

Accounting for Emission Trading Schemes in SEEA

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1. Introduction

The 2008 *System of National Accounts (SNA)* and 2012 *System of Environmental-Economic Accounting Central Framework (SEEA)* provide early guidance on how to account for emission trading schemes (ETSs), but accounting standards for these somewhat complex and increasingly important instruments need updates and clarification. Accordingly, accounting for ETSs is an issue being addressed in both the 2025 SNA update and the upcoming SEEA update.

We believe that this is an opportunity to improve the usefulness of SEEA in answering the questions that stakeholders expect environmental accounts to answer, which may differ from the questions stakeholders expect the economic accounts to answer³. Accordingly, this SEEA update proposal is informed by outstanding SNA update proposals on the topic, without being bound to them.

Section 2 describes the basics of ETSs and some of the complicating implementation details that are encountered in practice. Section 3 discusses some of the questions a SEEA ETS account should be able to answer. Section 4 describes the current SNA/SEEA guidance and some relevant proposals for the 2025 SNA update. Section 5 proposes an alternative approach which we believe addresses the questions outlined in section 3 as well as concerns about the methods described in section 4, while also being less data intensive.

2. Emission Trading Schemes

An ETS (or cap-and-trade scheme) is a mechanism for reducing emissions of a given pollutant, using a market-based approach to preferentially incentivize low-cost emissions reduction measures. The basic structure of an ETS is that a government issues a quantity of permits (the “cap”). These permits may then be freely transacted on an open market (“trade”). Businesses that emit the regulated pollutant must, at

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³ We note that the broad purpose of the SEEA environmental activities accounts (the general category into which ETS accounting falls) is to present transactions already present in the economic accounts in a manner more useful for environmental analysis.

the end of the compliance period, surrender to the government sufficient permits to cover their emissions for that period.

Various implementations of this basic structure introduce a variety of factors which complicate national accounting:

- Governments may allocate permits to businesses for free, or they may sell them at auction, with different implications for government revenues.
- Some ETSs are international in scope. For example, the European Union operates a large multinational ETS for greenhouse gases, while the U.S. state of California and the Canadian province of Quebec operate a joint ETS.
- Some ETSs have multi-year compliance periods, during the early years of which emitting establishments are only required to turn in permits corresponding to a certain percentage of their emissions. Permits corresponding to the remainder of their emissions are not required to be turned in until the final year of the compliance period.
- ETS permits may or may not expire after a certain point. They may also be purchased by non-emitting entities such as environmental organizations with the intent of holding them permanently.
- Data on ETS transactions may or may not be readily available to national accountants.

3. Questions for SEEA ETS Account to Answer

We believe that stakeholders expect environmental accounts to answer different questions than the economic accounts. For an ETS account specifically, they might ask questions such as:

- What do industries and households pay for their emissions?
- How much state income comes from ETS revenue?
- What are the international flows associated with multinational ETSs?
- How big is the implicit subsidy to polluting industries when allocating permits freely?
- How much arbitrage do polluting industries receiving permits for free undertake?
- What are the “physical” flows of permits?

4. SNA/SEEA Guidance

A. Current Guidance

The 2008 SNA provides minimal guidance on accounting for ETs, but much is left unclear, including whether the permits are to be classified (as taxes or as assets)⁴. More specific guidance was given by the Intersecretariat Working Group on National Accounts (ISWGNA) in 2011 (ISWGNA, 2011) and 2012 (ISWGNA, 2012). This guidance splits the value of a permit into two portions: a financial asset representing prepaid taxes on production, with a corresponding liability for the government, with a value determined by the original average⁵ issuance price of the permits; and a non-produced, non-financial (NPNF) asset with a value determined by the difference between the average issuance price and the current market price.

There are some issues with this guidance:

- Taxes on production are recorded even for businesses/industries that obtained all their permits for free, since all permits are valued at the mean issuance price.
- Cross-boundary flows are explicitly ignored due to expected data limitations.
- The liability recorded for the government could persist indefinitely if permits are not surrendered and do not expire.
- The value of the NPNF asset can go negative if the market price drops below the average issuance price.

B. Proposed Alternatives

Leading up to the 2025 SNA revision, a number of proposed alternative approaches have been considered by the ISWGNA, the Advisory Expert Group on National Accounts (AEG), and various task forces. These are summarized briefly here, and in greater detail in the *WS.7 Guidance Note on the Treatment of Emission Trading Schemes* (Manolikakis & Tebrake, 2022).

i. Option 1: ETS as Permits to Use Natural Resources

⁴ “These permits do not involve the use of a natural asset (there is no value placed on the atmosphere so it cannot be considered to be an economic asset) and are therefore classified as *taxes* It is inherent in the concept that the permits will be tradeable and that there will be an active market in them. The permits therefore constitute *assets* and should be valued at the market price for which they can be sold” (SNA 17.363, emphasis added).

⁵ Since a significant proportion of permits are allocated freely, it is recommended not to try and distinguish the issuance price of a given permit. Rather, the “price” assigned to each permit is the mean price of all permits, including those allocated freely. For example, if 100 permits were sold at \$10 each and 100 permits were allocated for free, each of the 200 permits would be valued in the accounts at \$5 each.

Option 1 considers ETS permits as non-produced, non-financial assets (permits to use natural resources). One of the primary reasons given in existing SNA guidance for treating permits as taxes is that the atmosphere is not considered an asset. Option 1 does not propose recognizing the atmosphere as an asset; instead, the right to access the atmosphere as a sink for emissions would be considered an asset. Freely allocated permits would be valued at the market or auction price and considered a capital transfer from government to industry. This approach addresses all four issues with the current guidance listed in section 4.A and was expected to have fewer data requirements. However, it was not accepted due to existing guidance stating that since the atmosphere is not an asset, rights to use the air as an emissions sink could also not be considered assets (Manolikakis & Tebrake, 2022).

ii. Option 2: ETS as Resource Leases

Option 2 *does* propose recognizing the atmosphere as an asset, with ETS permits considered as a financial asset (resource lease). Option 2 proposes recognizing the market value of surrendered permits as revenue (resource rent) to the government at the time of surrender. Some issues with this approach are that, in addition to requiring that the atmosphere be recognized as an asset, Option 2 would overstate (understate) government revenue relative to actual cash received by the government to the extent that companies experience holding gains (losses) while holding purchased permits. Additionally, how to treat freely allocated permits is not clear.

iii. Option 3: ETS as Permits to Use Natural Resources with Taxes on Production Recorded at Auction

To eliminate some of the source data requirements of the current SNA guidance, Option 3 drops the idea of accounting for ETSs on an accrual basis and records taxes on production at the time permits are sold at auction. The permits, as non-produced, non-financial assets, are created directly in the purchasers' accounts via the "Other Change in the Volume of Assets" account. How freely allocated permits would be treated is not clear since no tax revenue to the government nor capital transfer from the government would be recorded. Additionally, taxes would not necessarily be attributed to the correct businesses/industries, if there is an active secondary market in the permits (which is the intent behind an ETS).

iv. Option 4: ETS as Financial Asset with Taxes Recorded at Surrender

This was the option chosen by the ISWGNA and AEG. Under this approach, permits are considered to be financial assets for the purchaser, with corresponding financial liabilities held by the government. These are initially valued at the price for which the government sells them, and then are revalued as the market price shifts. At the time of surrender (as a proxy for the time of emissions), the financial asset and

corresponding liability are extinguished and taxes on production are recorded (as a tax expense for the business and tax revenue for the government) at the *original purchase price*. Recognizing that this might be infeasible due to data constraints, such as if the original purchase price is not knowable for a given permit, it is suggested that instead the taxes on production could be recorded at the market price *at time of surrender*.

This approach has some major issues. First, it is unclear how this approach would handle permits allocated for free. Second, the government's recorded financial position is impacted by movements in the secondary market for permits as the financial liability representing issued permits changes value.

Additionally, the solution presented for the case of data constraints, in which taxes are recorded at the time of surrender at the current market price, separates recorded tax revenue from actual revenues received by the government. This will be particularly a problem in the case of permits allocated for free since tax revenue will be recorded at the market price when no revenue was received by the government at all.

v. Option 4(a)*: Minor Modifications to Current Guidance

Some concerns about Option 4 were settled by presenting essentially the status quo as a way of implementing Option 4. One significant change from the current guidance is that ETS permits sold at auction would be valued at the auction price, while those allocated freely would be valued at zero. This has most of the same issues as the current guidance, except that under this option the implicit subsidies to businesses/industries allocated permits for free are ignored, rather than being replaced by taxes on production, while the taxes on production for businesses/industries not allocated permits for free are more accurately valued.

C. Concerns with Current and Proposed Guidance

Major concern from the perspective of the environmental accounts with the current SNA/SEEA guidance on accounting for ETSs are the treatment of permits allocated freely by the government and of multi-national ETSs. If freely allocated permits are valued at zero, as in most of the proposed alternatives approaches, then the effective subsidy/transfer to businesses/industries receiving permits for free is not acknowledged. If the permits are valued at the mean price across issued permits, as in the current guidance, the problem is worse because these businesses/industries will have taxes on production recorded instead of subsidies/transfers.

Tax-based alternatives, including the current guidance as well as Options 3 and 4, do not deal easily with multi-national ETSs. This is an acknowledged shortcoming, and one that is explicitly ignored by the current guidance. As multi-national ETSs seem likely to become more important in the future, we should have accounting systems in place that can accommodate these more readily. Additionally, if taxes are recorded at the time of sale, they do not match up with the emissions they are intended to regulate, while if they are recorded at time of surrender they do not match up with the government's receipt of cash.

Financial asset/liability-based approaches, such as the current guidance and options 4 and 4(a)*, create a liability for the government. When this liability is revalued with changes in the market price of permits, as in option 4, the government's financial position is impacted by the secondary market for permits in a way that does not make sense. When the liability is constrained to be equal to the value of the cash received (as in the current guidance and option 4(a)*), it does balance with the increase in assets. In either case, though, multi-national ETSs present a problem: when permits are surrendered in a different jurisdiction than they were issued, it may be difficult to ensure that the correct financial liability is extinguished.

5. Proposal

Essentially, we propose adopting WS.7 GN Option 1, permits as non-financial assets, as the SEEA method of accounting for ETSs. This proposal adds some refinements, primarily for the case of multi-year compliance periods. It diverges from the 2008 SNA and current SNA guidance in two fundamental ways:

- *Implementing Option 1:* Although we do not propose considering the atmosphere as an asset, we recognize that national governments can and do control access to the atmosphere as a sink for emissions, and we propose that these access rights be considered assets. This is analogous to the treatment of harvesting rights over fish in the open sea (SEEA 5.16) and is the same reasoning as in WS.7 GN Option 1 (Manolikakis & Tebrake, 2022).
- *Refinement for multi-year compliance periods:* The SNA explicitly does not recognize non-financial liabilities (SNA 11.4). This proposal suggests that in the case of ETSs with multi-year compliance periods, the compliance obligation incurred during early years of the compliance period may best be represented as a non-financial liability.

Table 1. The government creates 1000 permits. 500 are sold at auction, while 500 are allocated for free. Newly created permits are valued at the price revealed in the subsequent auction.

Account name	Accounts of industry A				Accounts of government			
	Transactions		Balance Sheet		Transactions		Balance Sheet	
	Δ Assets	Δ Liabilities	Assets	Liabilities	Δ Assets	Δ Liabilities	Assets	Liabilities
OCVA			0	0	1000		1000	0
Capital account	500				-500			
Cash	-500		500	0	500		500	0
Capital account	500		1000	0	-500		0	0

We propose treating ETS permits as non-produced, non-financial assets (permits to use natural resources). The government creates these permits via the “Other Changes in Volume of Assets” (OCVA) account, then either sells them to businesses or makes a capital transfer to allocate them for free, as shown in table 1; in either case the permits are valued at the market/auction price. As changes in the market price occur, the assets held by businesses/industries are revalued (see table 2).

When a business/industry incurs a compliance obligation (generally by emitting the regulated pollutant) an environmental compliance expense is recorded, valued at the current market price of the corresponding permits⁶. When these permits are surrendered to the government to meet the compliance obligation (or when permits expire) they are extinguished from the business/industry accounts via the OCVA account. Since a liability does not exist for the government in regard to outstanding permits, the government’s financial position is unaffected if entities choose to bank permits or to hold them indefinitely rather than surrendering them.

Both sold and freely allocated permits are treated identically (after the point of sale/allocation) and valued at the current market price, so the proposed method is useable and consistent even in the presence of data constraints that make it infeasible to distinguish sold from freely allocated permits, or to identify the original purchase price at the time a permit is surrendered.

If the permits are sold to establishments in other jurisdictions, this is treated as the sale of a non-produced, non-financial asset. There is no impact on the accounts of either government from either this transaction or the subsequent surrender (or not) of the sold permits. A worked-out example is in table 2, as follows:

- Assumptions/setup:
 - 1000 permits (each allowing 1 unit of emissions) were created and auctioned/allocated for free at the beginning of year 1, as shown in table 1.

⁶ If the permits are collected from a different entity than the actual emitter (for example, an upstream fuel supplier) it may be appropriate to attribute this expense proportionately to the final emitters rather than to the entity from whom the permits are collected.

- The ETS is multinational, so industries in countries X and Y may trade permits freely and may surrender permits originally issued in either jurisdiction to satisfy their compliance obligations.
- Industry A, in country X, sells \$250 worth of permits to industry B, in country Y.
- Industry B immediately surrenders the newly acquired permits to the government of Y to satisfy its compliance obligations. An environmental compliance expense is recorded, and these permits are extinguished via the OCVA account.
- No entries are made in the account of either government in regard to the international transaction or the subsequent surrender.

Note that in this case, the accounts will clearly show the revenue received from permit sales in each country, as well as the value of permits surrendered by businesses in each country. One of the primary advantages of the proposed method is that it accommodates multinational ETSs quite naturally and in a way that parallels the actual flows of revenue and assets.

Table 2. International transactions under multinational ETS. A business in industry A, country X sells \$250 worth of permits to a business in industry B, country Y. The country Y business immediately surrenders them to its own government to meet its compliance obligations. The permits (NPNF asset) are extinguished from the accounts of the business via OCVA. Neither country's government accounts are impacted.

Country X	Accounts of industry A				Rest-of-world accounts		No effect on government accounts
	Transactions		Balance Sheet		Transactions		
	Δ Assets	Δ Liabilities	Assets	Liabilities	Δ Assets	Δ Liabilities	
Account name							
Cash	250				-250		
Capital account	-250		750	0	250		

Country Y	Accounts of industry B				Rest-of-world accounts		No effect on government accounts
	Transactions		Balance Sheet		Transactions		
	Resource/ Δ Assets	Uses/ Δ Liabilities	Assets	Liabilities	Δ Assets	Δ Liabilities	
Account name							
Cash	-250				250		
Capital account	250		250	0	-250		
Expense	250						
OCVA	-250		0	0			

If emissions occur during an accounting period but permits do not yet need to be surrendered (as in the case of a multi-year compliance period), we propose that a non-produced, non-financial liability be created (via the OCVA account) for the emitting business/industry. The value of this liability is based on the quantity of permits that will need to be surrendered at the end of the compliance period, times the current market price of permits. This liability will be revalued just like permit holdings are when there is a change in the market price of permits. When permits are surrendered to fulfill this compliance obligation, the same value is removed from both the asset and liability accounts of the business/industry (via the OCVA account) to represent this obligation being satisfied. Table 3 contains a worked-out example, as follows:

- Assumptions/setup:
 - 1000 permits (each allowing 1 unit of emissions) were created and auctioned/allocated for free at the beginning of year 1, as shown in table 1.
 - The compliance period is 2 years, beginning with year 1; polluting industries do not need to surrender permits at the end of the first year but must surrender sufficient permits to cover both years' emissions at the end of the second year.
- End of year 1, the market price of permits is \$1.50 and industry A reports 500 units of emissions:
 - Permits held by industry A are revalued from \$1000 to \$1500.
 - Industry A incurs an environmental compliance expense of \$750 = (500 units of emissions * \$1.50 market price of permits).
 - An NPNF liability valued at \$750 is created for industry A via the OCVA account.
- End of year 2, the market price of permits is \$0.80, industry A reports 400 units of emissions, and industry A surrenders 900 permits to fulfill compliance obligations for the entire compliance period:
 - Permits (NPNF assets) held by industry A are revalued from \$1500 to \$800.
 - Compliance liability from year 1 (NPNF liability) held by industry A is revalued from \$750 to \$400.
 - Industry A incurs an environmental compliance expense of \$320 = (400 units of emissions * \$0.80 market price of permits).
 - \$720 of permits (NPNF assets) and \$400 of compliance liability (NPNF liability) held by industry A are extinguished via the OCVA account.

Table 3. Revaluation to market prices at year end. Environmental compliance expenses (at current market price of permits) incurred at year end. Compliance liability (NPNF liability) created at end of year 1, and revalued at end of year 2. Satisfied compliance liability (NPNF liability) and surrendered permits (NPNF assets) extinguished at end of year 2.

Account name	Accounts of industry A				Accounts of government			
	Transactions		Balance Sheet		Transactions		Balance Sheet	
	Resources/ Δ Assets	Uses/ Δ Liabilities	Assets	Liabilities	Resources/ Δ Assets	Uses/ Δ Liabilities	Assets	Liabilities
End year 1	Revaluation	500	1500	0			0	0
	Expense	750						
	OCVA		750	1500	750		0	0
End year 2	Revaluation	-700	-350				0	0
	Expense	320						
	OCVA	-720	-400				0	0

With the introduction of an NPNF liability to represent a compliance obligation incurred in one period but for which permits are not surrendered until a subsequent period, the proposed method accommodates multi-year compliance period schemes (like those used in various U.S. and Canadian ETSs) in a natural way,

with government revenues reflected accurately, compliance expenses recorded every year at the relevant value for business decision making (the then-current price of permits), and permits held by businesses/industries being valued at market prices throughout.

6. Conclusion and Recommendations

Although the proposed method deviates from SNA guidance (2008 and almost surely 2025 as well) on accounting for ETSs, we believe that the benefits of this proposal outweigh the costs. SNA guidance does not accommodate either permits allocated for free or multinational ETSs—both very common—well at all, in addition to other concerns detailed above. This proposal accommodates both permits allocated for free and multinational ETSs in a consistent and natural framework. We believe that the proposed framework will also allow national environmental statisticians to readily answer the questions stakeholders will expect SEEA ETS accounts to answer.

For the update to the SEEA CF, we make the following recommendations:

- That specific and detailed guidance be given on accounting for ETSs as one of the environmental activity accounts.
- That accurate recording of government revenues and financial position, and the recording of compliance expenses to businesses in the period that emissions occur, be emphasized as guiding principles in this treatment.
- That, as detailed in this proposal, the SEEA CF treat ETS permits as non-produced, non-financial assets, recognizing that governments can and do control access to the atmosphere for use as a sink for emissions, and that this right may properly be considered an asset.
- That, to accommodate multi-year compliance periods, the SEEA CF allow for the recording of non-produced, non-financial liabilities representing compliance obligations incurred one or more periods before the corresponding permits must be surrendered.
- To include the example transactions described in this paper (or similar ones) in the SEEA CF.

We welcome discussion and feedback from the London Group on this proposal.

Works Cited

ISWGNA. (2011, February). *SNA News and Notes*.

ISWGNA. (2012, March). *SNA News and Notes*.

Manolikakis, E., & Tebrake, J. (2022). *WS.7 Guidance Note on the Treatment of Emission Trading Schemes*. Washington, D.C.: Advisory Expert Group on National Accounts, Twenty-first Meeting.

United Nations Statistics Division. (2008). *Updated System of National Accounts 2008*. United Nations Publication, Sales No. E.08.XVII.29.

United Nations Statistics Division. (2012). *System of Environmental-Economic Accounting 2012*. United Nations Publication, Sales No. E.12.XVII.12.