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CREATION AND
IMPLEMENTATION OF A
MEASUREMENT, REPORTING AND
VERIFICATION (MRV) SYSTEM

CHILE'S GREEN TAX





Creation and Implementation of a Measurement, Reporting, and Verification (MRV) System

RESUMEN

The design and implementation of an emissions measurement, reporting, and verification (MRV) mechanism forms part of a long-term environmental policy that sets out to achieve two goals. The general objective is to instate an MRV system in the broad sense, addressing issues of how to measure, compare, and verify emissions for public policy purposes. Thus, the specific objective is to bolster the implementation of green taxes through a system that features defined measurement, reporting, and verification mechanisms at each source. The design of the MRV system took into account: i) Consistency between the challenges of such taxation (levying a tax on local pollutants and responding to the global challenges of climate change); ii) differences between stakeholders subject to the tax in different sectors and using different technologies; and iii) regulatory consistency regarding regulations applicable to different sectors.

INTRODUCTION

In 2017 Chile implemented taxes (Law 20.780) on emissions of local (PM, NO_x, SO₂) and global (CO₂) pollutants from stationary sources¹. This required the development of a measurement, reporting, and verification (MRV) mechanism for emissions at each applicable source. The system is based on methodologies, protocols, and guidelines that establish what, how, when, and by whom these emissions are measured, reported, and verified. However, the MRV system fulfils a number of purposes over and above those necessary for green taxes, such as developing inventories, enhancing domestic and international comparability, facilitating management within companies, and even advancing towards more sophisticated carbon credit markets, such as compensation mechanisms, offsets, and/or an emissions trading system. Meanwhile, the MRV system offers a number of benefits from a public policy perspective: for instance, it strengthens the institutional framework for environmental oversight, creates a setting that promotes the consolidation of emissions monitoring, and builds professional capacities for information system management.

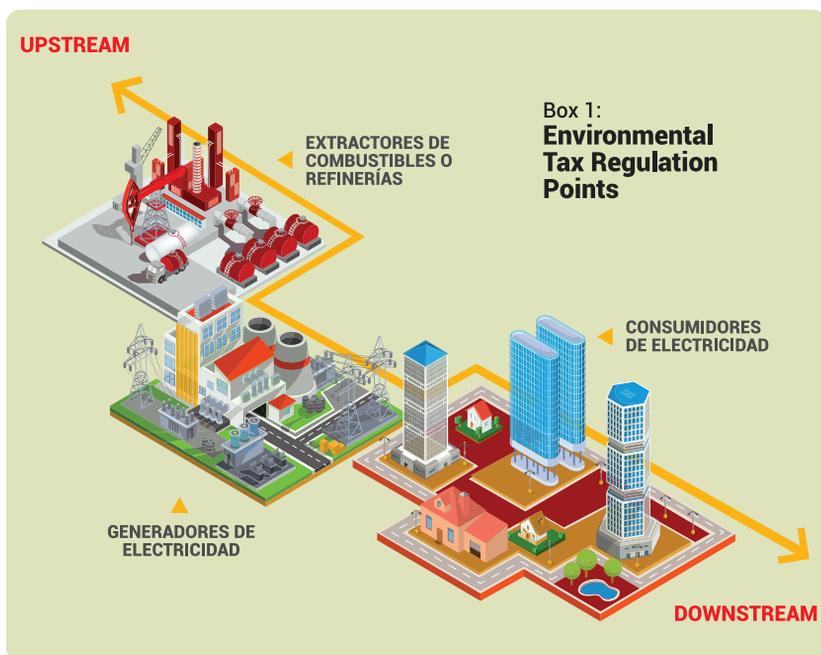
MRV IN THE GREEN TAX SYSTEM

Systems that levy taxes on pollutant emissions can be applied at a wide range of stages in the production chain. Upstream regulation affects raw materials, such as the production,

1. For more details on how the taxes are calculated, see: Pizarro, Rodrigo (2016). **Ley 20.780 Artículo 8°: Impuestos verdes a las fuentes fijas**. Nota técnica, División de Información y Economía Ambiental, Ministerio del Medio Ambiente. Santiago, Chile.

import, and sale of fossil fuels. Later in the production chain, midstream measures normally apply to direct emissions, such as in electricity generation or industrial processes. At the end of the chain, downstream regulation addresses final goods and services. Chile's green taxes are applied through midstream regulation², but can also be viewed as downstream because it is the emissions that are taxed, not the carbon content of the products or services (see Box 1).

Defining the regulation point is vital for implementing a tax, as this decision affects the complexity of the system's institutional infrastructure. The further down the production chain the emissions measurement, reporting, and verification systems operate, the more complex they become. Downstream taxes, applied to direct emissions, require the development of more complex and comprehensive institutional infrastructure, as they involve measuring emissions at each source. The definition also specifies the type of pollutant to be considered. Emissions of local pollutants (PM, NO_x, SO₂) depend on the technologies and processes used for both production and pollution abatement.



2. For more details on downstream taxes, see: Brochure 2. Institutional Infrastructure for Green Taxes

THE MRV SYSTEM IN CHILEAN ENVIRONMENTAL POLICY

The Ministry of the Environment (MMA) is the institution tasked with both environmental and climate change policy. This dual responsibility led it to form a green tax strategy to run alongside other environmental oversight measures, comprising:

- i) Developing a mechanism (green tax) to serve a number of purposes: reducing emissions of local pollutants, while also taxing emissions of global pollutants so as to uphold national commitments regarding climate change.
- ii) Consolidating suitable institutional infrastructure to meet multiple goals. This means creating a structured and organized institutional framework based on a suite of arrangements, legislation, protocols, and regulations that set out to remain compatible with existing regulations and standards while also allowing the system to build up implementation of a range of mechanisms.
- iii) Creating a measurement system that is consistent with existing mechanisms, scalable to other areas, and comparable with similar systems in other countries.

The MRV system that Chile has designed constitutes both a general mechanism and a specific implementation. In general terms, it seeks to complement other measurement initiatives, such as emissions inventories, that comprise internationally comparable mechanisms. Here, the MRV system is not only an integral component of the taxation mechanism but also forms part of a general measurement system that must be integrated and consistent across all elements of emissions control policy:

National Greenhouse Gas Inventory System (SNICHILE)³. Chile implements a national emissions inventory by means of a top-down approach. The MRV system complements this information with data compiled using a bottom-up methodology, providing a more precise profile of each source, which can be used in the future to calibrate emissions in the national inventory.

Green Taxes: The MRV system permits the implementation of green taxes through protocols that establish what, how, when, and by whom these emissions are measured, reported, and verified, with a high degree of certainty.

Production sectors: A suitable MRV system must allow the application of measurement mechanisms that are adapted to the situation of each sector and must allow the evaluation of real-world advances in emissions reduction in different sectors, in which to date only general measurement parameters have been available.

Mitigation: Establishing precise quantitative data on mitigation actions, and allowing full **international comparability** in Nationally Appropriate Mitigation Actions (NAMAs).

3. For more details, see: <http://www.snichile.cl>

In the current specific implementation, the MRV system must be able to be adapted to different legal frameworks, problems, and technologies used in the applicable sectors. Indeed, one of the most fundamental aspects of the system is the **measurement (M)** component, which comprises a wide range of emissions quantification techniques⁴ that were designed taking into account the regulations currently in force and the sectors involved⁵. Thus, a measurement system has been developed to fit with existing infrastructure and regulations, so as to avoid any possible redundancy in regulatory matters.

The main challenge affecting the **reporting (R)** component comprises introducing a new report while retaining coherence with the current recording and reporting mechanisms that apply to the Pollutant Release and Transfer Register (PRTR). The decision was therefore made to retain the existing reports (SICTER)⁶ and to add a new one, the Green Tax System (SIV) for facilities that were not previously covered. These two mechanisms make up the green tax reporting system and are consolidated under a new register of boilers and facilities subject to the tax.

This expansion of the existing structure without creating new mechanisms converts the PRTR into the main centre of environmental public policy information, as the methodologies, protocols, and mechanisms designed for the tax are also useful in other policy areas.

The **verification (V)** component was designed to be used in two roles. First, verification functions together with monitoring for public policy issues relating to compliance with the regulation, enhancing state oversight capacities. This means that the implementation of a verification system operating through Environmental Oversight Technical Agencies (ETFAs) and Environmental Certification Technical Agencies (ETCAs) creates room for synergy or joint oversight between the regulated sector, the oversight bodies, and the State. Secondly, the verification mechanism allows the tax to be applied and calibrated correctly, and in the future may allow it to be expanded with other mechanisms relating to carbon prices, which require third-party verification, in line with the challenges of climate change.

MRV systems are tools that play a key role in the design, implementation, and assessment of all public policies, most of all in the field of climate policy. Policies and decisions on how to address each of these aspects depend on local conditions and circumstances. Thus, designing a green tax policy in Chile demanded the creation and implementation of a multi-purpose MRV system that is compatible with the country's environmental policy and the type of downstream taxation that was selected.

4. For more details on the quantification methodologies, see **Exempt Resolution 1053: Instructions for quantifying emissions from stationary sources subject to taxation under Law 20.780, Article 8** (Office of the Superintendent of the Environment, November 2016).

5. Specifically, Ministry of the Environment Supreme Decree 13/2011, which regulates thermal power plants, and Ministry of Health Supreme Decree 138/2005, which regulates all sources of atmospheric emissions.

6. The Thermoelectric Plant Information System (SICTER) was established under Ministry of the Environment Supreme Decree 13, which establishes emissions regulations for thermoelectric plants.

To meet these challenges, the institutional infrastructure for the taxes has been provided with a number of protocols, guidelines, and regulations that, together, form an MRV system that is anchored in existing institutions. Indeed, the Chilean environmental oversight system prior to the new tax already included an information system based in the PRTR that received annual reports from approximately 22,000 facilities. It was logical for the PRTR to form the basis for the new MRV system, taking into account that it is not only a mechanism for applying the tax but also part of a broader environmental policy.

COMPONENTS OF THE MRV SYSTEM

The MRV system is made up of four components: the register of sources, which comprises a prior survey of facilities that may be subject to the tax; the measurement (M) component, regulated under the emissions quantification guidelines; reporting (R), which stipulates guidelines for emissions reporting; and verification (V), covered under regulatory verification guidelines. Each of these components is analyzed below (see Box 3).

Registration⁷

The register of sources is a key element that forms the foundations of the MRV system. Its objective is to identify facilities that may be subject to the tax. All individuals and legal bodies that own one or more boilers and/or turbines with a rated thermal power level of 5 MWt or more are obliged to register with the PRTR uniform public service system, although only facilities that have a combined rated thermal power level of 50 MWt or more are subject to the tax. They must also provide relevant information to determine whether or not they are subject to the tax. The register is based on information submitted in a number of sector-based systems that companies are already using for reporting purposes. Therefore, the register does not impose any additional administrative costs on them, but rather forms part of their regular obligations. The Ministry of the Environment uses this information to draw up a list of facilities liable for taxation each year. This list is non-binding and can vary depending on changes in production conditions at applicable facilities.

Measurement⁸

Whenever companies and the facilities they operate are subject to the tax, they must apply emissions quantification methodologies so as to determine the amount payable. The

7. For more details, see: **Manual de registro de calderas y turbinas para el pago de impuestos verdes** (Registration manual of boilers and turbines, for payment of green taxes, Ministry of the Environment, October 2016). Available online at: <http://vu.mma.gob.cl/index.php?c=documento/descargar&codigo=03afdbd66e7929b125f8597834fa83a4>
8. For detailed information on the measurement protocol, see: **Instructivo para la cuantificación de las emisiones de fuentes fijas afectas al impuesto del artículo 8° de la ley n° 20.780.** (Instructions for quantification of emissions from stationary sources subject to taxation under Law 20.780, Article 8) Available online at: http://www.sma.gob.cl/transparencia/doc/resoluciones/RESOL_EXENTA_SMA_2016/RESOL%20EXENTA%20N%201053%20SMA.PDF

companies are responsible for selecting the quantification method that they use, choosing from a list of available options in line with rules laid out in guidelines issued by the Office of the Superintendent of the Environment (SMA). Quantification may be implemented by means of monitoring and measurement or estimation:

- **Sampling and measurement:** This comprises the direct quantification of the outlet emissions concentrations, using measurement equipment installed at the facility. Both sampling and continuous measurement are included amongst quantification options.
 - **Discrete sampling:** Monitoring equipment is used to take a sample, which is then analyzed in a laboratory or on site. This method is used to determine output concentration and representative flow rate at the time when the measurement is taken.
 - **Continuous:** Emissions sampling and analysis in real time, using a continuous emissions monitoring system (CEMS). This normally provides hour-by-hour emissions averages over the course of the year.
- **Estimation:** This method comprises the indirect quantification of emissions using emission factors (for the specific production process in question) and annual activity records (such as operating hours and fuel consumption).

Together with this methodology, a number of quantification options are specified in Environmental Regulation Standards (ICAs)⁹ that apply to each facility. The Instruction offer 11 + 1 options, divided into three groups (see Box 2).

BOX 2: EMISSIONS QUANTIFICATION OPTIONS, BY SECTOR AND MEASUREMENT SYSTEM				
Applicable sectors	Measurement system			In-house methodology
	CEMS*	Discrete	Estimation	
Power plants subject to Supreme Decree 13/2011	1			
		2		
	3			
	4			
	5			
Power plants not subject to Supreme Decree 13/2011	6			
	7			
		8		
		9		
			10	
Boilers and/or Turbines (Not power plants)			11	
				12

*CEMS: continuous monitoring system

9. Environmental Regulation Standards (ICAs) comprise the Environmental Resolutions, Prevention Plans, Decontamination Plans, Environmental Quality Standards, Emissions Regulations, Management Plans, and other oversight mechanisms operated by the SMA.

Additionally, when a facility subject to the tax is unable to apply any of these options, it may propose an alternative quantification methodology; this methodology must be internationally accepted and supported with the necessary technical background information for it to be evaluated.

It should be made clear that each facility is responsible for deciding whether to use a single option or a combination of options for quantifying all applicable parameters of its emissions. Facilities will be obliged to submit a methodological proposal for emissions quantification to be maintained throughout all hours of the calendar year (except for new sources), for evaluation by the SMA.

These 11 + 1 methodologies are developed with standards for the different sectors and technologies that are subject to the tax. The green tax applies to technologies rather than production sectors, so measurement mechanisms used in different industries - some of them already covered under emissions regulations - need to be homologated. As shown in Figure 1, 55 taxable facilities are power plants, and 45 of these were already regulated under Supreme Decree 13/2011. Thus, 48 facilities were not covered under this regulation, imposing the challenge of implementing the mechanisms associated with the tax. Meanwhile, technological and process differences in each sector have imposed an additional challenge for the Ministry of the Environment and the SMA. In response, site visits have been made to facilities in order to check system implementation conditions, in addition to the register of sources.

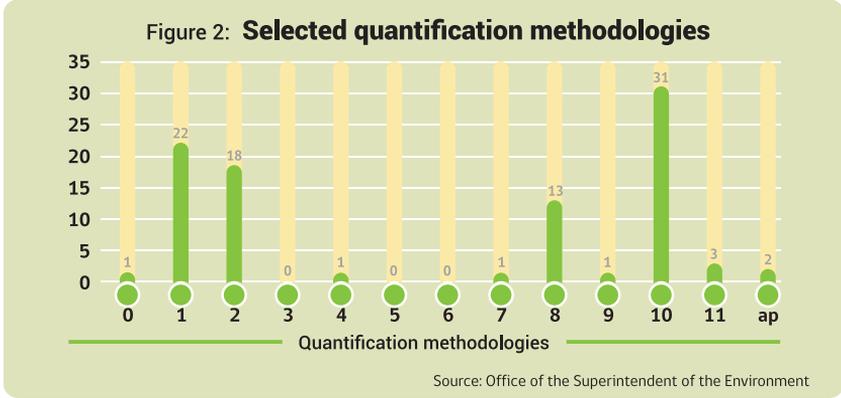
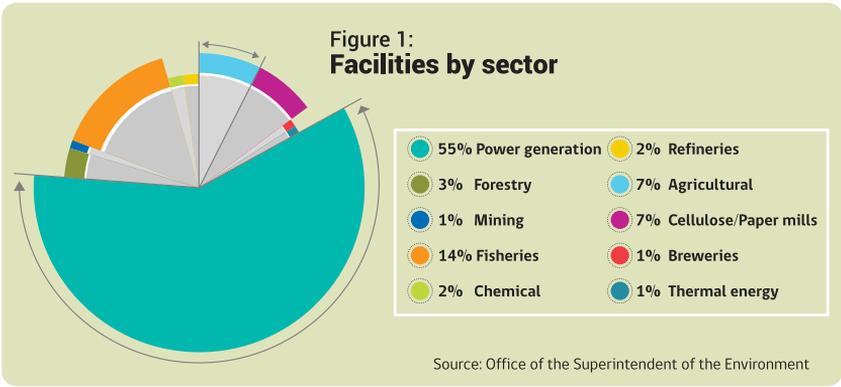
Finally, most facilities have selected quantification methodologies based on estimation from emission factors specified by the Ministry of Health (Methodology 10) and CEMS methodologies (Methodology 1) that apply to power plants (see Figure 2).

Reporting¹⁰

The emissions reporting process is based on guidelines that determine the conditions and standards that must be met when reporting emissions subject to the tax. For these purposes, the SMA prepared emissions reporting guidelines that set out to regulate administrative duties for reporting the data and background information necessary to calculate the tax. This calculation is then performed by the Internal Revenue Service on a case by case basis for each source. The SMA instruction also specifies the rules for submitting an individual report to the National Energy Commission (CNE) and the National Electricity Coordinator, containing the consolidated and hour-by-hour emissions released at all power plants subject to their coordination.

Under the instruction, all facilities subject to the tax must make a report, using the PRTR uniform public service system. However, the emissions reporting mechanism depends on the

10. For more details, see: **Instructivo para el Reporte de las emisiones de fuentes fijas afectas al impuesto del artículo 8° de la ley n° 20.780.** (Instructions for reporting emissions from stationary sources subject to taxation under Law 20.780, Article 8) Office of the Superintendent of the Environment (2017). Available online at: http://www.sma.gob.cl/transparencia/doc/resoluciones/RESOL_EXENTA_SMA_2017/RESOL%20EXENTA%20N%20184%20SMA.PDF



type of source, and it may be processed either by SICTER¹¹ or by the SIV. These reports are submitted on a quarterly basis.

The following emissions declaration mechanisms are available, grouped by type of facility and applicable regulations:

- If the source is a power plant regulated under Supreme Decree 13¹² and has selected measurement options 1, 2, 3, 4, and/or 5 in the list shown above for all of its parameters, reports shall be submitted to SICTER via the uniform public service system.
- If the source is a power plant regulated under Supreme Decree 13 and has not selected measurement options 1, 2, 3, 4, and/or 5 for absolutely all of its green tax parameters, reports shall be submitted to the SIV via the uniform public service system.
- If the source is not subject to Supreme Decree 13, reports shall be submitted to the SIV via the uniform public service system.

11. The Thermolectric Plant Information System (SICTER) was established under Ministry of the Environment Supreme Decree 13, which establishes emissions regulations for thermolectric plants.

12. This requirement relates to Ministry of the Environment Supreme Decree 13, which establishes emissions regulations for thermolectric plants. This regulation applies to power plants that feature boilers or turbines with a thermal power rating of 50 MWt (megawatts thermal, as calculated from the upper limit of the fuel's energy value) or more.

Verification

Verification is currently implemented through oversight by the Ministry of Health (MINSAL) and the Office of the Superintendent of the Environment (SMA). The Ministry of Health is tasked with compiling the background information submitted by the operators of stationary sources of pollutant atmospheric emissions, for use estimating emissions from each source. These estimates are made using existing domestic or international emission factors, as applicable for each source (Ministry of Health Supreme Decree 138/2005 Article 2). On an annual basis, each source must submit information on its processes, production levels, abatement technologies, and fuel quantities and types used at the sources subject to declaration requirements (Article 3) in order to estimate emissions (Article 4).

Within this framework, regional divisions of the Ministry of Health oversee emissions based on the information provided by applicable facilities in their declarations. Meanwhile, the SMA prepares oversight programs for the different Environmental Regulation Standards, as part of its general oversight role. These oversight programs include activities associated with the emission regulations that, for green taxes, comprise the regulations on thermoelectric plants (Supreme Decree 13/2011). 127 oversight activities have been programmed for 2017: 80 undertaken by the SMA, and 47 by the Ministry of Health¹³.

The implementation of green taxes has led to the preparation of new verification protocols, to be conducted in parallel with the future actions of the SMA and the Ministry of Health. Indeed, there are currently two processes underway: short-term verification for the current tax, and long-term verification to fine tune the system and build potential to move towards other carbon pricing mechanisms. This could include the incorporation of third-party verification (by bodies and/or individuals).

The emissions verification framework – specified in SMA Exempt Resolution 962/2017¹⁴– was designed based on current institutional conditions, in adherence to the legal framework. It is therefore framed in a number of regulations, including: ISO standards; the SMA Organizational Law (LOSMA 20.417); Ministry of the Environment Supreme Decrees 38/2013, on ETFA Regulations, and 39/2013, on ETCA Regulations; and the capacities of the National Standards Institute (INN).

Following this period of analysis of regulatory consistency, a protocol was drawn up establishing a general verification procedure, specifying the audit process that shall be applied to the facilities. In addition to the general protocol, a digital information verification protocol has been prepared, describing the conditions for meeting quality assurance and

13. For details, see: Exempt Resolution 1208/ 2016 Specification of environmental emission regulation oversight program and sub-programs for the year 2017. Available online at: <http://snifa.sma.gob.cl/v2/Resolucion/Programa>

14. For details, see: Exempt Resolution 962/20,780 Approving instructions for verification of emissions from stationary sources subject to taxation under Law 20.780, Article 8. Available online at: <https://www.leychile.cl/Navegar?idNorma=1107474>

quality control standards in reported information.

Finally, verification guidelines for facilities subject to the green tax are being prepared, to form a reference document for persons in charge of facilities¹⁵ that will be obligated to respond to information requests in the audit process. This document sets out the details (step by step) of the procedure that must be followed in order to validate the accuracy of the measured and reported emissions. This verification will be divided into three components:

- **Methodological Verification:** Ensuring that monitoring procedures and systems are suitable for the purposes of quantification.
- **Quantification Verification:** Checking that the measurement/sampling method has been undertaken in compliance with the directives of the reference methods.
- **Reporting Verification:** Confirming that the information reported is consistent with other data provided by the facilities (operational data).

BOX 3: DIAGRAM OF THE MRV SYSTEM IN CHILE

Action	What?	Who?	How?	When?	Support Mechanism	
Register	Sources: boilers and turbines of 5 MWt or more	Head of facility subject to the tax	PRTR Uniform Public Service System (Ministry of the Environment)	After being stipulated by the Ministry of the Environment as a facility subject to the tax	Registration manual of boilers and turbines	
MRV system	Measurement	Emissions of PM, NO _x , SO ₂ , and CO ₂ (tons)	Head of facility subject to the tax	Quantification Instruction Application (CEMS, Discrete, and estimated)	Quarterly	Emissions Quantification Guidelines (Exempt Resolution 1053/SMA, 2016)
	Reporting	Measured emissions	Head of facility subject to the tax	Submitted to PRTR uniform public service system, forwarded to SICTER or SIV (depending on plant type)**	Quarterly	Emissions Reporting Guidelines (Exempt Resolution 184/SMA, 2017)
	Verification	Emissions measured and reported are indeed as declared	In the short term SMA oversight personnel, medium and long term potentially third-party verification (by ETFAs or ETCAs)*	Digital: QA system. Auditing: i) SMA oversight ii) Accredited third party	To be defined	Emissions Verification Instruction (in process)

Source: Prepared for this document

15. In accordance with the SMA; the person in charge of a facility is: The user of the uniform public service system, comprising the most senior person at the facility, responsible for reports and declarations that must be made for that facility (Ministry of the Environment Exempt Resolution 1139/2014).

CONCLUSIONS

The implementation of a green tax system requires the development of new mechanisms to provide technically robust control systems that are consistent with regulations in force while also achieving high levels of accuracy, for the correct application of the tax.

The MRV system has been consolidated as part of a broader environmental policy that sets out to: provide environmental taxation with regulatory coherence, in line with the challenges imposed by local and global pollution; strengthen the institutional structure by means of protocols and guidelines that consolidate the role of agencies such as the SMA in the environmental oversight framework; and achieve compatibility with regulations in force and the sectors subject to the tax.

The MRV system's implementation has brought with it a process of conceptualization, design, implementation, and training, moving from the existing RETC process to a full MRV system tailored to the needs of implementing the tax but that also retains a capacity to scale into other sectors or technologies to which the current tax does not apply, or, in the future, into more complex pricing structures.

This MRV system not only contributes to the correct implementation of a specific carbon price mechanism, it also helps to enhance the information available for public policy design and evaluation.

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