Chapter IV

Environmental activity accounts and related flows

4.1 Introduction

4.1 An important component of environmental-economic accounting is the recording of transactions in monetary terms between economic units that may be considered environmental. Generally, these transactions concern activity undertaken to preserve and protect the environment. Further, there are a range of transactions, such as taxes and subsidies, that reflect efforts by governments, on behalf of society, to influence the behaviour 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 owing to the structure of the accounts or the types of classifications that are used. The present chapter describes approaches that have developed for recognizing these transactions and provides appropriate definitions and accounts for organizing 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 help assess whether economic resources are being used effectively to reduce pressures on the environment and maintain the capacity of the environment to deliver benefits. In addition, 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 environmental transactions, the primary rearrangement is based on consideration of 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 the underlying statistics also be capable of reorganization so as to provide the requisite information.

4.5 As explained in this chapter, the first task (carried out in sect. 4.2) is to define environmental activities and the associated products and producers.

4.6 Section 4.3 describes the compilation of two sets of information needed for the analysis of environmental transactions: the environmental protection expenditure account (EPEA) and statistics on the environmental goods and services sector (EGSS). Both the EPEA and the EGSS statistics 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 of, and perspective on, environmental activities. Section 4.3 also explains that the structure of the EPEA may be applied in the assessment of expenditures associated with resource management activities.

4.7 Section 4.4 considers a range of other transactions, including environmental taxes and subsidies, and 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 capable of identifying the economic activities, products and producers that are characteristic of the environment. Alternative classifications are needed to distinguish the products and industries frequently associated with the environment from those in other activities through consideration of the purpose of different activities. Using a purpose-based approach, the present section examines the environmental activities covered in the Central Framework and discusses 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 varying degrees, all economic activities require a functioning environment and interact with the environment in some way. Hence, an exhaustive categorization and description of all environmentally related activities are not pursued in the SEEA.

4.10 This section concludes with a presentation of 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 encompasses 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 of their ecological functions; monitoring of the quality of the natural environment (air, water, soil and groundwater); research and development on environmental protection; and the general administration, 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.*** These activities include, but are not limited to, reducing the withdrawals of natural resources (including through the recovery, reuse, recycling and substitution of natural resources); restoring natural resource stocks (increases or recharges of natural resource stocks); the gen-

eral 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 undertaken specifically for biodiversity or landscape protection (e.g., 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 be undertaken only for a single purpose, many activities are 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 and resource management. In practice, the primary purpose must be attributed to particular transactions or groups of transactions as recorded in the accounts.

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 by considering the good or service in question 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 to be related to the environment. Historically, two broad types of economic activity have been discussed in this context, in addition to environmental activities of environmental protection and resource management defined above. They are: natural resource use activities; and activities associated with the minimization of the impact of natural hazards.

4.19 Natural resource use activities involve the extraction, harvesting and abstraction of natural resources, including related exploration and development. These activities are not considered environmental but owing to the specific and direct effect of the production processes involved on the environment, they may be of particular interest in the assessment of environmental impacts and the development of environmental policy.

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

4.21 Often, information on natural resource use activities is contained in standard presentations of economic statistics and 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, owing to variation in the 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 V.

4.22 The second set of economic activities related to the environment comprises activities associated with the minimization of the impact of natural hazards on the economy and society. These activities could include research, observation and measurement networks; surveillance and 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 (e.g., fire barriers in forests, avalanche prevention barriers, dams to slow down water flows, and structures associated with renaturalization 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 organization of information on activities that minimize the impact of natural hazards may be of particular interest in understanding the economic response to natural hazards and may also provide indicators of the economic impacts of changes to landscapes and water systems, including environmental changes due to climate change. While economic activity associated with adaptation to climate change is not considered an environmental activity per se, it is recognized 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 that minimize the impact of natural hazards. Consequently, no recommendations regarding measurement scope, classification or compilation of accounts are provided in the Central Framework.

4.25 Besides economic 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 changing residence or job; expenditure on cleaning and restoring buildings that have been dirtied or damaged by air pollution; and expenditure on hospital treatment for people adversely affected by poor-quality environments. The common focus of these activities and expenditures is on protecting and managing the impact of environmental changes on people and produced assets rather than on protecting and managing the environment itself. Consequently, these activities are not considered environmental activities and are not discussed further in the Central Framework.

4.26 Increasingly, there are enterprises operating within traditional industry structures that aim to produce the same outputs but through means that may be viewed as more environmentally or ecologically "friendly", including ecotourism, resource-efficient manufacturing and organic agriculture. The activities of these enterprises are considered environmental activities in the SEEA only to the extent that they satisfy the definition of environmental protection activities or resource management activities.

4.2.4 Classification of environmental activities

4.27 Section 4.2.2 above described the environmental activities in scope of the Central Framework. The present section outlines the classification of these environmental activities within the structure of the Classification of Environmental Activities (CEA).

4.28 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 activities and resource management activities). The broad structure for the CEA is presented in table 4.1. The structure of the first group—environmental protection activities—mirrors the structure of the existing *Classification of Environmental Protection Activities and Expenditure* (CEPA) (United Nations, 2000). In this group, the activities are classified by environmental domain, such as air, waste and water. The structure of the second group, resource management activities, is based on the different types of resources, such as mineral and energy resources, timber resources and aquatic resources. Within both activity groups, activities that are broad-ranging, such as those relating to management and research, are allocated to the last class. Detailed classes and associated definitions for group I are consistent with the CEPA. Detailed classes and definitions for activities in group II have been included in annex I of the present publication to provide a starting point for the compilation of relevant statistics. However, further testing and development of these classes is required. This work is part of the SEEA Central Framework research agenda (see annex II).

Table 4.1

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 (excluding timber and aquatic resources)
	14 Management of water resources
	15 Research and development activities for resource management
	16 Other resource management activities

4.29 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 primary purpose of the activity, i.e., whether it is for environmental protection, resource management, or the general production of energy.

4.30 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 related to environmental protection and resource management over time and across countries. Countries should apply the principle of allocation of these activities based on primary purpose. However, in some cases, there may be analytical interest in classifying all such activities under resource management, regardless of the primary purpose, to facilitate international comparisons.

4.2.5 Environmental goods and services

4.31 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. "Ecosystem services" is the term used to describe the contributions of ecosystems to benefits used in economic and other human activity (e.g., extracted natural resources, carbon sequestration and recreational opportunities). In contrast, environmental goods and services in the SEEA comprise only flows of products within the economy.

4.32 Environmental goods and services include specific services, connected products and adapted goods. In practice, the definition and measurement scope of these different products vary depending on the type of account or set of statistics being compiled. Hence, the relevant scope and definition 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

4.33 Relevant sets of environmental producers can also 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 recognized in the different accounts and statistics is the specialist producer 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, although 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.

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

4.35 Following the SNA, own-account production is not normally separately identified and 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 may occur in the economy, it is recommended that own-account production activities be separately identified whenever possible. Separate identification allows for not only a complete coverage of environmental activities but also analysis of changes in the extent of outsourcing of these activities to other establishments compared with undertaking of the activities "in-house".

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

4.37 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 undertaken on own account, the output should also be recognized in accordance with the measure-

ment 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

4.38 The present section describes two different sets of information concerning environmental activity. The first set concerns recording, within an accounting framework, expenditures and related national accounts flows for 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 associated with the EPEA.

4.39 The scope of the EPEA is defined from a demand perspective in terms of 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 the use of these services are 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 services. A full EPEA therefore requires information from both purchasers and suppliers of environmental protection services.

4.40 The EPEA is a type of functional account, as described in the SNA.[29] The construction of the EPEA closely follows the concepts, definitions and accounting rules of the core national accounts. However, some degree of deviation from the SNA is required when considering either environmental specificities or the measurement objectives of the EPEA, which are more targeted than the broader macroeconomic focus of the core national accounts.

4.41 The second set of information focuses on the supply of environmental goods and services and is composed of a set of statistics describing 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; however, the statistics that are included are defined and measured in a manner consistent with national accounts principles.

4.42 While there is a reasonable degree of overlap between the EPEA and EGSS statistics, there are important differences as well. Section 4.3.4 contains a description of the relationship between the EPEA and EGSS statistics.

4.43 The compilation of the EPEA and EGSS statistics requires the collection and organization of data from a variety of sources. This section does not provide details on how these data can be obtained; however, compilation guidance and additional detail regarding these two sets of information can be found in *SERIEE Environmental Protection Expenditure Accounts: Compilation Guide* (European Commission and Eurostat, 2002a) and *The Environmental Goods and Services Sector: A Data Collection Handbook* (European Commission and Eurostat, 2009).

29 See chap. 29 of the 2008 SNA.

4.44 Section 4.3.5 introduces an account for resource management expenditures. Although not widely developed, the construction of these accounts can be undertaken following the approach used for the EPEA. Resource management expenditure accounts may be of particular relevance in assessing responses to climate change and the management of natural resources.

4.3.2 Environmental protection expenditure accounts

Purpose of the EPEA

4.45 The purpose of establishing accounts for environmental protection expenditure is to enable identification and measurement of society's response to environmental concerns through the supply of and demand for environmental protection services and through the adoption of production and consumption behaviour aimed at preventing environmental degradation. To this end, the EPEA provide information on the output 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 With this information, the EPEA can be used to analyse the extent of environmental protection activities and to assess how expenditure on environmental protection is financed. The accounts can also be used to derive indicators for highlighting change in key areas, such as the expenditure on pollution prevention and abatement, the contribution made by environmental protection activities to the economy, and the shift to pollution-preventing technologies.

4.47 Measuring the financial commitment of an economy to environmental protection may assist in evaluating the influence of environmental protection costs on international competitiveness, the execution of the polluter pays principles, and the cost-effectiveness of environmental control mechanisms. Monetary data may also be used to examine the extent to which different economic agents internalize the actual costs of environmental protection in their decision-making. In this regard, data on environmental taxes may provide useful complementary information (see sect. 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 quantity of air emissions. Models may be developed that link potential changes in environmental pressures, such as air emissions, to future economic activity, given particular amounts of expenditure on environmental protection.

EPEA tables

4.49 There are four main, interlinked EPEA tables. The first table is a combined production and generation of income account which presents information on the production of characteristic environmental protection products, i.e., environmental protection specific services, by resident producers. The second is a supply and use table for these specific services, which displays the total supply of specific services from resident producers and the rest of the world and the use of 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 includes capital formation for environmental protection activities by specialist, non-specialist and own-account producers, and relevant environmental protection transfers. The inclusion of these flows provides an estimate of the total outlays by an economy on environmental protection which is reflected in the aggregate: national expenditure on environmental protec-

tion. The fourth table is an extension of the third table designed to present the financing of national expenditure on environmental protection.

4.51 The EPEA tables are all couched within the broader sequence of economic accounts that defines relationships between various transactions. Using the structure of the sequence of accounts means that the various transactions related to environmental protection can be easily related to each other and to other transactions, following the same accounting conventions that apply in the SNA.

4.52 The transactions in 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

4.53 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.

4.54 The production of environmental protection specific services is presented in table 4.2. 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.

Table 4.2
Production of environmental protection specific services (*currency units*)

	Producers				
	Specialist producers				
	Government producers	Other specialist producers	Non-specialist producers	Own-account producers	Total
Output of environmental protection specific services	3 000	6 500	2 400	1 600	13 500
Intermediate consumption	2 000	3 000	600	400	6 000
Environmental protection specific services	1 800	1 500	500	300	4 100
Other goods and services	200	1 500	100	100	1 900
Gross value added	1 000	3 500	1 800	1 200	7 500
Compensation of employees	600	2 000	1 200	800	4 600
Taxes less subsidies on production					
Consumption of fixed capital	400	1 000	600	400	2 400
Net operating surplus		500			500
Supplementary items					
Labour input (hours worked)	4 000	10 000	4 500	4 000	22 500
Gross fixed capital formation	1 100	1 000	2 000	500	4 600
Acquisition less disposals of non-produced, non-financial assets		200			

4.55 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 output but have a different primary activity. The EPEA does not present information on the producers of other environmental goods and services.

4.56 The table shows output of environmental protection specific services and goes on to show a full range of production-related 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.

4.57 An additional entry is made for gross fixed capital formation and acquisitions less disposals of non-produced, non-financial assets (such as land) used in the production of environmental protection specific services. Gross fixed capital formation targeted towards the production of specific services of specialist as well as other producers should be included.

4.58 All of the values in table 4.2 are measured in a manner consistent with the accounting conventions of the SNA. Consequently, aggregates such as gross value added and net operating surplus can be meaningfully compared with macroeconomic aggregates such as gross domestic product (GDP) as derived from the core national accounts framework.

4.59 However, it is noted that the inclusion of own-account production extends the range of entries compared with that of the core national accounts and hence measures of output and intermediate consumption will be larger in the EPEA relative to the core accounts than it would be if this activity were not separately identified. For market producers, the valuation of own-account production depends on the nature of the use of the production within the producing unit. If the production is used as part of intermediate consumption, then the output is valued as the sum of intermediate consumption, compensation of employees, other taxes (less subsidies) on production, and consumption of fixed capital. If the production is used as own-account capital formation, the value of output is the sum of the costs as just listed plus a net return on the fixed assets used in production. For non-market producers, such as government units, the output is measured as the sum of costs listed above and, by convention, no net return on fixed assets is included.

Supply and use of environmental protection specific services

4.60 The production of environmental protection specific services is supplemented by imports in order that a measure of total supply may be obtained. Total supply is used by other economic units in the economy and may also be exported. These flows are recorded in table 4.3. The top half of the table, the supply table, shows the supply of specific services from the 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 II.

4.61 In the second half of the table, the use table, the total supply of specific services is shown as: (*a*) intermediate consumption by either specialist or other producers, (*b*) final consumption by households or governments, (*c*) gross fixed capital formation or (*d*) exports to the rest of the world. All entries in the use table are in purchasers' prices.

Expenditure for environmental protection purposes

4.62 Table 4.4 constitutes 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 specific services as presented in table 4.3. The scope covers expenditure on all goods and services used for environmental pro-

Table 4.3
Supply and use of environmental protection specific services (*currency units*)

Supply table

	Output at basic prices	Taxes less subsidies on products	Trade and transport margins	Output at purchasers' prices	Imports	Total supply
Environmental protection specific services	13 500	270		13 770		13 770

Use table

	Intermediate consumption		Final consumption		Gross fixed capital formation	Exports	Total use
	Specialist producers	Other producers	Households	Government			
Environmental protection specific services	1 500	7 400	2 970	1 800	100		13 770

tection, including (*a*) expenditure on environmental protection specific services; (*b*) expenditure on environmental protection connected products; and (*c*) expenditure on adapted goods.

4.63 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, for example, for environmental protection research and development (R&D) (to the extent that the R&D is considered capital formation in the SNA) or 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 4.4, as they represent expenditure by non-resident economic units.

4.64 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 similar 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).

4.65 Environmental protection specific services have been 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.*** 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.

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 purchased by households should be treated as connected products but those that are purchased by specialist producers engaged in collecting waste should not be treated as connected products but, instead, should be included in the intermediate consumption or gross fixed capital formation of the specialist producers.

Table 4.4
Total national expenditure on environmental protection (*currency units*)

	Users						
	Industry						
	Producers of environmental protection specific services						
	Specialist producers	Non-specialist and own-account producers	Other producers	Households	General government	NPISH[a]	Total
Type of expenditure by product							
Environmental protection specific services							
Intermediate consumption	NI	4 000	3 400				7 400
Final consumption				2 970	1 800		4 770
Gross fixed capital formation	NI		100				100
Connected products							
Intermediate consumption	NI		200				200
Final consumption							
Gross fixed capital formation	NI						
Adapted goods							
Intermediate consumption	NI						
Final consumption				600			600
Gross fixed capital formation	NI						
Capital formation for characteristic activities	2 100	2 500					4 600
Transfers for environmental protection not included above							
Environmental protection transfers to and from the rest of the world (net)					200		200
Total national expenditure on environmental protection	**2 100**	**6 500**	**3 700**	**3 570**	**2 000**		**17 870**

Note: Dark grey cells are null by definition.
"NI" means "not included in the derivation of total national expenditure on environmental protection".
[a] Non-profit institutions serving households.

4.67 ***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.*** Examples of adapted goods include desulphurized fuels, mercury-free batteries and CFC-free products. Only the extra costs paid in order to acquire adapted goods are considered environmental protection expenditure. Some specific difficulties in measuring adapted goods are discussed further below.

4.68 In table 4.4, all resident users 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. In this table, the entries in the columns for households, general government, and non-profit institutions serving households relate only to their consumption of environmental protection products. Any production of environmental protection products by these institutional sectors, including own-account production, should be included in the relevant industry column.

4.69 While table 4.4 provides the broad framework for the calculation of total national expenditure on environmental protection, a number of factors need to be considered.

(a) Measurement of gross fixed capital formation

4.70 The expenditure on assets by specialist producers and other producers required for the production of environment specific services are recorded separately. To the extent that specialist producers engage in no significant non-environmental protection activities, all of their expenditure on assets, including the purchase of fixed assets to undertake the production and the acquisition less disposal of non-produced, non-financial assets, particularly land, is within scope of environmental protection expenditure. The inclusion of all expenditure on assets does not apply to non-specialist or own-account producers.

4.71 As the gross fixed capital formation for characteristic activities by specialist, non-specialist and own-account producers is recorded in a separate row in table 4.4, in principle, any such expenditure that includes purchases of environmental protection goods and services should not be counted a second time. For specialist producers, the cell for gross fixed capital formation on environmental protection goods and services is labelled "NI" (not included) in table 4.4. For non-specialist and own-account producers, such expenditure should also be counted only once.

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

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

(*b*) Expenditure on "integrated" investments, also called cleaner technologies. These are new or modified production facilities designed 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.

4.73 Depending on the nature of the integrated investment, expenditure can be estimated based on the cost of the modification of existing equipment or 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 respect of measuring adapted goods, as described below.

(b) Measurement of adapted goods

4.74 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 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 advantages may include savings on, or substitution of, raw materials and higher productivity, which cannot be isolated in terms of cost.

4.75 The steady integration of environmental standards into equipment and processes makes it more difficult over time to distinguish between a cleaner good and the equivalent normal good. Given the variety of speeds at which new environmental standards are incorporated into different types of equipment in different countries, the ability to make comparisons of long time-series across industries and countries may be limited.

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

4.77 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 desulphurized fuels used). These estimates are then valued by the extra costs associated with environmental protection features. As extra costs can be difficult to survey directly, expert assessment and technical knowledge may be used to estimate them (e.g., the extra costs of producing desulphurized fuels or environmental adaptations of vehicles).

4.78 While these measurement difficulties do exist, a misleading picture of expenditure for environmental protection purposes would result if the value of adapted goods was ignored. To support the measurement of adapted goods, lists of relevant products have been developed to form a basis for that measurement.[30] Although many adapted goods may exist, experience from countries that have compiled an EPEA suggests that only a few are quantitatively important and involve significant extra costs. Indeed, for many adapted goods, no extra costs exist.

(c) Accounting for intermediate consumption

4.79 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 4.4 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. These environmental protection goods and services are either supplied by specialist or non-specialist producers, or imported.

4.80 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 of environmental protection specific services by the producers in the column for non-specialist and own-account producers in table 4.4 is the total value of own-account output, since this is the amount that represents the value of the intermediate consumption of environmental protection services in the main activity of the establishment.

4.81 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.

4.82 Special consideration is required concerning the intermediate consumption of environmental protection goods and services. For specialist producers, in order to prevent double-counting, the intermediate consumption of environmental protection goods and services 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 of environmental protection goods and services by specialist producers are labelled "NI" (not included) in table 4.4.

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30 For example, see *SERIEE Environmental Protection Expenditure Accounts: Compilation Guide European Commission and Eurosta*t (2002a).

4.83 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., they are used for own-account activities or to produce and sell environmental protection goods and services on the market. In practice, it is assumed that these uses are not significant; therefore, this adjustment is not necessary for non-specialist and own-account producers.

(d) Adjustments for transfers and financing by the rest of the world

4.84 There may be transfers between economic units that affect the level of spending on environmental protection but are not recorded in the earlier categories of expenditure shown in table 4.4. For example, if government subsidizes 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 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 4.4.

(e) Total national expenditure on environmental protection

4.85 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 (*s*pecific services, connected products and adapted goods), except intermediate consumption and gross fixed capital formation for characteristic activities
- *Plus* gross fixed capital formation (*a*nd acquisition less disposal of non-produced, non-financial assets) for environmental protection characteristic activities
- *Plus* 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

4.86 The estimates of national expenditure on environmental protection show expenditure as undertaken by different users, but may not show who is the direct bearer of the cost because of environmental protection transfers between units. Such information, however, provides valuable insight regarding the source of the funds that finance national expenditure on environmental protection and regarding 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 investment in environmental protection technology and processes.

4.87 The expenditure undertaken by the users shown in table 4.4 can be cross-classified to show which units are directly responsible for the expenditures and which bear directly the costs of financing them. This is shown in table 4.5. 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 transfer has a reduction.

Table 4.5
Financing of national expenditure on environmental protection *(currency units)*

	Users							
	Producers of environmental protection specific services							
Financing units	Specialist producers	Non-specialist and own-account producers	Other producers	Households	Government	NPISH[a]	Rest of the world	Total
Government	1 300	1 100			1 700		300	4 400
Corporations								
Specialist producers	800	5 400						6 200
Other producers			3 700					3 700
Households				3 570				3 570
National expenditure	2 100	6 500	3 700	3 570	1 700		300	17 870
Rest of the world					100			100
Total uses of resident units	2 100	6 500	3 700	3 570	1 800		300	17 970

[a] Non-profit institutions serving households.

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

4.89 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.[31]

4.90 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 organizations, corporations or by households through non-governmental organizations.

4.91 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. Further, 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 with a view to examining the net cost burden of environmental protection are not considered in the SEEA.

31 To come under the rubric of 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 sect. 4.4.).

4.3.3 Environmental goods and services sector (EGSS)

Purpose of the EGSS statistics

4.92 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 the depletion of natural resources. 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.

4.93 EGSS statistics also provide an information source for assessing (*a*) the potential for economic activity and employment to be based on environmentally friendly and more resource-efficient activities and (*b*) 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. EGSS statistics may also provide valuable source data for the EPEA or resource management expenditure accounts.

4.94 In principle, there is a wide range of economic variables that might be considered within an EGSS context but, owing to the complexity of measurement in this area, focus in the Central Framework is on the variables that give an indication of the relative economic size and contribution of the EGSS. Thus, the main variables included are 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 been defined.

Scope and definition of the EGSS

4.95 The EGSS consists of producers of all environmental goods and services. Thus, all products that are produced, designed and manufactured for purposes of environmental protection and resource management are within scope of the EGSS. This aligns with the intent of the EGSS to provide information on the extent to which the economy may become more environmentally friendly and resource-efficient. The types of 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 directly below.

4.96 The first type of environmental goods and services in the EGSS is environmental specific services. These services comprise environmental protection and resource management products that are "characteristic" or typical of those activities. Hence, ***environmental specific services are environmental protection and resource management specific 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.

4.97 Consistent with the definition of environmental protection and resource management activities (see sect. 4.2), environmental specific services are those services that have the main purpose of:

(*a*) Preventing or minimizing pollution, degradation or natural resources depletion (including the production of energy from renewable sources);

(*b*) Treating and managing pollution, degradation and natural resource depletion;

(*c*) Repairing damage to air, soil, water, biodiversity and landscapes;

(*d*) 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.

4.98 The second type of environmental goods and services is environmental sole-purpose products. ***Environmental sole-purpose products are goods (durable or non-durable) 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., solar panels).

4.99 The third type of environmental goods and services is 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 the EGSS, adapted goods are either:

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

(*b*) "Resource-efficient" goods, which help to prevent natural resource depletion because they contain fewer natural resources in the production stage (e.g., recycled paper and renewable energy, heat from heat pumps and solar panels); and/or in the use stage (e.g., resource-efficient appliances and water-saving devices such as tap filters).

4.100 Adapted goods differ from environmental specific services and sole-purpose products because, while they serve an environmental protection or resource management purpose (through being cleaner or more resource-efficient), these are not the primary reasons for their production (e.g., the primary purpose for manufacturing buses with lower air emissions is transportation).

4.101 Compared with the definition of adapted goods in the EPEA, the scope of adapted goods in the EGSS is broader through the inclusion of goods beneficial for resource management and also because the full value of adapted goods is included rather than only the extra cost compared with that of the equivalent normal good. A consequence of these differences is that the number of adapted goods within scope of the EGSS is much larger. Some of the difficulties in measuring adapted goods as described in section 4.3.2 apply equally in the EGSS context.

4.102 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:

(*a*) *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. Examples include plants within which to treat sewage, equipment for measuring air pollution, and facilities for the containment of high-level radioactive waste;

(*b*) *Integrated (pollution prevention) technologies*, which are technical processes, methods or knowledge used in production processes that are less polluting and less resource-intensive

than the equivalent "normal" technology used by other producers. Their use is less environmentally harmful than that of relevant alternatives.

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

4.104 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, mobilization and exploitation of natural resources are also excluded.

4.105 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 for use in environmental protection or resource management. 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 based on an assessment of whether, by virtue of its technical nature, the good is environmentally friendly or cleaner.

4.106 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 vice versa) and, in principle, the two systems can be fully reconciled. A reconciliation 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 achieved.

4.107 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 the EPEA which is limited to producers whose primary activity is the production of environmental protection specific services.

4.108 Government producers are separately recorded as an important type of specialist producer. Non-specialist and own-account producers, including households, are also separately identified in the EGSS. Own-account production is measured following the treatment outlined in section 4.2.

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

Statistics on the EGSS

4.110 The basic structure of statistics concerning the EGSS follows the format presented in table 4.6. Each type of output of environmental goods and services may also be classified, following the relevant parts of the Classification of Environmental Activities, by allocating the value of output to relevant classes of environmental protection activity or resource management activity.

Table 4.6
Environmental goods and services sector (*currency units*)

		Producers			
		Specialist producers			
		Government producers	Other specialist producers	Non-specialist producers	Own-account producers
Output of environmental goods and services					
Environmental specific services	Environmental protection	3 000	6 500	2 400	1 600
	Resource management	3 100	4 500	300	1 600
Sole-purpose products	Environmental protection			250	
	Resource management			400	
Adapted goods	Environmental protection			1 000	
	Resource management			3 000	
End-of-pipe technologies	Environmental protection	100	200	1 200	100
	Resource management	100	300	1 500	
Integrated technologies	Environmental protection			800	
	Resource management			700	
Total environmental goods and services produced		**6 300**	**11 500**	**11 550**	**3 300**
Intermediate consumption		3 800	6 500	6 700	1 450
Gross value added		2 500	5 000	4 850	1 850
Compensation of employees		2 100	4 200	4 300	1 500
Gross fixed capital formation		1 500	1 820	1 500	590
Exports of environmental goods and services			200	2 300	
Employment (thousands of people)		120	210	220	80

4.111 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 also produce a range of other goods and services and therefore the production of environmental goods and services may be only a relatively small component of their total output. This may be recognized through inclusion of data on the total output of other goods and services and derivation of the share of environmental goods and services in total output.

4.112 All variables are 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 reflect amounts related only to an establishment's production of environmental goods and services. Where direct estimates of these variables with respect to the production of environmental goods and services cannot be obtained, an estimation approach can be utilized, which entails multiplying the 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 of 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. This is particularly the case with regard to estimates of gross fixed capital formation, since the relationship between patterns of investment and the output of environmental goods and services may vary considerably.

4.3.4 Relationship between the EPEA and the EGSS

4.113 While both the EPEA and the EGSS are focused on the measurement of environmental activities, they so do from different perspectives. Consequently, there are important differences between them. The main differences are described directly below and summarized in table 4.7.

4.114 *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 (including 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.

4.115 *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. It is noted, however, that the accounting structure of the EPEA can be applied in the development of a resource management expenditure account.

4.116 *Coverage of 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 environmental goods and services. For example, capital formation within environmental protection expenditure will include not only any specialized equipment purchased, but also the more general expenditure on buildings, cars, computers, etc., required by producers of environmental protection specific services. The EGSS, on the other hand, focuses on environmental goods and services from a production perspective and defines the scope of goods and services from a technical product-based perspective.

4.117 *Coverage of environmental producers.* In the EPEA, as the information concerning production is limited to environmental protection specific services, its specialist producers 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.

4.118 *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 therefore only the extra cost associated with the purchase of adapted goods is included. Thus, the expenditure on cleaner goods that are not more costly is not included in the EPEA.

4.119 *Coverage relating to international trade.* Both the EGSS and the EPEA record imports and exports of goods and services in a manner consistent 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.

4.120 *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 4.7
Comparison of the EPEA and the 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 services used for environmental protection and resource management
Coverage of goods and services	All environmental protection goods and services and expenditure on other goods and services for environmental protection purposes	All environmental protection and resource management goods and services
Coverage of environmental producers	Producers included only 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

4.3.5 Accounts for resource management expenditures

4.121 Although not widely developed in practice, it is possible to develop accounts for recording expenditures for resource management purposes following the same basic structure as outlined for the EPEA. Resource management expenditure accounts may thus comprise accounts encompassing the production of resource management specific services, the supply and use of resource management specific services, national expenditure on resource management, and the financing of national expenditure on resource management. Similar considerations concerning the measurement of expenditure also apply.

4.122 It may be relevant to compile resource management expenditure accounts for a specific type of resource (e.g., timber resources or water resources) rather than for all types of resources. Again, the same structure of accounts can be applied.

4.123 The development of resource management expenditure accounts may benefit from the development of EGSS statistics that encompass the production of resource management goods and services.

4.4 Accounting for other transactions related to the environment

4.4.1 Introduction

4.124 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 the EPEA and the EGSS. In that section, emphasis was placed on the purpose of the transaction from the perspective either of the producer or of the purchaser. The types of transactions considered primarily related to output, intermediate consumption, final consumption and gross fixed capital formation.

4.125 The present section focuses on other transactions in the core national accounts framework which may be of interest in the analysis of the economic aspects of the environment. Of particular interest in this regard are flows of environmental taxes and subsidies.

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

4.127 Many of the mechanisms by which economic behaviour is influenced so that environmental policy objectives can be met 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 relating to the environment. This section describes the relevant definitions and boundary issues relevant to enabling the organization of information about these transactions and allowing comparisons over time and across countries.

4.128 Environmental taxes and subsidies must be considered within a broader framework of payments to and from government. This is required because under 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.

4.129 The SEEA records only 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, through 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.

4.130 In addition to payments to and from government, there are other transactions of a similar nature recorded in the national accounts that may be of interest in the analysis of environmental matters. Examples are donations made by households and enterprises to nonprofit environmental groups. Table 4.8 describes a broader framework of payments to and from government and similar transactions between other sectors.

4.131 The final type of transactions discussed in the Central Framework are those transactions associated with the extraction and use of environmental assets (primarily natural resources) 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 for recording permits for the use of environmental assets as a sink.

4.132 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 restoring the surrounding environment.

4.133 While the set of transactions covered in this section is broad-ranging, all of these transactions fit within the structure of the sequence of accounts, as described in section 6.2. The sequence of accounts highlights relationships between different types of transactions and ensures that all transactions can be related to particular economic aggregates and balancing items such as GDP, gross national income and net saving.

Table 4.8
Selected payments to and from government and similar transactions

		Payments received by				
		Government	Corporations	Households	NPISH[a]	Rest of the world
Payments made by	Government	Transfers between levels of government	Subsidies and investment grants	Current and capital transfers	Subsidies; current and capital transfers	Current and capital transfers
	Corporations	Taxes, fines, fees, charges and rent	Rent	Rent	Donations	Donations to NPISH in rest of the world
	Households	Taxes, fees, charges and fines			Donations	Donations
	NPISH[a]	Taxes	Current and capital transfers	Current and capital transfers		Current and capital transfers
	Rest of the world	Taxes and current transfers			Donations	

[a] Non-profit institutions serving households.

4.134 Discussed below are payments by government; payments to government, primarily environmental taxes; payments for the extraction and use of environmental assets; and, finally, transactions in fixed assets used in economic activities related to the environment.

4.4.2 Environmental payments by government

4.135 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.

4.136 All of the payments 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.***[32] Consequently, this section does not include payments by government for the purchase of goods and services.

4.137 Often, transfers by government are generically referred to as "subsidies". However, in economic accounting, only certain transfers are treated as subsidies. The relevant definitions for the various transfers by governments are outlined directly below.

Environmental subsidies and similar transfers

4.138 An environmental subsidy or similar transfer is a transfer intended to support activities that protect the environment or reduce the use and extraction of natural resources. It includes

32 See para. 8.10 of the 2008 SNA.

those transfers defined by the SNA as subsidies, social benefits to households, investment grants and other current and capital transfers.[33] More specifically:

- *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 and services that they produce, sell or import.
- *Social benefits to households* are current transfers received by households that are 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 resident units or non-resident units to finance all or part of the costs of their acquisition of 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. They include transfers between levels of governments, between general government and foreign governments, and transfers to and from non-profit institutions.
- *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.

4.139 Determination of 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 for resources to be used for either environmental protection or resource management purposes.

4.140 In principle, a decision on 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.

4.141 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 provide information by type of government programme, thus including a large number of individual transfers. It will usually be the case that such programmes 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.

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

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33 Detailed descriptions of these transfers are contained in paras. 7.98-7.106, 8.87-8.140 and 10.200-10.212 of the 2008 SNA.

4.143 The determination of primary purpose should not be based on whether the use of the resources by the recipient of the transfer results in positive outcomes for the environment. 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.

4.144 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.

(a) Classification of environmental subsidies and similar transfers

4.145 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 classify these transfers using the Classification of Environmental Activities (CEA), part I (Environmental protection activities), and part II (Resource management activities). However, given the multipurpose nature of these transfers, fine levels of disaggregation may be difficult to compile in practice.

4.146 For accounting and analytical purposes, it is necessary to separate the transfers into those of a current and those of a capital nature following the definitions in the SNA.[34] It may also be useful to classify the transfers by the industry or institutional sector of the recipients following ISIC or standard SNA institutional sector classifications.

(b) Potentially environmentally damaging subsidies

4.147 The definition of environmental subsidies and similar transfers focuses on the government's intention rather than on the effect on the environment arising 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 the potentially environmentally damaging subsidy (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 Environmental payments to government

Environmental taxes

4.148 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.

4.149 ***Taxes are compulsory, unrequited payments, in cash or in kind, made by institutional units to government units.***[35] They are grouped in the following categories:

(*a*) *Taxes on products*, which are taxes payable per unit of some good or service. Taxes on products include value added type taxes, taxes and duties on imports, and export taxes;

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34 See para. 8.10 of the 2008 SNA.

35 For details on the definitions of the different types of taxes, refer to paras. 7.71-7.97, 8.52-8.64 and 10.207 of the 2008 SNA.

(*b*) *Other taxes on production*, which comprise 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;

(*c*) *Taxes on income*, which are taxes on incomes, profits and capital gains;

(*d*) *Other current taxes*, which are current taxes on capital and miscellaneous current taxes (such as payments by households to obtain certain licences);

(*e*) *Capital taxes*, which are taxes levied at irregular and infrequent intervals on the values of assets or net wealth 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.

4.150 The decision on 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 regarding whether the tax base in each circumstance is something that has a negative environmental impact.

4.151 Since the application of this definition may vary across countries, for the purposes of international comparison of environmental taxes, lists of relevant tax bases that satisfy this definition have been developed by the Organization for Economic Cooperation and Development and Eurostat.[36]

4.152 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 taxpayer does not know in advance what the tax payment might be used for by the government, nor are the reasons for levying a tax, as stated by the legislator, a reliable basis for international comparisons. The primary purpose of taxation may sometimes be to create incentives to reduce environmental pressures, or to raise revenue for the purpose of financing environmental protection. However, in many cases, the specific reason may not be stated and often the primary purpose of taxation will be the raising of funds to pay for general social services such as health and education.

4.153 In cases where the use of the tax revenue 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.

4.154 The approach taken to the definition of environmental taxes in the SEEA differs from the approach commonly found in the economics literature, where environmental taxes are defined with reference to taxing negative externalities, i.e., Pigovian taxes. These types of taxes are based on an assessment of the motive for setting rates of tax, i.e., the extent to which a particular tax rate will reduce the negative externality. Pigovian taxes do not include taxes collected for fiscally motivated reasons. Since determining the precise motivation for taxation involves a difficult measurement issue, the approach in the SEEA is to consider the underlying tax base.

(a) Environmental tax bases and categories

4.155 There are four broad categories into which environmental taxes are generally grouped: energy, transport, pollution and resources, described below:

36 See Environmental Taxes: A Statistical Guide (European Commission and Eurostat, 2001).

(*a*) *Energy taxes*:

(i) This category includes taxes on energy products used for both transport and stationary purposes. Taxes on fuel used for transport purposes should be shown as a separate subcategory of energy taxes. Energy products for stationary use include fuel oils, natural gas, coal and electricity;

(ii) Taxes on carbon are included under energy taxes rather than under pollution taxes. If they are identifiable, carbon taxes should be reported as a separate subcategory within energy taxes. A special type of carbon taxes are payments for tradable emissions permits. The treatment of payments for these permits is discussed later in this section;

(*b*) *Transport taxes*. This category includes mainly taxes related to the ownership and use of motor vehicles. Taxes on other transport equipment (e.g., planes), and related transport services (e.g., duties 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;

(*c*) *Pollution taxes*. This category includes taxes on measured or estimated emissions to air and water, and the generation of solid waste. Taxes on carbon are an exception and are included under energy taxes, as discussed above. Taxes on sulphur are included here;

(*d*) *Resource taxes*. This category typically includes taxes on water abstraction, extraction of raw materials and other resources (e.g., sand and gravel). Consistent with the general scope of environmental taxes, payments to government for the use of land or natural resources are treated as rent and are therefore excluded from resource taxes. For a detailed discussion of the treatment of rent, see paragraphs 4.160-4.163.

4.156 Table 4.9 shows a possible recording of environmental taxes by type of tax. The types of taxes in the columns follow the higher-level structure of taxes in the SNA. Where other payments to government are of particular significance, they could be added within a table of

Table 4.9
Environmental taxes by type of tax

Type of environmental tax	Type of tax						
	Taxes on products	Other taxes on production	Taxes on income		Other current taxes	Capital taxes	Total
			Corporations	Households			
Energy taxes	10 800	1 500				300	12 600
Carbon taxes	4 600						4 600
Taxes on fuel used for transport	4 700						4 700
Other energy taxes	1 500	1 500				300	3 300
Transport taxes	2 600	800			1 400	100	4 900
Pollution taxes	400	500			200		1 100
Resource taxes	200	400			300		900
Total environmental taxes	**14 000**	**3 200**			**1 900**	**400**	**19 500**
Non-environmental taxes	79 000	15 400	23 000	74 000	5 800	1 600	198 800
Total taxes	**93 000**	**18 600**	**23 000**	**74 000**	**7 700**	**2 000**	**218 300**
Share of environmental taxes (percentage)	*17.7*	*20.8*	*0.0*	*0.0*	*32.8*	*25.0*	*9.8*

this type. For some types of environmental taxes, particularly energy taxes, a breakdown of payments by industry may be relevant. Ideally, an industry breakdown should be aligned to the breakdown used for the recording of related physical flows as shown in chapter III. For example, for energy taxes, an industry breakdown following the industry structure of the air emissions accounts may be relevant.

(b) Treatment of value added taxes (VAT)

4.157 Generally, value added taxes are excluded from the definition of environmental taxes because it is considered that, unlike other taxes on environmental tax bases, they have no influence on relative prices (i.e., the 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 deductibility of the VAT for many taxpayers.

4.158 There is one, relatively specific, exception to this general treatment. In principle, where the 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, excluding the part that is deductible by the taxpayer) 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 the VAT may require additional information.

Other payments to government

4.159 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 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. These other types of payments to government are described directly below

(a) Rent

4.160 There are certain environmental assets, particularly mineral and energy resources, that are owned by government and payments to government by extractors are often required. 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.

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

4.162 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).

4.163 As the government is the taxation authority, it is possible for different arrangements to be established by which the government collects the rent that is due to it 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 V discusses the estimation of resource rent and the determination of the proportion that accrues to the different economic units.

(b) Sales of goods and services

4.164 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 that are made by users are often referred to as "fees". A common situation is the payments made to general government units that operate collection schemes for the disposal of waste. In some cases, making the distinction between these payments as purchases of goods and services and as taxes can be difficult, since it must be determined whether the purchaser has received a service from the government in return for the payment. The general guidance in the SNA should be followed.[37]

(c) Fines and penalties

4.165 Fines and penalties are distinguished from taxes by being compulsory payments imposed on institutional units by courts of law or quasi-judicial bodies.[38] 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, for example, polluting water bodies. The recording of fines and penalties also arises in the case of the use of environmental assets as sinks (see sect. 4.4.5).

4.4.4 Environmental transfers by non-government institutional units

4.166 While taxes and subsidies are flows that, by definition, are receivable or payable by government units, the other types of transfers outlined in this section can take place between other institutional units as shown in table 4.8. For example, households may donate money to conservation groups which are recorded as other current transfers.

4.167 Where information on these flows is of interest, the amounts to be recorded as environmental should follow the same principles as are 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 payment is environmental protection or resource management.

4.168 A particular instance of transfers between institutional units concerns flows between international organizations 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 organizations to institutional units within a country should be considered environmental if the primary intent of the international

37 See paras. 7.80 and 8.64 of the 2008 SNA.

38 Ibid., para. 8.135.

organization is that the money be spent for environmental protection or resource management purposes.

4.4.5 Permits to use environmental assets

4.169 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, as in the case of fishing licences; in other cases, they may relate to the use of the environment as a sink for emissions.

4.170 Permits and licences relate to the general concept of property rights and, in this context, it is important to distinguish between the right to use 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 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.

4.171 In certain cases, the property rights obtained represent an asset of the holder. In order for the definition of an asset to be satisfied, the property rights 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 the 2008 SNA, chapter 17, part 5.

4.172 Payments for property rights through the purchase of permits, licences and similar arrangements are 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.

4.173 The present subsection 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 on the precise nature of the way in which the permits and licences are granted and can be exercised. The section considers first payments to extract and harvest natural resources and then payments to use the environment as a sink for emissions.

Permits to extract and harvest natural resources

4.174 The SNA outlines a range of general considerations that should be taken into account in determining an appropriate treatment.[39] Considered below are the relevant issues that arise in the context of different types of natural resources and the common licensing and permit arrangements.

(a) Mineral and energy resources

4.175 Mineral and energy resources differ from other natural resources in that all extraction necessarily reduces the amount of the resource available in the future. The owner (in many but not all circumstances, government) generally does not have a productive activity associated with the extraction and, commonly, payments of rent are made regularly based on the amount

39 See paras. 17.313-17.343 of the 2008 SNA.

of the resource that is extracted. Payments of rent are discussed in paragraphs 4.160-4.163 and the appropriate asset and income account entries in respect of recording the ownership and use of mineral and energy resources are discussed in chapter V, section 5, entitled "Asset accounts for mineral and energy resources".

(b) Land

4.176 Land (and the associated natural resources) may be sold outright when the legal ownership is transferred from one institutional unit to another. Acquisitions and disposals of land should be recorded in the capital account. 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.

(c) Timber resources

4.177 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 or long-term yield (among other possible conditions); hence, 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.

(d) Aquatic resources

4.178 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 for them. Fishing quotas may therefore be considered permits to use a natural resource that are transferable and in these situations, the quotas are considered assets in their own right.

4.179 Under an alternative regime, a permit is issued 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.

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

(e) Water resources

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

4.182 The recording of transactions related to the use of the environment as a sink entails a separate set of considerations. 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.

4.183 A number of treatments may apply, depending on the nature of the arrangements. The treatments align with the definitions of the various payments to government outlined above. The following scenarios and treatments are the most common:

(*a*) The government may require payments to be made in situations where there are illegal emissions of substances beyond certain levels. If these payments are intended to reduce or inhibit discharges and emissions in the future, they should be treated as fines;

(*b*) 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;

(*c*) 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:

(i) Where an economic asset exists 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;

(ii) Where an economic asset does not exist following the principles of the SNA, then the payment for the permit should be treated as a tax, as is commonly the case with regard to the atmosphere, inland water resources and the seas, and this treatment generally applies to carbon emissions permit schemes.

4.184 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.

4.185 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. SNA decisions on the appropriate accounting treatment are followed in the SEEA. The details of the SNA treatment of emissions permits are set out in SNA News and Notes (United Nations, 2012).

4.186 In summary, the key aspects of the accounting treatment are as follows:

(*a*) The payments for emission permits, issued by governments under cap-and-trade schemes, should be recorded at the time the emissions occur as taxes on production on an accrual basis;

(*b*) The timing difference between the payments received by government for the permits, and the occurrence of the emission, gives rise to a financial liability (accounts payable) for government and a financial asset (accounts receivable) for the permit holder. The difference between the prepaid tax value of the permit and the market value of the permit at any point in time represents a marketable contract (non-produced, non-financial asset) for the holder. The creation and disappearance of the non-produced, non-financial asset are recorded as other changes in the volume of assets;

(*c*) The approach to accruing payments for emission permits should be based on the underlying assumption that permits issued by a particular country are more likely than not to be surrendered in that country;

(*d*) In the simple case of a pure national scheme, the taxes should be accrued in the following way: the tax recorded for any single permit surrendered in relation to emissions that occurred in period t is equivalent to the total stock of relevant other accounts payable for the government in relation to emission permits, divided by the total number of active permits issued (and remaining in circulation) at time t; [40,41]

(*e*) For multinational schemes, the situation is more complex; as in any single country, more or fewer permits may be surrendered than the number that were originally allocated to the country.

4.187 The taxes paid for tradable emissions permits are treated as environmental taxes and categorized as energy taxes when the permits relate to emissions of carbon dioxide. Where possible, these taxes should be separately identified within energy taxes. When the tradable permits relate to other types of emissions, the taxes should be categorized as pollution taxes.

4.188 Table 4.10 presents the type of information that may be compiled regarding the quantity of emissions permits—expressed in terms of millions of tonnes of carbon dioxide. 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 among flows of free permits, non-free permits and permits from multinational schemes should be recorded.

Table 4.10
Account for tradable emissions permits (*millions of tonnes of carbon dioxide*)

	Institutional sector				
	Corporations	General government	Households	NPISH[a]	Total
Opening stock of permits	1 133	225		5	1 363
Permits allocated free of charge	2 355	987			3 342
Permits purchased	1 851	616			2 467
Permits sold	925	1 169			2 094
Losses (cancelled permits)	9			2	11
Permits surrendered to offset emissions	3 612	144			3 756
Closing stock of permits	793	515		3	1 311

[a] Non-profit institutions serving households.

4.189 Depending on the purpose of analysis and data availability, the columns in the table may reflect the holding of permits by industry (classified following the ISIC) or by institutional sector (as shown in table 4.10). 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.

40 One permit represents the emission of one tonne of carbon dioxide or one tonne of carbon dioxide equivalent.

41 The relevant other accounts payable should in theory exclude any permits that were surrendered after time t in respect of permits that occurred before time t. In addition, the total number of permits active (and remaining in circulation) at time t should also exclude these permits. In practice, however, it can be assumed that the time at which the permit is surrendered is the same as the time when the emissions occur, as long as there is no significant lag between the two events and the lag time is constant.

4.4.6 Transactions concerning fixed assets used in economic activities related to the environment

4.190 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. Different economic activities will entail the use of different types of fixed assets. Often, there is interest in the fixed assets used to extract and harvest natural resources as well as 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.

4.191 There are no strict boundaries determining which fixed assets may be of interest; and no aggregate for environment-related fixed assets is defined in the SEEA. Rather, the measurement scope will depend on the economic activities of interest. For example, fixed assets related to environmental protection expenditure will cover any specialized equipment purchased and also the expenditure on more generic assets such as 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.

4.192 It is noted that some fixed assets are also considered environmental assets. Both animals that produce outputs on an ongoing basis (such as various breeding stock, dairy cows producing milk and sheep producing wool) and plants that yield multiple outputs (as in vineyards, orchards and rubber plantations) are types of fixed assets that are also environmental assets. The accounting for these assets is explained in chapter V.

4.193 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

4.194 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:

- Nuclear power plants are decommissioned and final storage of nuclear waste must be provided
- Oil rigs and other mining equipment are dismantled and removed
- Landfills are sealed, gas and leakage collection systems are closed, and monitoring equipment installed
- Mines are closed and mining slag heaps are treated to minimize leaching

4.195 Costs incurred in these types of situations are referred to as decommissioning costs. Decommissioning costs may be divided into: terminal costs and remedial costs. *Terminal cost*s are costs that can and should be anticipated during the production periods prior to closure; provision should be made for meeting them during the life of the fixed 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.

4.196 The key distinction between terminal and remedial costs is based on the timing of the costs (see below) and on 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 fixed asset (oil rig, nuclear power plant, etc.) and form part of the link between the value of the fixed 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 takes place only at the end of the operating life of the asset.

4.197 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.[42]

(a) Consumption of fixed capital

4.198 As decommissioning costs are associated with measuring the use of fixed assets in the SNA, the present 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 of the expected stream of income arising from the use of the asset over the remainder of its asset life.

4.199 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 recognized as a cost of production.

(b) Treatment of terminal costs

4.200 In principle, once price changes and other changes in volume[43] are taken into account, the difference between the acquisition and disposal values of a fixed asset should be equal to the value of consumption of fixed capital accumulated over the life of the asset. In the case of 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.

4.201 Immediately before the disposal, the asset will have a negative value which returns 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 the asset but will have to pay another unit to take over responsibility for the asset.[44]

4.202 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: (*a*) it is often difficult to anticipate their final amount and (*b*) the original owner or operator

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

43 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 under other changes in assets accounts (see 2008 SNA, chap. 12).

44 See para. 10.161 of the 2008 SNA.

may no longer be an active business able to cover the costs, if it has ceased business or declared bankruptcy or if an associated surety was based on underestimated terminal costs.

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

4.204 Nonetheless, there are a number of indications that terminal costs can reasonably be expected: (*a*) there is an upfront bond (or some other form of surety) that has been provided; (*b*) the enterprise is required to progressively put in place contributions to fund the final decommissioning activities; (*c*) indications based on the past record of the enterprise; and (*d*) there is a commitment to environmental restoration by the government of the country in which operations are taking place.

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

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

(*a*) In situations where the terminal costs ultimately incurred exceed the cumulated consumption of fixed capital allowance, the full costs are 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 additional consumption of fixed capital. This is a pragmatic recommendation and will lead to overstatement of net value added during the periods the asset is in use and understatement in the period when the remaining costs are incurred;[45]

(*b*) 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;

(*c*) 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 through the other changes in volume of assets account, thus leading to a rise in the value of the fixed asset on the balance sheet.[46] Any subsequent decommissioning costs incurred by units other than the operator are treated as remedial costs;

(*d*) If terminal costs are overestimated compared with actual terminal costs ultimately incurred, this overestimate is corrected through an entry in the other changes in volume of assets account, leading to a rise in the value of the fixed asset on the balance sheet.

45 See para. 10.162 of the 2008 SNA.

46 Ibid., chap. 12.

(c) Treatment of remedial costs

4.207 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: (*a*) expenditures to restore land to allow its use for some other purpose; and (*b*) expenditures to ensure that no harmful emissions from deposits of pollutants and other residuals from past activity are able to leach into the surrounding environment 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.

4.208 For remedial costs, there is no special consideration required regarding the timing of reporting nor are there questions regarding 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.

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