

Climate and Ozone Protection Alliance (COPA)
Thematic Working Group on Financing Mechanism

Minutes of Meeting for the
Thematic Working Group on Financing Mechanism (TWG FM)
Thursday 30th March 2023 from 3:00 to 4:00 pm Central European Time

Content:

1. Agenda
2. Next meeting
3. Minutes of meeting
4. Action Points list
5. Participants attending
6. Annex

1. AGENDA:

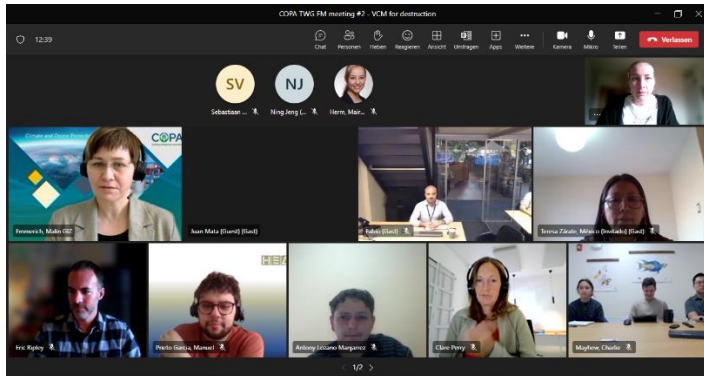
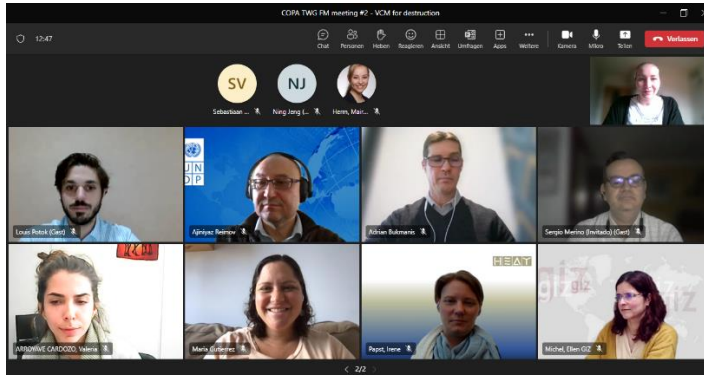
- Welcome & Agenda
- 1) Introduction of elected Chair & Vice-Chair
 - 2) Presentation of Result from study on:
Viability of carbon markets for financing EOL management of refrigerants
 - 3) Q&A
 - 4) Closing remarks, next meeting

2. Next meeting:

- 20-21st June 2023, in alignment with the COPA first Plenary

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3. Minutes of Meeting (MoM)

COPA TWG FM Meeting #2		Date/Time: Thursday 30 th March 2023 3:00-4:00 pm CET Moderation: Malin Emmerich, GIZ Next meeting: 20-21 June 2023, time tbd	Room: MS Teams
Theme	Time	Content	Responsibility
Welcome and Agenda	5min	Agenda content, short introduction of the speakers, photo session, short poll (Annex 1).  	Malin Emmerich, GIZ
1 Introduction of elected Chair & Vice-Chair	10min	Getting to know the newly elected TWG FM Chair and Vice-Chair, for the legislation period 2023-2025: <ul style="list-style-type: none"> • Louis Potok – Chair, CEO and founder of Recoolit (US and Indonesia) • Adrian Bukmanis – Vice-Chair, CEO and founder of Veridien (Singapore, France) 	Louis Potok – chair Adrian Bukmanis – Vice-Chair
2 Presentation of Result from study	40 min	Introduction of the purpose of the study and presentation of the consultant Juan Mata by Ajiniyaz Reimov, UNDP Presentation Title: Experience, methodologies and tool to estimate the viability of carbon markets for financing EOL management of refrigerants (Presentation in Annex 2)	Ajiniyaz Reimov, UNDP Juan Mata, Consultant

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		<p>After the presentation, Juan also showed how to use the tool in a live session, filling in cell values.</p> <p>Chat discussion (Eric, Louis, Maria) about publicly available information for ODS destruction projects. Project underway are not publicly listed until credit issuance by the registries. Ongoing but not included projects in Indonesia and Honduras.</p> <p>Clarification in chat by Eric about MRV methodologies for carbon credits: Project emissions from destruction and transport are included in ACR and CAR methodologies. It is a default factor.</p>	
3	Q&A	<p>Q & A after presentation:</p> <p>Rachel asked how the break-even price for destruction was calculated. Answer is that the break-even carbon price depends on several factors, such as country experience, type of ODS involved (GWP), scale of the project, and if grants are provided or not. Normal “break even” carbon price for an HCFC-22 destruction project with no access to grants, with a scale of 10-30 mt, would range between 25-29 USD/tCO₂eq. For CFC-12 with similar project scale range, the “break even” carbon price can drop below 10 USD/tCO₂eq. The excel tool include examples of different break-even cost calculations.</p> <p>Adrian asked if the baseline calculation from the different GHG emission reduction methodologies impact the excel tool? Answer is that this was not considered in the tool’s calculations. The Methodologies were analysed with respect to their scopes and limitations for potential project developers and countries to take into account when developing ODS destruction projects with carbon revenues.</p> <p>Malin asked if the tool will be available. Ajiniyaz answered that the tool will be updated with the input provided, but after that it will be available upon request to him / UNDP.</p>	All
4	Closing remarks, next meeting	<p>Next meeting date, COPA plenary on: 20-21 June 2023, details will follow.</p>	Malin Emerich, GIZ

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4. Action Point list:

Nr	What	Who	When / Date
1	Distribute Minutes of Meeting (MoM) for approval to upload on COPA TWG FM Website to Ajiniyaz, Louis, Adrian	Malin Emmerich	2023-03-31

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5. Participants attending meeting:

Nr	Name	Organisation
1	Ajiniyaz Reimov (moderator)	UNDP
2	Malin Emmerich (moderator)	GIZ Proklima
3	Sarah Frisse (moderator support)	GIZ Proklima
4	Ellen Michel	GIZ Proklima, Head of COPA Secretariat
5	Adrian Bukmanis	Veridien RM (VRM)
6	Antony Lozano Manjarrez	Ecosave
7	Valeria Arroyave Cardozo	UNIDO
8	Clare Perry	Environmental Investigation Agency (EIA)
9	Eric Ripley	A-GAS
10	Mairin Herm	GIZ Proklima
11	Juan Mata	Consultant (for UNDP, presenter)
12	Louis Potok	Recoolit
13	Mariá José Gutiérrez Murray	Tradewater LLC
14	Charlie Mayhew (with colleagues)	Yale Carbon Capture Lab (guest)
15	Ning Jeng	Recoolit
16	Irene Papst	Heat
17	Rachel Pekker	BMWK
18	Sanjeev S. Tamhane	Frankfurt School
19	Sebastian Visser	AFS Group (guest to COPA)
20	Sergio Merino González	Secretariat of Environment and Natural Resources of Mexico
21	Teresa Zárate	Mexico (colleague to Sergio?)
22	Anja Werntges	GIZ Proklima
23	Manuel Prieto García	Heat
24	Fabio Pullara	AFS Energy (guest)

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Annex I - Poll

15
Antworten

00:56
Durchschnittliche Zeit für das Ausfüllen

Aktiv
Status

Ergebnisse anzeigen

In Excel öffnen ...

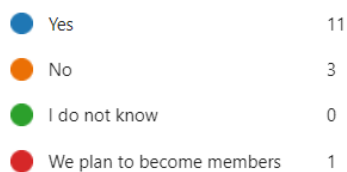
1. Is this your first TWG FM meeting

[Weitere Details](#)



2. Are your organisation a COPA Member?

[Weitere Details](#)



3. What country are you located in?

5 Befragten (33%) antworteten **Germany** für diese Frage.

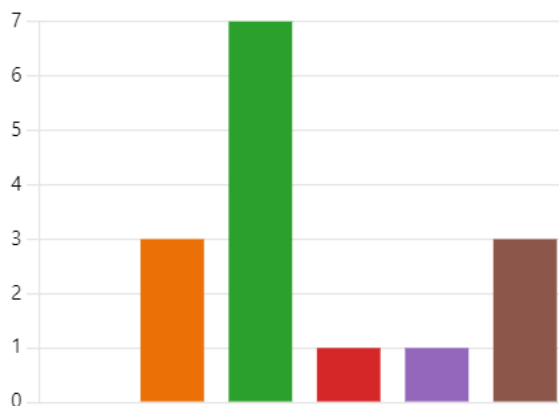


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4. What area are you work mostly related to?

[Weitere Details](#)

● Finance and accounting	0
● Carbon Markets	3
● End of Life mgmt	7
● ODS Destruction	1
● Technical Solutions	1
● other	3



5. What thematic should the TWG FM wok on, according to you?

2 Befragten (18%) antworteten **carbon markets** für diese Frage.



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Annex II – Presentation by Juan Mata



**Experience, methodologies and tool to
estimate the viability of carbon markets for
financing EOL management of refrigerants**

**2nd Meeting of the COPA Thematic Working
Group on Financing Mechanism (TWG FM)**

Juan Mata
Consultant
March 30, 2023

Content



1. International experiences of ODS destruction projects using revenues from carbon markets;
2. Barriers and Opportunities for financing EOL ODS management projects;
3. Methodologies for quantification of GHG emission reductions from EOL ODS destruction projects;
4. Tool for Evaluating Financial Viability of ODS Destruction Projects using Revenues from the ITMO transfer of Article 6.2 of the Paris Agreement.

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International experiences of ODS destruction projects using revenues from carbon markets (1/2)



Until November 2022, approximately **30 million ODS credits** have been issued. From them nearly **4.2 million credits** belong to projects in A5 countries, the rest to non-A5, mainly **U.S.A. and Canada**

Country	Status	Voluntary Registry	First year of project	Credits Issued (tCO _{2eq}) to date	Credits Retired
India	Completed	CAR	2009	683,087	683,087
India	Completed	CAR	2010	551,802	517,957
Mexico	Completed	CAR	2010	2,602,812	2,597,770
Mexico	Completed	CAR	2012	89,834	9
Nepal	Completed	CAR	2013	82,391	31,500
Ghana	Registered	VCS	2018	155,431	145,023
Dominican Republic	Registered	VCS	2021	23,657	3,000
Saudi Arabia	Listed	ACR	--	0	0
South Africa	Under development	VCS	--	0	0
Total				4,189,014	3,978,346

Source: Voluntary Registry Offsets Database

International experiences of ODS destruction projects using revenues from carbon markets (2/2)



1. Although not mandated by the MP or the KP, ODS need to be recovered and properly treated to avoid their release into the atmosphere over time due to leakage or intentional venting;
2. Not being a common practice in A5 countries, ODS management and destruction have become a technical and financial challenge for governments;
3. So far, A5 countries participation in carbon markets has been limited to the selling of ODS banks to project developers for destruction mainly in U.S. facilities;
4. This activity has generated carbon credits used by U.S. firms mainly for voluntary carbon offsetting purposes;
5. However, ODS destruction projects implementation poses financial & technical challenges and risks when a country's government is directly handling it, as it is the case of A5 countries interested in evaluating possible engagement in Art. 6.2 mechanism;
6. Therefore, a new approach (different from selling ODS banks to project developers) need to be designed.

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Barriers and Opportunities for financing EOL ODS management projects; (1/2)



Main Barriers (financial, technical & managerial):

1. Upfront finance for ODS destruction is rarely available in developing countries;
2. Limited carbon finance capacity in A5 countries, specially in LDCs;
3. Projects generate carbon revenues only once the offset credits are sold;
4. High costs associated with carbon development projects;
5. Limited knowledge from A5 governments and local developers about carbon prices;
6. The opportunity cost of ODS destruction (particularly the reuse market);
7. Lack of supportive legal and regulatory frameworks in least developed A5 countries;
8. Limited knowledge from A5 governments & local developers on where accessible ODS sources exist;
9. Limited A5 governments & local project developer's capacity (technical & human) to manage ODS destruction projects;
10. Limited knowledge from A5 governments & local developers about ODS destruction cost structure (collection, recovery, transport, destruction);
11. Carbon market eligibility of HCFC destruction projects is questionable in most A5 countries where HCFC production/consumption has not been phased-out and import banned.

Barriers and Opportunities for financing EOL ODS management projects; (2/2)



Main Opportunities (financial, technical & managerial):

1. MDB's and developed countries to provide upfront financing for ODS destruction investment and project finance;
2. Capacity building to A5 governments & developers on ITMOs mechanism from UNDP, WB, Switzerland, Sweden, etc;
3. Reduce ITMOs transaction costs for issuing parties through grants from MDB's or ITMO recipient parties;
4. A5 countries to adjust legal/regulatory frameworks and market conditions to accelerate HCFC phase-out, ban ODS reuse, and promote a transformational change towards the use of ODS free refrigerants and foams;
5. MLF to continue financing technical assistance and capacity building for ODS identification, management and disposal in A5 countries;
6. Implement PPP business models for ODS destruction projects with clearly defined roles and shared responsibilities and benefits for public entities and private sector.

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Methodologies for quantification & MRV of GHG emission reductions from ODS destruction projects(1/3)

Methodology Aspect	ACR ODS from International Sources v1.0	VM0016 Recovery & Destruction of ODS v1.1	CAR Art.5 ODS Project Protocol v2.0
Applicability			
ODS	MP Group1 Annex A	MP Group1 Annexes A, B & C	MP Group1 Annex A
Use	Refrigerant	Refrigerant and Blowing Agent	Refrigerant
Source	- Bulk/Stockpiled (used & virgin) - Recovered from equipment	- Bulk/Stockpiled (only CFCs) - Recovered from equipment/foam	- Bulk/Stockpiled (not virgin) - Recovered from equipment
Location/Party	ODS source: outside U.S.A. ODS destruction: U.S.A. or outside	ODS source: All countries ODS destruction: All countries	ODS source: Art. 5 countries ODS destruction: U.S.A.
Eligibility and Additionality Criteria at Project's Country			
CFCs are phased out	Yes	Yes	Yes
ODS destruction not req.	Yes	Yes	Yes
Must comply with local regulations.	Yes	Yes	Yes
Additionality Test	- Legal Requirement Test - Performance Std Evaluation	- Regulatory surplus & positive list in VMD0048; - CDM additionality demo tool.	- Legal Requirement Test - Performance Std Test
Destruction Facility	- TEAP stds. - DRE = 99.99%	- TEAP stds. - DRE (for BA) = 85% - DRE (conc. ODS) = 99.99% - DRE (dilute ODS) = 95%	- TEAP stds. - DRE (conc. ODS) = 99.99% - DRE (dilute ODS) = 95%

Methodologies for quantification & MRV of GHG emission reductions from ODS destruction projects (2/3)

Methodology Aspect	ACR ODS from International Sources v1.0	VM0016 Recovery & Destruction of ODS v1.1	CAR Art.5 ODS Project Protocol v2.0
Baseline Emissions and Quantification of GHG			
ODS released at end -of-life (equipment)	Yes	Yes	Yes
ODS from leaks/servicing (equipment)	No	No	Yes
ODS released at storage (bulk/stockpiled)	Yes	Yes	Yes
Specific emissions from energy consumption at recovery (fuel/ electricity/ODS oxidation) & from transport	No	Yes	No
Aggregated emissions from ODS transport & destruction	Yes	Yes	Yes
Emissions from use of ODS substitutes (leakage)	Yes	Yes	Yes
Monitoring and Verification			
Specifies types of measured/recorded data	Yes	Yes	Yes
Specifies monitoring/testing methodologies	Yes	Yes	Yes
Specifies monitoring times/periods	Yes	Yes	Yes
Specifies roles/responsibilities for monitoring/data collection/storage	Yes	Yes	Yes
Specifies doc. required for validation & verification	Yes	Yes	Yes

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Methodologies for quantification & MRV of GHG emission reductions from ODS destruction projects (3/3)



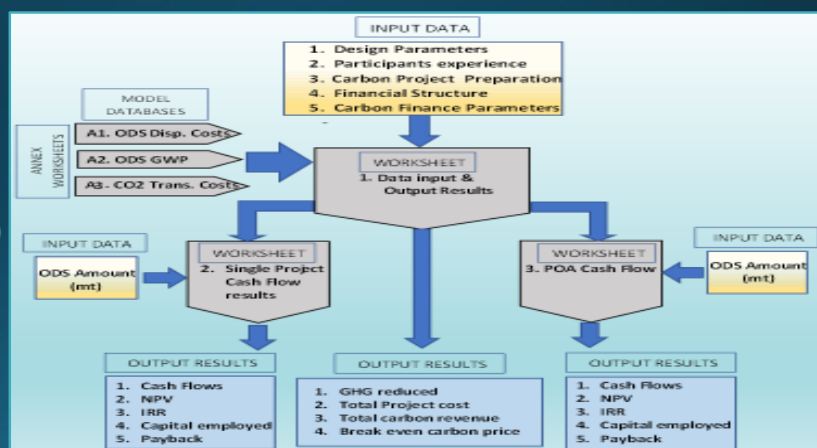
1. VCS standard applies to all MP Group 1 ODS from Annexes A, B & C, CAR and ACR methodologies are limited to CFCs from Group 1 Annex A;
2. VCS standard applies to ODS used as refrigerants and blowing agents, CAR and ACR methodologies are specific for refrigerants;
3. The three methodologies admit ODS originated in A5 countries;
4. CAR methodology limits ODS destruction to the U.S., VCS and ACR admit destruction in any country that complies with technical specifications;
5. VCS methodology quantifies specific GHG emissions from ODS transportation from recovery/storage to destruction, CAR and ACR methodologies calculate them aggregated with ODS destruction emissions;
6. VCS methodology is the only one that quantify disaggregated GHG emissions from energy consumption at recovery facility (fuel, electricity, ODS oxidation), CAR and ACR methodologies quantify them aggregated to the ODS transportation/destruction emissions.
7. CAR methodology is the only that considers ODS from leaks/servicing (during operation of equipment), for the definition of baseline.

Flowchart of Tool for ODS Destruction Projects with Revenues from ITMO Transfer



- Objective: provide **governments** and **developers** of ODS destruction projects with indicative financial parameters to decide their participation in the ITMOs transfer mechanism.

Interlinkage of input data and output results among the tool worksheets.



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Worksheet 1: Data Input and Output Results (1/2)

Worksheet Name	Function	Requested Data Input
WS1. Data Input & Output Results	<ol style="list-style-type: none"> Centralizes input parameters for estimation of: ODS destruction project costs, carbon revenues, and financial indicators. Centralizes output results: project costs, carbon revenues, “break even carbon cost” etc 	<ol style="list-style-type: none"> Design parameters: ODS type, amount, use, sector, etc.; Participants experience in ODS destruction project stages; Definition of ITMO project preparation activities: documentation, validation, verification, registry, fees, etc.; Carbon revenue parameters: carbon price, carbon revenue start year, SoP, OMG, etc.; Financial structure: equity, debt, grant, cost of capital, etc.

Worksheet 1: Data Input and **Output Results** (2/2)

Worksheet Name	Function	Data Output
WS1. Data Input & Output Results	<div>1. Centralizes input parameters for estimation of: ODS destruction project costs, carbon revenues, and financial indicators.</div> <div>2. Centralizes output results: project cost carbon revenues, “break even carbon cost”,etc</div>	<div>1. Project Performance (US\$/tCO2, US\$/mt ODS);</div> <div>2. Project implementation costs per stage and total ;</div> <div>3. ITMO Project Transaction Costs (Total and per tCO2eq (or per ITMO);</div> <div>4. Carbon revenue performance (Total revenues (\$), break even cost (\$/tCO2eq),</div>

	Input data supplied by user
	Input data selected by user from a predetermined list
	Output data provided by the system
	Output results provided by the system

Output Results		
Project Performance		
ODS destroyed (mt)	20.00	
ODS GWP	1810	
GHG reduced (tCO2eq)	36200	
GHG reduced accountable after OMGE & SOP (tCO2eq)	36200	
Expenditure per ODS destroyed (US\$/mtODS)	\$ 42,917.00	
Expenditure per GHG reduced before OMGE & SOP (US\$/tCO2eq)	\$ 23.71	
Break even cost (US\$/tCO2eq)	Total Project Cost (US\$)	Total Carbon revenue (US\$)
\$ 23.71	\$ 858,340.00	\$ 732,989.44

Project Implementation Costs Budget	US\$/mt (Model)	US\$ (Model)	US\$ (Project Developer)
Segregation & Collection	\$ 8,000.00	\$ 160,000.00	
Transport to recovery	\$ 7,000.00	\$ 140,000.00	
Recovery (processing)	\$ 15,000.00	\$ 300,000.00	
Transport to destruction	\$ 2,700.00	\$ 54,000.00	
Destruction	\$ 2,400.00	\$ 48,000.00	
Total Project Costs	\$ 35,100.00	\$ 702,000.00	\$ -
Carbon Project Transactions Costs Budget	US\$/tCOeq (Model)	US\$ (Model)	US\$ (Project Developer)
Documentation & supervision	\$ -	\$ -	
Validation process	\$ 0.55	\$ 20,000.00	
Verification process	\$ 0.55	\$ 20,000.00	
Mitigation Action Project (MAP) application fee	\$ 0.01	\$ 500.00	
Mitigation Action Identification (MID) fee	\$ -	\$ -	
Corresponding Adjustment fee (US\$/tCO2eq)	\$ 3.00	\$ 108,600.00	
Listing fee (US\$/tCO2eq)	\$ 0.20	\$ 7,240.00	
Total Transaction Costs	\$ 4.32	\$ 156,340.00	\$ -

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Worksheet 2: Single Project Cash Flow (1/1)

Input data supplied by user
Output results provided by the system

Concept	Total	1	2
Year of operation		1	2
ODS destroyed (mt)	15	15	
BHGs mitigated (tCO ₂ e)	27150	27150	
Project Implementation Costs	US\$		
Storage & Collection	(120,000)	(120,000)	\$ -
Transport to recovery	(105,000)	(105,000)	\$ -
Recovery (processing)	(225,000)	(225,000)	\$ -
Transport to destruction	(40,500)	(40,500)	\$ -
Destruction	(36,000)	(36,000)	\$ -
Total Project Implementation Costs	(526,500)	(526,500)	\$ -
Carbon Project Transaction Costs	US\$		
Documentation & supervision	\$ -	\$ -	\$ -
Validation process	(20,000)	(20,000)	\$ -
Verification process	(20,000)	(20,000)	\$ -
MAP application fee	(500)	(500)	\$ -
Corresponding Adjustment fee	(81,450)	(81,450)	\$ -
Listing fee	(5,430)	(5,430)	\$ -
Total Transaction Costs	(127,380)	(127,380)	\$ -
Total Project Costs	(653,880)	(653,880)	\$ -
Project Debt Cost	US\$		
Project Loan	0	0	0
Loan Payment	\$ -	\$ -	\$ -
Project Income from Carbon Revenues	US\$		
Gross Carbon Revenue	\$ 549,277.08	\$ -	\$ 549,277.08
Overall Mitigation in Global Emissions (OMGE)	\$ -	\$ -	\$ -
Share of Proceedings (SOP)	\$ -	\$ -	\$ -
Advance payment of MOPA	\$ -	\$ -	\$ -
Discount over Carbon Revenues	\$ -	\$ -	\$ -
Net Carbon Revenue	\$ 549,277.08	\$ -	\$ 549,277.08
Project Grant	US\$		
Amount of Grant	\$ 130,776.00	\$ 130,776.00	\$ -
Cash Flows	US\$		
Cash Flow	\$ 26,173.08	\$ 121,104.00	\$ 549,277.08
PV of Cash Flows	\$ 17.03	\$ 523,104.00	\$ 523,121.03
Cumulative Cash Flows		\$ 523,104.00	\$ 26,173.08
NPV of total Cash Flows	\$ 17.03		
IRR (%)	5.06%		
Capital employed (USD)	(653,880)		
Profitability Index	0.000026		

Name of worksheet	Function	Requested Data Input	Data Output
WS2. Single Project Cash Flow	Delivers a Balance of Costs & Revenues for a 1 Year ODS destruction project, using Input data from WS1.	Total ODS destroyed (mt)	1. Cash Flows (\$); 2. PV of Cash Flows (\$); 3. Cumulative Cash Flows (\$); 4. NPV (\$); 5. IRR (%); 6. Capital employed (\$); 7. Payback (year)

Worksheet 3: POA Cash Flow (1/1)

Input data supplied by user
Output results provided by the system

Concept	Total	1	2	3	4
Year of operation		1	2	3	4
ODS destroyed (mt)	15.00	15	15	15	15
BHGs mitigated (tCO ₂ e)	27150	9050	9050	9050	9050
Project Implementation Costs	US\$				
Storage & Collection	(120,000)	(40,000)	(40,000)	(40,000)	\$ -
Transport to recovery	(105,000)	(35,000)	(35,000)	(35,000)	\$ -
Recovery (processing)	(225,000)	(75,000)	(75,000)	(75,000)	\$ -
Transport to destruction	(40,500)	(13,500)	(13,500)	(13,500)	\$ -
Destruction	(36,000)	(12,000)	(12,000)	(12,000)	\$ -
Total Project Implementation Costs	(526,500)	(175,500)	(175,500)	(175,500)	\$ -
Carbon Project Transaction Costs	US\$				
Documentation & supervision	\$ -	\$ -	\$ -	\$ -	\$ -
Validation process	(20,000)	(20,000)			
Verification process	(20,000)	(20,000)	(20,000)	(20,000)	\$ -
MAP application fee	(500)	(500)			
ROA MOP fee	\$ -	\$ -	\$ -	\$ -	\$ -
Corresponding Adjustment fee	(81,450)	(27,150)	(27,150)	(27,150)	\$ -
Listing fee	(5,430)	(1,810)	(1,810)	(1,810)	\$ -
Total Transaction Costs	(127,380)	(69,460)	(48,960)	(48,960)	\$ -
Total Project Costs	(653,880)	(244,960)	(224,460)	(224,460)	\$ -
Project Debt Cost	US\$				
Project Loan	0	0	0	0	0
Project Income	US\$				
Gross Carbon Revenue	\$ 549,277.08	\$ -	\$ 183,092.36	\$ 183,092.36	\$ 183,092.36
Overall Mitigation in Global Emissions (OMGE)	\$ -	\$ -	\$ -	\$ -	\$ -
Share of Proceedings (SOP)	\$ -	\$ -	\$ -	\$ -	\$ -
Advance payment of MOPA	\$ -	\$ -	\$ -	\$ -	\$ -
Discount over Carbon Revenues	\$ -	\$ -	\$ -	\$ -	\$ -
Net Carbon Revenue	\$ 549,277.08	\$ -	\$ 183,092.36	\$ 183,092.36	\$ 183,092.36
Project Grant	US\$				
Amount of Grant	\$ 130,776.00	\$ 48,960.00	\$ 48,960.00	\$ 48,960.00	\$ -
Cash Flow	US\$				
Cash Flow	\$ 5,896.92	\$ 105,960.00	\$ 3,524.36	\$ 3,524.36	\$ 183,092.36
PV of Cash Flows	\$ 31,350.76	\$ 105,960.00	\$ 3,524.36	\$ 3,524.36	\$ 183,092.36
Cumulative Cash Flows		\$ 105,960.00	\$ 109,484.36	\$ 113,008.72	\$ 313,101.08
NPV of total Cash Flows	\$ 31,350.76				
IRR (%)	-1.02%				
Capital employed (USD)	(653,880)				
Profitability Index	0.045001				

Name of worksheet	Function	Requested Data Input	Data Output
WS3. POA Cash Flow	Delivers a Balance of Costs & Revenues for an ODS destruction Multiyear Program of Activities (POA), using Input data from WS1.	ODS destroyed per year (mt)	1. Cash Flows (\$); 2. PV of Cash Flows (\$); 3. Cumulative Cash Flows (\$); 4. NPV (\$); 5. IRR (%); 6. Capital employed (\$); 7. Payback (year)

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Annex 1: ODS Disposal Costs (1/1)

Name of worksheet	Function	Requested Data Input	Data Output
A1. ODS Disposal Costs	Database of implementation costs for ODS project stages. Source: TEAP, 2009	N/A	Min/Max costs for ODS segregation, collection, processing, transportation & destruction, for ODS types, application sectors, domain, and country experience.

Effort Required	Sector	Population Density	ODS Type	Segregation/Collection Costs		Transport to recovery Costs		Recovery Processing Costs		Transport Costs (In country Destruction)		Transport Costs (International Destruction)		Destruction Costs (In country Destruction)		Destruction Costs (International Destruction) (All Tech except Plasma Arc)		Destruction Costs (International Destruction) (Plasma Arc)	
				min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Low	Domestic refrigeration	D	R	6000	30000	6000	8000	10000	20000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Domestic refrigeration	D	BA	6000	30000	6000	8000	20000	30000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Commercial refrigeration	D	R	8000	12000	8000	10000	8000	15000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Commercial refrigeration	D	BA	8000	12000	8000	10000	25000	35000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Transport refrigeration	D/S	R	N/A	N/A	N/A	N/A	15000	20000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Industrial refrigeration	D/S	R	N/A	N/A	N/A	N/A	4000	6000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Stationary A/C *	D	R	1000	2000	N/A	N/A	4000	25000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Mobile A/C	D	R	1000	2000	N/A	N/A	4000	6000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
High	Domestic refrigeration	S	R	10000	15000	30000	40000	10000	20000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Domestic refrigeration	S	BA	10000	15000	30000	40000	20000	30000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Commercial refrigeration	S	R	15000	20000	40000	50000	8000	15000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Commercial refrigeration	S	BA	15000	20000	40000	50000	25000	35000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Stationary A/C *	S	R	1000	2000	N/A	N/A	10000	35000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Mobile A/C	S	R	1000	2000	N/A	N/A	4000	6000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Steel forced panels	D	BA	75000	90000	5000	10000	30000	40000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Block-pipe	D	BA	10000	15000	15000	20000	30000	40000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Block-Slab	D	BA	80000	100000	5000	10000	30000	40000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500
	Block-Slab	D	BA	80000	100000	5000	10000	30000	40000	250	1000	1400	4000	4000	7000	2400	6000	7400	19500

Source: Authors' own elaboration based on information from the TEAP 2009. Population density: D=dense; S=sparse. ODS Recovery Agent** Covering shipment distances of 200000 km for country destruction; longer distances such as those incurred through exporting materials in high transport costs. International transport includes import and management fees according to Basel Convention procedures. * Assumed recovery.

Annex 2: ODS GWP (1/1)

Substances controlled by the Montreal Protocol	Formula	GWP (100 years)
CFC-11	CCl ₃ F	4,750
CFC-12	CCl ₂ F ₂	10,900
CFC-13	CClF ₃	14,400
CFC-113	CCl ₂ FCF ₃	6,130
CFC-114	CClF ₂ CClF ₂	10,000
CFC-115	CClF ₂ CF ₃	7,370
Halon-1301	CBrF ₃	7,140
Halon-1211	CBrClF ₂	1,890
Halon-2402	CBrF ₂ CClBrF ₂	1,640
Carbon tetrachloride	CCl ₄	1,400
Methyl bromide	CH ₃ Br	5
Methyl chloroform	CH ₃ CCl ₃	146
HCFC-21	CHCl ₂ F	148
R-22 (HCFC-22)	CHClF ₂	1,810
HCFC-123	CHCl ₂ CF ₃	77
HCFC-124	CHClF ₂ CF ₃	609
HCFC-141b	CH ₃ CCl ₂ F	725
HCFC-142b	CH ₃ CClF ₂	2,310
HCFC-225ca	CHCl ₂ CF ₂ CF ₃	122
HCFC-225cb	CHClF ₂ CF ₂ CF ₃	595

Source: Authors' own elaboration based on information from UNEP and IPCC.

Name of worksheet	Function	Requested Data Input	Data Output
A2. ODS GWP	Database of GWP of ODS controlled by the MP.	N/A	GWP of 19 ODS controlled by the MP.

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Annex 3: CO₂ Project Transaction Costs (1/1)

Typical Transaction Costs of Mitigation Actions for ITMOs Transfer under Ghana's Article 6.2 Framework			
Concept	Costs (USD)		Concept Description
	min	max	
Project preparation	0	6000	This step includes the cost of consultants support to undertake a initial feasibility assessment, develop project documents, and support the validation and registration processes. This cost may be considerably lower than cost of local consultants (in-country) are used, or particularly, if expert consultants are hired to undertake the tasks. In the case of the Ghana government, GH Foundation can sponsor up to 6000 USD for NAOB development.
Third party validation	7500	20000	Business of ITMOs development cost, but might be slightly reduced for particularly simple or small projects. Note that this fee is not required for CCAR CAR, hence reference of ITMO projects to an average cost of validation of USD 75,000-USD 20,000 for ITMO projects.
Third party verification	7500	20000	Like the cost of validation, this cost is fixed but might be slightly lower for particularly simple or small projects. For projects carried out on an ongoing or multi-year basis, this would be an annual cost. Hence reference of ITMO projects to an average cost of verification of USD 75,000-USD 20,000 for ITMO projects.
Mitigation activity development (NAP for activity application fee)	500	3000	This fee is paid by an activity developer who has received a Mitigation Action Project (NAP) account on the Ghana Carbon Registry (GCR) to submit a Mitigation Activity Development (NAP) for the first mitigation activity aiming to generate validated ITMOs. For small-scale projects, the GCR for registry validation prospective international Credits Standard (ICS) in the framework. Fee is paid also by voluntary carbon project developer seeking formal recognition to create an account on the GCR and issuance of the credit for trading on the GCR. The value ranges from USD 500-USD for small-scale projects or forestry projects to USD 3000 for large-scale commercial non-forestry projects.
Mitigation activity development (NAP fee)	250	500	Fee is paid by an activity developer seeking to create an ITMO for additional mitigation activity to be carried out by the first activity developer on the same NAP account. The value ranges from USD 250-USD for small-scale projects or forestry projects to USD 500 for large-scale commercial non-forestry projects.
Corresponding Adjustment Fee	0	10000	Fee is paid by an activity developer or participating acquiring Party to compensate for the opportunity cost for existing Ghana NAOB and the marginal cost for creating asset with the regulatory framework and reporting of formal verifiable mitigation outcomes. The value ranges from USD 0-USD for small-scale projects, USD 1000 for forestry projects, to USD 10,000 for large-scale commercial non-forestry projects.
Trading Fee (USD/ITMO)	0.1	0.2	A fee of USD 0.1/ITMO is paid to the issuer based on activity developed from the activity aiming to create and transfer ITMOs for transfer formal held on the GCR. A fee of USD 0.2/ITMO is paid to the issuer based on the VCM project developed for a trading carbon trading fee (USD/ITMO).

Source: Authors' own elaboration based on information provided by the Climate Action Reserve; VCS; ICF International; and The National framework of Ghana for market and non-market mechanisms under Article 6 of the Paris Agreement

Name of worksheet	Function	Data Output
A3. CO ₂ Project Transaction Costs	Database of transaction costs of a mitigation action seeking the transfer of ITMOs under Article 6.2. Source: CAR, Gold Std, VCS, Ghana A6.2 Guideline, Klik	Average transaction costs incurred in an ITMO project development: 1. Preparation; 2. Validation; 3. Verification; 4. Fees (Application, MID, CA, listing).

Thanks!

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