Climate Change Mitigation: Classification of Expenditures

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INTRODUCTION

Climate change represents one of the foremost contemporary environmental, economic and statistical challenges. The transition towards low-emission economies requires the transformation of energy, production, urban and territorial systems, as well as statistical instruments capable of identifying the economic resources mobilized for that transformation. The availability of monetary information on climate-related expenditure is essential for assessing public policy priorities, analyzing the allocation of resources and linking environmental actions with macroeconomic variables.

International measurement of climate expenditure has developed through heterogeneous approaches, including budget tagging, climate markers and different financing frameworks. Guidance Note C.5 of the SEEA update process explicitly recognizes this fragmentation and proposes that statistical systems should advance towards robust and internationally recognized methodologies. The document notes growing demand for mitigation and adaptation statistics and observes that existing approaches often cover only parts of the economy.

Mexico has an important institutional advantage: INEGI has a well-established infrastructure of System of Environmental-Economic Accounting of México (SEEA Mx). The SEEA Mx make it possible to link environmental information with economic variables and to measure Environmental Protection Expenditure (EPE). This infrastructure creates an opportunity to develop a derived measure of mitigation expenditure without the need to build an entirely new statistical source from scratch.

The central question is therefore whether EPE can be used as a basis for estimating expenditure devoted to mitigation. The hypothesis of this paper is affirmative, provided that EPE is not automatically interpreted as climate expenditure. A second stage of identification through the environmental classification and an explicit attribution methodology is required.

SEEA CONCEPTUAL FRAMEWORK

The SEEA update recognizes mitigation and adaptation expenditure as a substantive issue and proposes a dedicated module within the accounting framework. Its objective is to develop statistics compatible with the System of National Accounts and cover the different sectors of the economy.

The definition of mitigation used is based on the IPCC: a human intervention intended to reduce greenhouse gas emissions or enhance their sinks. This definition encompasses both direct emission reductions and technological substitution, as well as actions aimed at improving natural or technological sinks.

In accordance with Guidance Note C.5, expenditure should first be identified by its primary purpose and, where appropriate, by its secondary purpose and technical specifications. This approach is preferable to relying exclusively on the stated intention of expenditure or on its observed impact, owing to the difficulties of establishing causality and measuring impacts at the time of statistical compilation.

The methodological implication is important: climate expenditure statistics should be constructed from identifiable activities and products, rather than solely from budget programmed labelled as climate-related.

The focus on mitigation responds to several considerations, including the greater ease of delimiting mitigation-related activities, products and expenditure; its closer correspondence with the activities already covered by the EPE methodological framework, which allows the initial methodological development to be more bounded and manageable; and an explicit international demand for statistics on greenhouse gas emission reduction. Guidance Note C.5 likewise indicates that mitigation activities appear easier to identify through lists of products and activities, whereas adaptation is more diffuse and requires additional descriptions to determine what should be included.

This separation also reduces the potential problem of double counting. It should be recognized that certain activities may simultaneously belong to mitigation and adaptation. If both accounts were added without resolving this double recording, the phenomenon could be overestimated.

For this reason, an initial statistical product on mitigation, separate from a future adaptation account, may be a prudent strategy. Alternatively, a third variable could be developed to show mixed expenditure, namely expenditure on mitigation and adaptation activities when these cannot be identified separately.

MEXICO AND INEGI'S EXPERIENCE

Mexico has a well-established trajectory in environmental accounting. The SEEA Mx constitute a satellite account linked to System of National Accounts of Mexico, within which Environmental Protection Expenditure and its distribution by environmental activities are measured.

This institutional progress is particularly relevant because INEGI uses the Classification of Environmental Purposes as the basis for organizing expenditure. This structure provides a common language between economic expenditure and environmental activity, making it possible to adopt an incremental methodology: starting from an existing statistic and generating a derived climate account.

The latest information shows that in 2024, Mexico's public-sector Environmental Protection Expenditure amounted to MXN 232,882 million, equivalent to 0.7 per cent of GDP. Environmental categories include protection of air, environment and climate; water

resource management; wastewater; waste; research and development; mineral and energy resources; biodiversity; and other activities.

This data should not be interpreted directly as mitigation expenditure. Their heterogeneity demonstrates precisely the need for an attribution procedure. One portion of expenditure will have a direct relationship with emission reductions; another will generate partial climate benefits; and another will pursue environmental objectives that should not be counted as mitigation.

ENVIRONMENTAL PROTECTION EXPENDITURE AS THE STATISTICAL BASIS

Environmental Protection Expenditure constitutes the initial statistical universe of the proposal. Its principal advantage is that it already forms part of the SEEA Mx and is therefore integrated into an accounting system that provides conceptual consistency, temporal continuity and the possibility of linkage with economic variables.

However, Environmental Protection Expenditure and mitigation expenditure are distinct concepts. Environmental protection encompasses activities aimed at reducing pollution, managing resources, conserving biodiversity or protecting ecosystems. Some of these activities also reduce emissions or enhance sinks, but not all do so to the same extent. The proposed methodology can be expressed as follows:

$$ME = \sum_{i} (EPE_i)(AR_i)$$

Where:

ME: represents the estimated Climate Change Mitigation Expenditures
EPE_i: represents the Environmental Protection Expenditures recorded for environmental activity or purpose i
AR_i: mitigation attribution rate

The equation makes it possible to move from the EPE account to a climate measurement instrument. Its advantage is that it preserves the original EPE data while adding a transparent layer of attribution.

CLASSIFICATION OF ENVIRONMENTAL PURPOSES AND CLIMATE CORRESPONDENCE

As shown in the preceding examples, the analysis initially focuses on activities whose relationship with mitigation is more readily traceable. These include greenhouse gas reduction, energy efficiency, renewable energy, selected forms of low-emission transport, carbon capture and storage, and activities that enhance natural sinks.

There are also environmental activities with a partial relationship to mitigation. Waste management may reduce methane; wastewater treatment may alter emissions; reforestation and ecosystem restoration may increase carbon storage; and certain agricultural practices may improve soil carbon.

The classification should reflect the mechanism through which the climate contribution is generated. This condition is important because the mere existence of an environmental benefit does not automatically imply mitigation.

CORRESPONDENCE BETWEEN MITIGATION ACTIVITIES AND THE FUNCTIONAL CLASSIFICATION

The second methodological component is the correspondence between the environmental classification and mitigation activities. Building on Guidance Note C.5, categories particularly related to mitigation can be identified, including greenhouse gas reduction and control, renewable energy, and energy saving and management, while also recognizing activities related to soil, biodiversity and forest resources that may increase carbon storage.

In the Mexican context, this correspondence can be structured through a matrix linking each environmental activity with its mitigation activity, climate mechanism, available evidence and attribution rate.

The matrix makes it possible to distinguish three situations: first, activities with a direct or predominant relationship to mitigation; second, multipurpose activities in which only part of the expenditure contributes to the climate objective; and third, activities with no sufficiently demonstrable relationship to mitigation.

This procedure prevents an entire category from being classified as climate-related merely because it contains some component associated with climate change.

As a first step, the categories of the Classification of Environmental Purposes (CEP) linked to climate change mitigation activities are identified. For this proposal, the focus is on reducing CO_2 emissions, low-carbon transport, and improving or expanding carbon sinks. This analysis is conducted at the greatest possible level of detail through an assessment of the linkage between each environmental activity and purpose and mitigation activities. The tables in Annex A present a preliminary assessment of the degree of linkage that each CEP category may have—none or low, partial, or high. This assessment is intended to support the definition of the study universe and, potentially, the definition of attribution rates.

Once the categories of the functional classification have been identified, a correspondence analysis is undertaken between mitigation activities (rows) and CEP categories (columns). The mitigation activities are drawn from Recommendation 7 of DGI-3. Under the SEEA-CF approach, correspondence should be established on the basis of the primary purpose of the environmental activity. A mitigation activity may be linked directly to a CEP category when the objective explicitly coincides, or indirectly when the contribution to mitigation is secondary or enabling.

Table 1. Mitigation Activities–CEP Matrix

Mitigation activity	01 Air and climate	02 Energy	03 Wastewater and water resources	04 Waste, recovery and material savings	05 Soil, surface and groundwater, biodiversity and forests	06 Noise and radiation	07 Research and development	08 Cross-cutting and other environmental purposes
Support services for renewable energy	D	D	I	I			D	I
Energy efficiency improvements	D	D	I	D			D	I
Low-carbon transport	D	D		I		I	D	I
Carbon capture and storage	D	I	I	I	D		D	I
Afforestation and reforestation	I				D		D	I
Sustainable agriculture	I	I	I	I	D		D	I
Research and development (R&D) activities	I	I	I	I	I		D	I

Where:
D = Direct correspondence
I = Indirect correspondence
Blank cell = No relevant correspondence

ATTRIBUTION RATES: RATIONALE AND PROPOSAL

Attribution rates constitute the central element of the proposal because there is a need to assign rates or coefficients that determine the degree to which each environmental activity contributes to mitigation activities, and to discuss these rates with national and international experts.

An attribution rate may be defined as the proportion of expenditure on an environmental activity that can reasonably be associated with mitigation. Thus, if an activity records MXN 10,000 billion and its attribution rate is 40 per cent, the attributed mitigation expenditure would be MXN 4,000 billion.

In general, four levels may be established: 100 per cent for predominantly climate-related activities; a high proportion for activities with a significant but shared climate contribution;

a low proportion for activities with a partial contribution; and 0 per cent where no demonstrable relationship exists.

These values constitute an initial approximation and should not be regarded as official national rates. They provide an initial structure that should be validated through analysis for each category and/or jointly with experts in each thematic area. Ideally, the rates would evolve from expert judgement towards coefficients supported by physical, technological or economic evidence.

PROPOSED STATISTICAL PROCEDURE

Mexico's proposal for measuring Environmental Protection Expenditure linked to climate change mitigation is described in the following stages:

1. Identify CEP categories related to mitigation activities.
2. Construct a CEP versus mitigation activities matrix documenting their correspondence.
3. Define the statistical universe based on the EPE measured in the SEEA Mx.
4. Assign an attribution rate to each activity or sub-activity, supported by technical evidence.
5. Calculate mitigation expenditure by summing the products of EPE and the attribution rate.
6. Validate, update and conduct sensitivity analysis.

The result could be presented as an account derived from Environmental Protection Expenditure, with full traceability to the original source and documentation of each stage of data processing, the attribution rates adopted and the areas for improvement.

APPLICATION OF THE METHODOLOGY AND EXAMPLES

The following examples describe the assignment of attribution rates for expenditure measured as part of Environmental Protection Expenditure.

Urban Electric Train System in the Guadalajara Metropolitan Area.

Using four attribution-rate levels, this activity/expenditure could initially be assigned 75 per cent because, although it reduces CO_2 emissions, its primary purpose is transport.

A more detailed analysis shows that the electric train replaces journeys made by private cars and more fossil-fuel-intensive public transport, uses electricity instead of internal-combustion fuels, reduces traffic congestion, and lowers CO_2 emissions and other air pollutants. For this Electric Train, an annual reduction of approximately 17,000 tonnes of CO_2 was estimated as a result of modal shift towards mass public transport.

Taking the above into consideration, there are two possibilities:

- Direct mitigation: 90% to 100% when the project involves the construction, expansion, modernization or operation of electric rail lines intended to replace higher-emission motorized travel.
- Significant but non-exclusive mitigation: 80% to 90% when it is recognized that the project also pursues mobility, accessibility, urban development and social well-being objectives.

A technically defensible assessment would be to use a climate change mitigation contribution of 90 per cent.

Rationale:

The electric rail system promotes sustainable mobility by replacing trips made in internal-combustion vehicles, reducing greenhouse gas emissions and improving the energy efficiency of metropolitan urban transport. Electric rail infrastructure constitutes a recognized direct mitigation measure within low-carbon transport strategies.

Let us consider another example.

Major refurbishment of hydroelectric power plants

Based on the available information, a technically defensible assignment would be 90% to 100% contribution to climate change mitigation; therefore, it is proposed to adopt a weighted attribution rate of 95%, corresponding to the midpoint of that technical range.

Rationale
The project consists of rehabilitating, modernizing and upgrading existing hydroelectric power plants by replacing turbines, generators, transformers and other equipment with more efficient technology. Its objetives are:

- Increase electricity generation from renewable sources.
- Improve the energy efficiency of the plants.
- Extend their service life by several decades.
- Replace electricity generation from fossil sources within the National Electric System.
- Indirectly reduce greenhouse gas (GHG) emissions.

The modernization of hydroelectric plants is expected to increase clean and reliable energy generation, expanding installed capacity and annual renewable generation.

For these reasons, it is justified to use a rate slightly below 100%: although the project's dominant objective is mitigation, some of its benefits are also associated with:

- Energy security.
- Operational reliability of the electric system.
- Extension of asset service life.
- Reduction of risks to infrastructure and downstream populations.

As illustrated by the second example, in some cases it is appropriate to deduct a small proportion of expenditure to recognize non-climate objectives.

Where expenditure relates to the construction of new renewable infrastructure (solar or wind), the associated attribution rate could be 100 per cent.

This correspondence was applied to each record in the Central Government Environmental Protection Expenditure measurement and, together with an analysis of each purpose, a possible attribution rate was determined for each record.

The following tables present several examples:

Table 2. Activities Clearly Linked to Mitigation

Environmental activity	Relationship with mitigation	Suggested attribution rate
Research on climate change mitigation	Explicit climate change and green growth objective.	100%
Mitigation policies within Climate Action	Design and implementation of national climate policy.	100%
Forest protection	Avoids emissions from forest fires and forest degradation; increases carbon sequestration.	60% a 80%
Sustainable Forest Development for Well-being	Sustainable forest management and conservation of carbon sinks.	50% a 70%
Directorate-General for Industry, Clean Energy and Air Quality Management	Emission regulation and promotion of clean energy.	70% a 100%

Table 3. Activities with Significant but Non-exclusive Contribution

Environmental activity	Rationale	Suggested rate
Protection and Restoration of Priority Ecosystems and Species	Ecological restoration with carbon sequestration benefits.	40% a 60%
Conservation and Management of Protected Natural Areas	Conservation of terrestrial carbon sinks.	30% a 50%
Conservation for Sustainable Development	Conservation activities with climate co-benefits.	20% a 40%
Environmental regulation	Part of the regulation contributes to reducing emissions.	20% a 40%
Socio-environmental regulation	Includes air quality and environmental management.	30% a 50%
Planning, Monitoring and Evaluation of Environmental Policy	Includes climate components as well as general environmental components.	20% a 40%

In this way, using illustrative data, it is possible to observe how mitigation-related results can be derived from the calculation of Environmental Protection Expenditure, including the relationship between environmental purposes and mitigation activities.

The following table presents examples illustrating this relationship.

Table 4. Environmental Protection Expenditure by Environmental Purpose and Its Relationship with Mitigation Activities

Environmental activity	Mitigation ($)	Mitigation activities	Mitigation ($)
Protection of air, environment and climate	**14,010**	Research and development (R&D) activities	-
		Sustainable agriculture	-
		Carbon capture and storage	-
		Afforestation and reforestation	-
		Public mitigation management	43
		Energy efficiency improvements	3,621
		Support services for renewable energy	-
		Public transport and infrastructure	10,346
Management of mineral and energy resources	**2,374**	Research and development (R&D) activities	-
		Sustainable agriculture	-
		Carbon capture and storage	86
		Afforestation and reforestation	-
		Public mitigation management	-
		Energy efficiency improvements	398
		Support services for renewable energy	1,890
		Public transport and infrastructure	-

RESULTS OF THE MITIGATION EXPENDITURE ESTIMATION
(ILLUSTRATIVE, NON-OFFICIAL DATA)

Table 5. Environmental Protection Expenditure to Mitigation

Mitigation activities	Mitigation expenditures ($)
Research and development (R&D) activities	2,163
Sustainable agriculture	18,073
Carbon capture and storage	1,397
Afforestation and reforestation	3,273
Public mitigation management	561
Energy efficiency improvements	7,178
Support services for renewable energy	1,890
Public transport and infrastructure	10,346
TOTAL	**44,882**

Table 6. Environmental Protection Expenditure to Mitigation by Environmental Purpose

CPE	Description	EPE ($)	Mitigation ($)
101	Reduction and control of greenhouse gases	10,389	10,389
102	Reduction and control of other air pollutants	4,828	3,621
103	Air and climate monitoring and measurement	-	-
201	Energy from renewable sources	1,890	1,890
202	Energy saving and management	5,716	377
301	Wastewater management	8,133	3,694
302	Water saving and management of natural water resources	29,231	14,239
303	Wastewater and water resources monitoring and measurement	-	-
401	Waste management	13,331	3,161
402	Material recovery and savings	4,649	107
403	Monitoring and measurement of waste, recovery and material savings	-	-
501	Protection of soil, surface water and groundwater	2,682	2
502	Protection of biodiversity and landscape	2,538	642
503	Forest resource management	3,150	1,877
601	Protection against noise and vibration	-	-
602	Protection against radiation	121	-
603	Noise and vibration monitoring and measurement	-	-
604	Radiation monitoring and measurement	-	-
701	Research and development for the reduction and control of atmospheric emissions	1,228	265
702	Research and development for energy	-	-
703	Research and development for wastewater and water resources	325	163
704	Research and development for waste management, recovery and material savings	10,139	41
705	Research and development for soil, biodiversity and forest resources	438	328
706	Research and development for noise and radiation	-	-
707	Research and development for other environmental purposes	2,554	1,366
801	Environmental education, training and outreach	2,111	1
802	Administration, regulation, management and support for environmental protection and resource management	4,469	591
803	Other environmental purposes not elsewhere classified	7,621	2,128
TOTAL		**115,544**	**44,882**

LIMITATIONS AND RESEARCH AGENDA

The first limitation concerns the availability of sufficiently disaggregated information for assigning attribution rates. For some activities, the available information will permit direct attribution; for others, sectoral evidence or expert judgement will be required. These rates constitute a transitional stage intended to evolve progressively towards coefficients supported by physical, technological or economic evidence.

The second limitation is that broad economic classifications may simultaneously contain climate-related and non-climate uses. This requires more detailed correspondence among activities, products and classifications.

The third limitation is the need for international validation. The methodology should remain aligned with the evolution of the SEEA and with the classifications developed by organizations such as the United Nations, Eurostat and the IMF.

The proposed future agenda is to develop a mitigation–CEP matrix, establish initial rates, document the evidence, validate the methodology with experts, produce historical series, conduct sensitivity analyses and subsequently explore an adaptation account.

CONCLUSIONS

This paper demonstrates that it is possible to develop a statistical measure of climate change mitigation expenditure from already established statistical frameworks, without necessarily requiring the creation of new statistical operations. Mexico's experience shows that existing environmental accounts can constitute an effective platform for responding to growing demands for climate information within the framework of the System of Environmental-Economic Accounting.

The principal innovation of the proposal consists of transforming existing environmental statistics into climate statistics through the combination of environmental classifications and explicit attribution mechanisms. This approach preserves consistency with national accounts, leverages existing statistical infrastructure and guarantees full traceability between climate expenditure estimates and their original sources.

The expression $ME = \sum_i (EPE_i)(AR_i)$ summarizes the methodological principle: not all environmental expenditure is climate expenditure, but an identifiable proportion of environmental expenditure may contribute to mitigation.

The approach has the advantages of being gradual, transparent and compatible with environmental accounts. It also makes it possible to generate a national indicator that can evolve into a more comprehensive account as international methodologies mature.

The importance of this development lies not merely in producing a figure. It is about constructing a statistic capable of reproducibly answering how much of the resources devoted to environmental activities contribute to reducing emissions or enhancing greenhouse gas sinks.

The proposed approach could be particularly useful for countries that already produce Environmental Protection Expenditure statistics but still face difficulties in measuring climate change mitigation expenditure consistently. In this regard, the proposal offers a possible pathway for gradual implementation towards the development of climate statistics compatible with emerging SEEA recommendations and other international frameworks.

DISCUSSION

The main contribution of this proposal is to conceive the measurement of mitigation expenditure as a statistical transformation of existing Environmental Protection Expenditure. This makes it possible to advance without immediately creating a new primary source.

Attribution rates are essential because many environmental activities are multipurpose. Their use explicitly recognizes that the same expenditure may generate benefits relating to pollution, biodiversity, natural resources and climate.

The challenge is to ensure that attribution rates are transparent, reproducible and updateable. To this end, the sources, assumptions and technical criteria used must be documented.

Sensitivity analysis is also recommended. If an activity is attributed at 30 per cent, the national result should be capable of recalculation at 20 per cent and 40 per cent, showing the extent to which the estimate depends on the underlying assumptions.

Questions for the Forum

- Do you consider the Classification of Environmental Purposes sufficient for measuring climate change mitigation expenditure?

- Do you consider that some activities would remain outside the scope of mitigation expenditure measurement under this approach?

ANNEXES

Annex A. CEP and Its Linkage to Mitigation

Table 1. CEP Subgroups Highly Linked to Climate Change Mitigation

CEP subgroup	Reason
Reduction and control of greenhouse gases	Activity specifically designed to reduce GHG emissions.
Energy from renewable sources	Replaces fossil energy with low-emission energy.
Energy saving and management	Reduces energy consumption and associated emissions.
Material recovery and savings	Reduces demand for raw materials and energy in production processes.
Forest resource management	Maintains and enhances carbon sinks through sustainable forest management.
Research and development for energy	Development of low-carbon energy technologies.
Research and development for forest management	Supports carbon capture and storage activities in forest ecosystems.

Table 2. CEP Subgroups Partially Linked to Mitigation

CEP subgroup	Reason
Wastewater management	May include methane capture and biogas utilization.
Waste management	Recycling, composting and energy recovery reduce emissions.
Monitoring and measurement for material recovery and savings	Supports material efficiency programmes.
Protection of biodiversity and landscape	Conservation of forests, mangroves and wetlands functioning as carbon sinks.
Investigación y desarrollo para reducción y control de emisiones atmosféricas	A significant portion may target GHG reduction, although it may also address local pollutants.
Research and development for wastewater management	May include methane reduction technologies.
Research and development for water resources	Some applications improve the energy efficiency of water use.
Research and development for waste management	May develop circular economy solutions and reduce GHG emissions.
Research and development for material recovery and savings	Contributes to material efficiency and indirect emission reductions.
Research and development for soil, groundwater and biodiversity	Some applications strengthen carbon sequestration in ecosystems.
Environmental education and training	May promote low-emission behaviours and technologies.

Environmental administration, management, regulation, outreach and consultancy	Supports climate policies and mitigation programmes.
Other environmental purposes	May contain climate projects not elsewhere classified.

Table 3. CEP Subgroups with No or Limited Linkage to Mitigation

CEP subgroup	Reason
Reducción y control de otros contaminantes del aire	Primarily focused on local air quality, not necessarily GHGs.
Protection of soil, surface water and groundwater	Focused on pollution control and remediation.
Protection against noise and vibration	No significant relationship with climate emissions.
Protección contra radiaciones	Related to environmental health and radiological safety.
Research and development for noise and radiation	Linked to acoustic or radiological pollution, not climate.