Experience Spotlight: South-South Cooperation
Virtual Training Workshops
Climate MRV in the solid waste sector

Context

Peru faces a number of challenges in the solid waste sector, from a significant lack of solid waste infrastructure, to precarious fiscal management and inadequate data management. Moreover, municipalities have not received enough attention for capacity building. Less than 49% of the 23,000 tons/day of solid waste generated in the country are disposed in a landfill[1]. There are more than 1,585 uncontrolled open dumps. Composting is an emerging activity.

The General Directorate of Solid Waste Management (DGRS) of the Peruvian Ministry of the Environment (MINAM) is the entity in charge of the Solid Waste Management Information System (SIGERSOL), which allows municipalities to report indicators on solid waste management and also recently to calculate greenhouse gas (GHG) emissions. The system is under a permanent development and updating, users are being trained, and the DGRS specialists require technical assistance and training in order to lead SIGERSOL toward a comprehensive MRV system.

This spotlighted experience on climate MRV workshops in the solid waste sector complies with the objective of the Coordination Framework of the Pacific Alliance's MRV Technical Subgroup (SGT-MRV) on "*… promoting specific capacity building initiatives in each country to improve and align their MRV methodologies*". In addition, it meets the training needs identified in the document "Baseline for MRV of Mitigation Activities in Peru" (August 2019), which drew some of the conclusions of the successful meeting held in Arequipa on "Solid Waste Valuation at Municipal Level"[2]. (September 2019)

The workshops were carried out through a South-South technical cooperation approach between Chile and Peru, contextualized in the Pacific Alliance's political framework, with the aim of strengthening the national and sub-national climate MRV system, and increase the effectiveness of the MRV of NDC/SLCP mitigation projects in Peru.

The Peruvian Ministry of Environment (MINAM) led the initiative and the Pacific Alliance's MRV Technical Subgroup (SGT-MRV), in collaboration with the Chilean Ministry of the Environment (MMA) and the technical and financial support of Environment and Climate Change Canada (ECCC). The training sessions allowed to share the practical experience and lessons learned from the "Organic Recycling Program" operating in Chile[3].

[1] Orbegozo, C. and Muller, S. "Solid Waste Valuation at Municipal Level. Part A: The institutional mapping". IKI Project "Mobilizing investments for the implementation of NDCs".
[2] See the Executive Summary (English) and the Full Report (Spanish)
[3] The Organic Recycling Program is a technical collaboration between Canada and the Chilean Ministry of the Environment, ARCADIS and ImplementaSur.

Learning Needs and Objectives

A previous analysis on the learning needs led to a list of learning objectives, selection of topics and identification of specialists to elaborate the theoretical-practical program of the four virtual workshops. The following table shows the result of this work.

Table 1. Learning needs and objectives identified

Learning needs	Learning objectives
To understand the relationship between climate change, mitigation actions and sustainable waste management. Their relationship with the Peruvian NDCs.	• To explain the link between GHG emissions and the environmental impact of solid waste management.
Components of the climate MRV system. Differences between emissions MRV, mitigation actions MRV and climate finance MRV.	• To define what an MRV system is, and differentiate between emission MRV, mitigation action, and climate finance one. • To identify elements of the Chilean Organic Recycling Program that can be adapted to the Peruvian characteristics and serve to improve the MRV system and also the SIGERSOL platform.
Available protocols to calculate the GHG emission factors in the solid waste sector, taking into account the different climates of Peru.	• To calculate GHG emissions using established protocols. GHG Report of Municipalities using local Emission Factors. • To explain the design of the MRV module in the SIGERSOL platform, taking into account the different climates of Peru, including emissions inventory, mitigation actions and climate financing.
Available technologies to take advantages of solid waste. Relationship with GHG mitigation and economic value of GHG reductions generated.	• To qualify the feasibility of using solid waste valuation technologies that mitigates GHG in municipalities. • To calculate the economic value of GHG reductions and participate as a municipality in the emissions market, knowing how they can register their projects.
Investment and operation models that enable the implementation of GHG mitigation projects for solid waste management. Emission market operation. Participation of municipalities with their own projects.	• To describe the relevant enabling conditions and mechanisms for an effective municipalities participation in the NDC achievement for the solid waste sector and introduce the corresponding adjustments in their operations/activities.
Experience exchanges between peers regarding the composting and biogas MRV.	• To describe the main strengths, opportunities, weaknesses and threats faced in the design and implementation of the Chilean Organic Recycling Program MRV platform and other relevant experiences.
The SIGERSOL system. Its conversion into an emission, mitigation actions and climate financing MRV system.	• To know methodologies to measure GHG emissions in the solid waste sector- • To describe digital technologies for reporting and verification, learning from the Chilean experience. To know its advantages and risks.
Mapping the relationship between municipalities and MINAM on climate MRV.	• Mapping responsible persons (key actors) and their roles for climate mitigation actions in the municipalities. • To assess the feasibility of using of digital technologies in Peru.

Quality assurance and quality control (QA & QC) methods for the information reported by municipalities in SIGERSOL. Software used by SIGERSOL to estimate GHG.	• To use standard report and measurement protocols of mitigation actions in accordance with MINAM regulations. • To report municipalities information in SIGERSOL under international quality standards and use an improved software for estimating emissions.
Advances in information report and verification through digital developments	• To carry out calculations using the Technical-Economic Analysis Model (TEAM) for solid waste sector. • To learn about the various alternatives that Peru offers to register emission inventories and reductions in a digital form.

Source: Own elaboration

Analysis of the workshops[4] and their outcomes

The virtual workshops were developed in four sessions, on January 20, 21, 27 and 28, 2021. An average of 167 attendees from 24 countries actively attended the four workshops. Specifically, representatives of 56 Peruvian municipalities', the participation as observers of other three Pacific Alliance member countries (Chile, Colombia and Mexico) and the participation of several member countries (14) of the West African MRV Program (WA-MRV).

The training included inputs of two municipality representatives (Lima and Arequipa), who shared their practical experiences. The first one, in fact, is in the process of finalizing its Local Climate Change Plan considering an improvement of the city's resilience facing the climate change effects, which includes, among other activities, the valuation of organic solid waste.

On the other hand, Arequipa is an active city regarding solid waste management within the framework of its Comprehensive Solid Waste Environmental Management Plan (PIGARS) and its Environmental Agenda towards the Bicentenary. Its work is justified because of the high generation of per capita solid waste (0.48 kg) and its actions include solid waste management, public cleaning service and training, strengthening, strategies, monitoring and surveillance activities.

Main elements discussed

Session 1

- Solid waste management is associated with environmental impact and GHG emissions.
- The Chilean Organic Recycling Program was introduced and methane as the main GHG in the solid waste sector, in addition to being a short-lived climate pollutant (SLCP).
- Good solid waste management eliminates risks to the population due to bad smells, vectors and leachates that affect people health, especially those living near landfills or dumps.

[4] For materials, recordings and minutes of the workshops, please use the links available in the Annex:

- Methane is the main GHG generated in this sector, but black carbon from burning must also be considered. A programmatic management close to the population benefits their health and the environment.

- In Peru, methane account for 95% of the solid waste sector's emissions. Under a life-cycle approach, both the product and the waste transport generate emissions.

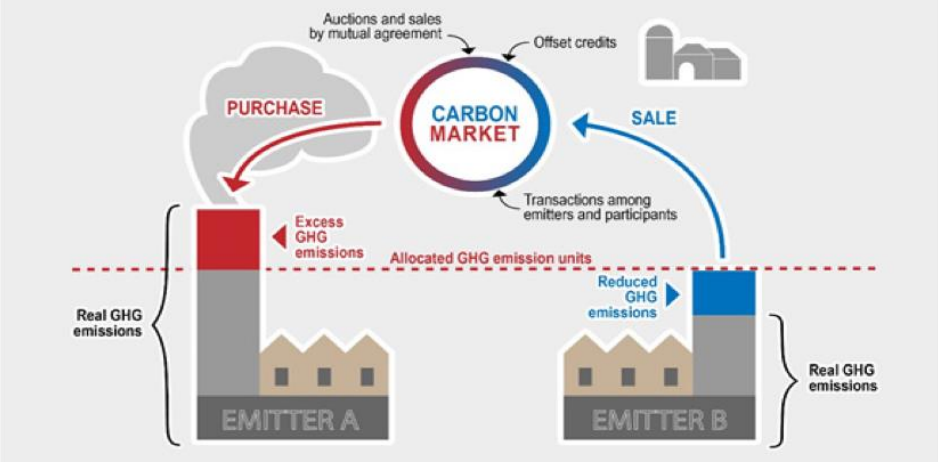
- According to Municipal SIGERSOL Information System, 55% of municipal waste is organic; each person produces 0.8 kg per day and a total of around 4 million tons of $CO2_{eq}$ are emitted annually. (Municipal SIGERSOL, 2020)

- SIGERSOL Platform has support material for the municipalities: studies and plans, among others. In addition to the modules of municipality's general data, solid waste management, administration and finance, and environmental education, a climate change module has been enabled that contains the baseline and project GHG emissions calculation. The mitigation technologies used are: power generation, centralized and decentralized burning, composting, recycling and semi-aerobic process. The outputs are also part of the Annual GHG Reports (RAGEI) of solid waste sector.

- Implementation of carbon offset methodologies, which can be applied to reduce the cost of compliance for organizations regulated under emission reduction programs. That is why a correct quantification is important. There are many available methodologies: GHG Protocol, ISO 14064, IPIECA and API Compendium, among others.

- IPCC proposes the basic (Tier 1), intermediate (Tier 2) and advanced (Tier 3) levels. There are several countries that already have implemented or promulgated standards.

Graph 1: Carbon Market vs. Offset Market



- Carrying out a practical exercise calculating GHG emissions with established protocols for a composting project.

- Finally, the development process of the Composting MRV Protocol in Chile was shared.

"Composting plants and practical exercises [were the topics that interested me the most]. The practical exercises helped a lot to understand how one can put MRV into practice in waste management."
Alejandro Peláez, Chile

Session 2

- Definition of climate MRV concept: GHG emissions, climate mitigation and climate financing actions.
- Identification of MRV users, better access to financing and its multilevel and multisectoral nature.
- Chile's Extended Producer Responsibility Law (RED).
- Feasibility of using solid waste recovery technologies (landfill as the worst option)
- The sustainable solid waste management has a circular economy approach, because it ranges from prevention, preparation for use, recycling, energy recovery and disposal (the least recommended).
- There are various technologies such as composting, vermicomposting, thermal drying, anaerobic digestion, and sewage treatment, among others.
- Equipment reference costs, operation and implementation costs, using data from Chile's National Organic Waste Strategy (ENRO)

Graph 2: The concept of circular economy applied to solid waste management

- Mitigation monitoring tools (MRV).
- Specific modules for GHG mitigation in SIGERSOL.
- MINAM is the national authority on climate change issues and INFOCARBONO is the toll used for annual GHG reports (RAGEI).
- The Peru Carbon Footprint is another tool aimed at public and private organizations and includes carbon neutrality. There are already 250 registered companies.
- The National Registry of Mitigation Measures (RENAMI) is another instrument of the System for Monitoring Adaptation and Mitigation Measures and follows up the progress of the implementation of NDCs' mitigation measures (not yet published)

- Carrying out a practical exercise to calculate the economic value of GHG reductions. First, it was explained how public and private projects are assessed; reference prices for emissions were shown. The economic externality, social prices, the carbon market price (carbon tax) and the reference value of emissions trading system (ETS) were discussed. A composting plant in Chile was used as an example.

Session 3

- Chile's National System for the Declaration of Non-Hazardous Solid Waste (SINADER), a module as part of the Pollutant Release and Transfer Register (RETC) whose declarants are: industrial and municipal generators, waste reception and storage facilities and final recipients. The information must be traceable.

> *"The experience [application of the digital MRV in Copiulemu landfill] was very good. Therefore, if it has worked in that city, it is likely to work in the others. It is only a matter of political decision (budget, etc.)"*
> ***Nancy Edith Porto Lopez, Peru***

- Use of carbon offsets report and measuring standard protocols. Case study from Chilean experience (landfill in Copiulemu)

- Need to adapt IPCC[5] methodologies to each country. In the case of Chile, this adaptation was made in six steps, applying GHG's accounting principles (GHG Protocol) and ISO 14064 standard. The landfill gas capture and destruction methodology was based on the Quebec Protocol for Landfill - Treatment and Destruction of CH_4, the Program "Landfill Initiative Protocol" from the Ontario's Offset Initiative Protocols and the USA Landfill Protocol (CAR).

- Examples of CAR eligibility rules for the Landfill Protocol applied to Chile and the Compost Protocol (Fy Factor).

- Successful case of SINADER application in the Integrated Household Solid Waste Management Plant (PIMR) of the Santa Juana Municipality, and its MRV module. It began in 2018 with a community environmental education campaign. The collection is house by house towards the collection centre. A project was submitted to the Organic Recycling Program. The municipality was supported with technical assistance and machinery. The entire process and the benefits for the participating population were explained. All the information is registered into Excel sheets.

- A practical exercise was carried out to map key actors and apply a calculation methodology to measure emissions in SIGERSOL. The IPCC model for solid waste (waste model) used for the module included in SIGERSOL, the difference between Tier 1 and Tier 2, the necessary information and the key actors was shown. The exercise began with a quick survey on the ease of obtaining data to calculate emissions.

Session 4

- Use of digital technologies for reporting and verification.

- Technical-Economic Analysis Model (TEAM) for solid waste. TEAM is used for decision-making on GHG and SLCP mitigation strategies in key industrial sectors; includes co-benefit assessment, and is applied from a facility to a geographic region or jurisdiction.

- Concept of marginal abatement cost curves (MAC)

- The work process with TEAM and a real-time demonstration via web.

[5] IPCC: Intergovernmental Panel on Climate Change (www.ipcc.ch)

- The Blockchain MRV Digital pilot experience in Copiulemu landfill, as part of the Chile-Canada Organic Recycling Program. IOTA[6], a tool used for this purpose was introduced. The challenges identified in developing MRV were: inefficiency of the MRV process, credibility and usefulness of the results, and cohesion of the MRV systems. Copiulemu was chosen for its particular characteristics, such as: proven and mature technologies (low scientific risk), new built headquarters, modern equipment, digital measurement equipment and data management system that allows a fast connection with the Digital MRV (without additional costs), the site is relevant to various stakeholders (mitigation, inventories, financing). The development of Chile's solid waste MRV is part of a broader technical assistance.

- Overview of digital MRV model, its advantages and scalability criteria.

- Carrying out a practical exercise focused on preparing a requirements list for attendees to validate the feasibility of applying digital technologies in the solid waste sector in their municipalities.

- A poll carried out during the session revealed that the municipalities are not technologically prepared for a sub-national level MRV (60% have a medium or poor connection), there is an inadequate data systematization (71% use Excel sheets), insufficient communication and coordination, high staff turnover, real-time information gap, insufficient useful information (50% report relevant information) and lack of human resources specialized in solid waste (38% invest in training, equipment and software)

- With these inputs, the steps to implement an informatic application for solid waste management were introduced.

In summary

Attendees evaluated positively virtual workshops. The South-South technical cooperation approach between Chile and Peru was reflected in each of the four sessions and allowed the transfer of knowledge and experiences gained by Chile, with technical assistance from Canadian specialists, to be used by the attendees. The workshops were developed from the most basic to the most complex. The proposed model worked.

Regarding the topics addressed, the introduction of Organic Recycling Program and SIGERSOL platform allowed a comparison between both climate instruments and attracted the attention of the DGRS-MINAM specialists, as well as the attendees. Although the Program is still in the process of implementation in Chile, the Canadian specialists showed the technical, environmental and social rationale for the proposed solutions, as well as real examples of their application. The participation of a Chilean municipality implementing the Program attracted the interest of the attendees; it was reflected in the number of questions to the speaker, which proves that the participation of local managers or technicians is very important, so that the attendees have a reference point from the operation side, and are identified with them.

[6] Advanced technology ecosystem for exchanging value and data between humans and machines. It has tamper-proof data, lightweight scalable infrastructure, and elimination of vendor dependency risk, high level of transparency, and no built-in fees to use the network.

On the other hand, the technological dimension of the climatic tools in the solid waste sector allowed deepening the knowledge of the attendees, to understand closely the existing validated solutions and to take this knowledge to their own municipalities, work centres or communities, thus initiating a multiplier effect that was one of the objectives of the virtual workshops.

Last, but not least, is the follow-up possibility to invite attendees to various learning spaces in this sector or others of their interest.

Conclusions

The final poll was an important feedback source from the attendees regarding the topics of their greatest interest, their suggestions about the reinforcement of these topics or new ones, their ideas for mitigation projects, and their training needs and resources to adapt and propose environmental and climate actions in their municipalities.

> *"I would like to learn a little more about this topic [MRV in the solid waste sector] in my country and thus seek alternatives such as those proposed in this course"* ***Manuela Sánchez Quintero, Colombia***

From their opinions, the following stands out: the South-South collaboration had a positive effect, the topics were well developed and they able to consolidate their knowledge, the initiatives, cases and examples can be adapted to their own municipalities, the practical exercises were very well qualified, they suggest that this workshops model could be repeated, other related topics be presented, some topics developed in this event should be deepened (clean environmental solutions crosscutting to the 2030 Agenda and the circular economy) and more Digital MRV and TEAM successful cases of application, deepen into the concept of blockchain and how it is applied to MRV, cost-benefit analysis of actions and more practical exercises using GHG calculators.

From the registration stage, the organizers have recognized a significant need for knowledge in the target audience. For various reasons, a part of the registered persons could not participate. However, it was achieved that the selected topics, the quality of the specialists and the practical exercises attract the attention of this audience. The statistics and the outcomes reflect it. Significant experience has also been obtained in the organization and management of participatory virtual workshops, which serve to apply similar formats in other topics of interest of the Pacific Alliance's SGT MRV.

For more information on this 'spotlight paper', please contact the main researcher, Mr Carlos Orbegozo, or for more information on any other Spotlight Series documents, contact the SGT-MRV coordinator, Mr Francisco Pinto.

Annex

Workshop material

- Agenda
- Session 1 recording (Part 1 and 2)
- Session 2 recording (Part 1 and 2)
- Session 3 recording (Part 1 and 2)
- Session 4 recording (Part 1, 2, 3 and 4)
- Session 1 English translation audio (Part 1 and 2)
- Session 2 English translation audio (Part 1, 2 and 3)
- Session 3 English translation audio (Part 1, 2 and 3)
- Session 4 English translation audio (Part 1 and 2)
- Exercise session 1 (Excel file)
- Exercise session 2 (Excel files 1 and 2)
- Exercise session 3 (Excel file)
- Exercise session 4