated organic waste worldwide since it was first commercialised in 1992.



## 5.2 Process of the Destruction

- **PLASCON - A**

The ODS waste will be destroyed in a destruction facility that is compliant with both the international standards specified in the Technology and Economic Assessment Panel (TEAP) Report of the Task Force on Destruction Technologies and Code of Good Housekeeping. This project will focus exclusively on the destruction of waste CFCs, no CTC or halon will be involved in this pilot project.

- **Electric ARC Plasmas**

Plasma is an ionized gas consisting of molecules, atoms, ions and electrons. It differs from the normal gaseous state because it is electrically conducting. Plasma is often referred to as the fourth state of matter, since material passes from solid, to liquid, to gas and finally becomes plasma with increasing temperature. Gases become electrically conducting at temperatures in excess of 4,000°C and in most industrial plasmas temperatures greater than 10,000°C are attained. A plasma

column is generated by the passage of an electric current through a gaseous medium between a cathode and an anode.

Electric arc plasmas offer the advantage of very high temperature, high energy density and accurate, rapid control of the process; attributes which if correctly used, make the technology particularly relevant to waste destruction applications. Any organic molecule injected into the plasma decomposes instantaneously into its component atoms and ions due to the very high temperatures involved.

- **PLASCON Generic Process Description**

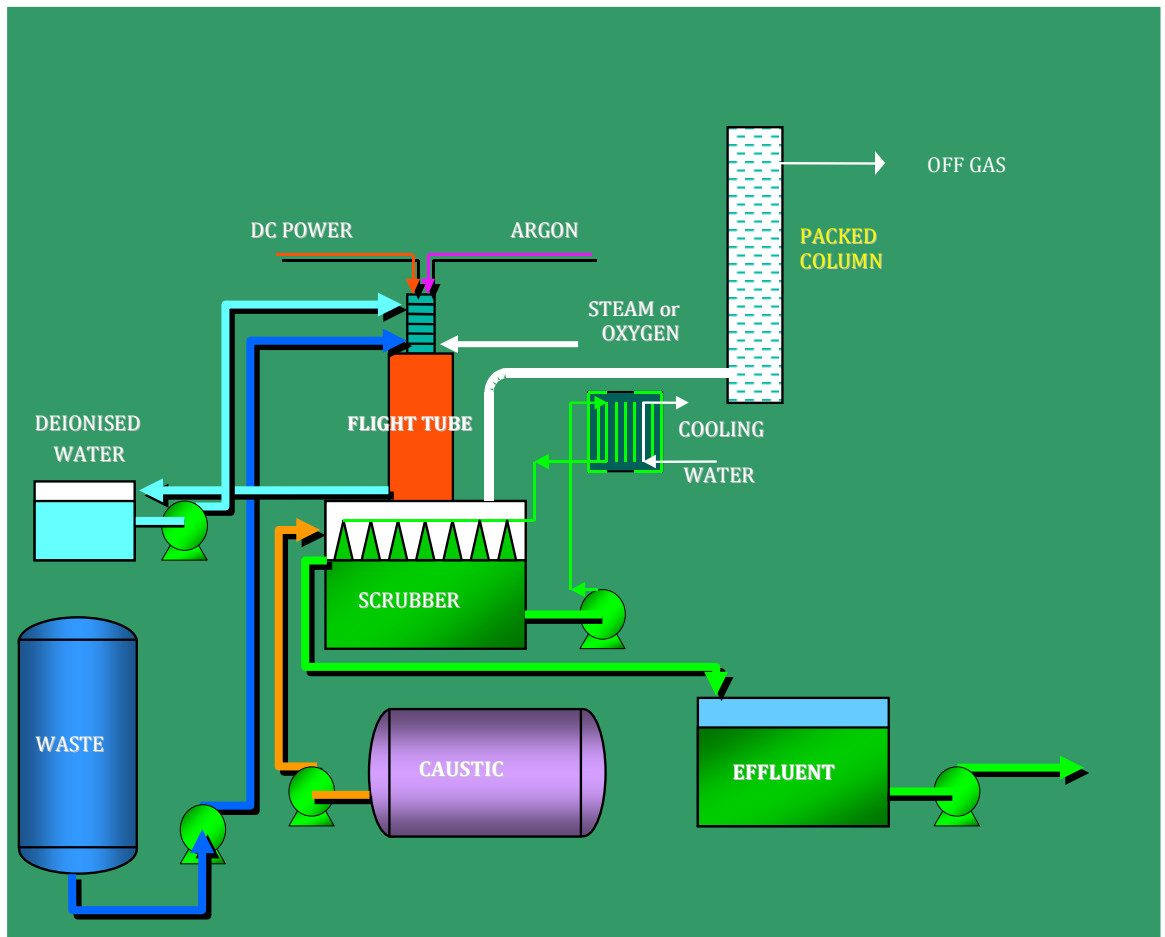
PLASCON is an in-flight argon plasma arc facility for the destruction of organic waste liquid and gases. PLASCON is especially useful for the destruction of concentrated organic halogenated compounds that other processes have difficulty in treating. Typical PLASCON feed stocks are CFCs, Halons, PCBs, organochlorine pesticides and herbicides, chlorinated solvents, sulphur hexafluoride, dioxins and other waste organic compounds.

The PLASCON process is designed to have a high destruction performance for a wide range of materials and to suppress any potential back reactions that would lead to undesirable by-products. This is particularly important when treating chlorinated organic wastes. Although the PLASCON process cannot directly treat solid wastes, the addition of suitable front-end technologies in combination with PLASCON allow for effective treatment of solid wastes. Front- end technologies that have proven successful for treating solids include thermal desorption and solvent extraction. Solid wastes must be evaluated on a case-by-case basis to assess the suitability of the PLASCON process for a particular application.

The process inputs (*electricity, argon, oxygen or steam and sodium hydroxide*) are significantly less than those required for a comparably sized high temperature incinerator. Consequently, the process effluents are also substantially less. The liquid effluent is a low volume, concentrated inorganic salt solution suitable for discharge to an industrial sewer. The gaseous effluent consists of a mixture of argon, carbon gases and water vapor.

The critical conditions that PLASCON achieves are rapid heating of the waste (1 ms to about 3,000°C), pyrolysis (about 20 ms), followed by rapid quenching (from 1,500°C to less than 100°C in 2 ms). The essential components of the PLASCON process include:

- 1 Plasma generation and waste injection
- 2 Reaction chamber (flight tube)
- 3 Quench
- 4 Scrubbing system
- 5 Off Gases
- 6 Liquid Effluent
- 7 Destruction Efficiency
- 8 Power supply
- 9 Process control system



- **Plasma Generation and Waste Injection**

The plasma torch is of segmented design using argon as the plasma gas. The argon plasma is generated by a direct current discharge between a cathode and anode. At typical operating conditions the mean exit enthalpy of the plasma is about 11 MJ/kg at a mean exit temperature in excess of 10,000°C. The torch is rated at 150 kW and has an electrical efficiency of roughly 50%. Argon was chosen as the plasma gas since it has suitable thermodynamic properties, is monatomic and for its inertness to the torch components. A durable, long-life torch design is therefore possible which is crucial to any industrial application.

Waste enters the torch at a specially designed *Injection Manifold* and instantly mixes with the plasma. The mixture temperature at this point is approximately 3,000°C.

- **Reaction Chamber (Flight Tube)**

The waste is rapidly pyrolysed (degraded by heat) in the injection zone and the hot gases pass down the flight tube (a water-cooled reaction chamber) undergoing further pyrolysis. Virtually all intractable waste materials contain little or no oxygen and when pyrolysed will produce copious amounts of soot (carbon). Therefore, depending on the nature of the waste stream, oxygen or steam is added at the injection manifold to ensure that all carbon is converted to carbon gases. The hot plasma gases continue to cool to approximately 1000°C in the reaction chamber.

- **Quench**

The hot gas mixture at the bottom of the flight tube resulting from the decomposition of a halogenated organic waste stream is typically CO, CO<sub>2</sub>, acid halide gases, Ar and water vapour,

together with trace amounts of carbon fines (less than 0.1% of the feed). The hot gases exiting the *Flight Tube* undergo rapid quenching to approximately 50°C by direct sprays of cool alkaline liquor. This rapid quenching prevents the formation of any undesired organic molecules such as Dibenzodioxins or Dibenzofurans.

- **Scrubbing**

The cool gases from the *Quench* are further sprayed with alkaline scrubber liquor to neutralise acid halide gases. The gas mixture is then passed to a counter-current, packed column where final traces acid gases are removed. A percentage of the carbon dioxide in the gas stream is also removed during this process.

- **Off Gases**

The composition of the off gas from the packed column is dependent on the nature of the waste stream being treated. Off gases resulting from the destruction of ODS gases (CFCs and Halons) can be discharged directly to atmosphere. The destruction of other chlorinated organic wastes results in an off gas mixture that contains levels of H<sub>2</sub> and CO. These gases are passed to a small ground flare that converts CO to CO<sub>2</sub> and H<sub>2</sub> to H<sub>2</sub>O prior to atmospheric discharge.

- **Liquid Effluent**

Liquid effluent is an alkaline, near saturated aqueous solution of sodium halide salts. The solution also contains sodium carbonate and bicarbonate. The flow rate of the liquid effluent is generally 1.2 - 2.4 m<sup>3</sup>/h. By-products may be recoverable.

- **Destruction Efficiency**

The destruction efficiency of the PLASCON process is typically in excess of 99.9999%, exceeding all current and predicted international standards. PLASCON produces no detectable levels of dioxins or any other undesirable organic compounds

- **Power Supply**

The power supply has been designed to meet the needs of the PLASCON process. It is a 12 pulse, SCR based transformer/rectifier that converts a 415 V AC 3 phase power input into a current controlled DC output. The power supply is designed for an electrical efficiency of at least 95%, with provision for power factor correction from 150 kW to 200 kW. A specialised arc starting device initiates the arc between the cathode and the primary anode.

- **Process Control**

PLASCON operation is controlled by a fully integrated, process control software system that monitors forty-nine process parameters on a continuous basis. Data is logged and stored for analysis, fault finding and to meet regulatory requirements. If set points are exceeded by a specified amount the entire system instantaneously shuts down. Under normal operating conditions a soft shut down routine is executed. In this mode the system shuts down in under one minute. Start-up from cold takes between two and three minutes.

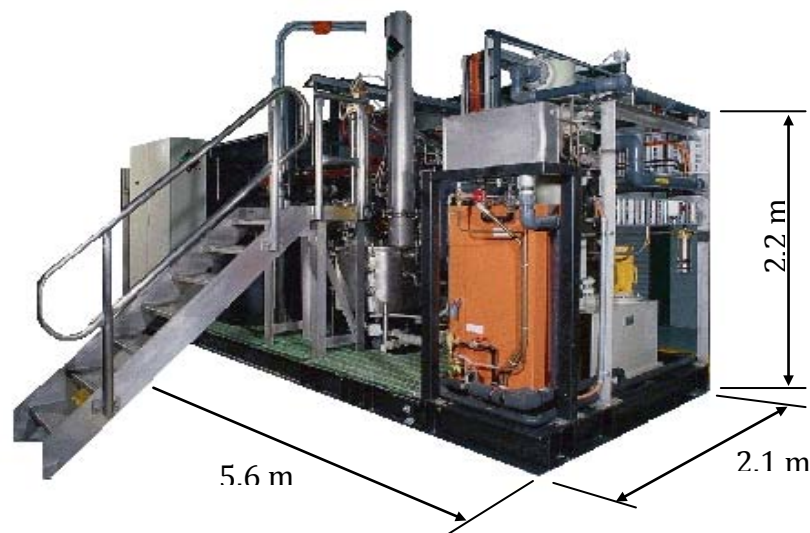
No specialized skills are needed to operate the process. Once the elemental composition of the feed is known all the process parameters can be predetermined and the system then operates in the most efficient manner.

The electrical nature of PLASCON and the unit's rapid start up and shut down capability marry well with a sophisticated process control system. A small distributed process control (DCS) system is the usual control device, although PLASCON is flexible and can easily run on a PLC type controller. PLASCON is fully automatic and can be operated remotely and unmanned if so desired. All critical parameters are constantly monitored by the control system so that rapid shut down is automatically initiated if control is lost.

Less than 0.5 gram of waste is present in the flight tube at any instant so the probability of significant amounts of untreated waste entering the environment by accident is negligible. In this respect alone, PLASCON offers great safety advantages over conventional long residence time processes.

- **Physical Dimensions**

The skid mounted PLASCON™ plant is very compact, being the size of a standard shipping container. This makes the process easy to locate and relocate if the need arises.



The PLASCON™ skid itself includes all of the core PLASCON™ technology components such as the plasma torch, reaction chamber, quench, packed column, steam boiler where required, feed mass flow controller, heat exchangers, closed loop de-ionized water cooling systems and all associated instrumentation and electrical controls. The PLASCON™ power supply and control PC are the only core hardware items that are mounted off-skid.

For safety reasons PLASCON™ is normally mounted in a covered bounded area. The Power supply requires a small undercover area at least 3m \* 3m \* 2.4m, with adequate ventilation for heat removal.

## 6. Project implementation

### 6.1 Implementation structure and beneficiaries

The project proposes multi-dimensional and multi-level implementation model, in order to cover the largest range of stakeholders for a better coverage of activities, sustainability of the action and results, as well as increasing its impact in the relevant sector and the country.

#### 6.1.1 Collection

- **RAC sector and servicing companies, sector associations**

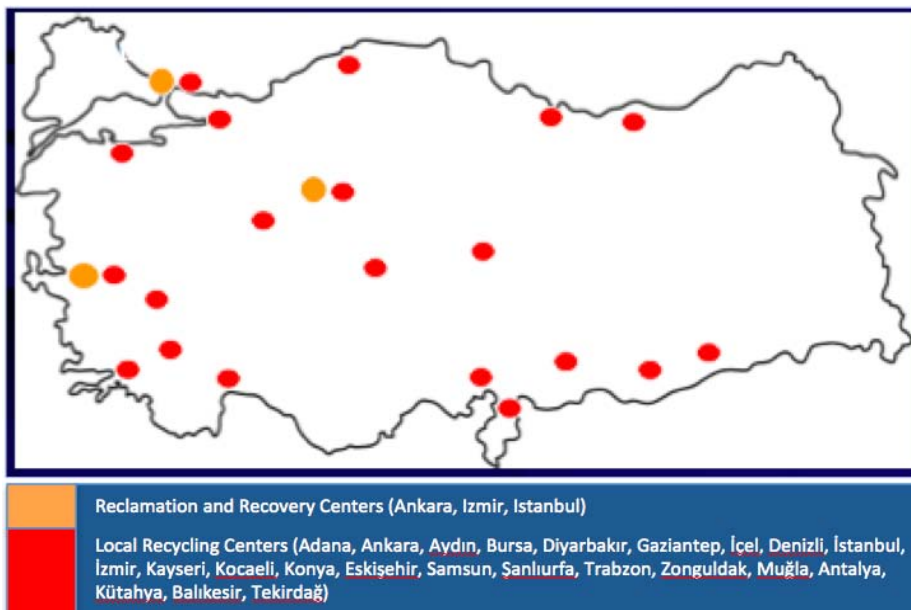
In Turkey, more than 2.000 service shops registered to the ODS Monitoring database of the NOU, as well as more than 50 RAC manufacturing companies of different scale and product range, who are actively involved in the collection of all types of ODSs from the market and existing equipment containing refrigerants like CFCs, HCFCs and HFCs. The collection activities will be organized in cooperation with (but not limited to) the below listed institutions, considered as the beneficiaries of the project.

- **Metal Goods Craftsmen Federation (MESF)**

MESF is an institution established to represent people and companies in ore extraction and metal-working industry. Throughout Turkey, MESF has 300 000 producer members. MESF provides assistance to its members and helps them improve their business. A country-wide communication platform has been created to improve cooperation between members of MESF, dealing with many aspects of general and specialized business issues. Among all the 33 job disciplines, MESF has the highest acceptance among workers.

According to the needs of today's world, MESF started to operate through online market in order to create electronic demand and supply. New developments are also expected to be pursued as the needs change.

#### Map: Spatial distribution of the recovery centers and local recovery units of MESF in TR



## **Recycling & Electronical Equipment Demanufacturing Facilities**

### ▪ **ULUSOY SDK International Co. and GEP Engineering Co. (SEG Umwelt Service GmbH partner)**

Ulusoy Recycling and Waste Management established in 2009, has begun its operations within the body of Ulusoy International Investment Holding. It operates in the areas of directly packaging, disaggregation and selling of a portion of all kinds of scrap and waste material, including but not limited to iron, nonferrous metals, plastic, nylon, paper, cardboard and wood packages, waste batteries and accumulators, used waste tires, waste electrical and electronic goods and cards with their scraps, by bringing them to the field of Ulusoy Recycling and Waste Management.

Ulusoy Recycling and Waste Management provides support and service with a strong supply, marketing and distribution organization structure. The management team mainly composed of qualified engineers.

The business processes of Ulusoy Recycling and Waste Management works with Customer Relationship Management, Reporting and Warehouse Management supported by management information systems. The company renders service in several places in Turkey, with representations in Kocaeli.

Activities of the Company:

- Buying and selling all kind of scraps.
- Removal and transport operations of scraps from the field.
- Disposal of return products guaranteed.
- Disposal of products under control, which should not be released, and making them unusable.
- Delivery of environmentally harmful products to necessary destinations under the necessary rules and procedures.

As per the information provided by the company officers, there is an ongoing cooperation with the GEP Engineering Co, the representative of SEG Umwelt Service GmbH in Turkey, for the establishment of a fridge de-manufacturing and recycling facility, which is planned to have a capacity of 300.000 fridges/year.

### ▪ **EXITCOM Co.**

As the quantity of electric and electronic waste generated in Turkey has grown rapidly during the past years, Exitcom provides recycling services in the field of electric and electronic waste at plants in Germany and Turkey since 1999. Within the scope of WEEE, the facilities offer recycling services with high environmental orientation necessary to implement the legal requirements of WEEE and provide support in consulting, logistics, recycling certification, environmental technologies and reverse supply chain management. The company ascribes to a high environmental profile, safety issues, and high quality of services through certified ISO 14001, ISO 9001, and OHSAS 18001 management systems which apply to the entire operation. Adding to this, Recycling services are also offered business partners in Europe and the Middle East.



Exitcom runs large projects with international companies, as well as sets up co-operations on a regular basis; for example IBM, DELL, HP, XEROX, SAMSUNG, ALCATEL, SIEMENS, VODAFONE, FUJITSU, TOSHIBA, TCHIBO, etc. An additional business operation is the collection and pre-sorting of batteries in Turkey (TAP – Portable Batteries and import dealers institute). In collaboration with TUBİTAK (T.S.T.R.I. / Turkish Scientific and Technical Research Institute) new recycling systems are set up with the objective to introduce new recycling technology to Turkey. Exitcom also established the first recycling plant for electric and electronic waste in Turkey where used fluorescent lamps were processed. The underlying strategy of the company is to prevent recyclable materials going to landfill or incineration before recycling treatment. In a similar approach, a closed recycle system for Toner Cartridges was developed - before used products were simply sent to incineration. In the recycling process toner dust is separated, with a recovery rate of up to 98 %. A total 42 % of the recovered material is plastic, which can be used in other industrial production processes.

The enterprise also offers know-how to support the implementation of the WEEE directive in Turkey. It co-operates in projects with Turkey's largest electronic markets as ELECTRO WORLD MEDIA MARKT AND TEKNOSA, etc, and shares experiences gained in other European countries and collaborates closely with the Ministry of Environment. Exitcom also works for constitutions running collecting areas in municipalities like ISTANBUL, KOCAELİ, BURSA, IZMIR, SAKARYA, MERSIN, SAMSUN etc, and provides education programmes for schools, universities and other companies.

### **Other Relevant Institutions**

#### **▪ Turkish Municipalities Union (TBB)**

Established in 1945 in order to work in the field of municipality working; it operates been as an NGO.

The main roles of the Union are to:

- Train the employees of municipalities in terms of “e-municipalities”, information technologies and knowledge management
- Present opinions when new laws for municipalities are prepared
- Improve the coordination and communication among all the municipalities as well as supporting technical and administrative knowledge exchange
- Pursue the developments in municipalities among the world and attend to conferences, seminars, discussions and technical trips which are related to them
- Provide printed publications such as books, magazines etc. which are related to municipalities
- Cooperate and work together with other organizations such as government organizations, NGOs, universities and design projects with them.
- Cooperate with international organizations who are working in the field of municipalities and being a member of international communities in related fields, building up relationships with other country municipalities
- In the procedures of European Union membership, supporting the country to develop local administration skills, build up Projects to work together with EU

## 6.1.2 Storage, registration and verification

### Recovery and reclamation centers

#### ▪ **Turkish Halon Bank (ASO)**

Turkey presented this National Programme to the Multilateral Fund in 1992 and as a result it got the right to benefit from the financial resources for projects. Through the World Bank, financial resources were provided for the Turkish Halon Bank Project. With the coordination of the Ministry of Environment and Forestry and Ankara Trade Center, this Halon Bank was established.

Halon Bank is responsible for:

- Recording of existing amounts of halons in Turkey
- Providing technical support for alternatives of halons
- Storing and testing halons and selling it to firms and organizations still allowed to use halons (critical uses)

#### ▪ **ISISO**

This company was founded in 1986 with the objective to help small companies and provide technical assistance. It operates in the region of İstanbul.

Apart from the main goal of establishment, which is to help the partners having their own businesses as developing their technical capabilities, other goals such as providing knowledge of modern production methods, enhancing the coordination between companies and improve their occupational knowledge have gained importance.

#### ▪ **ESSIAD**

The Association of the Aegean Industrialists and Businessmen of Refrigeration (ESSIAD) was founded by leading businessmen and enterprises of the HVAC-R sector (Heating, Ventilation, Air-conditioning and Refrigeration sector) in 1990. The main purpose of the Association is to keep the rights and the legal ethics of the people and companies in the HVAC-R sector, to support market improvement plans and deliver high quality products to the end-user. The association counts 103 members, from academics to leading regional companies. ESSIAD became the first sector association with ISO-9001:2000 Quality Management System Certificate.

In the following, the most important activities are summarised:

- Authorized ODS recovery and reclamation center in Aegean region.
- Conferences and meetings about CE Marking and similar rules of EU, arranging conferences with EU Business Development Centers and KOSGEB in order to train the members on getting maximum financial and technical support from EU.
- Studies for establishing permanent sector specific trainings and hence plan to increase the number of qualified personnel.

- Increasing Capacity for International Competitiveness of HVRAC Sector, to be funded by the Ministry of Economy of Turkey.
- Feasibility Study Project for an Accredited Test and Analysis Laboratory which is funded directly by Izmir Development Agency.
- Leonardo Da Vinci – European Union Vocational Education and Training Mobility Program. ESSIAD signed the local partnership statement with Buca DMO Multi-programmed High School, who presented this project within “Researching the Hygiene and Mechanical Air-Conditioning Systems in Buildings”. ESSIAD attends abroad visits within this content.
- ESSIAD issues a refereed journal under the name “Refrigeration World” four times a year.

### **6.1.3 Destruction and incineration**

#### **▪ IZAYDAŞ**

This company was founded in May 1996, established by Kocaeli Metropolitan Municipality, and it has been working in waste management since 1997.

IZAYDAŞ manages all types of waste including

- Clinical and hazardous waste incineration and energy production
- Waste storage and disposal
- Sterilization of medical waste
- Biogas center

The company runs the biggest incineration facility and is able to incinerate all types a waste dealt within this project. However, certification to operate on voluntary carbon markets has not yet been received. A certification in accordance with VCS is considered for the later phase of this project.

#### **▪ PAN GULF**

Pan Gulf will provide disposal and incineration services involving voluntary carbon markets (CAR). See chapters 4 and 5.

### **6.1.4 Implementation structure**

## Proposed Implementation Structure

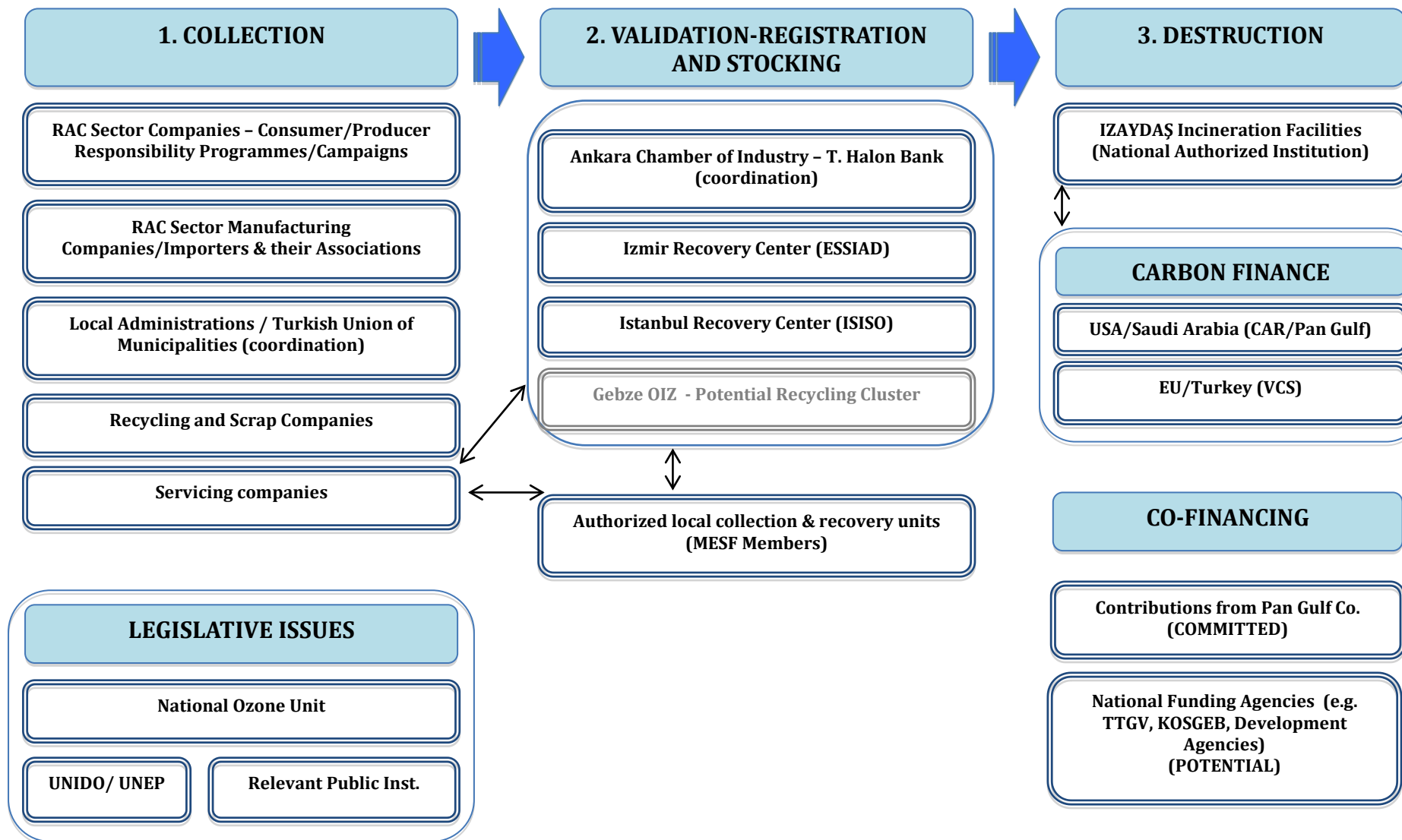
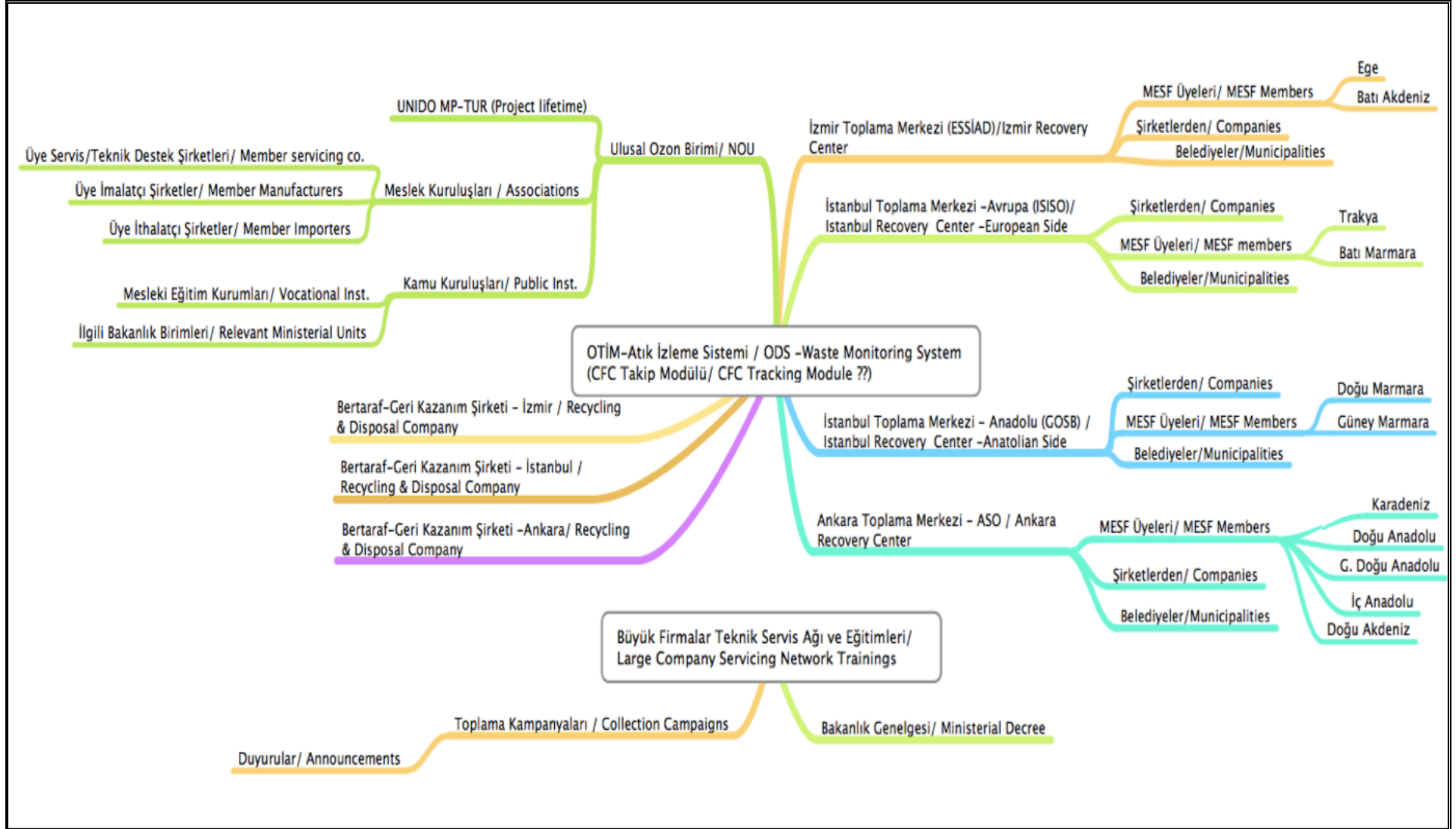


Figure 2: Draft chart for national implementation system



## 6.2 Sustainability of the business model

Based on the refrigerator manufacturing data of the country between 1992-2004, representing the period of the official years of CFC phase-out, an approximate total of 30.6 million refrigerators produced in the country out of which 15.1 million were sold in the domestic market, while 16.7 million exported, with a very small ratio of imports to the country. This represents an average amount of 1.16 million refrigerators sold per year in the domestic market (Table 3).

**Table 3: Manufacturing, Domestic sales and Export Data for refrigerator production (x1000 units) 1992-2004**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
<b>Production</b>	1087	1247	1265	1637	1638	1850	1875	2139	2446	2483	3 319	4 286	5 308
<b>Domestic sales</b>	796	927	767	834	963	1230	1410	1258	1468	1018	1088	1362	2 004
<b>Export</b>	281	397	586	802	695	784	818	1046	1088	1530	2247	3035	3 014
<b>Export/Prod. (%)</b>	26	32	46	49	42	42	44	49	44	62	68	71	63

Considering an average 20 years life span of refrigerators, it means 5% demand of the total amount annually. For 100% market penetration it means  $15 \times 0.05 = 0.75$  million pieces as annual demand with annual domestic sales of more than 2 millions. Because of the average life span of 20 years and the phase out of CFC from the manufacturing at 2005, about half of the appliances running contain CFCs.

In 2011, 5% of this 15 million refrigerators running in Turkey calculated to reach the end of their life (0.75 million pieces), half of which (0.375 million) estimated to contain CFCs. Considering that one unit contains 0.10 kg of CFC-12 as a refrigerant and 0.5 kg of CFC 11 in the insulation foam of the fridge, as an average, altogether ( $375\ 000 \times 0.60\ \text{kg} =$ ) 225 metric tons of CFCs will be calculated as an installed capacity which 37.5 t of it is the refrigerant (CFC 12) and 187.5 t CFC 11 in the foam insulation in the domestic refrigerators and freezers.

As a good estimate, also taking into account the recession of the past years, for 2011 only 2 million pieces is calculated in this project.

Till 2005, CFC 12 was used predominantly; therefore half of the running appliances, about 1 million domestic air conditioning units contain CFC 12. This results in an installed capacity of 1 million  $\times 1.5\ \text{kg/unit CFC content} = 1\ 500\ \text{t}$  installed capacity.

The information provided by the private sector recycling and de-manufacturing companies included to the project beneficiaries list (the companies plan investments to improve existing plants for de-manufacture of used equipment), represent the below figures as a base for the assumptions on the total amount to be considered in the project:

Assumptions:	
Plant Input	300,000 fridges/annum
Recovery of CFC-12 from cooling system	130 g/fridge (average)
Recovery of CFC-11 from insulation foam	320 g/fridge (average)

These assumptions would result in annual ODP reduction potential of 30 ODP MT out of which CFC-12 will be approximately 27 ODP MT and CFC-11 will be 3 ODP MT.

## 7. Activities and project costs

The project has three main phases: “Collection”, “Storage and Verification” and “Destruction / Incineration”. The activities of these phases are indicated below.

**Table 4: Implementation phases and activities**

<b>Project Phase</b>	<b>Activities</b>
<b>COLLECTION</b>	1. Stage I CFC-12 recovery units with separation of oil and gas
	2. Awareness raising
<b>STORAGE AND VERIFICATION</b>	1. Carbon market project management (documentation, sale etc.)
	2. Destruction of CFC-12 already collected by existing Energy Efficient Appliances Replacement Programs in Turkey
	3. Incineration of halons
	4. Monitoring and verification of ODS destruction
<b>DESTRUCTION/ INCINERATION</b>	1. Three ISO containers (10000 litres)
	2. Health, safety, environment training (technical workshop with international expert)
	3. Transportation of aggregated CFC-12 to US destruction facility REMTEC

## 7.1 Implementation schedule

The implementation schedule of the activities, for the two years of the project (MLF funded), will follow a strict time plan given in table 5.

**Table 5: Implementation schedule 2 years (MLF funded)**

Tasks	Months - Year 1												Months - Year 2											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
MLF approval and funding	■																							
Financial appraisal																								
Aggregation of already collected ODS at a central location (Ankara)	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						
Transportation of already collected ODSs to the USA *								■	■	■	■	■							■	■	■	■		
Destruction of ODSs *											■	■										■	■	
CAR project development *		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Monitoring of ODS destruction according to the CAR *											■	■	■	■	■	■	■	■	■	■	■	■	■	
Verification of issuance of carbon credits *													■	■	■	■	■	■	■	■	■	■	■	
Adaptation of legislation										■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Commercialization of carbon credits *													■	■	■	■	■	■	■	■	■	■	■	
Workshops (4) *					■	■						■				■					■			
Equipment specification					■	■																		
Equipment procurement										■	■													
Project monitoring	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Project monitoring milestones							■						■					■					■	

\* Tasks undertaken by Pan Gulf



## 7.2 Project costs

The following table gives an overview of the activities requested to be funded by the MLF. The co-financing component by Pan Gulf is indicated where it is relevant.

Table 6: The following table gives an overview of the total costs, co-financing component and phase(s) of the activities.

Item	Activity	MLF Funding	Co-Financing Pan Gulf	Project Phase	Activities to be undertaken by Pan Gulf
1	Stage I CFC-12 recovery units with separation of oil and gas	185,000		COLLECTION	
2	Three ISO containers (10000 litres)	60,000		DESTRUCTION/ INCINERATION (STOCK AND VERIFICATION)	
3	Carbon market project management (Documentation, Sale etc.)	125,000		STOCK AND VERIFICATION	XX
4	Health, safety, environment training (Technical workshop with international expert)	65,000	In kind contribution (workshops, trainers, experts): USD 150,000*  1. 1 Workshop in a destruction facility in the USA hosting 10 participants;  2. 1 workshop in Saudi Arabia for max 50 participants;  3. 2 workshops in Turkey for max 150 participants.  <i>*This contribution does not cover the travel and</i>	DESTRUCTION/ INCINERATION & STOCK AND VERIFICATION	XX

			<i>accommodation costs.</i>		
5	Awareness raising	50,000		COLLECTION	
6	Destruction of CFC-12 already collected by existing energy efficient appliances replacement programs in Turkey	440,000	Incentive program for CFC-11 & CFC-12, as indicated in table 2	STOCK AND VERIFICATION	XX
7	Incineration of halons	225,000	Incentive program for halons as indicated in table 2	STOCK AND VERIFICATION	
8	Monitoring and verification of ODS destruction	100,000		STOCK AND VERIFICATION (DESTRUCTION/INCINERATION)	XX
9	Transportation of dispersed ODS within Turkey to centralized facility to aggregate in ISO containers for transport to the US	50,000		COLLECTION	
10	Transportation of aggregated CFC-12 to US destruction facility RemTec	150,000		DESTRUCTION/INCINERATION	XX
	<b>SUBTOTAL</b>	<b>1,450,000</b>			
	Contingencies (10% all items except 4 and 5)	133,500			
	<b>TOTAL</b>	<b>1,583,500</b>			

## Annex: Linkages between Montreal Protocol and the Carbon Market(s)

### 1. Overview of GHG Markets

By implementing the **Kyoto Protocol** and its flexible mechanisms (article 6 Joint Implementation = **JI**, article 12 Clean Development Mechanism = **CDM** and article 17 International Emissions Trading = **IET**) for the first time a market for greenhouse gas (GHG) emission reductions was established<sup>3</sup>. While JI/CDM are project based mechanisms (**crediting system**, meaning that credits are only issued after emissions have been reduced) the IET is classified as a **cap and trade system** (where a central authority issues “allowances” which can be sold and bought immediately after issuance; emission reductions are occurring if the central authority issues less allowances than required by market participants under business as usual scenarios)

Additionally to the carbon market created by the Kyoto Protocol several countries or **regional initiatives have established (compliance) emission trading systems** (e.g. EU ETS, New Zealand etc.) including energy intensive corporations (primarily power companies and heavy industry). Units traded in those systems are usually similar in their nature (presenting 1 ton of CO<sub>2</sub>e) and structure (allowances allocated through an authority versus carbon credits/offsets from specific projects). However they often differ in their requirements for quality and project categories<sup>4</sup>.

Info box 1 provides an overview of the most common carbon markets and units traded:

#### **Units defined by the Kyoto Protocol:**

- Assigned Amount Units (AAUs)
- Certified Emission Reductions (CERs)
- Emission Reduction Units (ERUs)
- Removal Units (RMUs)

#### **• Units defined by EU and national legislation:**

- EU Allowances
- UK Allowances and Credits
- Australian Abatement Certificates and Sequestration Rights
- US SO<sub>x</sub> and NO<sub>x</sub> Allowances, Regional Greenhouse Gas Initiatives
- Other

#### **• Units defined by contracts and non governmental regulated standards:**

- Verified Emission Reductions (VERs)

<sup>3</sup> Often also referred to as carbon market since the general unit traded is 1 ton of CO<sub>2</sub>-equivalents (other types of GHG emissions such as CH<sub>4</sub> or HFC-23 are converted into 1 ton of CO<sub>2</sub>e; E.G. 1 ton HFC equals 11700 tons of CO<sub>2</sub>e)

<sup>4</sup> E.G. The EU recently stopped the inflow of carbon credits from HFC-23 and N<sub>2</sub>O (from adipic acid production) CDM projects by May 2013, while New Zealand may still allow them (but is also discussing a restriction)

Besides the so called “**compliance markets**” a market for verified or voluntary emission reductions units<sup>5</sup> has developed over the past few years. The “**voluntary market**” defines its units through contracts and non-governmental regulated standards (see footnote below for examples). VERs are mainly bought by private persons (to offset their carbon footprint) or companies not covered by any compliance regime in their Corporate Social Responsibility (CSR) programs. This said it is natural that VERs usually achieve lower prices than units traded in compliance carbon markets<sup>6</sup>.

Table shows the dominant role of the EU ETS in the global arena with a market value in 2009 of 118,474 Mio USD, but even the market for voluntary emission reductions has a volume of 419 resp. 338 Mio USD in 2008 and 2009.

**Table 7: Overview of Carbon Markets (Source: World Bank)**

	2008		2009	
	Volume (MtCO <sub>2</sub> e)	Value (US\$ million)	Volume (MtCO <sub>2</sub> e)	Value (US\$ million)
<b>Allowances Markets</b>				
<b>EU ETS</b>	3,093	100,526	6,326	118,474
<b>NSW</b>	31	183	34	117
<b>CCX</b>	69	309	41	50
<b>RGGI</b>	62	198	805	2,179
<b>AAUs</b>	23	276	155	2,003
<b>Subtotal</b>	3,278	101,492	7,362	122,822
<b>Spot &amp; Secondary Kyoto offsets</b>				
<b>Subtotal</b>	1,072	26,277	1,055	17,543
<b>Project-based Transactions</b>				
<b>Primary CDM</b>	404	6,511	211	2,678
<b>JI</b>	25	367	26	354
<b>Voluntary market</b>	57	419	46	338
<b>Subtotal</b>	486	7,297	283	3,370
<b>Total</b>	<b>4,836</b>	<b>135,066</b>	<b>8,700</b>	<b>143,735</b>

Subtotals and totals may not exactly add up because of rounding.

The following table shows prices of different kind of VERs. While **CRTs** achieved prices of USD 8.8 and 7.1 in 2008 and 2009, **VCUs** could only be sold at prices of USD 5.5 and 4.6 respectively. This difference in prices can mostly be explained by perceptions of market participants that the inclusion of CAR into any compliance emissions trading in the United States would be more probable in the future than the inclusion of VCS projects.

<sup>5</sup> In general Verified Emission Reductions (VERs) but specifically in the Voluntary Carbon Standard (VCS) Voluntary Carbon Units (VCUs) are traded under Climate Action Reserve (CAR) Climate Reserve Tons (CRT).

<sup>6</sup> This is not always true, in certain cases prices of units traded in compliance markets have gone virtually to zero if there is high oversupply and if such units cannot be traded on other markets (e.g. EU ETS in 2007)

**Table 8: Overview of the North American Carbon Market (Source: World Bank)**

**TABLE 2 North American carbon market – traded volumes and values, 2008–09**

	Average Price (US\$/tCO <sub>2</sub> e)		Volume (MtCO <sub>2</sub> e)		Value (million US\$)	
	2008	2009	2008	2009	2008	2009
RRGI (Allowances) <sup>†</sup>	3.9	3.3	61.9	805.2	198.2	2,178.6
Alberta (Offsets/EPCs)	10.0	13.5*	3.4	4.5	33.5	60.8
CCX (CFIs)	4.4	1.2	69.2	41.4	306.7	49.8
Voluntary Offset Market	6.8	4.9	15.4	29.0	104.1	143.4
of which CAR	8.8	7.1	5.3	14.9	46.6	104.5
of which CCX	4.8	0.8	1.0	7.4	4.8	5.9
of which VCS	5.5	4.6	1.5	3.3	8.3	15.2
of which ACR	3.8	3.4	4.3	1.8	16.3	6.1
of which Other	8.5	7.3	3.3	1.6	28.1	11.7
<b>Total market</b>			<b>149.9</b>	<b>880.1</b>	<b>642.5</b>	<b>2,432.5</b>

Source: Bloomberg New Energy Finance, Ecosystem Marketplace. Notes: <sup>†</sup> RRGI includes quarterly auction figures, \* Alberta price is an estimate.

## 2. Relation of GHG Markets to the Montreal Protocol (MP)

Many chemicals used as refrigerants and blowing agents not only are depleting the ozone layer (Ozone Depleting Substances = ODS) but are also having a significantly adverse effect on the global climate (Greenhouse Gases =GHGs). While the MP regulates consumption and production of ODS (not disposal) the KP regulates emissions not covered by the MP (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, SF<sub>6</sub>).

Since most ODS are not included in the “Kyoto basket” of gases **reductions of such ODS cannot (yet) be structured as CDM or JI projects** (Please see info box 2 below for details)

*Paragraph 44 of the Modalities and Procedures for the CDM requires that a baseline shall cover emissions from all gases, sectors and source categories listed in Annex A of the Kyoto Protocol within the project boundary.*

*Paragraph 17 of EB 34 provides guidance on project/leakage emissions of GHGs as defined in paragraph 1 of the Convention but not included in Annex A of the Kyoto Protocol such as GHG gases (e.g., CFCs, HCFCs) covered under the Montreal Protocol.*

***Hence, claiming emission reductions associated with the replacement of CFC or HCFC refrigerants and blowing agents with no-ODP and low-GWP gases is not eligible in accordance to CDM modalities and procedures.***

*Paragraph 17 of EB 34:*

*17. With reference to a proposed methodology, the Board considered the analysis of implication of different options proposed by the Meth Panel with regard to accounting emissions of GHGs and also implications on gases covered under the Montreal Protocol.*

*The Board agreed that:*

*(a) The project boundary shall encompass all anthropogenic emissions by sources of greenhouse gases, as defined in paragraph 1 of the Convention but not included in Annex A of the Kyoto Protocol, under the control of the project participants that are significant and reasonably attributable to the CDM project activity.*

*(b) The leakage emissions from greenhouse gases, as defined in paragraph 1 of the Convention but not included in Annex A of the Kyoto Protocol, should be accounted, if the CDM project activity results in an increase of such emissions.*

*(c) The global warming potentials used to calculate the carbon dioxide equivalence of anthropogenic emissions by sources of greenhouse gases not listed in Annex A, shall be those accepted by the Intergovernmental Panel on Climate Change in its third assessment report*

While the international Kyoto based market cannot uptake any emission reductions generated through the destruction of ODS some voluntary standards as well as regional compliance markets have begun to recognize ODS destruction as a highly verifiable source of GHG reduction credits.

**In 2007** the Chicago *CCX Offset Project Protocol: Ozone Depleting Substances Destruction*

**On January 25<sup>th</sup> 2010** the Voluntary Carbon Standard [www.v-c-s.org](http://www.v-c-s.org) *Extension of Scope to Include Ozone-Depleting Substances* and on May 3<sup>rd</sup> 2010 the first methodology proposal “*Greenhouse Gas Emission Reductions By Recovering and Destroying Ozone Depleting Substances (ODS) from Products*” was submitted which is currently assessed

**On February 3<sup>rd</sup> 2010** *Article 5 Ozone Depleting Substances Project Protocol Destruction of Article 5 Ozone Depleting Substances Banks Version 1.0* as well as *U.S. Ozone Depleting Substances Project Protocol Destruction of U.S. Ozone Depleting Substances Banks Version 1.0* was accepted by the board.

**On December 16<sup>th</sup> 2010** the California Air Resources Board endorsed the cap-and-trade regulation, marking a significant milestone toward reducing California’s greenhouse gas emissions under its AB 32 law. Included in the regulation are four protocols, or systems of rules, covering carbon accounting rules for offset credits in forestry management, urban forestry, dairy methane digesters, *and the destruction of existing banks of ozone-depleting substances in the U.S.* (mostly in the form of refrigerants in older refrigeration and air-conditioning equipment).

As of January 2011, 9 ODS destruction projects are registered under the Climate Action Reserve and around 2.5 mio CRTs have been generated. These developments impressively show the increasing importance of ODS destruction projects as GHG mitigation measure and the relevance of the carbon market to incentives destruction activities.

### **3. Possible Ways of the Utilization of the Carbon Market: Comparison between CAR and VCS**

According to decision XX/7 adopted by the Parties to the Montreal Protocol the project is using the carbon market to leverage seed funding from the MLF. The first analysis of Annex I explains in detail which carbon markets resp. regulations/standards accept the creation of carbon credits through the destruction of ODS. It also shows that the Climate Action Reserve

and the Voluntary Carbon Standard are the two main possibilities, which currently provide the most suitable methodologies to calculate, monitor and verify emission reductions achieved through the destruction of ODSs from Article 5 countries. The country should be completely aware of the working mechanism, conditions and possible consequences of selecting one or the other scheme, since it has important long term effects.

### Main Characteristics

The two main structural differences between CAR and VCS are the regulations regarding the location of the destruction and the sort of ODSs eligible for destruction.

- Location of the destruction:  
CAR requires destruction in the United States, while VCS allows destruction in the project's host country.
- Sort of ODSs eligible for destruction:  
CAR covers the destruction of refrigerant gases only (CFC-12 in the project case) in Article 5 countries. VCS also covers the destruction of CFC-11 contained in foams.

### Considering Advantages and Disadvantages

As mentioned earlier, any of the carbon market schemes can be applicable for the present project under appropriate considerations, however it is essential to take into account the disadvantages of the schemes just as much as the advantages.

- Location of the destruction:  
CAR disposes upon destruction (exclusively) in the United States. This obviously takes the burden of destruction off the stakeholder country in terms of logistics, necessary investments at the incineration facilities, etc. However, the cost of ODS transportation to the United States obviously represents a massive expenditure.

The following table shows the destruction facilities used by all ODS destruction projects registered under the CAR:

Destruction facilities used for ODS destruction projects under the CAR	
Facility	Location
Clean Harbors El Dorado	Arkansas, U.S.
RemTec International Plascon Arc Plasma Destruction facility	Ohio, U.S
Veolia Environmental Services	Texas, U.S.

VCS allows destruction in the project's host country, which may raise more challenges in the beginning. However, in the long-term the development of national capacities should pay off.

- Sort of ODSs eligible for destruction:  
CAR covers the destruction of CFC-12 only; it does not offer any solutions for CFC-11 contained in foams.  
Under VCS there is no such problem or limitation.

Apart from the above it should be also mentioned that there is no experience worldwide on ODS destruction projects under VCS mechanism, while CAR has already been used for that purpose.

### Revenues from the Carbon Markets

Another very important viewpoint is the amount of the expected revenues from the carbon market. As it can be seen in the table below, CAR has offered higher prices than VCS, even during the decreasing tendencies of 2010.

US offset prices 2010

Table 9: Overview Market Prices per VER

	2010	CAR	VCS
Average mid-market price, US\$/tCO <sub>2</sub> e	1st Q	\$4.6	
	2nd Q	\$3.3	\$2.8
	3rd Q	\$3.5	\$3.1
	4th Q	\$2.9	\$1.4

*Carbon Market Analyst-North America, Point Carbon Research, March, 2010*

It should be noted that CAR prices have to be considered always together with the transportation cost to the United States, as mentioned above.

The following table sums up what the two schemes would mean to Turkey, taking into consideration all the pros and contras.

CAR	VCS
Destruction out of Turkey.	Destruction in Turkey.
Local capacities are not involved.	Local capacities are involved.
Higher transportation costs to US.	Local transportation costs.
Destruction of only CFC-12.	Destruction of CFC-12 and CFC-11.
Higher market prices.	Lower market prices.
Experience in ODS destruction projects.	No experience in ODS destruction projects.

### Which carbon market schemes to choose?

Being aware already of all the most important points that should be considered when making a decision, the two most convenient options are presented below in details.

#### ➤ Option 1: VCS – Using Local Resources

Using VCS means using and continuously improving local resources and capacities. This option would offer a solid, calculable plan for the whole length of the project. It would



bring benefits such as the implementation of state of the art recovery and collection technologies, which could be also considered as preparation for EU accession, continuous tracking of ODS movement within the country and many other factors like replacement of old equipment implying improvement of energy efficiency, etc.

➤ Option 2: CAR and VCS – A Combined Solution

This option divides the destruction project into two phases:

The first phase, the first 2 years of the project, would use exclusively CAR. Thanks to the higher market prices of CAR, the income of the destruction would be considerable and could be used in Turkey for the preparation to the second phase of the project and to miscellaneous local investments, e.g. conversions at the companies.

The second phase, the additional years in the future, would then use the combination of CAR and VCS. In this way, under VCS, the destruction of CFC-11 could also happen.

In the first 2 years the project will destroy all the CFC-12, which had already been collected from various sources in Turkey. The collected CFC-12 will be incinerated in an eligible destruction facility in the United States as required by the CAR Protocol Article 5 Ozone Depleting Substances Project Protocol Destruction of Article 5 Ozone Depleting Substances Banks Version 1.0 (see <http://www.climateactionreserve.org/> ) (Additionally during this start up phase an effective legislative system for ODS-containing appliances can be established.) (The MLF shall fund the transportation/storage and destruction activities of the first 2 years, costs of changing legislation will be covered by income from sale of carbon credits in the 1st year.)

The financial benefit gained during the first two years of the project through the carbon market, can be used to incentivize further ODS waste management and destruction activities in the future, which will lead to further destruction of CFC-11 and CFC-12. It is essential to point out that in this phase of the project there can not be any funding requested from the MLF.

## Annex I: ODS Destruction Project in Turkey

### Revised Project Costs after discussion with the Multilateral Fund Secretariat

Item	Activity	MLF Funding	Co-Financing Pan Gulf	Activities to be undertaken by Pan Gulf
1	Three ISO containers (10000 litres)	60,000		
2	Carbon market project management (Documentation, Sale etc.)	100,000		XX
3	Health, safety, environment training (Technical workshop with international expert)	30,000	<p>In kind contribution (workshops, trainers, experts): USD 150,000*</p> <p>1. 1 Workshop in a destruction facility in the USA hosting 10 participants;</p> <p>2. 1 workshop in Saudi Arabia for max 50 participants;</p> <p>3. 2 workshops in Turkey for max 150 participants.</p> <p><i>*This contribution does not cover the travel and accommodation costs.</i></p>	XX
4	Destruction of CFC-12 already collected by existing energy efficient appliances replacement programs in Turkey	550,000	Incentive program for CFC-11 & CFC-12, as indicated in table 2	XX
5	Monitoring and verification of ODS destruction	85,000		XX

6	Transportation of dispersed ODS within Turkey to centralized facility to aggregate in ISO containers for transport to the US	50,000		
7	Transportation of aggregated CFC-12 to US destruction facility RemTec	150,000		XX
	<b>SUBTOTAL</b>	<b>1,025,000</b>		
	Contingency (5% all items except Activity 3)	51,250		
	<b>TOTAL</b>	<b>1,076,250</b>		

## Annex II :

### Revised amounts of ODS to be included in the project

<b>Source of collection</b>	<b>Quantity CFC-12</b>
ASO Recovery Center (Turkish Halon Bank-TUHAB)	0,62 MT
Metal Goods Craftsmen Federation (MESF)	5,1 MT
Service Shops (members of MESF)	3 MT
ESSIAD	20 MT
Other sources (reported by servicing companies for refrigeration and air-conditioning equipment, responsibility programmes,etc)	75 MT