REVISION OF THE SYSTEM OF ENVIRONMENTAL - ECONOMIC ACCOUNTS (SEEA)

United Nations Committee of Experts on Environmental Economic Accounting (UNCEEA)

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Chapter 4: Monetary flow accounts

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4.1 Introduction

4.1 An important component of environmental and economic accounting is the recording of the transactions between economic units that may be considered environmental. Generally, these transactions concern activity undertaken to preserve and protect the environment. As well, there are a range of transactions, such as taxes and subsidies, that reflect efforts by governments to influence behaviours of producers and consumers with respect to the environment.

4.2 Most of these environmental transactions are recorded within the core national accounts framework but many cannot be easily identified due to the structure of the accounts or the types of classifications that are used. This chapter describes approaches that have developed for recognising these transactions and provides appropriate definitions and accounts for the organisation of information on environmental transactions.

4.3 A strong motivation for undertaking this work is to identify an environmental component within the key aggregates of the SNA. Further, in combination with information on the changing pressures on the environment, information on these transactions may be used to assess whether economic resources targeted at reducing the pressures on the environment and maintaining the capacity of the environment to deliver benefits is being used effectively and different policies may be compared and contrasted.

4.4 The general approach to identifying transactions related to a particular theme or topic is described in the SNA in its discussion of satellite accounts. A satellite account is formed through the adaptation and rearrangement of the core structures of the SNA to suit particular objectives. For the objective of identifying environmentally related transactions, the rearrangement is based on considering the purpose underlying each transaction and using so-called functional classifications. The compilation of accounts, known as functional accounts, using these alternative classifications requires that underlying statistics can also be reorganised to provide the requisite information.

4.5 As explained in this chapter, the first task is to define environmental activities and the associated products and producers. This is done in section 4.2.

4.6 Section 4.3 explains the compilation of two sets of information for the analysis of environmentally related transactions – the Environmental Protection Expenditure Account (EPEA) and statistics on the Environmental Goods and Services Sector (EGSS). Both the EPEA and the EGSS provide information that assists in understanding society's response to the challenge of environmental degradation and depletion of natural resources and the potential for economic activity to be based on environmentally friendly and more resource efficient activities. However, each set of information presents a different coverage and perspective on environmental activities.

4.7 The final section, section 4.4, considers a range of other environmentally related transactions, including environmental taxes and subsidies, permits and licences to use environmental assets and transactions relating to fixed assets used in economic activities related to the environment.

4.2 Environmental activities, products and producers

4.2.1 Introduction

4.8 The traditional industry and product classifications are not sufficient to identify the economic activities, products, and producers that are characteristic of the environment. Alternative classifications are needed to discriminate between those products and industries frequently associated with the environment. This is done by considering the purpose of different activities. Using a purpose based approach, this section defines the environmental activities in the central framework and presents their scope and classification.

4.9 A distinction is drawn between those economic activities that should be considered environmental, and other economic activities that are closely associated with the environment or that use the environment directly in their production processes – for example, the extraction of mineral and energy resources. These activities may be considered "environmentally related" but, to some degree, all economic activities require a functioning environment and interact with the environment in some way. Hence an exhaustive categorisation and description of all environmentally related activities is not pursued in the SEEA.

4.10 The last parts of the section present the different sets of environmental goods and services that are relevant in measuring the extent of environmental activities and the associated groups of environmental producers.

4.2.2 The scope and definition of environmental activities

4.11 The scope of environmental activities is those economic activities whose primary purpose is to reduce or eliminate pressures on the environment or to make more efficient use of natural resources. Examples of these activities are restoring polluted environments, conservation and resource management, and investing in technologies designed to prevent or reduce pollution.

4.12 These various activities are grouped into two broad types of environmental activity - environmental protection and resource management. ***Environmental protection activities are those activities whose primary purpose is the prevention, reduction and elimination of pollution and other forms of degradation of the environment.*** These activities include, but are not limited to, the prevention, reduction or treatment of waste and wastewater; the prevention, reduction or elimination of air emissions; the treatment and disposal of contaminated soil and groundwater; the prevention or reduction of noise and vibration levels; the protection of biodiversity and landscapes, including their ecological functions; monitoring of the quality of the natural environment (air, water, soil, groundwater); research and development; and the general administration and training and teaching activities oriented towards environmental protection.

4.13 ***Resource management activities are those activities whose primary purpose is preserving and maintaining the stock of natural resources and hence safeguarding***

against depletion. This includes actions and activities aiming at reducing the withdrawals of natural resources (recovery, reuse, recycling, substitution of natural resources) as well as restoring natural resource stocks (increases or recharges of natural resource stocks). It also includes the general management of natural resources (including monitoring, control, surveillance and data collection), and the production of goods and services used to manage or conserve natural resources.

4.14 Resource management activities may result in associated secondary environmental benefits such as protection and restoration of wildlife and natural habitats. However, activities specifically for biodiversity or landscape protection (for example, management of protected forests) and activities aimed at preserving certain functions or the quality of the natural environment should be treated as environmental protection.

Determination of primary purpose

4.15 While some economic activities may only be undertaken for a single purpose, many activities are often undertaken for a variety of purposes. Following general principles of classification, activities are deemed to be environmental activities only if the primary purpose of the activity is consistent with the definitions of the two types of environmental activity listed as environmental – i.e. environmental protection or resource management. In practice, the primary purpose must be applied to particular transactions or groups of transactions as recorded in the accounts in terms of production, consumption or accumulation.

4.16 In determining the primary purpose, a variety of motivations for undertaking the activity may be relevant. The activity may be undertaken on a purely voluntary basis or in order to comply with relevant legislation or regulation or within the framework of a voluntary agreement.

4.17 In some situations, it is necessary to consider the suitability of various goods and services for achieving environmental purposes through consideration of the good or services from a technical perspective. This is particularly relevant in the assessment of whether certain goods are cleaner or more environmentally friendly than other similar goods. The issues of determining primary purpose are discussed further in Section 4.3.

4.2.3 Other economic activities related to the environment

4.18 Many economic activities may be considered as being related to the environment. Historically, two broad types of economic activity have been discussed in this context, in addition to the environmental activities of environmental protection and resource management. They are natural resource use activities and activities associated with the minimisation of the impact of natural hazards.

4.19 Natural resource use activities involve the abstraction, harvesting and extraction of natural resources, including relevant exploration and development. These

activities are not considered environmental but due to the specific and direct effect of their production processes on the environment, these activities may be of particular interest in the assessment of environmental impacts and the development of environmental policy.

4.20 A specific area of interest in this regard is activities associated with the abstraction and distribution of water. Functional accounts that cover both the use and management of water resources have been developed that consider the investment in water storage and abstraction facilities and the associated economic activity of abstracting and managing water resources.

4.21 Often, information on natural resource use activities is described in standard presentations of economic statistics and the national accounts following the standard classifications of economic activity. However, the level of detail required to target only the natural resource use activity may be hidden due to varying levels of integration of associated economic activity undertaken by the establishments involved (e.g. processing of fish caught at sea). Information on natural resource use activity is of particular importance in the compilation of asset accounts for environmental assets as described in Chapter 5.

4.22 The second set of economic activities related to the environment concerns the minimization of the impact of natural hazards on the economy and society. These activities could include research, observation and measurement networks, surveillance, administration of hazard warning systems, provisions for fighting the effects of floods, forest fires and other natural hazards (including equipment), provisions for the evacuation of the population, and the building of structures to prevent hazards (for example, fire barriers in forests, avalanche prevention barriers, dams to slow down water flows, and renaturalisation of river banks and other landscapes). In some cases the primary purpose of these activities may be environmental protection in which case they should be recorded as part of environmental protection activities as defined above.

4.23 The collection and organisation of information on minimising the impact of natural hazards may be of particular interest in understanding the economic response to natural hazards and also provide indicators of the economic impacts of environmental changes to landscapes and water systems, including environmental changes due to climate change. It is noted that economic activity associated with adaptation to climate change is not considered an environmental activity but it is recognised that information on this activity may be of particular interest.

4.24 At this stage there has been little development of functional classifications or accounts relating to activities concerning the minimisation of the impact of natural hazards. Consequently, no recommendations regarding the measurement scope, classification or the compilation of tables are provided in the central framework.

4.25 As well as activities aimed at protecting the environment and managing natural resources, there are activities aimed at avoiding or treating damage resulting from an already polluted environment. Examples include expenditure associated with avoiding local noise or air pollution by moving house or changing job; expenditure on cleaning

and restoring dirty or damaged buildings resulting from air pollution; and hospital treatment for people adversely affected by poor quality environments. The common focus of these activities and expenditures is that they relate to protecting and managing the impact of environmental changes on people and produced assets rather than protecting and managing the environment. Consequently, these activities are not considered environmental activities and are not discussed further in this chapter.

4.2.4 Classification of environmental activities

4.26 Section 4.2.3 described the environmental activities in scope of the central framework. This section outlines the classification of these environmental activities – the Classification of Environmental Activities (CEA).

4.27 The CEA is a functional classification used to classify environmental activities, environmental products, and environmental expenditures and other transactions. It covers the two types of environmental activities (environmental protection and resource management). The top level classes for the two groups of the CEA are outlined in Table 4.2.2. Within Group I: Environmental Protection, the activities are classified by environmental domain such as air, waste, and water. For Group II: Resource management, the activities are classified by type of resource, broadly following the classification of environmental assets described in Chapter 5. Activities that are broad ranging, such as those relating to management and research, are allocated to classes at the end of each group.

Table 4.2.2 Classification of Environmental Activities - Overview of groups and classes

Group	Classes
I: Environmental Protection (EP)	1 Protection of ambient air and climate
	2 Wastewater management
	3 Waste management
	4 Protection and remediation of soil, groundwater and surface water
	5 Noise and vibration abatement (excluding workplace protection)
	6 Protection of biodiversity and landscapes
	7 Protection against radiation (excluding external safety)
	8 Research and development for environmental protection
	9 Other environmental protection activities
II: Resource Management (RM)	10 Management of mineral and energy resources
	11 Management of timber resources
	12 Management of aquatic resources
	13 Management of other biological resources (excl. timber and aquatic resources)
	14 Management of water resources
	15 Research and development activities for resource management
	16 Other resource management activities

4.28 A particular boundary issue concerns the treatment of activities associated with the production of energy from renewable sources and the treatment of activities associated with energy saving. To a large extent the treatment is likely to depend on the structure of the energy supply in each country. The treatment should be determined on the basis of the application of the primary purpose of the activity whether it is for environmental protection, for resource management or for the general production of energy.

4.29 Where activity related to energy saving and renewable energy sources is of considerable importance, the allocation of this activity to different classes in different situations may impact on the comparability of aggregates relating to environmental protection and resource management over time and across countries. In general, countries should therefore include the production of renewable energy and energy saving activity under resource management unless there are clear reasons for classifying part of these activities elsewhere.

4.2.5 Environmental goods and services

4.30 Based on the definitions of environmental activities, it is possible to define environmental goods and services and environmental producers. Environmental goods and services are different from ecosystem services and ecological goods and services which are terms used to describe various flows within the environment and from the environment to

the economy and society. In contrast, environmental goods and services in the SEEA are flows of products produced within the economy.

4.31 In general terms, environmental goods and services comprise the following types of products:

i. Environmental specific services that are "characteristic" or typical of either environmental protection or resource management (for example, waste and wastewater management and treatment services);

ii. Products that are used only in undertaking environmental protection or resource management activity, known as either "connected" or "sole-purpose" products depending on the type of statistics being compiled (examples of these products include catalytic converters, septic tanks and rubbish containers); and

iii. Adapted goods, often known as "cleaner" or "environmentally friendly" goods (for example, energy efficient washing machines, and glass bottles made from recycled glass).

4.32 In addition, there is often interest in "end-of-pipe" and "integrated" technologies that are for environmental protection or resource management purposes.

4.33 In practice, the definition and measurement scope of these different products varies depending on the type of account or set of statistics being compiled. Hence, the relevant definitions of environmental goods and services for measurement purposes are separately described for Environmental Protection Expenditure Accounts (EPEA) and statistics on the Environmental Goods and Services Sector (EGSS) in Section 4.3

4.2.6 Environmental producers

4.34 Relevant sets of environmental producers can be defined but, as for environmental goods and services, the measurement scope varies depending on the type of account or set of statistics being compiled. The main type of producer recognised in the different accounts and statistics is specialist producers whose primary activity is the production of environmental goods and services. Also separately identified are non-specialist producers (who produce environmental goods and services for sale but for whom this is not their primary activity) and own-account producers. The relevant definitions of environmental producers for measurement purposes are described separately for EPEA and statistics on EGSS in Section 4.3.

4.35 Some general comments on environmental producers do apply however. Own-account producers are units that produce characteristic products but do not sell the products to other economic units and instead consume the outputs themselves. Examples of this type of production include depollution of exhaust gases and the own-account incineration of waste. Since this own-account production is not the primary activity of these units, they are not treated as specialist producers but rather together with non-specialist producers.

4.36 Following the SNA, own account production is not normally separately identified and rather the costs of undertaking the activity are assumed to be part of the overall

costs of producing the primary or secondary output of the establishment. However, in the SEEA, given the need to focus on specific environmental activities, wherever they occur in the economy, it is recommended that own-account production activities be separately identified wherever possible. This separate identification allows a complete coverage of environmental activities and also allows analysis of changes in the extent of outsourcing of these activities to other establishments compared to undertaking the activity "in-house".

4.37 Many producers of environmental goods and services are government units that may either be specifically established to deliver these outputs (and hence are considered specialist producers) or they may be part of larger government agencies. Some of these units may be non-market producers. Since the output of non-market units is measured in quite a different way (as the sum of costs) it is recommended that all relevant government producers be clearly separated.

4.38 Many environmental protection and resource management activities are undertaken by household units. Where production is undertaken for sale, these units are treated in the same way as any other specialist or non-specialist producer. Where the production is done on own-account, the output should also be recognised in line with the measurement of own-account production as discussed above. In this case, the value of own-account production will be reflected as household final consumption or gross fixed capital formation depending on the type of output produced.

4.3 Environmental activity accounts and statistics

4.3.1 Introduction

4.39 This section describes two different sets of information concerning environmental activity. The first set concerns the recording, within an accounting framework, of expenditures and related national accounts flows in relation to environmental activities. Accounts of this type have been developed in relation to environmental protection. These Environmental Protection Expenditure Accounts (EPEA) and supporting statistics on environmental protection expenditure are widely available. Similar accounts and statistics for resource management activities are not as developed but can be compiled following the same concepts and definitions as for EPEA.

4.40 The scope of the EPEA is defined from a demand perspective by the expenditures undertaken by economic units for environmental protection purposes. In addition, for environmental protection specific services, which are considered characteristic or typical of this activity, both the supply and use of these services is considered within the EPEA framework. Thus while the EPEA does not provide a complete view of the supply side for relevant goods and services, it does provide information on the supply of some of the more important environmental protection goods and services. A full EPEA therefore requires information from both purchasers and suppliers of environmental protection goods and services.

4.41 EPEA are a type of functional account as described in the SNA.[23] The construction of EPEA closely follows the concepts, definitions and accounting rules of the core national accounts. However, a degree of deviation from the SNA is applied to either consider specificities of environmental aspects or the measurement objectives of the EPEA that are more targeted than the broader macro-economic focus of the core national accounts.

4.42 The second set of information focuses on the supply of environmental goods and services and is composed of a set of statistics describing major components of the Environmental Goods and Services Sector (EGSS). These statistics include information on the production of the range of environmental goods and services including environmental protection and resource management specific services, environmental sole-purpose products and adapted goods. Unlike the EPEA, statistics on the EGSS are not compiled in a full accounting format but the statistics that are included are defined and measured in a manner consistent with general national accounts data.

4.43 There is a reasonable degree of overlap between the EPEA and the EGSS but there are important differences. The final part of this section describes the relationship between EPEA and EGSS statistics.

4.44 The compilation of EPEA and EGSS statistics requires the collection and organisation of data from a variety of sources. This section does not provide details on how these data can be obtained. Compilation guidance and additional detail regarding these two sets of information can be found in SERIEE – Environmental Protection Expenditure

[23] See 2008 SNA, Chapter 29.

Accounts : Compilation Guide (Eurostat, 2002) and The Environmental Goods and Services Sector: A Data Collection Handbook (Eurostat, 2009).

4.3.2 Environmental Protection Expenditure Accounts (EPEA)

Purpose of EPEA

4.45 The reason to establish accounts for environmental protection is to identify and measure society's response to environmental concerns through the supply and demand for environmental protection goods and services and through the adoption of production and consumption behaviour aimed at preventing environmental degradation. Directly, the EPEA provides information on the value of environmental protection specific services produced across the economy and on the expenditure of resident units on all goods and services for environmental protection purposes.

4.46 Using this information, the EPEA can be used to analyse the extent of environmental protection activities and to assess how expenditure on environmental protection is being financed. The accounts can also be used to derive indicators to highlight change in key areas, such as the resources spent on pollution prevention and abatement, the contribution that environmental protection activities make to the economy, and the shift to pollution preventing technologies.

4.47 Measuring the financial commitment of an economy to environmental protection helps to evaluate the influence of environmental protection costs on international competitiveness, the execution of the polluter pays principles and cost-effect analyses of environmental control mechanisms. Monetary data may also be used to examine the extent to which different economic agents internalise the actual costs of environmental protection in their decision-making. In this regard, data on environmental taxes may provide useful complementary information (see Section 4.4).

4.48 Additional analysis may also be supported by linking expenditure on environmental protection to physical data such as the amount of waste treated or the level of air emissions. Models may be developed that link potential changes in environmental pressures, such as air emissions, to future economic activity given particular levels of expenditure on environmental protection.

EPEA tables

4.49 There are three main, interlinked EPEA tables. The first table presents information on the production of characteristic environmental protection products, i.e. environmental protection specific services by resident producers in the form of a combined production and generation of income account. The second table presents a supply and use table for these specific services. It incorporates the total supply of specific services from resident producers and the rest of the world and the use of those environmental protection specific services by various economic units.

4.50 The third table broadens the scope of the EPEA to include connected products and adapted goods purchased by those undertaking environmental protection activities. It also adds in capital formation for environmental protection activities by specialist, non-specialist and own-account producers, and relevant environmental protection transfers. The addition of these flows provides an estimate of the total outlays by an economy on environmental protection that is reflected in the aggregate, national expenditure on environmental protection.

4.51 The environmental goods and services presented in the tables in this section can be further disaggregated by classifying the relevant production and expenditure according to the environmental protection classes of the Classification of Environmental Activities as presented in Section 4.2.

Production of environmental protection specific services

4.52 Environmental protection specific services are those products that are "characteristic" or typical of environmental protection activity. Hence, ***environmental protection specific services are environmental protection services produced by economic units for sale or own-use.*** Examples of environmental protection specific services are waste and wastewater management and treatment services.

4.53 The production of environmental protection specific services is shown in Table 4.3.1. The production of environmental protection services is broken down by specialist producers, non-specialist producers and own account producers. In addition government specialist producers are separately identified.

4.54 Specialist producers in the EPEA are establishments whose primary activity is the production of environmental protection specific services. Non-specialist producers are those establishments that produce environmental protection specific services as secondary or own-account output but have a different primary activity. The EPEA does not present information on the producers of other environmental goods and services.

4.55 The table shows output of environmental protection specific services and goes on to show a full range of relevant variables including intermediate consumption, value added, and compensation of employees. Where possible the intermediate consumption of these producers should be split into the intermediate consumption of environmental protection specific services and the intermediate consumption of other goods and services.

4.56 An additional entry is made for gross fixed capital formation and acquisitions less disposals of non-produced, non-financial assets (such as land) by producers of environmental protection specific services. Since the activity of specialist producers is primarily targeted toward environmental protection, all of their expenditure, including the purchase of capital equipment to undertake their production, is within scope of environmental protection expenditure. This does not apply to other producers where only capital formation for characteristics activities i.e. capital formation targeted towards the production of specific services should be included.

Table 4.3.1 Production of environmental protection specific services

		Producers				Total
		Specialist producers		Non-specialist producers	Own account producers	
		Government producers	Other specialist producers			
Output of environmental protection specific services						
Intermediate consumption						
Environmental protection specific services						
Other goods and services						
Gross Value Added						
Compensation of employees						
Taxes less subsidies on production						
Consumption of fixed capital						
Net Operating Surplus						
Supplementary items						
	Labour input					
	Gross fixed capital formation					
	Acquisition less disposal of non-produced, non-financial assets					

4.57 All of the values in Table 4.3.1 are measured in a manner consistent with the accounting conventions of the SNA. Consequently, the aggregates such as gross value added and net operating surplus can be meaningfully compared to macro-economic aggregates such as GDP as derived from the core national accounts framework.

4.58 However, it is noted that the inclusion of own-account production extends the range of entries compared to the core national accounts and hence measures of output and intermediate consumption will be larger than if this activity were not separately identified.

Supply and use of environmental protection specific services

4.59 The production of environmental protection specific services is supplemented by imports to obtain a measure of total supply. Total supply is used by other economic units in the economy and may also be exported. These flows are recorded as in Table 4.3.2. The top half of the table is the supply table. It shows the supply of specific services from output of resident producers and from imports, and the link between the output of specific services valued at basic prices and the valuation of this output at purchasers' prices. This follows the standard valuation relationships as described in Chapter 2.

4.60 The second half of the table is the use table. In this table the total supply of specific services is shown as used as (i) intermediate consumption by either specialist or other producers, (ii) final consumption by households or governments, (iii) gross fixed capital formation, or (iv) exports to the rest of the world. All entries in the use table are in purchasers' prices.

Table 4.3.2 Supply and use of environmental protection specific services

	Output at basic prices	Taxes less subsidies on products	Trade and transport margins	Output at purchasers' prices		Imports	**Total supply**
Environmental protection specific services							
	Intermediate consumption		Final consumption		Gross fixed capital formation	Exports	**Total use**
	Specialist producers	Other producers	Households	Government			
Environmental protection specific services							

Expenditure for environmental protection purposes

4.61 Table 4.3.3 outlines a table relevant for the assessment of expenditure for environmental protection purposes. The scope of information on expenditure for environmental protection purposes is not limited to the use of environmental protection services as presented in Table 4.3.2. The scope covers expenditure on all goods and services used for environmental protection. This includes (i) expenditure on environmental protection specific services, (ii) expenditure on environmental protection connected products; and (iii) expenditure on adapted goods.

4.62 In addition, the table includes the total gross fixed capital formation and acquisitions less disposals of non-produced non-financial assets by specialist and other producers for the purposes of producing environmental protection specific services. Finally, the table includes subsidies and transfers to the extent that they are not included in the value of goods and services already recorded (e.g. subsidies that reduce the market price of products are added back in, and transfers to and from the rest of the world are included).

4.63 Environmental protection specific services are defined above. ***Environmental protection connected products are products whose use directly serves environmental protection purposes but which are not environmental protection specific services or inputs into characteristic activities.***

4.64 ***Adapted goods are goods that have been specifically modified to be more "environmentally friendly" or "cleaner" and whose use is therefore beneficial for environmental protection.*** Only the extra costs paid in order to acquire an adapted good are considered as environmental protection expenditure.

4.65 Examples of connected products include septic tanks, maintenance services and other products for septic tanks, catalytic converters for vehicles, trash bags, bins, rubbish containers and compost containers. Examples of adapted goods include de-sulphurised fuels, bio-fuels, mercury-free batteries and CFC-free products. Some specific difficulties in measuring adapted goods are discussed further below.

4.66 For connected products it is important to understand the production arrangements taking place within a country. For example, when estimating the expenditure associated with the use of bins, wheeled rubbish containers, etc., those that are owned by specialist producers engaged in collecting waste should not be treated as connected products but rather included in the intermediate consumption or gross fixed capital formation of the specialist producers.

4.67 The expenditure may relate to intermediate consumption, final consumption or gross fixed capital formation. There is potential for gross fixed capital formation to be recorded for environmental protection specific services in cases where the expenditure leads to improvements in land which, following the SNA, are treated as gross fixed capital formation in land improvements. Exports are not included in Table 4.3.3 as they represent expenditure by economic units in the rest of the world.

4.68 In Table 4.3.3 all resident purchasers of environmental protection goods and services are included. These comprise producers of environmental protection specific services, other producers, households, general government and non-profit institutions serving households.

Table 4.3.3 Total national expenditure on environmental protection

		Users						
		Industry			Households	General government	Non-profit institutions serving households	Total
		Producers of Environmental protection specific services		Other producers				
		Specialist producers	Non-specialist and own-account producers					
Type of expenditure by product								
Environmental protection specific services								
	Intermediate consumption	NI						
	Final consumption							
	Gross fixed capital formation	NI						
Connected products								
	Intermediate consumption	NI						
	Final consumption							
	Gross fixed capital formation	NI						
Adapted goods								
	Intermediate consumption	NI						
	Final consumption							
	Gross fixed capital formation	NI						
Capital formation for characteristic activities								
Specific transfers for environmental protection not included above								
Environmental protection transfers to and from the rest of the world (net)								
Total national expenditure on environmental protection								

NI – Not included in the derivation of total national expenditure on environmental protection

4.69 While Table 4.3.3 provides the broad framework for the calculation of total national expenditure, a number of factors need to be considered.

Measurement of capital formation

4.70 In addition to capital formation on environmental protection goods and services, there will be expenditure by specialist producers and other producers of environmental specific services on other capital items required for the production of environmental protection specific services. These amounts should be recorded separately.

4.71 Since the activity of specialist producers is primarily targeted toward environmental protection, all of their expenditure, including the purchase of capital equipment to undertake their production and the net acquisition and disposal of non-produced non-financial assets, particularly land, is within scope of environmental protection expenditure. This broad scope does not apply to non-specialist and own-account

producers where only capital formation targeted towards the production of specific services should be included.

4.72 As the total gross fixed capital formation (GFCF) for characteristic activities by specialist, non-specialist and own-account producers is recorded in a separate row in Table 4.3.3, in principle, any such GFCF that includes purchases of environmental protection goods and services should not be counted a second time. For specialist producers, such GFCF on environmental protection goods and services is labelled "NI" in Table 4.3.3. For non-specialist and own-account producers such GFCF should also be excluded.

4.73 For non-specialist and own account producers two particular types of gross fixed capital formation for environmental protection can be distinguished:

i. Expenditure on "end-of-pipe" technologies used to treat, handle or dispose of emissions and wastes from production. This type of spending is normally easily identified even within the context of own-account activity because it is usually directed towards an "add on" facility which removes, transforms or reduces emissions and discharges at the end of the production process;

ii. Expenditure on "integrated" investments, also called cleaner technologies. These are new or modified production facilities designed so as to ensure that environmental protection is an integral part of the production process, thereby reducing or eliminating emissions and discharges and thus the need for end-of-pipe equipment.

4.74 Depending on the nature of the integrated investment, expenditure can be estimated from the cost of the modification of existing equipment or based on the extra cost due to pollution control, energy savings and the like (i.e. the cost of "non-polluting or less-polluting" equipment is compared with that of "polluting or more-polluting" reference equipment). It is noted that estimating the expenditure on integrated investments requires consideration of the general concerns in measuring adapted goods as described below.

Measurement of adapted goods

4.75 While the general concept of adapted goods can be explained, there are significant measurement challenges in compiling estimates of adapted goods. The primary difficulty is that adapted goods must be defined in reference to a base or equivalent normal good. With this normal good in mind it can be determined as to whether another similar good is cleaner or more environmentally friendly. Such assessments are difficult to make when reference goods no longer exist or when new goods present other advantages in addition to their beneficial effects on the environment. These may include savings on, or substitution of, raw materials; higher productivity and so on, which cannot be isolated in terms of cost.

4.76 The measurement issues may be extended because of the steady integration of environmental standards into equipment and processes. This makes it more difficult over time to distinguish between a cleaner good and the equivalent normal good. Given the different speeds at which new environmental standards are incorporated into different types

of equipment and different countries, the ability to make comparisons of long time-series across industries and countries may be limited.

4.77 Once a set of adapted goods has been defined, the appropriate value of expenditure needs to be determined. For EPEA, only the net or extra cost of the adapted goods is included since it is considered that from the perspective of the purchaser it is this extra cost that represents the amount spent for environmental protection purposes.

4.78 Typically, the method used to estimate the expenditure associated with the purchase of adapted goods is based on physical information about market size (e.g. the amount of desulphurised fuels used). These estimates are then valued by the extra cost due to environmental protection features. Extra costs can be difficult to survey directly so expert assessment and technical knowledge may be used to estimate extra costs (for example, the extra costs of producing desulphurised fuels or of environmental adaptations of vehicles).

4.79 However, while these measurement difficulties exist, a misleading picture of expenditure for environmental protection purposes would be obtained if the value of adapted goods is ignored. To support the measurement of adapted goods, lists of relevant products have been developed to form a basis for measurement.[24] Although many adapted goods may exist, experience from countries that have compiled EPEA suggests that only a few are quantitatively important and involve significant extra expenditure, and for many goods no extra costs exist.

Accounting for intermediate consumption

4.80 In general terms, intermediate consumption is equal to the expenditure on goods and services by establishments in the production of their output. The intermediate consumption of other producers recorded in Table 4.3.3 therefore reflects the purchase of environmental protection goods and services (including specific services, connected products, and adapted goods) as part of their production of other goods and services. The environmental protection goods and services are supplied by specialist or non-specialist producers, or they may be imported.

4.81 For own account producers, their output of environmental protection goods and services is valued as the sum of the costs of producing the output. These costs will include the purchase of a range of goods and services (as intermediate consumption) as well as associated salaries and consumption of fixed capital. The amount to be recorded as intermediate consumption in Table 4.3.3 is the total sum of costs (i.e. the total value of own account output) of environmental goods and services, since this is the amount that represents the value of the intermediate consumption of environment protection goods and services into the main activity of the establishment.

[24] For example see SERIEE – Environmental Protection Expenditure Accounts : Compilation Guide (Eurostat, 2002).

4.82 For specialist and non-specialist producers, since their output is sold to other establishments, the costs of producing the output, including intermediate consumption, do not need to be recorded separately since the value is captured in the expenditure on environmental protection goods and services by other units.

4.83 Special consideration is required concerning the intermediate consumption of environmental protection goods and services. For specialist producers, in order to avoid double counting, this part of intermediate consumption must be excluded from total national expenditure on environmental protection as it is also included in the expenditure of other units purchasing the environmental protection specific services from specialist producers. Hence, the relevant cells for intermediate consumption on environmental protection goods and services by specialist producers are labelled "NI – not included" in Table 4.3.3.

4.84 In principle, this adjustment should also be made in relation to the intermediate consumption of environmental protection goods and services used by non-specialist and own-account producers to the extent that these products are used as inputs into characteristic activities, i.e. used for own-account activities or used to produce and sell environmental protection goods and services on the market. In practice, it is assumed that these uses are not significant so that this adjustment is not necessary for non-specialist and own-account producers.

Adjustments for specific transfers and financing by the rest of the world

4.85 There may be transfers between economic units that affect the level of spending on environmental protection but which are not recorded in the earlier categories of expenditure shown in Table 4.3.3. For example, if government subsidises some environmental protection expenditure, then the extent of this subsidy will not be shown at purchasers' prices in the expenditure recorded. Generally, these transfers relate to other subsidies on production and, in many countries, are not significant flows within the EPEA. It is noted that significant transfers may also be paid to and received from the rest of the world. Entries related to these transfers are recorded in the relevant rows at the bottom of Table 4.3.3.

Total national expenditure on environmental protection

4.86 With these considerations in mind, Total national expenditure on environmental protection is defined as

- Final consumption, intermediate consumption, and gross fixed capital formation on all environmental protection goods and services (specific services, connected products and adapted goods), except intermediate consumption and gross fixed capital formation for characteristic activities.

- Plus Gross fixed capital formation (including acquisition less disposal of non-produced non-financial assets) for environmental protection characteristic activities
- Plus specific environmental protection transfers by resident units not captured in the items above;
- Plus environmental protection transfers paid to the rest of the world;
- Less environmental protection transfers received from the rest of the world.

Financing environmental protection

4.87 The estimates of national expenditure on environmental protection show expenditure as undertaken by different units. This may not show who directly bears the cost because of specific transfers between units. However, such financing information provides a valuable insight regarding the source of the funds that finance the national expenditure and how changing financing structures may influence expenditure decisions. For example, if an investment grant for environmental protection is not available, an enterprise may be much less likely to undertake the capital formation in environmental protection.

4.88 The expenditure undertaken by the purchaser groups shown in Table 4.3.3 can be cross-classified to show which units are directly responsible for the expenditures and which directly bear the costs of financing them. This is shown in Table 4.3.4. For both current and capital transfers related to environmental protection, the unit making the transfer has an increase in expenditure and the unit receiving the transfers has a reduction.

4.89 Many of the specific transfers will be subsidies or investment grants where government is the payer of the transfers and it is industries, households or NPISH that benefit. An example of a transfer benefiting households may be a grant to improve house insulation or to increase the reuse of water. In these cases the expenditure can be shown against the government who is providing the funding rather than against the beneficiary.

4.90 Another type of financing arrangement for which an adjustment can be made concerns earmarked taxes. Earmarked taxes are recorded where a direct link exists between the tax revenue collected and expenditure on particular projects. Where the expenditure is for environmental protection purposes, the amount financed by earmarked taxes should be shown as being financed by the units paying the taxes.[25]

4.91 Relevant financing flows concerning the rest of the world correspond to the transfers for international cooperation in the field of environmental protection. These transfers can be financed either by the government, international organisations, corporations, or by households through non-governmental organisations.

[25] To be considered earmarked taxes, the payment must be considered a tax following the definitions of the SNA and there must be clear and unambiguous knowledge, often evidenced in legislation, that the tax revenue will be used for the specific purpose of environmental protection. Depending on their tax bases earmarked taxes may also be considered environmental taxes, see section 4.4.

Table 4.3.4 Financing of national expenditure on environmental protection (Currency units)

Financing units	Users							Total
	Producers of environmental protection specific services		Other producers	Households	Government	Non-profit institutions serving households	Rest of the world	
	Specialist producers	Non-specialist and own-account producers						
Government								
Corporations								
Specialist								
Other producers								
Households								
National expenditure								
Rest of the world								
Total Uses of resident units								

4.92 Making adjustments for these forms of transfers provides information on the source of funds but does not completely determine who ultimately bears the cost of environmental protection. Costs that are initially borne by enterprises are eventually passed on to their customers. This applies to both intermediate consumption and the costs of new capital formation. As well, all government expenditure is funded (at least in large part) by taxes and thus the cost is ultimately borne by those paying the taxes. However, further adjustments to examine the net cost burden of environmental protection are not described here.

4.3.3 Environmental Goods and Services Sector (EGSS)

Purpose of the EGSS statistics

4.93 The Environmental Goods and Services Sector (EGSS) considers environmental activities from the supply perspective and EGSS statistics present information on the production of environmental goods and services in as much detail as possible. This information is important in understanding the economic response to the challenges of environmental degradation and depletion of natural resources. Directly, EGSS statistics provide indicators of the production of environmental goods, services and technologies; the contribution of this production within the economy as a whole; and the extent of related employment, investment and exports from the sector.

4.94 Indirectly, the EGSS statistics provide an information base to assess the potential for economic activity and employment to be based on environmentally friendly and more resource efficient activities and to assess the extent to which the economy is responding to various public policies and initiatives that have this objective in mind. Defining these statistics in an internationally comparable way also permits cross-country comparison and assessment of best practice.

4.95 In principle there is a wide range of economic variables that might be considered within an EGSS context but, due to the complexity of measurement in this area, focus has been on the variables that give an indication of the relative economic size and contribution of EGSS. Thus the main variables under consideration have been the output, value added, employment, exports, and gross fixed capital formation related to the production of environmental goods and services. At this stage, a full functional account for the EGSS has not be defined.

Scope and definition of the EGSS

4.96 The EGSS consists of producers of all environmental goods and services. Thus products that can be identified as being specifically produced, designed, and manufactured for purposes of environmental protection and resource management are within scope of the EGSS. This aligns with the intent of EGSS to provide information on the extent to which the economy may become more environmentally friendly and resource efficient. The environmental goods and services in scope of the EGSS are environmental specific services, environmental sole-purpose products, adapted goods, and environmental technologies. The definitions of these goods and services are outlined in the following paragraphs.

4.97 The first type of environmental goods and services in the EGSS are environmental specific services. This set of services is defined by those products that are “characteristic” or typical of the field of study. In relation to the EGSS, the relevant characteristic activities are the production of environmental protection and resource management services. Hence, ***environmental specific services are environmental protection and resource management services produced by economic units for sale or own-use.*** Examples of environmental

specific services are waste and wastewater management and treatment services, and energy and water saving activities.

4.98 Consistent with the definition of environmental protection and resource management activities, environmental specific services are those services that have the main purpose of:

i. preventing or minimising pollution, degradation, or natural resources depletion (including the production of energy from renewable sources);
ii. treating and managing pollution, degradation, and natural resource depletion;
iii. repairing damage to air, soil, water, biodiversity, and landscapes;
iv. carrying out other activities such as measurement and monitoring, control, research and development, education, training, information, and communication related to environmental protection or resource management.

4.99 The second type of environmental goods and services is known as environmental sole-purpose products. ***Environmental sole-purpose products are goods (durable or non-durable goods) or services whose use directly serves an environmental protection or resource management purpose and that have no use except for environmental protection or resource management.*** Examples of these products include catalytic converters, septic tanks (including maintenance services), and the installation of renewable energy production technologies (e.g. installation of solar panels).

4.100 The third type of environmental goods and services is known as adapted goods. ***Adapted goods are goods that have been specifically modified to be more "environmentally friendly" or "cleaner" and whose use is therefore beneficial for environmental protection or resource management.*** For the purposes of EGSS adapted goods are either:

i. "Cleaner goods" that help to prevent pollution or environmental degradation because they are less polluting at the time of their consumption and/or scrapping compared to equivalent "normal" goods. Equivalent normal goods are goods that provide similar utility except for the impact on the environment Examples are mercury free batteries and cars or buses with lower air emissions.

ii. "Resource efficient" goods, that help to prevent natural resource depletion because they contain less natural resources in the production stage (for example, recycled paper and renewable energy, heat from heat pumps and solar panels) and/or in the use stage (for example, resource efficient appliances, water-saving devices such as tap filters, desalinated water).

4.101 Compared to the definition of adapted goods in the EPEA, this scope is broader through the inclusion of goods beneficial for resource management and also through the inclusion of goods that have no extra costs.

4.102 Adapted goods differ from environmental specific services and sole-purpose products as they do not have a primary purpose of environmental protection or resource management. In EGSS, the measurement scope of adapted goods is broader than in EPEA because the full value of adapated goods is included rather than only the extra cost

compared to the equivalent normal good. A consequence of this difference is that the number of adapted goods within scope of the EGSS is much larger. The same general difficulties of measuring adapted goods as described in Section 4.3.2 apply equally in the EGSS context.

4.103 The fourth type of goods and services is environmental technologies. ***Environmental technologies are technical processes, installations and equipment (goods), and methods or knowledge (services) whose technical nature or purpose is environmental protection or resource management.*** Environmental technologies can be classified as either:

i. End-of-pipe (pollution treatment) technologies which are mainly technical installations and equipment produced for measurement, control, treatment and restoration/correction of pollution, environmental degradation, and/or resource depletion. These installations and equipment operate independently of, or are identifiable parts added to, production and end-life consumption cycles. Examples include equipment to measure soil erosion, and facilities for the containment of high-level radioactive waste.

ii. Integrated (pollution prevention) technologies are technical processes, methods or knowledge used in production processes that are less polluting and resource intensive than the equivalent "normal" technology used by other national producers. Their use is less environmentally harmful than relevant alternatives.

4.104 Note that some environmental technologies may be included in the earlier categories of sole-purpose products or adapted goods.

4.105 Excluded from the scope of environmental goods and services are goods and services produced for purposes that, while beneficial to the environment, primarily satisfy technical, human, and economic needs or that are requirements for health and safety. Goods and services related to minimizing the impact of natural hazards and those related to the extraction, mobilisation and exploitation of natural resources are also excluded.

4.106 In practice, the measurement of environmental sole-purpose products and adapted goods relies on the development of lists of relevant goods and services. For sole-purpose products, the purpose of goods or services is predominantly determined based on the technical nature of the product and its technical suitability to be used for environmental protection or resource management purposes. In certain boundary cases, where the technical nature of the product does not provide a definitive guide, consideration may be given to the intent of the producer of the product. For adapted goods the lists are formed without reference to the primary purpose of the good but are formed rather on an assessment of the technical nature of the good being environmentally friendly or cleaner.

4.107 Many of the products supplied by the EGSS are also recorded in the EPEA described in Section 4.3.2. The EPEA can be an important data source for the EGSS and, in principle, the two systems can be fully reconciled. A reconcilitation would need to take into account, for example, that the EPEA includes all of the gross fixed capital formation for environmental protection characteristic activities but that not all of the products used

for this gross fixed capital formation can be identified as being specifically manufactured for environmental purposes in the EGSS. Hence the EGSS output of capital goods designed for environmental protection will differ from the total gross fixed capital formation recorded in the EPEA. In practice, a full reconciliation is a complex operation that is rarely done.

4.108 In the EGSS, specialist producers are those producers whose primary activity is the production of environmental goods and services, including specific services, sole-purpose products, adapted goods, and environmental technologies. This scope is broader than the scope of specialist producers in EPEA which is limited to producers whose primary activity is the production of environmental protection specific services. In the EGSS, government producers are separately recorded as an important type of specialist producer.

4.109 Non-specialist and own-account producers, including households, are also separately identified in the EGSS. Own-account production is measured following the treatments outlined in Section 4.2.

4.110 Because of the production focus of EGSS statistics, there may be interest in structuring information by institutional sector (corporations, government, households, non-profit institutions serving households) or by type of economic activity following ISIC.

Statistics on the EGSS

4.111 The basic structure of statistics concerning the EGSS follows the format presented in Table 4.3.5. For each type of producer the output may also be classified following the relevant parts of the Classification of Environmental Activities – that is, by allocating the value of output to relevant classes of environmental protection activity or resource management activity as appropriate.

Table 4.3.5 Environmental Goods and Services Sector

			Producers			
			Specialist producers		Non-specialist producers	Own-account producers
			Government producers	Other specialist producers		
Output of environmental goods and services						
	Environmental specific services	Env. protection				
		Resource mgt.				
	Connected products	Env. protection				
		Resource mgt.				
	Adapted goods	Env. protection				
		Resource mgt.				
	End-of-pipe technologies	Env. protection				
		Resource mgt.				
	Integrated technologies	Env. protection				
		Resource mgt.				
	Total environmental goods and services produced					
Output of Other goods & services						
Total output						
Share of environmental goods and services in total output						
Intermediate consumption		Total				
		For production of environmental g&s				
Gross Value Added		Total				
		From production of environmental g&s				
Compensation of employees		Total				
		For production of environmental g&s				
Employment		Total				
		For production of environmental g&s				
Gross fixed capital formation		Total				
		For production of environmental g&s				
Exports of environmental goods and services						

4.112 The size of the EGSS is not equal to the total output of all of the producers within scope of the EGSS. Most EGSS producers will produce a range of other goods and services and therefore, the production of environmental goods and services may only be a relatively small component of their total output. This is recognised in the table by the inclusion of the row "Output of other goods and services" and the derivation of the share of environmental goods and services in total output.

4.113 Output is measured following standard national accounts conventions and principles. Variables other than output such as intermediate consumption, gross value added, compensation of employees, employment, gross fixed capital formation and exports should only refer to an establishment's production of environmental goods and

services should not be related to the establishment's total output. Where direct estimates of these variables with respect to the production of environmental goods and services cannot be obtained, an estimation approach is to multiply the total estimate of the variable (e.g. total intermediate consumption) by the output share for environmental goods and services. Since this assumes that the production function for the producer is the same for environmental goods and services and other goods and services, estimates obtained using this approach should be assessed in conjunction with expert advice as available.

4.3.4 Relationship between EPEA and EGSS

4.114 While both EPEA and EGSS are focused on the measurement of environmental activities they so do from different perspectives and, consequently, there are important differences between them. The main differences are described in the following paragraphs and summarised in Table 4.3.6.

4.115 Accounting structure. The EPEA follows a more complete functional accounting structure. It links the supply and use of environmental protection specific services with expenditure on connected products and adapted goods and other relevant environmental protection transactions (such as taxes and subsidies) in the sequence of accounts. The EGSS, at this stage of its development, focuses only on statistics related to the production of environmental goods and services.

4.116 Coverage of environmental activities. The EPEA covers only environmental protection characteristic activities while the EGSS covers production activity for both environmental protection and resource management activity. It is noted however that the accounting structure of EPEA can be applied in the development of a resource management expenditure account.

4.117 Coverage of environmental goods and services. Given its demand perspective, the EPEA includes all goods and services that are used in undertaking environmental protection activity, not all of which are produced by EGSS producers. For example, fixed assets related to environmental protection expenditure will cover any specialised equipment purchased, and will also include the more general expenditure on buildings, cars, computers, etc required by specialist producers of environmental protection services. The EGSS, on the other hand, focuses on environmental goods and services from the production perspective and defines the scope of these products from a technical product-based perspective.

4.118 Coverage of environmental producers. In the EPEA, the information concerning production is limited to environmental protection specific services, thus the specialist producers in the EPEA are only those establishments whose primary activity is the production of environmental protection specific services. In the EGSS, production is the main focus and in these statistics specialist producers are those whose primary activity is the production of *any* environmental good or service.

4.119 Valuation of adapted goods. When valuing output the EGSS includes the total value of adapted goods. For the EPEA, the focus is on the cost incurred for environmental

protection purposes and hence only the *extra* cost associated with the purchase of adapted goods is included. The expenditure on cleaner goods which are not more costly is not included in the EPEA at all.

4.120 Coverage relating to international trade. Both EGSS and EPEA record imports and exports of goods and services consistently with the national accounts. However, in the EPEA the expenditure of residents includes imports *from* the rest of the world while in the EGSS the production of resident producers includes exports sent *to* the rest of the world. Comparison of aggregate measures of expenditure and production from each set of statistics should take this difference into account.

4.121 Treatment of taxes and subsidies. When valuing output the EGSS measures are valued at basic prices and hence exclude taxes on production and include subsides on production. Measures of expenditure in the EPEA are valued at purchasers' prices, thus including taxes on production and excluding subsidies on production. Also, the measure of national expenditure on environmental protection includes any additional environmental protection related subsidies that are not already captured in the value of expenditure on environmental goods and services themselves, as well as transfers to and from the rest of the world.

Table 4.3.6 Comparison of EPEA and EGSS

Area of difference	**EPEA**	**EGSS**
Accounting structure	Full functional account	Table of production related statistics
Coverage of environmental activities	Environmental protection characteristic activities	Production of goods and services used for Environmental protection and Resource management
Coverage of types of environmental goods and services	All	All
Coverage of environmental producers	Producers only included in relation to environmental protection specific services	Producers included in relation to all environmental goods and services
Valuation of adapted goods	Net / extra cost only	Full value (at basic prices)
Coverage relating to international trade	Imports included in aggregate measures of expenditure	Exports included in aggregate measures of production
Treatment of taxes and subsidies	Valuation of expenditure at purchasers' prices	Valuation of output at basic prices

4.4 Accounting for other environmentally related transactions

4.4.1 Introduction

4.122 There is a wide range of transactions related to the environment that are recorded in the core framework of the national accounts. Many of these transactions have been discussed in the previous section on the measurement of EPEA and EGSS. In that section, emphasis was placed on the purpose of the transaction either from the perspective of the producer or from the perspective of the purchaser and the types of transactions considered primarily related to output, intermediate consumption, final consumption and gross fixed capital formation.

4.123 This section focuses on other transactions in the core national accounts framework that may be of interest in the analysis of the economic aspects of the environment and hence be considered as environmentally related. Some of these transactions might also be identified as having an environmental purpose as discussed in Section 4.2 and hence are considered environmental transactions. Of particular interest in this regard are flows of environmental taxes and subsidies.

4.124 The role of government in the interactions between the economy and the environment is of particular interest to many. For politicians and government officials, there is interest in whether various incentives or penalties can be effectively used to influence economic and human behaviour in relation to the environment. For households and businesses there is interest in knowing the costs and benefits involved in using natural resources and ecosystem services, such as using the atmosphere as a sink for pollution.

4.125 Many of the mechanisms by which economic behaviour is influenced toward meeting environmental policy objectives involve payments to government, most commonly in the form of taxes, permits and rent; and payments by government in the form of subsidies and other transfers. These transactions are recorded in the national accounts framework but are generally not separately identified as environmentally related. In order to permit the organisation of information about these transactions and to allow comparisons over time and across countries, the section describes the relevant definitions and boundary issues.

4.126 Environmental taxes and subsidies must be considered within a broader framework of payments to and from government. This is required because following national accounting and government finance statistics guidelines there is generally a focus on how the payment relates to the production or consumption process rather than on the purpose of the payment. Thus, for example, taxes on income are clearly distinguished from taxes on goods and services.

4.127 The SEEA only records taxes and subsidies for which an actual transaction takes place between institutional units. In some cases there is interest in the value of so-called implicit subsidies, for example via tax exemptions or preferential tax rates. However, as there are no transactions recorded in relation to these amounts following standard national accounts principles, no estimates of the values of these flows are included in the SEEA.

4.128 In addition to payments to and from government, there are other transactions of a similar nature recorded in the national accounts that may be considered environmentally related and hence of interest in the analysis of environmental matters. Examples are donations made by households and firms to non-profit environmental groups. Table 4.4.1 describes a broader framework of payments to and from government and similar transactions between other sectors. Potentially, all of these types of transactions may be environmentally related in nature.

Table 4.4.1 Selected payments to and from government and similar transactions

		Payments received by				
		Government	**Corporations**	**Households**	**NPISH ***	**Rest of the world**
Payments made by	**Government**	Transfers between levels of government	Subsidies Investment grants	Current & capital transfers	Subsidies Current & capital transfers	Current and capital transfers
	Corporations	Taxes Fines Fees & charges Rent	Rent	Rent	Donations	Donations to NPISH in ROW
	Households	Taxes Fees & charges Fines			Donations	Donations
	NPISH *	Taxes	Current and capital transfers	Current and capital transfers		Current and capital transfers
	Rest of the world	Taxes Current transfers			Donations	

* Non-Profit Institutions Serving Households

4.129 The final type of environmentally related transactions are transactions concerning the use of environmental assets and transactions concerning fixed assets used in economic activities related to the environment. Transactions concerning the use of environmental assets include payments of rent, the granting of permits and licences, and other similar payments. A particular focus of discussion in this section is the appropriate accounting entries to record permits for the use of environmental assets as a sink.

4.130 Transactions concerning fixed assets used in economic activities related to the environment primarily concern the accounting entries required to consider the full cost of fixed assets and in particular, the cost of disposing of fixed assets at the end of their operational life and the remediation of the surrounding environment.

4.131 This section is structured to discuss environmentally related payments by government; then environmentally related payments to government, primarily environmental taxes; next payments for the use of environmental assets; and finally, transactions in fixed assets used in economic activities related to the environment.

4.4.2 Environmentally related payments by government

4.132 Payments by government are recorded in a number of places in the national accounts and government finance statistics. The treatment largely depends on how the payments relate to production and consumption and whether they are considered to be current or capital in nature.

4.133 All of the payments to be considered in this section are transfers. A transfer is a transaction in which one institutional unit (in this case the government) provides a good, service or asset to another unit without receiving from the latter any good, service or asset in return as a direct counterpart.[26] Consequently, this section does not include payments by government in the purchase of goods and services.

4.134 Often transfers by government are generically referred to as "subsidies". However, in economic accounting, only certain transfers are treated as subsidies. The following paragraphs outline the relevant definitions for the various transfers by governments.

Environmental subsidies and similar transfers

4.135 An environmental subsidy or similar transfer is a transfer that is intended to support activities which protect the environment or reduce the use and extraction of natural resources. It includes those transfers defined by the SNA as subsidies, social benefits to households, investment grants and other current and capital transfers. [27]

- Subsidies are current unrequited payments that government units, including non-resident government units, make to enterprises on the basis of the levels of their production activities or the quantities or values of the goods or services that they produce, sell or import.
- Social benefits to households are current transfers received by households intended to provide for the needs that arise from certain events or circumstances, for example sickness, unemployment, retirement, housing, education or family circumstances.
- Investment grants consist of capital transfers made by governments to other residents or non-resident institutional units to finance all or part of the costs of their acquiring fixed assets.
- Other current transfers consist of all current transfers between resident institutional units, or between resident and non-resident units, other than current taxes on income, wealth, etc, social contributions and benefits and social benefits in kind. It includes transfers between levels of governments, between general government and foreign governments, and transfers to and from non-profit institutions.

[26] 2008 SNA, paragraph 8.10

[27] For detailed descriptions of these transfers refer to 2008 SNA paragraphs 7.98 – 7.106, 8.87 – 8.140 and 10.200 – 10.212.

- Other capital transfers consist of all capital transfers except capital taxes and investment grants. Examples include transfers from central government to units at lower levels of government; and legacies, large gifts and donations by households or enterprises to non-profit institutions intended to finance the purchase of fixed assets.

4.136 The decision as to whether a particular transfer by government is environmental is based on consideration of the purpose of the transfer. From an analytical perspective the primary focus is to determine how much expenditure is being allocated towards achieving environmental outcomes. Thus, a subsidy or similar transfer should be treated as environmental when the primary intent or purpose of the government is that resources be used for either environmental protection or resource management purposes.

4.137 In theory, a decision as to whether the primary purpose of a transfer is environmental should be made for each individual transfer. Then, once a decision on the primary purpose has been made the total value of the transfer is treated as being for that primary purpose.

4.138 In practice, information on transfers by government is usually contained in budget and other government expenditure data. Generally, these data do not show individual transactions and more commonly will show information by type of government program thus including a large number of individual transfers. It will usually be the case that such programs have multiple purposes and hence determining the number and value of individual transfers that have a primary purpose of environmental protection or resource management may require additional information.

4.139 In these situations, it may be necessary to estimate the share of the value of transfers for a given government program that reflects the value of individual transfers within the program that have environmental protection or resource management as their primary purpose.

4.140 The treatment should not be determined based on whether the use of the resources by the recipient of the transfer results in positive outcomes for the environment. Thus while it is reasonable to consider that the purpose of the government in making the transfer and the purpose of the recipient are the same, it may not be the case that the expenditure of the transferred resources results in beneficial environmental outcomes even if this was the intent.

4.141 For analytical purposes, an aggregate measure of these different payments may be compiled. The aggregate measure of environmental subsidies and similar transfers paid by government is the summation of all those types of transfers listed above that are considered to be environmental based on the primary purpose of the payment.

Classification of environmental subsidies and similar transfers

4.142 Since the definition of environmental subsidies and similar transfers is based on the assessment of environmental protection and resource management purposes then, in principle, it is possible to consider the use of the Classification of Environmental Activities

(CEA) Part I (Environmental Protection Activities) and Part II (Resource Management Activities).

4.143 For accounting and analytical purposes, it is necessary to separate the transfers into those of a current and capital nature following the definitions in the SNA.[28] It may also be useful to classify the transfers by the industry or institutional sector of the recipients using ISIC or standard SNA institutional sector classifications.

Potentially environmentally damaging subsidies

4.144 The definition of environmental subsidies and similar transfers focuses on the government's intention rather than on the effect on the state of the environment from the use of the resources provided. Another perspective that may be taken is whether the size and structure of payments from governments are environmentally beneficial or environmentally damaging. A measure reflecting this perspective is Potentially Environmentally Damaging Subsidies (PEDS), encompassing subsidies and similar transfers that support activities that are considered environmentally damaging. In some definitions this measure also includes so-called implicit (or indirect) subsidies, such as preferential tax rates. A definition of PEDS is not included in the SEEA.

4.4.3 Environmentally related payments to government

Environmental taxes

4.145 The majority of the different payments made to government are taxes. Taxes may be labelled in different ways and thus care must be taken to ensure that the underlying basis of the payment is well understood.

4.146 Taxes are compulsory, unrequited payments, in cash or in kind, made by institutional units to government units[29]. They are grouped in the following categories

- Taxes on products consist of taxes payable per unit of some good or services. Taxes on products include value added type taxes, taxes and duties on imports, and export taxes.
- Other taxes on production consist of all taxes except taxes on products that enterprises incur as a result of engaging in production. Examples include taxes payable on land, fixed assets or labour employed in the production process.
- Taxes on income consist of taxes on incomes, profits and capital gains.
- Other current taxes consist of current taxes on capital (such as taxes on land, buildings and net wealth) and miscellaneous current taxes (such as payments by households to obtain certain licences).

[28] 2008 SNA, paragraph 8.10

[29] For details on the definitions of the different types of taxes refer to 2008 SNA paragraphs 7.71 – 7.97, 8.52 – 8.64 and 10.207.

- Capital taxes consist of taxes levied at irregular and infrequent intervals on the values of assets or net worth owned by institutional units or on the values of assets transferred between institutional units as a result of legacies, gifts inter vivos or other transfers.

4.147 The decision as to whether a payment regarded by the SNA as a tax is environmental is based on consideration of the tax base. Specifically, an environmental tax is a tax whose tax base is a physical unit (or a proxy of it) of something that has a proven, specific negative impact on the environment. In practice, this definition is applied by looking at all of the various taxes levied in a country and making an assessment as to whether the tax base in each circumstance is something that has a negative environmental impact.

4.148 Since the application of this definition may vary across countries, for the purposes of international comparison of environmental taxes, lists of relevant taxes bases that satisfy this definition have been developed by the Organisation for Economic Cooperation and Development, the European Environmental Agency and Eurostat.[30]

4.149 The consideration of the tax base in the determination of the environmental status of a tax is an exception to the general approach to defining the environmental status on the basis of the purpose of the transaction. However, in the case of taxes, generally the payer does not know in advance as to what the tax payment might be used for by the government. Indeed, the primary purpose of taxation in many cases will be the raising of funds to pay for general social services such as health and education.

4.150 In cases where the intended purpose of the tax is known, these taxes are considered "earmarked taxes". Those taxes that are earmarked for environmental protection are relevant in the calculation of environmental protection expenditure and are discussed in section 4.3.

Environmental tax bases and categories

4.151 There are four broad categories into which environmental taxes are generally grouped - energy, transport, pollution and resources.

i. *Energy taxes* This category includes taxes on energy products used for both transport and stationary purposes. The most important energy products for transport purposes are petrol and diesel. Energy products for stationary use include fuel oils, natural gas, coal and electricity. Taxes on fuel used for transport purposes should be shown as a separate sub-category of energy taxes.

   Taxes on carbon are included under energy taxes rather than under pollution taxes. There are several reasons for this. First, it is often not possible to identify carbon taxes separately in tax statistics, because they are integrated with energy taxes, for example

[30] See *Statistical Framework on Environmental Taxes in OECD Member Countries*, OECD, 1997 and *Environmental taxes – a statistical guide*, Eurostat, 2001.

via differentiation of mineral oil tax rates. In addition, they are partly introduced as a substitute for other energy taxes and the revenue from these taxes is often large compared to the revenue from the pollution taxes. This means that including carbon taxes with pollution taxes rather than energy taxes may distort international comparisons. If they are identifiable, carbon taxes should be reported as a separate sub-category within energy taxes. A special type of carbon taxes are payments for tradable emission permits. The treatment of these permits is discussed later in this section.

ii. *Transport taxes* This category mainly includes taxes related to the ownership and use of motor vehicles. Taxes on other transport equipment (e.g. planes), and related transport services (e.g. duty on charter or scheduled flights) are also included here as are taxes related to the use of roads. The transport taxes may be 'one-off' taxes related to imports or sales of the equipment or recurrent taxes such as an annual road tax. Taxes on petrol, diesel and other transport fuels are included under energy taxes.

iii. *Pollution taxes* This category includes taxes on measured or estimated emissions to air and water, and the generation of solid waste. An exception is taxes on carbon, which are included under energy taxes as discussed above. Taxes on sulphur are included here.

iv. *Resource taxes* This category typically includes taxes on water abstraction, extraction of raw materials and other resources (e.g. sand and gravel, forests). Consistent with the general scope of environmental taxes, payments to government for the use of land or natural resources are treated as rent and therefore are excluded from resource taxes. For detail on the treatment of rent see paragraph 4.150.

4.152 Table 4.4.2 shows a possible recording of environmental taxes. Where other payments to government are of particular significance they could be added within a table of this type. For some types of taxes, particularly energy taxes, a breakdown of payments by industry is relevant. An industry breakdown should be aligned to the breakdown used for the recording of related physical flows as shown in Chapter 3. Thus, for energy taxes, an industry breakdown following the structure of the air emission accounts would be relevant.

Treatment of Value Added Tax

4.153 Generally, Value Added Taxes (VAT) are excluded from the definition of environmental taxes because they are considered to have no influence on relative prices in the same way that other taxes on environmental tax bases do (i.e. VAT is levied on a broad range of goods and services regardless of their impact on the environment). This lack of direct influence is also reflected in the deductible nature of VAT for many tax payers.

4.154 There is one, relatively minor, exception to this general treatment. In principle, where VAT is calculated on a price that includes a duty or tax already determined to be an environmental tax, the relevant amount of non-deductible VAT (equal to the VAT rate multiplied by the amount of the environmental tax) can also be considered to be part of

environmental taxes and classified based on the nature of the underlying tax base. Such a situation may occur when VAT on petrol/gasoline is calculated including the fuel duty paid on hydrocarbon oils. In practice, the ability to isolate this amount of VAT may require additional information.

Table 4.4.2. Environmental taxes

	Type of tax						**Total**
	Taxes on products	Other taxes on production	Taxes on income		Other current taxes	Capital taxes	
			Corporations	Households			
Type of environmental tax							
Energy taxes							
Carbon taxes							
Taxes on fuel used for transport							
Other energy taxes							
Transport taxes							
Pollution taxes							
Resource taxes							
Total environmental taxes							
Non-environmental taxes							
Total taxes							
Share of environmental taxes							

Other environmentally related payments to government

4.155 Only those payments that are considered to be taxes according to the definitions of the SNA are within scope of environmental taxes in the SEEA. At the same time, there may be particular interest in recording other payments to government that may be considered environmentally related such as payments of rent, some sales of goods and services, and some fines and penalties. In determining the environmental status of these payments focus should remain on the basis for the payment rather than on either the name used to describe the payment or the purpose for which the revenue raised may be used. The following paragraphs describe these other types of payments to government.

Rent

4.156 There are certain environmental assets, particularly mineral and energy resources, that are owned by government and payments to government are often required to be made

by extractors of the resources since the government in these situations acts as both owner and taxation authority. These payments are treated as rent. Payments of rent in respect of mineral and energy resources are commonly referred to as royalties and, in resource endowed countries, these payments may represent an important component of total government revenue.

4.157 The income receivable by the owner of an environmental asset for putting the asset at the disposal of another institutional unit is rent. Rent is paid on the use in production of non-produced assets such as land and sub-soil mineral and energy resources. Rent is distinct from rentals that are paid by users of produced assets to the owners of those assets. Examples of rentals include payments for the hire of buildings or equipment and for the hire of cars for transport by tourists. Rentals are treated as payments for services.

4.158 Rent relates to a payment due for the use of an environmental asset for one accounting period. There may be a longer term lease permitting the extractor to operate for an extended period of time but the payment of rent is usually set on an annual basis. Payments of rent usually depend on the level of output of the extractor, usually determined on the basis of the value of sales of extracted resource (quantity extracted multiplied by the resource price).

4.159 As the government is the taxation authority, it is possible for different arrangements to be established by which the government collects the rent it is due as owner of the environmental asset. Some of these arrangements may be in the nature of taxes on profits as defined in the SNA. In principle, amounts of taxes on profits that relate to the income earned from the extraction of environmental assets should be treated as rent. In practice, separating the taxes on profits that relate to income from extraction activity as opposed to other income earned by the extracting company may be difficult. Chapter 5 discusses the estimation of resource rent and the determination of the proportion that accrues to the different economic units.

Sales of goods and services

4.160 In a number of situations the government undertakes a range of activities that provide goods and services to households and businesses. Such provision of goods and services constitute production by government units and payments made by users are often referred to as “fees”. A common situation is the payments made to general government units that operate waste collection schemes for the disposal of waste. In some cases making the distinction as to whether these payments are purchases of goods and services or taxes can be difficult to assess, since it must be determined as to whether the purchaser has received a service from the government in return for the payment. The general guidance in the SNA should be followed.[31]

[31] See 2008 SNA paragraphs 7.80 and 8.64.

Fines and penalties

4.161 Fines and penalties are distinguished from taxes as being compulsory payments imposed on institutional units by courts of law or quasi-judicial bodies.[32] These payments to governments are treated as miscellaneous current transfers. It may well be that some fines and penalties are related to illegal activities of interest in the context of environmentally related payments to government. The recording of fines and penalties also arises in the case of the use of environmental assets as sinks (see Section 4.4.5).

4.4.4 Environmental transfers by non-government institutional units

4.162 While taxes and subsidies are flows that, by definition, are received by or paid by government units, the other types of transfers outlined in this section can take place between other institutional units as shown in Table 4.4.1. For example, households may donate money to conservation groups recorded as other current transfers.

4.163 Where information on these flows is of interest, the amounts to be recorded as environmental should follow the same principles as applied in the case of government flows, i.e. transfers paid to other institutional units should be based on whether the primary purpose of the payer is environmental protection or resource management. Further, payments for the use of environmental assets should be considered environmentally related payments. These types of payments are discussed in more detail in section 4.4.5.

4.164 A particular instance of transfers between institutional units concerns flows between international organisations and national governments and other resident institutional units. In certain countries these flows may be significant. In line with the general principles outlined here transfers paid by international organisations to institutional units within a country should be considered to be environmental if the primary intent of the international organisation is that the money is spent for environmental protection or resource management purposes.

4.4.5 Permits to use environmental assets

4.165 A common and important mechanism for managing the interaction between the economy and the environment is the use of permits and licences to access, extract or use environmental assets. In some cases the permits and licences may relate to the physical removal of environmental assets, such as in the case of fishing licences, and in other cases they may relate to the use of the environment as a sink for emissions.

4.166 Permits and licences relate to the general concept of property rights and in this context it is important to distinguish between the right to the use of an asset and the asset itself. The right to use, or exercise control over, an environmental asset may come about by a number of mechanisms. For example, property rights may arise through the recognition of traditional rights, the ownership of some environmental

[32] See 2008 SNA paragraph 8.135.

assets may come to be regulated by government who then allocates or sells rights to use or control, or the government may issue entitlements to use an asset for free or may auction or otherwise sell the asset.

4.167 In certain cases the property right obtained represents an asset of the holder. To satisfy the definition of being an asset the property right must be conveyed for a period exceeding one year. In addition, there is a range of factors that should be taken into consideration in determining whether a particular arrangement represents an asset. These factors are discussed in detail in 2008 SNA Chapter 17, Part 5.

4.168 Payments for property rights through the purchase of permits, licences and similar arrangements are economic transactions and are important in the context of complete environmental and economic accounting. Increasingly, the permits that are granted can be traded in markets thus creating potential benefits for the holders of the permits beyond the benefits that are obtained from the use of the environmental assets themselves.

4.169 This section outlines the range of different arrangements that are generally encountered and describes the appropriate treatment of the payments following the treatments defined in the SNA. It is noted that compilers will often need to make on balance decisions on the appropriate treatment depending in the precise nature of the way in which the permits and licences are granted and can be exercised. The section is structured by first considering payments to extract and harvest natural resources and then considering payments to use the environment as a sink for emissions.

Permits to extract and harvest natural resources

4.170 The SNA outlines a range of general considerations that should be taken into account in determining an appropriate treatment.[33] The following is structured to consider relevant issues from the perspective of different types of natural resources and the common licensing and permit arrangements.

Mineral and energy resources

4.171 Mineral resources differ from other natural resources in that all extraction necessarily reduces the amount of the resource available for the future. The owner (in many but not all circumstances government) generally does not have a productive activity associated with the extraction but generally payments of rent are made on a regular basis based on the amount of the resource that is extracted. Payments of rent are discussed in Section 4.4 and the appropriate asset and income account entries to record the ownership and use of mineral and energy resources are discussed in Chapter 5, Section 5: Asset accounts for mineral and energy resources.

[33] See 2008 SNA paragraphs 17.313 – 343.

Land

4.172 Land (and the associated natural resources) may be sold outright when the legal ownership is transferred from one institutional unit to another. Land is also the type of asset most frequently subject to a lease. Commonly, farmers leasing land pay regular rent to the owner of the land and these flows are recorded in the allocation of primary income account.

Timber resources

4.173 It is common for logging to be allowed under strict limits with a fee payable per unit volume of timber removed. The limits are usually such that the harvest of timber satisfies conditions required for a sustainable yield and so the payments are recorded as rent in the allocation of primary income account. The acquisition and disposal of forest land including the value of the timber resources should be recorded in the capital account.

Aquatic resources

4.174 Fishing quotas established by national and international agreement may be allocated in perpetuity or for extended periods to particular institutional units. In such circumstances the quotas may be transferable and if so, there may be a well developed market in them. Fishing quotas may therefore be considered as permits to use a natural resource that are transferable and in these situations the quotas are considered assets in their own right.

4.175 An alternative regime is to issue a permit for a strictly limited period of time, less than a year, to a nominated institutional unit, often a non-resident. This is a common practice in some islands in the South Pacific, for example. In these cases the revenue from the licences should be recorded as rent in the allocation of primary income account.

4.176 A licence granted to a household for recreational fishing is considered, by convention, as payment of a tax.

Water resources

4.177 A body of water with an economic value can be sold in its entirety either as part of the land that surrounds it or as a separate entity.

4.178 It is possible that the use of an area of water could be permitted under a long term arrangement recreational purposes, for example. The treatment of payments for such arrangements should be as for land.

4.179 Of increasing interest is the extraction of water from water bodies. Regular payments for the extraction of water (as opposed to the delivery of it) should be treated as rent.

Permits for the use of the environment as a sink

4.180 In addition to recording transactions in relation to payments for the right to extract and access environmental assets, a separate set of considerations is required to record transactions related to the use of the environment as a sink. Specifically, this relates to the right to use the environment, i.e. the soil, water, air and associated environmental assets, as a sink for emissions from economic activity.

4.181 A number of treatments may apply depending on the nature of the arrangements. The following scenarios and treatments are the most common. The treatments align with the definitions of the various payments to government outlined earlier in this section and the same considerations should be considered in the following scenarios.

i. The government may require payments to be made in situations where there are illegal emissions of pollutants beyond certain levels. If these payments are intended to reduce or inhibit discharge and emissions in the future, they should be treated as fines.

ii. If the payments are linked to remedial action following the release of the emission or discharge, the payment is treated as a payment for a service unless the amount charged is out of all proportion to the remedial costs involved, in which case the payment should be treated as a tax.

iii. If a limited number of permits to discharge or emit are issued with the intent to ultimately restrict the overall quantity of discharges and emissions, the treatment of any payment associated with the permits depends on the ownership of the environmental asset into which the emission has been or will be released.

a. Where the economic ownership is established following the principles of the SNA, most commonly this occurs with land and soil, and the necessary conditions are met concerning the terms on which the discharge is permitted, then the payment for the permit should be treated in the same way as the payment for a licence to use an environmental asset.

b. Where the economic ownership is not established following the principles of the SNA then the payment for the permit should be treated as a tax. This is the common situation with regard to the atmosphere, inland water resources and the seas and this treatment generally applies to carbon emission permit schemes.

4.182 In all of these scenarios it is assumed that the permits issued are not tradable. Thus the timing of recording of the payments and the economic units involved can be determined in a relatively straightforward manner using standard accounting principles.

4.183 Increasingly, permits are issued that are tradable and there is an active market in them. Permits concerning carbon emissions are the most significant for most countries. The potential to trade the permits generates a range of accounting complexities concerning the timing of recording, the treatment of changes in the value of permits and the specific economic units involved.

4.184 The complete accounting treatment for tradable permits is still the subject of international discussion under processes managed by the Inter-Secretariat Working Group on National Accounts. The treatment for the final draft of this document will be determined following resolution of the treatment through the ISWGNA processes.

4.185 Although the final accounting treatment for tradable emission permits has not been determined, there is a range of quantity data on emission permits that may be compiled to assist in the analysis of this issue. Table 4.4.3 shows the type of information that can be used regarding the quantity of emission permits – expressed in terms of the millions of tonnes of CO_2. The table is structured along the lines of an asset account showing the opening and closing stock of permits and the various changes in the stock through new issues, purchases, sales and surrenders. Where possible distinctions between flows of free permits, non-free permits and permits from multinational schemes should be recorded.

4.186 Depending on the purpose of analysis and data availability, the columns in the table may reflect the holding of permits by industry (classified following ISIC) or by institutional sector (as shown in the table). While the focus of emission trading schemes is generally on governments and corporations, a significant proportion of permits may be purchased by non-profit institutions.

Table 4.4.3 Account for tradable emission permits (million tonnes CO_2)

	Institutional sector				
	Corporations	General government	Households	NPISH*	Total
Opening stock of permits					
Permits allocated free of charge					
Permits purchased					
Permits sold					
Losses (cancelled permits)					
Permits surrendered to offset emissions					
Closing stock of permits					

* Non-profit institutions serving households

4.4.6 Transactions concerning fixed assets used in environmentally related activities

4.187 Fixed assets cover the range of produced assets that contribute to production processes over a number of accounting periods. They include buildings, machines, various types of equipment including transportation equipment, land improvements, and intellectual property products such as software and research and development expenditure. In undertaking different economic activities different types of fixed capital will be used. Often there is interest in the fixed assets used to extract and harvest natural resources and there is also interest in the amount of investment that takes place in fixed assets for environmental protection or resource management purposes. For example, information on the amount of investment in equipment to capture energy from renewable energy sources may be of interest.

4.188 There are no strict boundaries on which fixed assets may be of interest and no definition of environmentally related fixed assets is provided in the SEEA. Rather, the measurement scope will depend on the focus of the activities being accounted for. For example, fixed assets related to environmental protection expenditure will cover any specialised equipment purchased and also the more general expenditure on buildings, cars, computers, etc required by specialist producers of environmental protection services. In all cases the accounting treatment for fixed assets should follow the treatments outlined in the SNA. These assets are included in the accounts described in Section 4.3.

4.189 It is noted that some fixed assets are also considered environmental assets, for example animals that produce outputs on an ongoing basis such as various breeding stock, dairy cows for milk and sheep for wool; and plants that yield multiple outputs such as vineyards, orchards and rubber plantations. The accounting for these assets is explained in Chapter 5.

4.190 A particular issue in the case of environmental accounting is the appropriate accounting for the costs of the disposal of fixed assets, a process that can have significant environmental impacts. Because of its importance this topic is covered in detail in the remainder of this section.

Environmental consequences of disposing of fixed assets

4.191 To provide a complete accounting for fixed assets it is necessary to consider the costs incurred to prevent environmental problems when production or operation ceases and use of fixed assets ends. For example when

i. Nuclear power plants are decommissioned and final storage of nuclear waste must be provided;

ii. Oil rigs and other mining equipment are dismantled and removed;

iii. Landfills are sealed, gas and leakage collection systems completed, and monitoring equipment installed,

iv. Mines are closed and mining slag heaps are treated to minimise leaching.

4.192 In aggregate these costs are referred to as decommissioning costs. Two types of decommissioning costs are defined – terminal costs and remedial costs. Terminal costs are costs that can and should be anticipated during the production periods prior to closure. Provision should be made to meet them during the life of the asset. Remedial costs are incurred when production has already ceased with no provision having been made for the taking of remedial action while production was in progress. Examples are the rehabilitation of sites contaminated by past activities, for example, fuel storage sites, and former landfill and abandoned mining sites.

4.193 The key distinction between terminal and remedial costs relates to timing of the costs (see below) and who incurs these costs since the nature of the goods and services purchased may be very similar. Terminal costs are incurred by the enterprise that owns the associated asset (oil rig, nuclear power plant etc.) and form part of the link between the value of the asset to the enterprise and the value of services rendered by the asset over its life. In principle they should be anticipated by the owner of the asset even if the expenditure only takes place at the end of the operation of the asset.

4.194 On the other hand, remedial costs are incurred after operations at a site have ceased and, often, are incurred by a unit other than the operator of the site.[34]

Consumption of fixed capital

4.195 As decommissioning costs are associated with measuring the use of fixed assets in the SNA, this discussion commences with a short introduction to the concept of consumption of fixed capital and its links to the value of fixed assets. Broadly, the economic assumption is that the cost of purchasing an asset, at any stage of its useful life, is equal to the net present value (NPV) of the expected stream of income arising from the use of the asset over the remainder of its asset life.

4.196 The using up of an asset over time through its use in production is accounted for by means of an allowance for consumption of fixed capital (commonly known as depreciation). This allowance should be deducted from income and recognised as a cost of production.

The treatment of terminal costs

4.197 In principle, once price changes and other changes in volume[35] are taken into account, the difference between the acquisition and disposal values should be equal to the value of consumption of fixed capital cumulated over the life of an asset. In the case of

[34] There may be cases in which a particular operation ceases but the owner of the site remains the same, e.g. land owned by government. The relevant costs should be considered remedial if they cannot be attributed financially to the original operation.

[35] Other changes in volume are those changes in assets that are not due to transactions between economic units or consumption of fixed capital. Examples include losses due to catastrophic events, uncompensated seizures and the discovery of natural resources. These flows are recorded in the SNA other changes in assets accounts (see 2008 SNA, Chapter 12).

assets with actual costs at the time of disposal, this means that consumption of fixed capital should cover anticipated terminal costs since these costs lower the disposal value. Terminal costs should therefore be written off over the whole life of the asset, regardless of the number of owners during the life of the asset.

4.198 Immediately before the disposal, the asset will have a negative value that is reduced to zero when the terminal costs incurred are treated as gross fixed capital formation. The apparent oddity of an asset with negative value reflects the fact that the owner not only could not sell it but would have to pay another unit to take over responsibility for the asset[36].

4.199 To estimate anticipated terminal costs, it is necessary to estimate not only the extent of these costs, but also their likelihood. In this regard terminal costs present a dual problem— (i) it is often difficult to anticipate their final size, and (ii) the original owner or operator may no longer be an active business able to cover the costs as they have ceased business, declared bankruptcy or an associated surety was based on under-estimated terminal costs.

4.200 There is the added factor that between the initial estimate of terminal costs and the time at which the terminal costs actually incurred, community standards may have changed markedly—meaning that the final terminal costs are meeting very different standards to those initially anticipated. This is especially true of operations conducted over very lengthy time periods.

4.201 Nonetheless, there are a number of indications that terminal costs can reasonably be expected: (i) if an upfront bond (or some other form of surety) has been provided; (ii) if the enterprise is required to progressively put in place contributions to fund the final decommissioning activities; (iii) the past record of the enterprise; and (iv) the strength and commitment of the government of the country in which operations are taking place.

4.202 Terminal costs should be recorded as gross fixed capital formation only at the time incurred but the deduction of these costs from income via consumption of fixed capital should be made progressively over the life of the asset. That is, consumption of fixed capital is charged against income before the disposal/terminal costs are incurred (or fully known). A practical difficulty in estimating terminal costs is that the asset life of the underlying fixed asset may change over time thus requiring changes in the estimates of terminal costs.

4.203 Since terminal costs must be estimated before being incurred, the following four accounting scenarios need to be considered.

i. In situations where the terminal costs ultimately incurred exceed the cumulated consumption of fixed capital allowance, the full costs are still treated as gross fixed capital formation and any amount not already covered by consumption of fixed capital during the life of the asset is written off at the time the costs are incurred as consumption of fixed capital. This is a pragmatic recommendation and will lead to

[36] 2008 SNA, paragraph 10.161

net value added to be over-stated during the periods the asset is in use and under-stated in the period when the remaining costs are incurred[37].

ii. Where no estimates of terminal costs have been made during the life of the asset any terminal costs should be treated as gross fixed capital formation and then immediately written off as consumption of fixed capital, provided that they are paid by the operator.

iii. Where terminal costs are anticipated and a consumption of fixed capital allowance is recorded but the terminal costs are never actually incurred by the operator, the initial estimate of terminal costs must be removed from the balance sheet via the other changes in volume of assets account. [38] Any subsequent decommissioning costs incurred by units other than the operator are treated as remedial costs.

iv. If terminal costs are overestimated compared to actual terminal costs subsequently incurred, this overestimate is corrected in the asset account through an entry in the of other changes in volume of assets account.

Treatment of remedial costs

4.204 Costs of a remedial nature are often incurred after a site has been closed and the operator has left. There are two main types of remedial costs (i) expenditures to restore land to allow its use for some other purpose; or (ii) expenditures to ensure no harmful emissions from deposits of pollutants and other residuals created by past activity are able to leach into surroundings and cause environmental damage. In both cases the relevant expenditures should be treated as gross fixed capital formation and give rise to a fixed asset – land improvement.

4.205 For remedial costs there is no special consideration required as to the timing of reporting or questions over whether the costs are anticipated, since, by definition, these costs are incurred after the operations at the site have ceased and are not incurred by the operator of the site who caused the need for the remediation.

4.206 In cases where environmental protection expenditures are incurred on an ongoing basis such that environmental damage is either inhibited or reduced on a continuing basis then these expenditures should be treated as intermediate consumption of the owner at the time they are incurred and not recorded as either terminal or remedial costs.

[37] 2008 SNA paragraph 10.162

[38] See 2008 SNA, Chapter 12