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Emissions and the National Accounts

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Summary

One of the research items on the System of National Accounts (SNA) agenda is a re-examination of the treatment and recording of emissions trading schemes in the national accounts. Currently it is recommended to record all emissions trading schemes (ETS) as taxes on production, in part because the SNA notes that these permits do not involve the use of a natural asset[2]. This note proposes an alternative method in which the atmosphere is viewed as a natural asset and; therefore, proceeds from ETS permits sold by governments are not recorded as taxes but as sales of non-produced assets.

[1] Prepared by Emmanuel Manolikakis and James Tebrake.
[2] 2008 SNA, para. 17.363

I. Introduction

1. Economic activity is having an increasingly negative impact on the environment. Rising levels of greenhouse gas (GHG) emissions are having far reaching and permanent impacts on the climate. GHG emissions are excessive because there is little incentive for firms and households to change their behavior to reduce emissions. To slow the increase in GHG emissions or eliminate them altogether, countries around the world have introduced or are introducing various polices aimed at reducing GHG emissions. In general, these policies apply a price to a broad set of emission sources that are aimed at encouraging businesses and individuals to innovate and change their behavior and therefore reduce the level of GHG emissions. For example, it is reasonable to conclude that carbon pricing will encourage investment in cleaner energy sources and help countries meet their carbon emissions reduction targets as set out by the Kyoto protocol, Clean Air and other initiatives, and later in the Paris Climate Agreement.

2. As countries adopt various carbon pricing strategies it is important that the associated transactions (non-financial and financial) across all sectors are properly accounted for and transparently presented in the System of National Accounts (SNA). Extensive discussions regarding the recording of carbon pricing schemes had taken place when the *2008 SNA* was drafted, as reflected in section Q of chapter 17, however emissions trading schemes were in their infancy. This guidance note proposes recommended updates to the SNA to clarify the treatment of emissions trading schemes.

II. Carbon Pricing Policy Instruments

3. There are two main carbon pricing policies employed by governments – carbon taxes and emissions trading schemes. While this guidance note focuses on the treatment of emissions trading schemes it is important to also explain carbon taxes in order to differentiate between the two approaches to pricing carbon.

A. Carbon Tax

4. Under a carbon tax, the government sets a price that polluters must pay for each ton of GHG they emit. Businesses and consumers will therefore adjust their consumption and seek out close substitutes by switching products or adopting new technologies, to reduce their emissions in order to avoid paying or at least minimize the tax. The effectiveness of this scheme depends on the chosen level of the tax and the availability of substitutes. For example, if the tax is too low firms and households are likely to opt for paying the tax and continue to pollute. If the tax is too high the costs will rise higher than necessary to reduce emissions, impacting international competitiveness, profits, jobs and household consumption. From a national perspective, governments need to find the right balance.

5. A carbon tax can be levied at any point in the energy supply chain. The simplest approach, administratively, is to levy the tax "upstream," where the fewest entities would be subject to it (for instance, suppliers of coal, natural gas processing facilities, and oil refineries). Alternatively, the tax could be levied "midstream" (electric utilities) or downstream (energy-using industries, households, or vehicles), or some combination of all three. At whichever point in the energy supply chain these "taxes" are levied they would meet the definition of a compulsory, unrequited payment to government and so be classified as taxes in macroeconomic statistics. Furthermore, they meet the definition of other taxes on production, as they are incurred based on units engaging in production and are levied in relation to an externality rather than the good or service being produced.

B. Emissions Permits (Cap and Trade)

6. An emissions permit (cap-and-trade) system is a flexible market mechanism and establishes a maximum level of pollution - a cap. Companies must have a permit to cover each unit of pollution they produce. Each permit stipulates the amount of GHG emissions

that can be emitted (quota). As such, each company must have a permit with a sufficient quota of units of pollution to cover their polluting needs (emissions). Permits are initially provided by governments through auctions or are distributed free of charge. The purchase of the permit is not restricted to the polluting entity. Currently, auction processes are not restricting participants, permits can be purchased by any market participant - individuals, investors, governments, nonprofit institutes, financial and non-financial companies[3]. It is presumed that only non-financial corporations will incur emissions liabilities and will need to offset these liabilities with emission permits. If companies exceed their quota for emissions, they can purchase unused permits from others, adjust their production or in the longer-term install technology that reduces emissions. Depending on the adaptability of firms' production functions, some firms will be able to adjust to the limits much easier than others.

7. Furthermore, a cap and trade system will set a limit to the amount of pollution in advance, which will create an emission price setting mechanism that will adjust to market conditions. During economic expansions the demand for permits will exceed supply and therefore, the price to acquire additional permits will rise, conversely when demand is less than supply (during a slowdown in production), the price of permits will fall, ceteris paribus. As a result, a price on pollution is created by establishing a ceiling on the overall quantity of emissions, which will lead to a reduction in the overall levels of pollution.

8. In the initial stages of some cap and trade schemes, permits were given to non-financial corporations freely. As a result, firms did not incur any additional production costs, unless they exceeded their quota and were required to purchase additional permits from others. More and more governments have decided to auction permits and allow all institutional sectors to participate in the auction process.

9. A carbon tax differs from a cap-and-trade program in that it provides a higher level of certainty about cost, but not about the level of emission reduction that needs to be achieved. Since carbon taxes generate revenue with a predetermined tax rate, the cost imposed is easier to determine. Whereas, a cap and trade scheme will require much more organization and administration to determine the quantity of permits to ensure that the reduction of emissions is steadily being lowered to the agreed upon limits and that companies are adhering to the permitted emission levels.

10. From CO2 emitting firms' perspective, an emission permit looks to be similar to a carbon tax at the point where the permit is surrendered to government to "pay for" carbon emissions. However, prior to this point emission permits are tradeable assets, whose value is not directly established by government but by market conditions. The picture is further complicated by the fact that the permits have value because of the scarcity of permits relative to the government's requirement for the surrender of permits by polluters.

11. Emissions permits also differ from some other types of permits issued by Government such as casino permits or taxi permits. These permits are issued in order to limit supply and in effect provide monopoly profits to the approved operators. The mandatory permit fee reflects the government's desire to recover some of these monopoly profits and are therefore recorded as taxes in the national accounts. The primary purpose of emissions permits is not to limit the supply of goods or services, nor provide monopoly profits to the permit holder. Rather, they are intended to limit emissions and alter the behavior of firms to adopt environmental technologies and processes.

III. Task Force Recommendations

12. The *2008 SNA* recommends that payments for permits relating to emissions into the atmosphere should be recorded as taxes because "*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 even though the permitted "activity" is one of creating an externality. It is inherent in the concept that the permits will be tradable*

[3] Participation restrictions may be introduced in the future.

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 " (Paragraph 17.363).

13. Recognizing that the proposed treatment in the *2008 SNA* does not fully articulate all the dimensions of tradeable emission permits, further guidance was requested by the Intersecretariat Working Group on National Accounts (ISWGNA)[4]. A task force (TF) was established in 2009, which examined the issue and produced a final report "OECD/Eurostat Task Force on the Treatment of Emission Allowances and Emission Permits in the National Accounts Final Report October 2010"[5]

14. The TF took as its starting point the recommendations found in the 2008 SNA manual, which stipulates that the atmosphere should not be considered as an economic asset, and that accordingly the permits when transacted with government should be recorded as taxes. Although, some TF members argued against this view, the discussions were framed within this context. The TF examined and took into considerations numerous aspects: the timing of the tax event; the valuation of the tax event; whether the surrender date versus issue date of permits should be used and what type of assets are emission permits.

15. The TF also reviewed how emission permits should be recorded in the national accounts. The review considered and provided numerical examples of various options ranging from non-produced non-financial assets, financial assets, split assets which embody two distinct assets - a non-produced non-financial asset and a financial asset. The TF even explored the possibility of a super national body where a distinction between national type programs and international ones were discussed. The TF recognized from the outset that although emission permits share similar attributes with some of the options considered, emission permits do not perfectly align with any and therefore; the TF needed to consider other criteria such as practicality, interpretability, data availability etc., to formulate a recommendation for the treatment and recording of emission permits.

16. After much deliberation the TF could not reach a consensus on which alternative was most suitable in consistently treating the transactions according to the national accounts. TF members seemed to lean towards two possible options to record emission schemes. Both of these options aligned with the *2008 SNA* recommendation to record payments for emissions permits as other taxes on production on an accrual basis, however there were differences in the amount of taxes payable and in the type of assets involved, depending on which treatment was adopted.

17. The first alternative, referred to as the split asset approach, treats the government auction of permits as a prepaid tax payable by corporations and a prepaid tax receivable by government. Upon surrender (as a proxy to the time of emission), government would record revenue (other taxes on production) at the original issue price and corporations would record a corresponding expense. As such, the tax accrual will be recorded when the emissions occurred at the original issuance value. If at any time the price of the permit differs from the original issuance price that difference will be recorded as a non-produced non-financial asset (NPNF) of the permit holder, where the value of the asset is equal to the difference between the original issuance price and market price of the permit. The appearance of the NPNF asset is not considered a transaction rather it will appear through the other change in volume account (OCVA). With this alternative, the taxes payable by the non-financial corporation will be equal to the cash received by the government. One anomaly with this approach is that the value of the non-produced non-financial asset may be negative if the market price falls below the issuance price[6]. In addition, the expense that will be incurred by the non-financial

[4] The following points are summaries of the discussions from *The Recording of Emission Permits Issued Under Cap and Trade Schemes in the National Accounts*, Update to SNA News and Notes Number 30/31 (February 2011), number 32/33, March 2012.

[5] The report may be found at http://unstats.un.org/unsd/nationalaccount/criList.asp

[6] If this continues to be the recommended approach perhaps it could be amended not to allow the NPNF asset to go negative.

corporation upon surrender of the permit and recorded in their financial statements may not align with the original tax liability to the government[7].

18. The second alternative, the financial asset approach, treats emission permits as financial assets valued at market prices. As permits are auctioned, the auctioned price will be the market price and the issuer (government) will incur a financial liability and the acquirer of the permit will have obtained a financial asset. What type of financial asset/liability needs to be defined. Given the marketability of the permit, it is not appropriate to record the financial asset as a prepaid tax as in the first option. Furthermore, the surrender value will be based on the prevailing market price which may differ from the issuance (auctioned) price, when a difference arises an other change in asset account transaction (revaluation) will be recorded. Similar to the first proposal, emission permits are treated as other taxes on production for polluters and the tax will be recorded at the time the permit is surrendered (as a proxy to the time when the emissions occurred), and the value of the permit will be based on the prevailing market price. Unlike the previous alternative, this treatment would align with the accounting records of the company and the tax accrual amount, which may differ from the original issuance value. Consequently, the tax revenue anticipated by the government may not equal the initial sales value of the emission permits[8].

19. In the appendix, the numerical examples illustrate how these options would be recorded in the national accounts and highlight the differences in net lending / borrowing (NLB), public debt and instrument classification. The examples highlight the differences in recording the various transactions that each of the options will have on the sequence of accounts, the impact on the key metrics considered by national accountants, and the practicality and interpretability of each option.

IV. ISWGNA recommendation

20. In following the consideration of the Task Force the ISWGNA chose to recommend the split asset approach. A recommendation which was described in SNA News and Notes numbers 30/31 and 32/33. It was this approach that was later described in the GFSM 2014 and has been adopted by most countries.

21. There are a number of practical challenges that countries have experienced when trying to implement the split-asset approach. Key amongst these are (i) how to deal with cross-border trading of permits and the resultant discrepancy between government revenue from auctions and the subsequent surrender of permits? (ii) how to treat permits which are freely given away by governments? These issues were recognized by the Task Force and ISWGNA and discussion of them can be found in SNA News and Notes.

V. Guidance according to the 2008 SNA

22. Before presenting the options for recording emission permits in the national accounts, it is important to recall certain concepts already in the *2008 SNA* and examine their applicability to emission trading schemes.

A. Taxes

23. The *2008 SNA* states that emission permits should be treated as other taxes on production: “these consist of taxes levied on the emission or discharge into the environment of noxious gases, liquids or other harmful substances. They do not include payments made

[7] For further information regarding the split asset approach please refer to the TF document on the treatment of emission allowances and emission permits in the national accounts pages 11-15 and for numerical examples starting on page 53.

[8] For further information refer to TF document pages 5 – 11 and numerical examples starting on page 42.

for the collection and disposal of waste or noxious substances by public authorities, which constitute intermediate consumption of enterprises". (Paragraph 7.97f)

24. "Taxes are compulsory unrequited payments, in cash or in kind made by institutional units to the general government exercising its sovereign powers. Taxes are described as unrequited because, in most cases, the government provides nothing commensurate in exchange to the individual unit making the payment. However, there are cases where the government does provide something to the individual unit in return for a payment in the form of the direct granting of a permit or authorization. In this case, the payment is part of a mandatory process that ensures proper recognition of ownership or that activities are performed under the strict authorization by the law" (Paragraph 22.88).

25. Emission permits are required by firms whose production processes generate pollution; the emission permit will not determine the optimum output the firm would like to achieve. A firm will consider the current market price that exists for emission permits and decide the optimal production function that will minimize costs, maximize profits and comply with the pollution regulations.

26. There are international emission trading schemes where corporations may purchase emission permits from one country and surrender them to another country. These cross-border transactions may imply that a country will be receiving tax revenue from production activities that occurred in another jurisdiction and consequently there will be a misalignment in both countries institutional sector accounts. International schemes pose additional data requirements, in addition to information regarding the number of emissions issued, outstanding, tax revenue received, compilers need to be able to identify the debtor and/or creditor and their respective jurisdictions. Neither the split-asset or financial asset approach are able to accommodate cleanly international schemes, additional adjusting entries are required, as such, the TF proposed a super national treatment (see page 65 of the TF report).

27. From the above discussion it is not apparent that emission permits fully satisfy the conditions of taxes as compulsory unrequited payments for all institutional units. A requirement exists for a non-financial corporation who exceeds the pollution regulation to either surrender an emission permit or face some punitive fine, however when an institutional unit other than an emitting non-financial corporation purchases an emission permit, they are acquiring a marketable asset. In addition, cross-border transactions in emission permits may (and do) create asymmetries for both the issuing country and the acquirer.

28. The previous arguments have highlighted some of the implementation and interpretability issues of treating emission permits as other taxes on production. Is the classification of a prepaid tax consistent with permit holders other than non-financial corporations? A different treatment could be considered when permits are purchased for other than emission objectives and by non-residents. The question that arises is whether the accounts should have a consistent treatment for all institutional units, or could the treatment vary depending on the intent?

B. Assets

29. According to the *2008 SNA*, the system defines an asset as "a store of value representing a benefit or series of benefits accruing to the economic owner by holding or using the entity over a period of time." (Paragraph 11.3). An asset, therefore, must have a life greater than one year; however, there are some exceptions to the one-year rule – inventories, short-term assets (commercial paper, trade receivable). Personal attributes that are normally referred to as assets, such as individual skills and abilities, are not considered as economic assets and are excluded from the national accounts' asset boundary. Economic assets are either non-financial or financial.

30. Non-financial assets can be further decomposed as produced or non-produced. Assets that are created from a production process, are classified as produced non-financial assets (AN1), whereas economic assets that do not originate from a production process are classified as non-produced non-financial assets (AN2).

31. Non-produced non-financial assets are further decomposed into the following subcomponents:

- Natural resources (AN21) such as land and mineral resources;
- Contracts, leases, licenses (AN22) are assets that have been created through government regulation, legislation or any other legal constructs, they consist of various non-produced assets: operating leases; licenses to undertake certain economic activities such as taxi licenses; permits to use natural resources (resource leases) and other government and legal constructs; and
- goodwill and marketing assets (AN23), a special type of asset that represents the difference between the acquisition price of a company and the fair value of the assets less liabilities (excluding equity).

32. In the case of contracts, leases and licenses, the *2008 SNA* stipulates, in paragraph 10.186, that in order to be classified as non-produced assets the following two criteria must be satisfied:

- "The terms of the contract, lease or license specify a price for the use of an asset or provision of a service that differs from the price that would prevail in the absence of the contract, lease or license"; and
- "One party to the contract must be able legally and practically to realize this price difference."

33. Although, emission permits share some attributes to contracts, leases and licenses, they do not fully comply with the current understanding of a contract, lease or license. First, with licenses the activity cannot be undertaken before a license or permit has been granted. Secondly, payment of the license or permit will be treated as a tax in exchange for a non-produced non-financial asset, unless the government has a financial obligation in which case the license will be shown as a financial asset, whereas the use of natural resources may be treated as a sale of an asset depending on whether the natural resource asset will be used to depletion and whether the right to use the natural resource transfers all the risk and rewards to the user.

34. One major difference between non-produced non-financial assets and produced non-financial assets is the treatment of consumption of fixed capital (CFC). With the latter, an estimate of the replacement value of maintaining the capital will be included to the sectors current and capital account to derive the sector's total saving from all sources. Charges for the depletion of natural resources or the write-down of a permit or license are not included in the estimation of CFC even though businesses will expense these as part of their operating costs. Rather, the accounts will account for these in the other changes in volume accounts. The treatment of depletion of natural resources is being re-examined as part of the 2025 update to the SNA.

35. Through these definitions the question that arises is whether emission permits satisfy the conditions of the **use of an asset**? From the introduction, we know that emission permits will provide a benefit to the economic owner, either in terms of being able to continue to operate or as a potential financial investment. Emission permits are designed to have a finite time period but will exist for longer than a year, the holder of the permit bears all the risks and rewards and they are transferable. As such, **they satisfy the conditions of an economic asset but do not fully meet the existing definitions of a contract, lease, and license asset**?

C. Valuation of Permits

36. The manual recommends that transactions should be recorded on an accrual basis and not when the actual payment is exchanged between the parties. This implies that emission permits should be recorded when the actual emissions occur, the time at which the firm surrenders their permit being considered a proxy for this. As a result, a timing difference may exist between the issuance of and the surrender of the permit. This timing difference will give rise to a financial asset/liability under the current treatment. For instance, if the emission permit is considered as an other tax on production, then the firm will have a financial

asset - prepaid tax (other accounts receivable) and the government will show a financial liability - prepaid tax (other accounts payable).

37. In the initial discussions of emission permits, the atmosphere was not considered as an asset and the recommended treatment of emission permits was based on this assumption. In addition, there was considerable discussion regarding the proper valuation of emission permits – time of issuance or time of surrender and it was decided that the latter would be the recommended treatment. However, if the atmosphere is not considered as an asset and the current treatment as other taxes on production continues perhaps it would be worthwhile to re-consider the timing and valuation of permits at the time of issuance. As such, the initial transactions could be recorded as other taxes received by the government and the purchase of an asset by the entity purchasing the permit. This recording would address a number of the practical issues associated with the split asset approach.

38. Although the two options described in points 17 and 18 were the ones that received the most merit by both the ISWGNA and the AEG, the question remains whether there are other alternatives that should be explored, because both of these approaches have important drawbacks.

1. Option 1: The split asset approach

39. Currently the split asset approach is the recommended treatment by the task force and was adopted as the recommended treatment by the AEG in the SNA News and Notes published on February 2011 and updated on March 2012. If this approach is adopted, it should be reflected in the updated SNA manual.

40. In addition, to interpretation and valuation issues, there are other practical data issues with the recommended split asset approach. Firstly, the data required to ensure the proper identification and sectoring of permits from the initial sale to the subsequent trading of the permits. Moreover, the approach requires complex recording of transactions across the sequence of accounts. These data demands could be very challenging and subject to potential error for even the most advanced statistical offices.

41. Nonetheless, corporations have been expensing the market value of the permits at the time of surrender which, as has been highlighted, may not align with the original issuance price. An additional consideration is that the data requirements for recording this option are significant. In addition to obtaining information related to the original issuance of the permit, compilers would also need to obtain information related to the current value of the permit and make additional entries if the market value and the value at issuance are different.

42. Table 1 and 2 show the significance of cap and trade schemes that have been introduced by various countries over the years. The tables show that although numerous countries have implemented an emission permit scheme to reduce GHG emissions, both the price per ton and the revenue generated are well below what was anticipated. A more practical and less data intensive approach could be considered.

Table 1
Selected Carbon Pricing Arrangements, 2019
Carbon Taxes

Country or Region	*Year Introduced*	*2019 Price ($/Ton CO_2)*	*Coverage of GHGs, 2018*	
			Million Tons	*Percent*
Chile	2017	5	47	39
Colombia	2017	5	42	40
Denmark	1992	26	22	40
Finland	1990	65	25	38
France	2014	50	176	37
Ireland	2010	22	31	48
Japan	2012	3	999	68
Mexico	2014	1-3	307	47
Norway	1991	59	40	63
Portugal	2015	14	21	29
South Africa	2019	10	360	10
Sweden	1991	127	26	40
Switzerland	2008	96	18	35
Emissions Trading Systems				
California	2012	16	378	85
China	2020	na	3232	
European Union	2005	25	2132	45
Korea	2015	22	453	68
New Zealand	2008	17	40	52
Regional Greenhouse Gas Initiative[1]	2009	5	94	21
Carbon Floor				
Canada	2016	15	na	70
United Kingdom	2013	24	136	24

Sources: Stavins 2019; World Bank 2019a; and IMF staff calculations. Note: CO_2 = carbon dioxide; GHG = greenhouse gas; na = not available.
[1] The Regional Greenhouse Gas Initiative is a market-based program in 10 states in the eastern part of the United States.

Table 2
Government Revenues in the past year (millions US$)

Year	*2018*	*2019*
Total Revenue ETS	20,292	21,161
Total Revenue Carbon Tax	23,860	23,671

source: CPI database

2. Option 2: Right to Use Asset Approach

43. The current recommended treatment is based on the fact that the atmosphere is not a natural asset as per paragraph 17.363 of the *2008 SNA*, where it states "*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 even though the permitted "activity" is one of creating an externality.*" It is becoming increasingly difficult to argue that the atmosphere is not a natural asset. Advances in the measurement and valuation of ecosystems recognize more and more the economic value of natural capital. It is

an important step forward for the accounting standards to start recognizing a broader set of natural assets that contribute to the functioning of the economy and society.

44. Additionally, it could be argued that when the government auctions off emissions permits, they are placing a value on the right to use the atmosphere and related processes for the purpose of using the services of the atmosphere. "In many countries permits to use natural resources are generally issued by government since government claims ownership of the resources on behalf of the community at large" (paragraph 17.313). Beyond that, the atmosphere confers many benefits such as providing businesses and households the capability to engage in transactions, improve their production processes and enhance their overall wellbeing, however we are focusing on only one of those services provided by the atmosphere.

45. The atmosphere is not owned or controlled by any economic unit and therefore it this proposal does not suggest that the SNA asset boundary be extended to include the atmosphere. "It must be noted that the accounts and balance sheets of the SNA are compiled for institutional units or groups of units and can only refer to the values of assets that belong to the units in question. Only those naturally occurring resources over which ownership rights have been established and are effectively enforced can therefore qualify as economic assets and be recorded in balance sheets" (paragraph 10.167). Rather, what is proposed is the creation of an asset that reflects the right to use the climate regulating services of the atmosphere as part of specific production activities. These assets first belong to governments stemming from each governments ability to regulate the behavior of the institutional units in its jurisdiction. Governments engage in this regulation to limit the degradation of the atmosphere. This is consistent with permits to use natural resources. When the user of the natural resource is given the right to use the natural resource without any intervention for a period of time, this "leads to the creation of an asset for the user, distinct from the resource itself but where the value of the resource and the asset allowing use of it are linked" (paragraph 17.315)

46. Consider the way the SNA recommends recording electromagnetic spectrum. An electromagnetic spectrum is considered a non-produced non-financial asset. When a government auctions off the electromagnetic spectrum (by selling transferable licenses), an asset (permit to use the electromagnetic spectrum) first appears via the other change in the volume of assets account on the government's balance sheet. Once its rights are sold there is a sale of an existing asset recorded in the capital account. The government receives cash and the corporation that purchased the permit receives rights to use the asset and records these rights to use the spectrum as an asset on their balance sheet. Since the rights can be sold the asset is recorded at market value and revalued over the life of the license[9].Similarly, one could argue that a fishing quota is not related so much to the fish but rather to the ocean (similar to the atmosphere). The ocean (ecosystem) can only produce so many fish – the government needs to restrict the amount of fish that are caught to ensure sustainability. Fishing quotas are treated as assets because the fish are considered a natural resource.

47. Should the right to use the atmosphere be treated differently from the right to use the electromagnetic spectrum? An argument can be made that the treatments should align. Prior to the advent of cellular technology, the electromagnetic spectrum did not have a value given there was no use. It could be argued that it was an asset, but the value recorded in the national accounts was zero (it had a price of zero). When technology advanced to a point that made it an important part of the production process (in terms of the delivery of communication services), it became valuable (its price increased) and governments exercised ownership over the asset. The value of the asset became the market price determined via electromagnetic spectrum auctions.

48. A similar argument can be made for emissions: prior to the widespread burning of fossil fuels the atmosphere could tolerate and continue to properly function despite the negative effects of GHG emissions. As GHG emissions increase, and the atmosphere is being

[9] Emission permits are not exactly the same as the use of the electromagnetic spectrum. First, the rights to use the spectrum are only given to institutional units that will use the spectrum in their production process. Secondly, once the spectrum becomes non-marketable, the services of the spectrum will be returned and will remain intact, whereas, emission permits will degrade the atmosphere.

drawn upon more and more in the production process, the price of one unit of atmosphere is no longer zero. Governments are deciding to start issuing rights to use the atmosphere in the form of emission permits. Viewing emission permits from this perspective could lead one to conclude that emission permits are not a tax but rather an asset (similar to fishing quotas and electromagnetic spectrum).

49. According to the SNA (p 10.158), "*the category other natural resources currently includes radio spectra. Given the increasing move to carry out environmental policy by means of market instruments, it may be that other natural resources will come to be recognized as economic assets. If so, this is the category to which they should be allocated*." One of the key differences in the case of the electromagnetic spectrum, fishing and other quotas is that in these cases, a natural resource is being used by an institutional unit to derive economic benefit (supply mobile phone services, or catch fish), whereas in the case of emission permits the natural resource is not being directly exploited to provide economic benefit, but rather is being degraded by the activities being undertaken to provide economic benefit. Hence, **emission permits do not cleanly adhere to the definitions of natural resources and therefore, a new sub-category could be created to accommodate assets that involve the use of nature/ecosystems such as wetlands, forest etc. For example, contract, licenses, permits and right to use natural assets.**

50. By treating permits as 'right-to-use' assets, which are created and sold by government, most of the practical concerns to record permits as taxes are overcome, particularly the issue of how to value the permit (issuance/prevailing price and the creation of a non-financial asset in the split asset option); or in the case where an institutional unit other than a non-financial emitter purchases permits and with cross border flows.

51. Further, in the case where emission permits are given freely by governments to non-financial corporations, the treatment will vary depending on whether the permits are considered a tax on production or an asset. The discussion has demonstrated that permits are valuable and when given freely could be considered as capital transfers or as subsidies if they are deemed to reduce the intermediate expenses of non-financial corporations. Such a treatment is straightforward where the government is selling a non-produced non-financial asset, but more challenging and complex in the split-asset approach where a tax on production is being recorded at surrender, and payments at auction are prepayments of tax.

52. If we consider emission permits as an asset and using the examples in the appendix where we assumed that the government issued 100 units for $10 and both financial and non-financial corporations bought 50 units. The transaction would be recorded as in Table 3.

53. In the first period, an appearance of an asset (emissions permit) in the government sector would occur through a volume change in the Other changes in the volume of Assets account. The appearance of the asset (emission permit) is not shown in the table, because we assume the appearance and subsequent capital transfer occur in the same period, hence only the sale of the existing asset (NP1) is shown in the capital account[10]. In the capital account there would be a positive entry under acquisition less disposals of non-produced assets for both corporations and a corresponding negative entry for government. For simplicity, we assume that there is no ownership transfer cost involved. As can been seen in Table 3, there is no impact on GDP; however, the net lending/borrowing (NLB) of corporations and governments will be impacted, to show the sale of the existing asset from the government account to the corporations accounts.

54. In period 2, the market price of a unit of emissions declines to 8. The change in market price will be shown in the revaluation account for both non-financial and financial corporations. When the non-financial corporation surrenders its permits, the impact will be recorded in the other change in volume accounts to illustrate the write down in the asset. In this scenario, there will not be any implication regarding government tax revenues or debt.

[10] In most cases, the asset will be recorded in a prior period and the acquisition in the following.

Table 3
Emissions trading schemes (ETS) considered as an Asset

	T=0, Sale of emission permits (PPP=$10) # 0f Units = 100							
	ETS = Asset							
	Debit				Credit			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Taxes	0	0	0	**0**	0	0	0	**0**
Capital Account	500	500	(1000)	**0**	0	0	0	**0**
NLB	(500)	(500)	1000	**0**	0	0	0	**0**

	T=1, NFC surrender 10 permits (PPP=$8)							
	ETS = Asset							
	Debit				Credit			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Taxes	0	0	0	**0**	0	0	0	**0**
Capital Account	0	0	0	**0**	0	0	0	**0**
NLB	0	0	0	**0**	0	0	0	**0**

	T=0, Sale of emission permits (PPP=$10) # 0f Units = 100							
	Opening balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
NPNF	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Non-Financial and Financial accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
NPNF	500	500	(1000)	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
NLB	**0**	0	0					
	Revaluation accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
NPNF	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Other changes in the volume of assets accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
NPNF	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Closing balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
NPNF	500	500	(1000)	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
Net Worth	0	0	0	**0**				

	T=1, NFC surrender 10 permits (PPP=$8)							
	Opening balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
NPNF	500	500	(1000)	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Non-Financial and Financial accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits				**0**				**0**
NPNF	0			**0**			0	**0**
	0	0	0	**0**	0	0	0	**0**
NLB	**0**	0	0					
	Revaluation accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
NPNF	(100)	(100)	0	**(200)**	0	0	0	**0**
	(100)	(100)	0	**(200)**	0	0	0	**0**
	Other changes in the volume of assets accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
NPNF	(80)	0	0	**(80)**	0	0	0	**0**
	(80)	0	0	**(80)**	0	0	0	**0**
	Closing balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	0	**(1000)**	0	0	0	**0**
NPNF	320	400	0	**720**	0	0	0	**0**
	(180)	(100)	0	**(280)**	0	0	0	**0**
Net Worth	(180)	(100)	0	**(280)**				

55. The source data requirements when emissions permits are recorded as a sale of an asset are relatively straightforward and are aligned with how emissions permits are recorded by some corporations. Businesses do not provide clear and uniform disclosures of cap-and trade impacts to the market. It has been noted that when permits are used to offset GHG emissions they are shown as current assets and valued similarly to inventory valuation. In other cases, they will be recorded as intangible assets or not disclosed altogether. Table 4 identifies how selected companies have identified emissions permits on their publicly available financial statements.

Table 4
Recording of ETS by selected corporations

Reporting Year	*Company*	*Account*	*Value*
2018	Nova Scotia power	Other current assets – inventory	21 M CAD $
2019	Edison International Energy report	Other current assets – inventory	50m US $
2019	Royal Bank	NA	Not disclosed
2019	Morgan Stanley Capital Group	NA	Not disclosed
2019	Merrill Lynch Commodities	NA	Not disclosed
2019	Green Future Opportunity Fund, LLC	NA	Not disclosed

3. Option 3: Resource Lease - Prepaid Rent approach

56. The alternative treatment of treating emission permits as resource lease argues that the atmosphere is an economic asset similar to the treatment of fishing quotas, timber and mineral resources and is proposing that one of the many services the atmosphere is providing could be valued by the sale of permits.

57. The notion of a resource lease as mentioned above presupposes that the use of the atmosphere (as a CO_2 sink) is restricted to a one-off application and does not take into consideration two key elements - time or quantity. Alternatively, one could consider the issuance of permits as a pre-paid resource rent, where the payment grants the acquirer with the right to emit a pre-specified quantity of CO_2 sometime in the future. One issue that requires further elaboration is how to deal with the potential change in price of the emission permit when it was acquired and the market price of the permit at the time of surrender. One approach to overcome the change in price is to introduce a 'Forward', a financial asset/liability which helps to bridge the difference between the issue price with the price at the time the permit is surrendered.

58. The main objective of the tables below is to illustrate the recording of a rent payment in connection to using the atmosphere as a sink by emitting certain amounts of CO_2. The example shows the impact when there's a positive price change and the second example (please see appendix) when there's a negative price change. Using the same criteria as in the previous examples, where we assumed that the government issued 100 units for $10 and both financial and non-financial corporations bought 50 units. At T=0, the sales of the permits initially lead to an increase (decrease) in cash for the government (corporations) exchanged for an accounts receivable for the corporations and a corresponding account payable for the government. Simultaneously, a forward assets/liability has been created with a zero value. In

other words, as soon as the permit is sold a forward transaction takes place with a market price equal to zero. In the following period (T=1), the market price increases from 10 to 12. The increase in the market price of the permit will in subsequent periods lead to a financial asset/liability tentatively classified as a forward. In other words, as the market price of the permit changes the forward obtains a value, however it is only recognized when the permit is surrendered. A price increase will lead to a financial asset in the accounts of the permit owners. Conversely, a price decrease will benefit the government, as permits will have been transacted for a lower price than the prevailing market price. The forward is required to match the surrender of a permit at the prevailing price with the corresponding counter transactions in the financial accounts. Table 5 illustrates how these transactions could be recorded and the impact they may have on the main aggregates in the national accounts.

VII. Recommended approach

59. For both conceptual and practical reasons, we recommend option 2 – Right to use a natural asset. Emissions permits can therefore be recognized as assets that "appear", are subsequently sold and are eventually extinguished. Given the analytical and potentially growing importance of ETS schemes it is recommended that a separate asset class be developed for ETS. Given the unique nature of these programs and growing policy importance of ETS a unique class is warranted. This treatment also aligns (mostly) with SNA 17.358 where "*A permit issued by government to undertake a specific activity may be treated as an asset only when all the following conditions are satisfied:*

> *a. The activity concerned does not utilize an asset belonging to government; if it does the permission to use the asset is treated as an operating lease, a financial lease, a resource lease or possibly the acquisition of an asset representing permission to use the asset at the discretion of the licensee over an extended period;*
>
> *b. The permit is not issued subject to a qualifying criterion; such permits are treated as either taxes or payments for services;*
>
> *c. The number of permits is limited and so allows the holder to make monopoly profits when undertaking the activity concerned;*
>
> *d. The permit holder must be legally and practically able to sell the permit to a third party.* "

60. The right of use asset approach minimizes the practical challenges that countries have experienced when trying to implement the split-asset approach including:

- The issue of recording a negative NPNF asset in the event that the market price falls below the issuance price.
- The potential discrepancy between government revenue from auctions and the subsequent surrender of permits when dealing with cross-border trading of permits.
- Treatment of permits which are freely given away by governments.
- Data inputs required to accurately reflect the transactions and stocks for the sequence of accounts

Table 5
Rent Approach with Positive Forward

	T=0 Rent Approach Current and Capital Account							
	Income				Expense			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Taxes	0	0	0	**0**	0	0	0	**0**
Rent								
Capital Account	0	0	0	**0**	0	0	0	**0**
NLB	0	0	0	**0**	0	0	0	**0**
	T=0, Sale of emission permits (PPP=$10) # 0f Units = 100							
	Opening balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
Rent								
Receivable /Payable	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Financial accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
Forward								
Receivable /Payable	500	500		**1000**	0	0	1000	**1000**
	0	0	1000	**1000**	0	0	1000	**1000**
NLB	**0**	0	0					
	Revaluation accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	0	0	0	0	0
Forward								
Receivable /Payable	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Other changes in the volume of assets accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
Forward								
Receivable /Payable	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Closing balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
Forward								
Receivable /Payable	500	500	0	**1000**	0	0	1000	**1000**
NPNF								
	0	0	1000	**1000**	0	0	1000	**1000**
Net Worth	0	0	0	**0**				

	T=1 Financial Asset Approach Current and Capital Account							
	Income				Expense			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Taxes	0	0	0	**0**	0	0	0	**0**
Rent			120		120			
Capital Account	0	0	0	**0**	0	0	0	**0**
NLB	0	0	120	**0**	120	0	0	**0**
	T=1, NFC surrender 10 permits (PPP=$12)							
	Opening balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
Rent								
Receivable /Payable	500	500	0	**1000**	0	0	1000	**1000**
	0	0	1000	**1000**	0	0	1000	**1000**
	Financial accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits				**0**				**0**
Forward	(20)			**(20)**			(20)	**(20)**
Receivable /Payable	(100)			**(100)**			(100)	**(100)**
	(120)	0	0	**(120)**	0	0	(120)	**(120)**
NLB	**(120)**	0	120					
	Revaluation accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
Forward	100	100					200	
Receivable /Payable	0	0	0	**0**	0	0	0	**0**
	100	100	0	**0**	0	0	200	**0**
	Other changes in the volume of assets accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
Forward								
Receivable /Payable	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Closing balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
Forward	80	100	0	**180**			180	**180**
Receivable /Payable	400	500	0	**900**	0	0	900	**900**
NPNF								
	(20)	100	1000	**1080**	0	0	1080	**1080**
Net Worth	(20)	100	(80)	**0**				

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Appendix [English only]

1. The numerical examples below illustrate how these options would be recorded in the national accounts and highlights the differences in net lending / borrowing (NLB), public debt and classification. The examples highlight the differences in recording the various transactions that each of the options will have on the sequence of accounts, the impact on the key metrics considered by national accountants, and the practicality and interpretability of each option.

Numerical Example

2. In T=0, the government auctions 100 emission permits at $10 per unit – resulting in a total value of $1,000. Both financial and non-financial corporations participate in the auction, with each acquiring 50 units. The permits have been assigned a certain emission allowance which will not vary with fluctuations in price because otherwise, the emission permit scheme would be counterproductive. In the following year (T=1), the market price of the permits falls from $10 per permit to $8 and the non-financial corporation surrenders 10 permits to the government.

3. Table 6 illustrates the transactions according to the split asset approach, table 7 the financial assert approach and table 8 the rent approach when there's a positive value for the forward.

4. Under all scenarios, the recording of the auction would not have any impact on GDP, rather the transactions would all be recorded in the financial account. Both financial and non-financial corporations would show a decrease in cash and deposits and an increase in a financial asset. The government would show an increase in cash and deposits and a new liability. There are therefore no changes in any institutional sector's net worth. The only difference between the alternatives is in the classification of the emission permits: the split asset approach would record the emission permits as an "other asset" (accounts receivable-prepaid tax) for the corporations and a corresponding other liability (accounts payable) for the government. The financial asset approach could record an increase in other security holdings of the corporations and a corresponding other debt security liability for the government. Similar to the split asset approach the rent approach will record an accounts receivable – prepaid rent for the corporations and a corresponding account payable for the government.

5. Assume that the following year T=1, the demand for emission permits declines and as a result, the price of emission permits decreases to $8 per unit. Let's further assume that the non-financial corporation must redeem 10 emission permits to satisfy its pollution obligation to the government. In this scenario, GDP would again not be impacted; however, the decrease in the unit price of emissions would have a different impact on taxes accrued, NLB, public debt, and net worth depending on the chosen option.

6. In the split asset approach, the current account of government would show a tax revenue valued at the original issuance price of 10 despite the decline in the market price. As a result, the NLB of government will increase by $100. However, NFCs would report an expense of $80 when they compile their profit and loss statements. Furthermore, the new market price of $8 would create a new non-produced non-financial (NPNF) asset equal to the difference between the original issue price of $10 and the current market price of $8. The unrealized capital loss would be reflected as a NPNF valued at -$80 for non-financial corporations and -$100 for financial corporations and would be shown in the other changes in the volume of assets (OCVA) account as a decrease in the value of the NPNF asset for the corporations, and there will not be any impact to government tax liabilities or debt outstanding

Table 6
Split Approach

	T=0, Sale of emission permits (PPP=$10) # 0f Units = 100							
	Current and Capital Account							
	Income				Expense			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Taxes	0	0	0	**0**	0	0	0	**0**
Capital Account	0	0	0	**0**	0	0	0	**0**
NLB	0	0	0	**0**	0	0	0	**0**
	T=0, Sale of emission permits (PPP=$10) # 0f Units = 100							
	Opening balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
receivable /payable	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Revaluation accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
receivable /payable	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Other changes in the volume of assets accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
receivable /payable	0	0	0	**0**	0	0	0	**0**
NPNF	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Closing balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
receivable /payable	500	500	0	**1000**	0	0	1000	**1000**
NPNF								
	0	0	1000	**1000**	0	0	1000	**1000**
Net Worth	0	0	0	**0**				

	T=1, NFC surrender 10 permits (PPP=$8)							
	Current and Capital Account							
	Income				Expense			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Taxes	0	0	0	**100**	0	0	0	**100**
Capital Account	0	0	0	**0**	0	0	0	**0**
NLB	0	0	0	**100**	0	0	0	**100**
	T=1, NFC surrender 10 permits (PPP=$8)							
	Opening balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
receivable /payable	500	500	0	**1000**	0	0	1000	**1000**
	0	0	1000	**1000**	0	0	1000	**1000**
	Revaluation accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
receivable /payable	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Other changes in the volume of assets accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
receivable /payable	0	0	0	**0**	0	0	0	**0**
NPNF	(80)	(100)	0	**(180)**	0	0	0	**0**
	(80)	(100)	0	**(180)**	0	0	0	**0**
	Closing balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
receivable /payable	400	500	0	**900**	0	0	900	**900**
NPNF	(80)	(100)	0	**(180)**	0	0	0	**0**
	(180)	(100)	0	**720**	0	0	900	**900**
Net Worth	(180)	(100)	100	**(180)**				

Table 7
Financial Asset Approach

	T=0 Financial Asset Approach Current and Capital Account							
	Income				Expense			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Taxes	0	0	0	**0**	0	0	0	**0**
Capital Account	0	0	0	**0**	0	0	0	**0**
NLB	0	0	0	**0**	0	0	0	**0**
	T=0, Sale of emission permits (PPP=$10) # 0f Units = 100							
	Opening balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
Other debt securities	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Financial accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
Other debt securities	500	500		**1000**	0	0	1000	**1000**
	0	0	1000	**1000**	0	0	1000	**1000**
NLB	**0**	0	0					
	Revaluation accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	0	0	0	0	0
Other debt securities	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Other changes in the volume of assets accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
Other debt securities	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Closing balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
Other debt securities	500	500	0	**1000**	0	0	1000	**1000**
	0	0	1000	**1000**	0	0	1000	**1000**
Net Worth	0	0	0	**0**				

	T=1 Financial Asset Approach Current and Capital Account							
	Income				Expense			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Taxes	0	0	0	**80**	80	0	0	**80**
Capital Account	0	0	0	**0**	0	0	0	**0**
NLB	0	0	0	**80**	80	0	0	**80**
	T=1, NFC surrender 10 permits (PPP=$8)							
	Opening balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
Other debt securities	500	500	0	**1000**	0	0	1000	**1000**
	0	0	1000	**1000**	0	0	1000	**1000**
	Financial accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits				**0**				**0**
Other debt securities	(80)			**(80)**			(80)	**(80)**
	(80)	0	0	**(80)**	0	0	(80)	**(80)**
NLB	**(80)**	0	80					
	Revaluation accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
Other debt securities	(100)	(100)	0	**(200)**	0	0	(200)	**(200)**
	(100)	(100)	0	**(200)**	0	0	(200)	**(200)**
	Other changes in the volume of assets accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
Other debt securities	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Closing balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
Other debt securities	320	400	0	**720**	0	0	720	**720**
	(180)	(100)	1000	**720**	0	0	720	**720**
Net Worth	(180)	(100)	280	**0**				

Table 8
Rent Approach with negative Forward

	T=0 Rent Approach Current and Capital Account							
	Income				Expense			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Taxes	0	0	0	**0**	0	0	0	**0**
Rent								
Capital Account	0	0	0	**0**	0	0	0	**0**
NLB	0	0	0	**0**	0	0	0	**0**
	T=0, Sale of emission permits (PPP=$10) # 0f Units = 100							
	Opening balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
Forward								
Receivable /Payable	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Financial accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
Forward								
Receivable /Payable	500	500		**1000**	0	0	1000	**1000**
	0	0	1000	**1000**	0	0	1000	**1000**
NLB	**0**	0	0					
	Revaluation accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	0	0	0	0	0
Forward								
Receivable /Payable	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Other changes in the volume of assets accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
Forward								
Receivable /Payable	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Closing balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
Forward								
Receivable /Payable	500	500	0	**1000**	0	0	1000	**1000**
NPNF								
	0	0	1000	**1000**	0	0	1000	**1000**
Net Worth	0	0	0	**0**				

	T=1 Rent Approach Current and Capital Account							
	Income				Expense			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Taxes	0	0	0	**0**	0	0	0	**0**
Rent			80		80			
Capital Account	0	0	0	**0**	0	0	0	**0**
NLB	0	0	80	**0**	80	0	0	**0**
	T=1, NFC surrender 10 permits (PPP=$8)							
	Opening balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
Forward								
Receivable /Payable	500	500	0	**1000**	0	0	1000	**1000**
	0	0	1000	**1000**	0	0	1000	**1000**
	Financial accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
Forward			(20)	**(20)**	(20)			**(20)**
Receivable /Payable	(100)	0	0	**(100)**	0	0	(100)	**(100)**
	(100)	0	(20)	**(120)**	(20)	0	(100)	**(120)**
NLB	**(80)**	0	80					
	Revaluation accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
Forward			200		100	100		
Receivable /Payable	0	0	0	**0**	0	0	0	**0**
	0	0	200	**0**	100	100	0	**0**
	Other changes in the volume of assets accounts							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	0	0	0	**0**	0	0	0	**0**
Forward								
Receivable /Payable	0	0	0	**0**	0	0	0	**0**
	0	0	0	**0**	0	0	0	**0**
	Closing balance sheets							
	Δ Assets				Δ Liabilities			
	NFC	FC	GG	**Total**	NFC	FC	GG	**Total**
Cash and deposits	(500)	(500)	1000	**0**	0	0	0	**0**
Forward	0	0	180	**180**	80	100	0	**180**
Receivable /Payable	400	500	0	**900**	0	0	900	**900**
NPNF								
	(100)	0	1080	**1080**	80	100	900	**1080**
Net Worth	(100)	(100)	280	**0**				

7. In the financial asset approach, the decline in the market price of the emission permits would be reflected in the tax paid by the corporation to the government. In the current and capital accounts, the government would have a tax revenue of $80 and the net lending of government will increase by the same amount and there will be a corresponding decline in NLB of the nonfinancial corporations. In the financial account there will be an $80 disappearance of government debt security and a corresponding decline in non-financial debt security assets[11]. Finally, the decline in the market price of emissions will create a downward revaluation for both financial and non-financial corporations of $-100 and a -$200 revaluation for government debt securities. The decline in the market price of emission permits would result in a decline in the outstanding debt of government.

8. In the rent approach, the price decrease will benefit the government as the market price is below the issuance price. The government will receive 80 in rent, that is the NLB will be 80, and the total debt will stand at 900 however the decrease in price will lead to a forward assets of 180, which will result to a net worth of 280, similar to the financial asset approach.

Table 9
Summary

	NLB	Debt	Other Asset	Net Worth
Split Asset Approach	100	900		100
Financial Approach	80	720		280
Rent Approach	80	900	180	280

[11] For illustrative purposes, the emission permit is treated as other debt securities, however we recognize that the emission permit does not have the characteristics of debt or equity securities. A new financial instrument could be created, or emission permits can be classified as other assets/liabilities not elsewhere classified.