

Environmental goods and services sector accounts

PRACTICAL GUIDE

2016 edition



**Environmental goods and
services sector accounts** | 2016 edition
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Preface

The environmental goods and services sector (EGSS) accounts are a young statistical product. A few country statisticians have some years of experience producing these accounts, but most countries have just started building capacity and national expertise. A lot of progress has been made in recent years to provide solid foundations to the EGSS accounts, first with the System of Economic-Environmental Accounting (SEEA CF, 2012) and then with the amendment to Regulation (EU) No 691/2011 adopted in 2014 (new Regulation Annex V). However, more know-how on practical estimation methods for EGSS is still needed.

The present *EGSS Practical Guide* serves a double purpose:

- First, to propose compilation methods for the EGSS accounts using existing data sources. Most of them are EU-wide sources and are available for all EU Member States as well as for other European countries. National compilers of EGSS accounts may make use of these methods if they feel it appropriate to their national circumstances. These methods may also serve as a basis for more refined and improved accounts based on more detailed national data sources.
- Secondly, to document methods that Eurostat has been using to produce estimates for a number of years. Those calculations started as feasibility tests and grew into regular and increasingly consolidated procedures. This experience shows that the methods in this guide are feasible.

The methods described in this guide are pragmatic and fit to existing data sources. Sometimes they are imperfect. In those cases the guide indicates this and earmarks areas for possible future improvement. In this sense, this guide indicates the current state of advancement of EGSS compilation in the EU.

The *EGSS Practical Guide* was written by Gerald Weber from Eurostat. It originally emerged from a peer review process in the Working Group on Environmental Expenditure Statistics. Drafting and discussion started in 2013. The guide then became a working group document in 2014 and was further improved in 2015, until it was updated to become a Eurostat publication in 2016. Arturo de la Fuente managed the publication project. Eurostat thanks all the experts who contributed with valuable advice and encouragement.

This guide is meant to be a companion of the *EGSS handbook, 2016 edition*. The *EGSS handbook* provides a complete explanation of the conceptual framework for the EGSS accounts (including their scope, definitions and classifications), the structure and contents of the reporting obligations under Regulation (EU) No 691/2011 and voluntary extensions, an overview of possible compilation approaches and suggestions on how to present and interpret the EGSS data. Readers familiar with the *EGSS handbook, 2016 edition* can skip chapters 1 and 2 of the *EGSS Practical Guide* and go straight to the compilation methods,

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List of abbreviations and acronyms

BoP:	Balance of Payments
CEPA:	Classification of Environmental Protection Activities
CIF:	cost – insurance - freight
CN:	Combined Nomenclature
COFOG:	Classification of the Functions of Government
CPA:	Statistical Classification of Products by Activity
CReMA:	Classification of Resource Management Activities
EBOPS:	Extended Balance of Payments Services
EGS:	Environmental Goods and Services
EGSS:	Environmental Goods and Services Sector
EP:	Environmental Protection
EPEA:	Environmental Protection Expenditure Accounts
EPS:	Environmental Protection Services
ESA 2010:	European System of Accounts (2010)
ESS:	European Statistical System
EU:	European Union
FOB:	free on board
FSC:	Forest Stewardship Council
FTE:	full-time equivalents
GDP:	Gross Domestic Product
GVA:	Gross Value Added
HS:	Harmonised Commodity Description and Coding System
IEEAF:	Integrated Environmental and Economic Accounting for Forests
ISIC:	International Standard Industrial Classification
LFS:	Labour Force Survey
LKAU:	Local Kind of Activity Unit
Mio EUR:	million euro
NA:	National Accounts
NACE:	Statistical Classification of Economic Activities in the European Community
OECD:	Organisation for Economic Cooperation and Development
PRODCOM:	Statistics on the Production of Manufactured Goods in the European Community
RAMON:	Reference and Management of Nomenclatures database
ReMEA:	Resource Management Expenditure Accounts
RM:	Resource Management
R&D:	Research and Development
SBS:	Structural Business Statistics
SEEA:	System of Environmental-Economic Accounting

SEEA-CF: System of Environmental-Economic Accounting – Central Framework

SITC: Standard International Trade Classification

SNA: System of National Accounts

UN: United Nations

VAT: Value added tax

WTO: World Trade Organisation

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1

Introduction

The environmental goods and services sector (EGSS) comprises all entities in their capacity as 'environmental producers', i.e., undertaking the economic activities that result in products for environmental protection and resource management. Producers in the EGSS may or may not be specialised in the production of environmental goods and services, and may produce them as principal or secondary activities or produce these products for own use. Consequently, the scope of the EGSS may overlap with existing legal definitions or statistical classifications of units only to a certain extent.

Environmental goods and services sector accounts are part of environmental accounts. Environmental accounts are a multipurpose data system defined in the System of Environmental-Economic Accounting 2012 - Central Framework (SEEA-CF 2012, United Nations et al., 2014a). Environmental accounts encompass a conceptual framework and tables which describe the interrelations between the economy and the environment in a way that is consistent with the System of National Accounts (SNA 2008, United Nations et al., 2009, chapter 29) and in the European System of Accounts (ESA 2010, Eurostat, 2013, chapter 22). Environmental accounts provide information related to a broad spectrum of environmental and economic issues including, in particular, the assessment of trends in the use of natural resources, the extent of emissions and discharges to the environment resulting from economic activity, and the extent of economic activity undertaken for environmental purposes.

The SEEA-CF section 4.3 titled *Environmental activity accounts and statistics* describes the purpose, scope and definition of the EGSS and other monetary environmental accounts. The EGSS accounts provide information on the production of environmental goods, services and technologies and statistical data on the contribution of this production within the economy as a whole. They also quantify related employment, gross value added and exports from the sector.

EUROPEAN STRATEGY FOR ENVIRONMENTAL ACCOUNTS AND LEGAL BASIS

In order to respond to the growing needs of information in the environmental-economic sphere in Europe, a multi-year European Strategy on Environmental Accounts (ESEA) was established. The first ESEA dates from 2003 and covered the period 2003-2007. This strategy was subsequently extended and improved. The ESEA currently in force covers the period 2014-2018 ⁽¹⁾ and was agreed by the European Statistical System Committee in its 21st meeting held in Luxembourg on 14th and 15th May 2014.

The progress achieved with ESEA led to adopting in 2011 a legal basis setting out a common framework for the collection, compilation, transmission and evaluation of European environmental-economic accounts (Regulation (EU) No 691/2011⁽²⁾). The Regulation stipulated mandatory reporting of three modules: air emissions accounts, environmental taxes and economy-wide material flow accounts.

Regulation (EU) No 691/2011 also requests the Commission to draw up pilot study programmes to test the

⁽¹⁾ European Statistical System Committee (2014)

⁽²⁾ Regulation (EU) No 691/2011 of the European Parliament and of the Council of 6 July 2011 on European environmental economic accounts

feasibility of the introduction of new environmental-economic accounts modules, including the EGSS accounts. A first pilot data collection was launched in 2009 followed by voluntary data collections in subsequent years. By 2014 the underlying conceptual framework and compilation methods had advanced to the point that the European Parliament and the Council agreed to include the EGSS accounts in the legal basis (Regulation (EU) No 538/2014 ⁽³⁾ amending Regulation (EU) No 691/2011).⁽⁴⁾

The scope of the mandatory reporting of the EGSS data is laid down in Annex V of Regulation (EU) No 691/2011. The EU Member States are requested to submit to Eurostat on an annual basis data on EGSS output, exports, gross value added and employment corresponding to market activities cross-classified by economic activities (NACE Rev. 2 A*21) and classes of the Classifications of Environmental Protection Activities (CEPA) and Resource Management Activities (CReMA). Besides the mandatory characteristics included in Annex V, the working group on environmental expenditure statistics identified other characteristics relevant for voluntary reporting, in particular output, gross value added and employment related to non-market activities, own final use and ancillary activities.

As provided for under Article 3.5 of Regulation (EU) No 691/2011 an indicative compendium of environmental goods and services and of the economic activities was established to facilitate a uniform delineation of environmental activities across the EU Member States. This list, comprising 46 groups of products and 46 groups of activities, was defined in the Annex of Commission Implementing Regulation (EU) No 2015/2174.⁽⁵⁾ Furthermore, the Implementing Regulation also states that the activities and products to be covered by EGSS accounts should be nationally relevant. As some activities and products may not exist or may not be statistically significant in some countries or as data sources for their estimation may be missing, the indicative compendium does not impose a mandatory list of activities and products on which countries should report the characteristics asked for.

PURPOSE AND STRUCTURE OF THE GUIDE

This guide originally emerged from a peer review process during the 2nd half of 2013 and Eurostat wrote it to provide national compilers with practical methods to compile EGSS statistics. The Working Group on Environmental Expenditure Statistics discussed a first draft in 2014 (*Practical guide towards compiling Environmental Goods and Services Sector Statistic* ⁽⁶⁾) and a revised and extended version in 2015. Eurostat has updated those working group documents for this publication, for two main reasons:

- First, in order to give full consistency with the *EGSS handbook, 2016 edition*
- In order to take account of the EPEA as a new data source for EGSS, paving the way for an integrated framework of monetary environmental accounts.

This guide is meant to be a companion of the *EGSS handbook, 2016 edition*. The *EGSS handbook* provides a complete explanation of the conceptual framework for the EGSS accounts (including their scope, definitions and classifications), the structure and contents of the reporting obligations under Regulation (EU) No 691/2011 and voluntary extensions, an overview of possible compilation approaches and suggestions on how to present and interpret the EGSS data. Instead, this guide has a narrower scope but develops it deeper: it focuses only on the compilation approach, in particular top-down techniques. This is the purpose of Chapters 3 to 5. In order to provide some context to the estimation techniques, Chapters 1 and 2 have been added summarising material from the *EGSS handbook*. Those chapters do not mean to replace the *EGSS handbook* and readers familiar with the *EGSS handbook* can skip them.

⁽³⁾ Regulation (EU) No 538/2014 of the European Parliament and of the Council of 16 April 2014 amending Regulation (EU) No 691/2011 on European environmental economic accounts

⁽⁴⁾ In total three modules were added in 2014: environmental protection expenditure accounts (EPEA), EGSS accounts and physical energy activity accounts

⁽⁵⁾ Commission Implementing Regulation (EU) 2015/2174 of 24 November 2015 on the indicative compendium of environmental goods and services, the format for data transmission for European environmental economic accounts and modalities, structure and periodicity of the quality reports pursuant to Regulation (EU) No 691/2011 of the European Parliament and of the Council on European environmental economic accounts

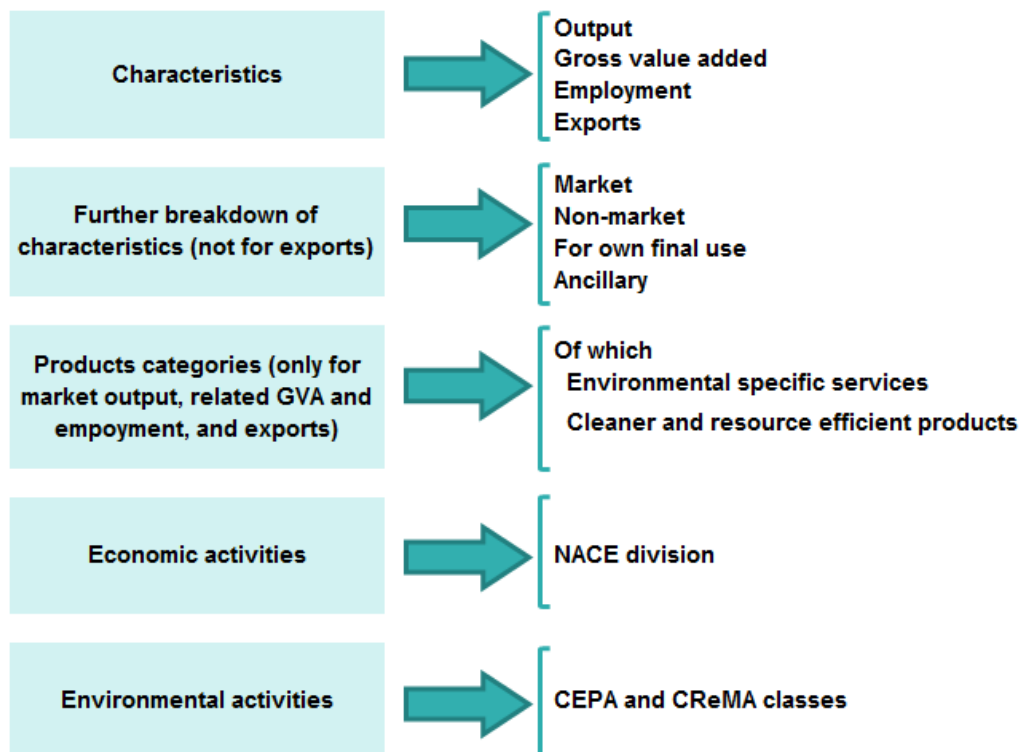
⁽⁶⁾ Available in CICABC in <https://circabc.europa.eu/w/browse/178f69e6-7339-4b40-8141-832eb567c18b>

2

Conceptual framework

This chapter briefly explains the conceptual framework of EGSS. In particular it presents the scope of EGSS, the characteristics (variables), and classifications used. It then provides an overview of data sources and the top-down compilation approach. A more detailed explanation can be found in the *EGSS handbook, 2016 edition*, Chapters 2 to 4. Readers familiar with the *EGSS handbook, 2016 edition* can skip this chapter.

Figure 1: Levels of detail for EGSS data collection



It is worth noting that the EGSS reporting framework has a mandatory part and a voluntary part. The mandatory part is the one in Regulation (EU) No 691/2011. Mandatory reporting on the EGSS covers the following characteristics:

- market output, of which
- exports;
- value added of market activities;
- employment of market activities.

For these characteristics the data shall be reported cross-classified by

- economic activities by the NACE Rev. 2 A*21 aggregation level as set out in ESA 2010, and by
- grouped CEPA and CReMA classes.

The voluntary extension of the EGSS reporting framework consists of:

- **Characteristics for voluntary reporting:** Besides the market output, the questionnaire allows to report the non-market output, output for own final use and ancillary output. The same is possible for gross valued added and employment related to those types of production. The questionnaire also allows reporting the total output, total gross valued added and total employment (total of market, non-market, for own final use and ancillary breakdowns).
- **Breakdown by product categories:** As concerns market activities and its characteristics (output, exports, gross valued added and employment) the questionnaire allows for voluntary reporting of two separate of-which-categories of environmental products: *environmental specific services* and *cleaner and resource efficient products*.
- **More detailed breakdowns by environmental and economic activities.** This extended breakdown can be applied to mandatory and voluntary characteristics.

2.1. Environmental activities and products

The environmental goods and services sector is a sub-set of the whole economy. Environmental producers are engaged in environmental activities. The outputs of those activities are environmental products. Whereas environmental producers, activities and products are quite closely related concepts, there is no perfect 1:1 relation between them as environmental producers may also be engaged in non-environmental activities (as secondary activities), and environmental activities may also produce non-environmental products. This guide will focus only on two of those approaches: activities and products. SEEA-CF conceptually starts from environmental activities and builds from there. An approach turning around environmental products may be useful in particular in countries using a product-based compilation approach.

This guide, the same as the *EGSS handbook*, addresses the definition of the scope of EGSS with an approach based on three layers. The first layer is the SEEA-CF, which provides the fundamental definitions, and is a worldwide standard. This concerns in particular the SEEA-CF definitions of environmental activities, environmental protection and resource management. The second layer, which is relevant EU-wide, consists of lists of environmental activities and products consistent with the SEEA-CF definitions. Those lists are more operational for the compilation of the accounts, in the sense that they link to statistical classifications and data sources. The third layer consists of (possible) national lists of environmental activities and products. National lists may be necessary if there is a need, under specific circumstances, to adjust the EU lists for national purposes. This set-up is explained in this section.

WHAT ARE ENVIRONMENTAL ACTIVITIES?

The SEEA-CF, Chapter 4 provides the basic definitions for environmental activities that are relevant for EGSS. Accordingly, environmental activities encompass those economic activities whose primary purpose is to reduce or eliminate pressures on the environment or to make more efficient use of natural resources.

In general, an activity occurs when resources are combined, leading to the creation of specific goods or services (ESA 2010, § 2.145). An activity is characterised by an input of products, a production process and an output of products, whereby production is an activity carried out under the control, responsibility and

management of an institutional unit that uses inputs of labour, capital and goods and services to produce outputs of goods and services (ESA 2010, § 3.07).

This guide defines: *Environmental activities* as activities that either directly serve an environmental purpose or produce specifically designed products whose use serve an environmental purpose. Environmental activities can be performed as principal, secondary or ancillary activities of a producer.

Environmental activities can be classified by their purpose. Regulation (EU) No 691/2011 distinguishes two broad types of environmental activities, in line with the SEEA-CF, according to their purpose:

- Environmental protection (EP) activities include all activities and actions which have as their main purpose the prevention, reduction and elimination of pollution and of any other degradation of the environment, and
- Resource Management (RM) activities include the preservation, maintenance and enhancement of the stock of natural resources and therefore the safeguarding of those resources against depletion.

Indeed the concept of environmental activities, which was introduced above, can be reformulated in terms of activities with EP or RM purpose. This definition emphasises the EP or RM purpose of an environmental activity or the purpose of the product produced as result of that activity.

WHAT ARE ENVIRONMENTAL PRODUCTS?

Environmental products are the outputs of environmental activities. In line with the definition of environmental activities all products that directly serve EP or RM or are specifically designed to be used for EP and RM are environmental products.⁽⁷⁾ Environmental products can be produced as principal, secondary or ancillary output of a producer. If a producer engaged in environmental activities also has non-environmental activities the output of the non-environmental activities are not EP or RM products.

OPERATIONALISING THE SCOPE OF EGSS: THE INDICATIVE COMPENDIUM

Whereas the SEEA-CF and Regulation (EU) No 691/2011 provide definitions for EP and RM activities and products, in practice they rely on a measurement approach based on purpose (of the producing activity and use of the products). Depending on the sources used for the compilation of EGSS accounts it may be rather difficult to interpret the SEEA-CF definitions. To ensure that compilers of EGSS working independently, e.g. in different countries, apply the definitions in identical ways it is important to make the definitions operational. This can be done with lists of environmental activities and products.

The Commission has established by means of an implementing act ⁽⁸⁾ an indicative compendium of environmental goods and services and of the economic activities to be covered by the EGSS accounts to facilitate a uniform application of Annex V of Regulation (EU) No 691/2011. Annex 1 of this guide reproduces the environmental products and activities according to this indicative compendium.

The definition of environmental activities in the SEEA-CF and the lists of EGSS products and activities in the indicative compendium complement each other. The SEEA-CF provides the conceptual foundations for the scope of the accounts. The indicative compendium provides a practical list of activities and products that can be identified from classifications and data sources. The SEEA-CF definition justifies the inclusion or exclusion of activities and products in the indicative compendium.

Whereas the compendium must operationalise the scope of the EGSS, it does not impose any specific compilation approach to the countries (activity based, product based or a mix of approaches; for detail see Chapter 4). It allows flexibility to take account of specific national situations as regards their economies and data availability. Regulation (EU) No 691/2011 recognises it with the wording *indicative compendium*. For this reason, the lists of activities and products in the indicative compendium are the core products/activities found relevant for EGSS accounts and important in most of the European countries.

National compilers are given flexibility to take account of the activities and products with national relevance. Countries can limit themselves to the compendium products and activities that are nationally relevant. Countries must however inform the Commission about those differences, justify them and verify periodically that they are still applicable i.e., that the products and activities in the compendium are not statistically significant in the country and data sources to estimate them do not exist. The intention is that such

⁽⁷⁾ See also SEEA-CF 2012, paragraph 4.95

⁽⁸⁾ Commission Implementing Regulation (EU) No 2015/2174 of 24 November 2015 on the indicative compendium of environmental goods and services, the format for data transmission for European environmental economic accounts and modalities, structure and periodicity of the quality reports pursuant to Regulation (EU) No 691/2011 of the European Parliament and of the Council on European environmental economic accounts, http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2015.307.01.0017.01.ENG

information is reported periodically, say every 5 years, as part of the EGSS quality reports.

In order to facilitate the use of the indicative compendium Eurostat maintains operational EGSS lists of activities and products.⁽⁹⁾ Those lists do not have a legal basis. They include correspondence with standard classifications, as follows:

- The operational list of EGSS activities (see an excerpt in Annex 2) reproduces in its first column the environmental activities from the compendium. The next three columns of the operational list refer to the NACE classification of economic activities. They indicate the NACE categories (up to the 4-digit class level) relevant for the identification of the environmental activities. There is mostly no strict 1:1 correspondence between them because more than one NACE category may be relevant for one item of the compendium and only in a few cases it may be assumed that an identified NACE category is entirely environmental. Therefore the operational list also indicates whether the identified NACE codes 100% represent an environmental activity or only partially do so. In the latter case normally only a certain percentage of the identified activity may be considered as environmental. This percentage may differ across countries.
- The operational list of EGSS products (which has a layout similar to that of the operational list of EGSS activities) reproduces in its first column the environmental goods and services from the compendium. The next six columns of the operational list refer to the CPA and CN classifications. They propose CPA categories (up to the 6-digit level) and CN categories (up to the 8-digit level) relevant for the identification of the environmental products. There is mostly no strict 1:1 correspondence between them because more than one NACE or CN category may be relevant for one item of the compendium and only in a few cases it may be assumed that an identified CPA or CN category is entirely environmental. Therefore the operational list also indicates whether the identified NACE and CN codes 100% represent an environmental product or only partially do so. In the latter case normally only a certain percentage of the characteristic (e.g. output, exports) of the identified product may be considered as environmental. This percentage may differ across countries.
- Both operational lists also indicate the classes of environmental activities into which the items in the compendium can be classified (for more detail on the CEPA and CReMA classifications see section 2.4 of the *EGSS handbook*). A specific item in the compendium may relate to more than one for the classes of environmental activities. E.g. training services in environmental protection and resource management can in principle relate to any of the classes of CEPA or CReMA. In such cases compilers need to find a distribution key or allocate the item to one environmental class presumed dominant.

National EGSS compilers are given flexibility to take account of the activities and products with national relevance. Countries can limit themselves to the compendium products and activities that are nationally relevant. National compilers can also take into account some environmental activities and products not listed in the compendium but relevant in their country. However in order not to threaten the comparability of EGSS data between countries such inclusion is only accepted if these activities and products are deemed to be country specific, i.e. have no statistical relevance for other countries.

Countries must inform the European Commission (Eurostat) about deviations between national lists and the lists in the indicative compendium. Countries must also justify those deviations and verify periodically that they are still applicable. The intention is that this is reported periodically, say every 5 years, as part of the EGSS quality reports. This process may lead to a revision of the compendium in future.

In any case it can be helpful for national compilers of EGSS accounts to compile their own country specific operational lists with the indicative compendium and Eurostat's operational lists used as starting points.

The treatment of some borderline cases is explained in the *EGSS handbook*, section 2.3

PRODUCT CATEGORIES FOR REPORTING TO EUROSTAT

Regulation (EU) No 691/2011 states that environmental goods and services fall within the categories of: environmental specific services, environmental sole purpose products (connected products), adapted goods and environmental technologies.⁽¹⁰⁾ The Regulation does not require that countries report the EGSS characteristics broken down by those product categories. Eurostat proposes a simpler categorisation of products in two broad categories, as follows:

⁽⁹⁾ See document ENV/ACC/WG04.3 presented at the meeting of the Working Group Environmental Expenditure Accounts of 12 and 13 April 2016

⁽¹⁰⁾ The SEEA-CF 2012 provides definitions of these categories (see also Annex 7 of this guide)

- *Environmental specific products* primarily serve environmental protection or resource management. Examples are sewerage services and collection, treatment and disposal services for waste, sound or thermal insulation materials, equipment for renewable energy production. *Environmental specific products* are divided into two subsets: *environmental specific services* is the subset covering only those environmental specific products that are services and *environmental specific goods* is the subset covering those environmental specific products that are goods;
- *Cleaner and resource efficient products* primarily serve a non-environmental purpose but may serve a secondary environmental purpose because they are specifically designed to be more environmentally friendly or more resource efficient than normal products of equivalent use. Secondary purpose should not be mistaken with secondary product, which is the output of a producer's secondary activity (ESA 2010, § 3.11). Examples of cleaner and resource efficient products are electric transport equipment, secondary raw materials, electricity, fuels, gas and heat from renewable sources, the most resource efficient domestic appliances. It is worth noting that secondary purpose should not be mistaken with secondary product, which is the output of a producer's secondary activity (ESA 2010, § 3.11).

Eurostat asks countries to report in the questionnaire (on a voluntary basis) *environmental specific services* and *cleaner and resource efficient products* as 'of which' positions of market output.

Cleaner and resource efficient products may or may not be easily identifiable. Environmental labelling schemes and standards can help identifying environmental products. This handbook proposes that countries select products that have the highest environmental class given by European schemes. Other guidance to identify cleaner and resource efficient products is provided in the *EGSS handbook* Chapter 4.

2.2. EGSS characteristics (variables)

2.2.1. Output

EGSS accounts define output in the same way as in national accounts. It is also valued according to the principles of the national accounts.

MARKET OUTPUT

According to national accounts, market output

- consists of output that is disposed of on the market or intended to be disposed of on the market (ESA 2010, § 3.17);
- includes products sold at economically significant prices⁽¹¹⁾, products bartered, products used for payments in kind, products supplied by one LKAU to another within the same institutional unit to be used as intermediate inputs or for final uses and products added to the inventories of finished goods and work-in-progress intended for one or other of the above uses (ESA 2010, §§ 3.18-3.19);
- is valued at basic prices which are the prices received from the purchasers plus subsidies on products minus taxes on products⁽¹²⁾, excluding any transport charges invoiced separately by the producer and excluding any holding gains and losses on financial and non-financial assets (for details see ESA 2010, §§ 3.43-3.44).

The main producers of market output in environmental products are the non-financial corporations sector and the unincorporated enterprises within the household sector.

NON-MARKET OUTPUT

Non-market output is an EGSS characteristic for voluntary reporting.

⁽¹¹⁾ ESA 2010, § 3.19 explains that the economically significant price of a product is defined in relation to the unit that has produced the output. Sold output of unincorporated enterprises owned by households is sold at economically significant prices. For other institutional units, the ability to undertake a market activity at economically significant prices is to be checked by the 50% criterion: To be a market producer, the unit shall cover at least 50% of its costs by its sales over a sustained multi-year period

⁽¹²⁾ Taxes on products include value added tax, import taxes and other taxes that are payable per unit of a product (ESA 2010, §§ 4.16-4.21). Subsidies on products include import subsidies and other subsidies that are payable per unit of a product (ESA 2010, §§ 4.33-4.35). It is to be noted that the taxes to be subtracted and subsidies to be added to the price received from the purchasers do not cover those that are not payable per unit of a product produced or transacted

According to the national accounts definition, non-market output is output provided to other units for free, or at prices that are not economically significant (ESA 2010, § 3.23).⁽¹³⁾ The main producers of non-market output are the general government sector and the non-profit institutions serving households sector.

EGSS non-market output covers a wide range of specific services such as regulation services, monitoring of environmental parameters, environmental control of enterprises, public approval procedures for environmentally relevant projects (e.g. environmental compatibility assessments). EGSS non-market output also covers some consulting, R&D and education in the domains of EP and RM or the production of environmental statistics. Wastewater or waste collection and treatment services may also be provided free or at prices not economically significant.

Non-market output is to be valued as the sum of costs of production i.e., the sum of intermediate consumption, compensation of employees, consumption of fixed capital and other taxes on production less other subsidies on production (ESA 2010, § 3.49).

OUTPUT PRODUCED FOR OWN FINAL USE

Output produced for own final use is an EGSS characteristic for voluntary reporting.

According to the national accounts definition, output produced for own final use consists of goods or services that are retained either for own final consumption or for capital formation by the same institutional unit (ESA 2010, § 3.20).

Products for own final consumption can only be produced by the household sector, whereas products used for own gross fixed capital formation⁽¹⁴⁾ can be produced by any sector of the economy (ESA 2010, §§ 3.21-3.22).

The *EGSS handbook* gives some example of output for own final use, e.g. R&D, photovoltaic electricity generated by households and manufacture of specific equipment used for EP or RM not sold but used for capital formation in the same institutional unit.

Output for own final use is to be valued at the basic prices of similar products sold on the market or, if not possible, at the costs of production (for more detail see ESA 2010, § 3.45). The costs of production (sum of cost approach) cover the intermediate consumption, compensation of employees, consumption of fixed capital, other taxes on production less other subsidies on production and a mark-up (except for non-market producers) for net operating surplus.

ANCILLARY OUTPUT

Ancillary output is an EGSS characteristic for voluntary reporting.

According to the national accounts definition, ancillary activity is an activity whose output is intended for use within an enterprise (ESA 2010, § 3.12). The output of ancillary activities is called ancillary output.

The difference between ancillary output and output for own final use (see previous category) is that the former will re-enter into production processes and be further transformed, whereas the latter is for final use (either consumption or fixed capital formation). Some goods may be used within an enterprise as intermediate consumption and others may be used as gross fixed capital formation (i.e. investment) and the distinction is very important in this context: the production of the former will be accounted as ancillary output whereas the latter as own gross fixed capital formation. In order to be output for own gross fixed capital formation the product must be a capital asset, which ESA 2010 calls 'produced non-financial asset'. Those are defined as outputs from production processes which are used repeatedly or continuously in production for more than one year (ESA 2010 § 7.22).

Ancillary environmental activities are activities that directly serve an environmental purpose and result in products for use (other than gross capital formation) within the same establishment to support its principal and secondary activities e.g. in-house EP services such as monitoring exhaust gas emissions.

National accounts does not record separately the ancillary output (ESA 2010, § 1.31). In this point EGSS deviates from national accounts. In the national accounts all inputs consumed by an ancillary activity -

⁽¹³⁾ Similarly to the definition of economically significant price (ESA 2010, § 3.19) prices are not economically significant if the sales cover less than 50% of the costs of the output provided to other units over a sustained multi-year period

⁽¹⁴⁾ Gross capital formation includes gross fixed capital formation, changes in inventories and acquisitions less disposal of valuables (ESA 2010, § 3.122). As products added to the inventories of finished goods and work in progress intended for later sale, bartering, payment in kinds or supply to another establishment of the same institutional unit is already included in market output (§ 3.18), EGSS output retained for own capital formation may include in practice only that used for gross fixed capital formation.

materials, labour, consumption of fixed capital, etc.- are treated as inputs of the principal or secondary activity which the ancillary activity supports. Correspondingly ancillary activities have no value added attributed in national accounts, all value added is attributed to the principal or secondary activity.

Moreover, in the national accounts all inputs consumed by an ancillary activity - materials, labour, consumption of fixed capital, etc.- are treated as inputs of the principal or secondary activity which the ancillary activity supports. Therefore neither the output nor the input of ancillary activities is recorded in the system of national accounts. Correspondingly they have no value added either in national accounts, all value added is attributed to the principal or secondary activity.

This guide recommends including as a separate category ancillary EGSS output that supports the production of non-environmental products⁽¹⁵⁾, whereas ancillary EGSS output for the production of environmental products is considered to be already implicitly recorded in the output value of these products.

This guide recommends to value ancillary output as the sum of costs. The sum of costs should cover intermediate consumption, compensation of employees, consumption of fixed capital, other taxes on production less other subsidies on production and a mark-up (except for non-market producers) for net operating surplus. It may, however, be difficult to quantify some of the above cost elements for an ancillary activity. For example, if there are no records on which of the fixed assets of a unit are used for its ancillary environmental activities and on the share of their use for the ancillary activity, in the best case a rough estimate may be made. An estimate may be even more difficult to provide for taxes, subsidies and the net operating surplus mark-up.

Taking into account only the intermediate consumption and the compensation of employees (the current expenditure) may deliver a sufficiently good valuation of ancillary output, in particular if no specific equipment is used for the ancillary activity. However, some of the equipment used for ancillary activities may be specific for them (e.g. apparatus to monitor exhaust gases or an oven for waste incineration). In this case an allocation to the ancillary activity can be made. However, the provisions (legal and technical) for reporting such detailed information and for transmission to the statistical system may not exist. Consequently if no specific information is available to EGSS compilers, it is recommended to use the share of current expenditure for the ancillary activity in the total current expenditure of unit or industry as a proxy for the ancillary activity's share of the other costs elements. Such a pro-rata approach will not result in a very precise valuation, but is a starting point that can be improved when more detailed information becomes available.

With the development of the production of renewable energy, which is by nature often decentralised, many producers pertaining to various industries produce electricity or heat for their own internal needs. In order to ensure a maximum of comprehensiveness and comparability of the data this handbook recommends to include this EGSS output as the same type of output as in national accounts i.e., market output, non-market output or ancillary output.

2.2.2. Exports

Exports of EGSS market output is a characteristic of mandatory reporting under Regulation (EU) No 691/2011.

EGSS follow the ESA 2010 definition of exports: exports of goods and services consist of transactions in products (sales, barter, and gifts) from residents to non-residents (ESA 2010, § 3.158). In national accounts exports occur when the economic ownership of the good changes between resident units and non-resident units (ESA 2010, § 3.162) or when a service is rendered by a resident to a non-resident (ESA 2010, § 3.171). This change-of-ownership principle applies irrespective of existence of corresponding physical movements of goods across frontiers.

The distinction between market, non-market, ancillary and for own final use does not exist for exports.

The valuation of exports of goods in the EGSS accounts is different from the valuation of exports of goods in the national accounts. Exports in national accounts are valued free on board (FOB), i.e. at the border of the exporting country for goods and at basic prices for services (ESA 2010, § 3.168).⁽¹⁶⁾ In EGSS accounts exports of goods should be valued at basic prices as EGSS considers exports from the supply side (i.e. the

⁽¹⁵⁾ For the sake of accuracy, please note that 'non-environmental products' in this section, as well as in sections 2.2.3 and **Error! Reference source not found.** actually means 'products outside the EGSS boundary'. EGSS includes cleaner and resource efficient products, which may be non-characteristic environmental products

⁽¹⁶⁾ However in the supply and use tables, imports of goods are valued at the cost –insurance-freight (CIF)

part of output which is exported). The exclusion of export related transport and distributive services is also in line with the exclusion of wholesale and retail trade from the scope of EGSS. If export data of environmental goods are valued FOB, compilers of EGSS accounts need to make appropriate valuation adjustments if related transport and distributive services as well as taxes less subsidies on the goods are significant and available source allow to estimate such adjustment.

2.2.3. Gross value added

Gross value added (GVA) is defined as the balancing item of the production account before the consumption of fixed capital, i.e. output at basic prices minus intermediate consumption at purchasers' prices (ESA 2010, § 9.06). This balancing item is conventionally considered to be valued at basic prices. Gross value added can also be calculated from the expenditure side and from the income side.

Following the definition of national accounts, intermediate consumption consists of products consumed as inputs by a process of production, excluding fixed assets, whereby the products are either transformed or used by the production process (ESA 2010, § 3.88). Paragraphs 3.89 and 3.90 list cases included and excluded. In particular, products which are received from another LKAU of the same institutional unit are included in intermediate consumption. Products used for intermediate consumption are valued at purchasers' prices prevailing at the time the products are used in the process of production (ESA 2010, § 3.91).

If an EGSS producer also produces non-environmental products the intermediate consumption should be split into a part relating to the production of the environmental products and a part relating to the non-environmental products. Only the part relating to the environmental products is to be subtracted from EGSS output to calculate EGSS gross value added. In the compilation practice this subtraction will often be done implicitly, for example, when ratios GVA / output derived from national accounts data are applied to calculate EGSS GVA from EGSS output. Alternatively, if the split into the parts relating to the production of the environmental products and relating to the non-environmental by-products cannot be made (neither explicitly nor implicitly), intermediate consumption of EGSS is to be adjusted proportionally according to the share of the non-environmental by-product in the total output of the EGSS market activity. If also this share information is not available the by-products may be exceptionally counted towards EGSS output and the total intermediate consumption of the EGSS activity is to be subtracted in order to calculate the EGSS GVA.

Regulation (EU) No 691/2011 requires countries to report the GVA corresponding to market activities of the EGSS. This concept does not exist in national accounts. The concept of market and non-market exists for output and for producers but not for GVA (ESA 2010, §§ 3.17, 3.23, 3.24, 3.26). Because the concept of GVA of market activities is listed in the Regulation, it is understood in this handbook that it means the GVA generated in the production of EGSS market output. If a producer is engaged in environmental and non-environmental (market) activities, only the former are recorded in EGSS. If there is no detailed information about the producer activities to make the distinction between environmental and non-environmental activities, the split can be done on a pro rata basis or with some coefficients.

Estimating the GVA of market activities would in theory consist of isolating the individual statistical units which only perform market production from those performing non-market activities, but not both. Disaggregating this way it is possible to produce the GVA estimates requested in the Regulation. However, if it is not possible to go down in such a level of detail, the problem is how to estimate which part of the intermediate consumption is used to produce market output and which to produce non-market output. A pro-rata approach (based on the ratios of market and non-market output to total output) can be used in those cases.

Whereas the Regulation only requires the GVA for the market activities, the voluntary part of the Eurostat data collection also encompasses the GVA related to non-market activities, production for own final use and ancillary environmental output.⁽¹⁷⁾

Only the GVA of ancillary environmental activities that support the production of non-environmental products should be recorded, whereas ancillary environmental activities that support the production of environmental products do not have to be separately identified. This is to avoid double counting with the GVA due to the non-ancillary production of environmental products. In practice, however, this distinction may be difficult to implement in full in surveys and other approaches are needed to estimate the EGSS gross value added. As a practical approach this handbook recommends not to account the gross value

⁽¹⁷⁾ with ancillary environmental output falling outside the production boundary of the national accounts

added (and output and employment) of ancillary environmental activities of the NACE divisions 37-39 (Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services). For other industries (e.g. manufacturing) it may be assumed that ancillary environmental activities serve primarily to make their non-environmental production environmentally more friendly and resource efficient. Under this assumption adding a separate estimate of the gross value added linked to ancillary EGSS activities would not result in a double counting.

2.2.4. Employment

Regulation (EU) No 691/2011 asks to report the employment corresponding to market activities of the EGSS.

The definition of employment in EGSS is the same as in national accounts (ESA 2010, § 11.11). Employment in EGSS market activities consists of all persons engaged in productive EGSS market activities that fall within the production boundary of the national accounts. Persons in employment are employees or self-employed persons according to the definitions and categories listed in ESA 2010 §§ 11.13-11.14 and 11.115-11.16.

If an EGSS producer is also engaged in non-environmental activities the employment should be split into a part relating to the production of the environmental products and a part relating to the non-environmental products. Only the part relating to the environmental products is to count towards EGSS employment.⁽¹⁸⁾

Whereas the Regulation only requires the employment for the market activities, the voluntary part of the Eurostat data collection also encompasses the employment related to non-market activities, production for own final use and ancillary environmental output. In the compilation practice the restriction to that part relating to the environmental products will often be made implicitly, for example, when employment: output ratios derived from national accounts data are applied to calculate EGSS employment from EGSS output. Alternatively, if data do not allow to exclude the part relating to the by-product (neither explicitly nor implicitly), employment is to be adjusted proportionally according to the share of the non-environmental by-product in the total output of the market activity. If also this share information is not available the total employment of the activity is (exceptionally) to be counted towards EGSS employment.

It is to be noted that employment in ancillary environmental activities should only be reported if the related GVA and output are also reported in the EGSS accounts. This is to ensure scope consistency between the characteristics of the EGSS accounts.

According to the Regulation, EGSS employment is to be reported in full-time equivalents (FTEs). The full-time equivalent is the number of full-time equivalent jobs, defined as total hours worked divided by average annual hours worked in full-time jobs (ESA 2010, §§ 11.32-11.34). Data measured in FTE may not be readily available in the basic sources for EGSS employment. In practice, estimates of persons employed or jobs can be converted into FTEs based on ratios between persons in employment or jobs and FTEs. Conversion coefficients can be calculated e.g. based on the shares of part-time workers and full-time workers or hours worked part and full time. This information is available from specific sources such as the Labour Force Survey.⁽¹⁹⁾

2.3. Classifications and other breakdowns used in EGSS accounts

Classifications are useful to break down the characteristics of the EGSS accounts (output, exports, gross value added and employment)⁽²⁰⁾, both for compilation and presentation purposes.

⁽¹⁸⁾ In the compilation practice the restriction to that part relating to the environmental products will often be made implicitly, for example, when employment: output ratios derived from national accounts data are applied to calculate EGSS employment from EGSS output. Alternatively, if data do not allow to exclude the part relating to the by-product (neither explicitly nor implicitly), employment is to be adjusted proportionally according to the share of the non-environmental by-product in the total output of the market activity. If also this share information is not available the total employment of the activity is (exceptionally) to be counted towards EGSS employment

⁽¹⁹⁾ Only in exceptional cases where such information is not available it may be acceptable to assume a conversion factor equal to one. This would, however, most likely result in an overestimation by 1-10% of EGSS employment measured in FTE

⁽²⁰⁾ For the definition of these EGSS characteristics see section 3.1 of this guide. In general, the EGSS accounts use the definitions for the corresponding transactions, variables and balancing items of the ESA 2010

NACE

The Statistical Classification of Economic Activities in the European Community, Rev. 2 (2008) (NACE Rev. 2) is the standard to report data by industries. An industry is the group of all local kind-of-activity units (LKAUs) engaged on the same or similar kind-of-activity (ESA 2010, §§ 1.59, 2.150-2.152). Industries and LKAUs are well suited to analyse production processes and technico-economic relationships (ESA 2010, § 2.03).

The LKAU (or establishment)⁽²¹⁾ is the statistical unit to be used for EGSS accounts because the EGSS characteristics (output, gross value added, employment, exports) all relate directly to production activities.

Regulation (EU) No 691/2011 requires the data to be broken down by NACE Rev. 2 using the A*21 aggregation level as set out in the ESA 2010. On a voluntary basis, countries can use a 39-category extension of A*21 as follows:

- Manufacturing (NACE section C) and professional, scientific and technical activities (NACE section M) use the A*38 NACE aggregation of the ESA transmission programme;
- Professional, scientific and technical activities (NACE section M) is split into NACE M69_M70 (legal and accounting activities; activities of head offices; management consultancy activities), NACE M71 (architectural and engineering activities; technical testing and analysis), NACE M72 (scientific research and development) and NACE M73-M75 (advertising and market research; other professional, scientific and technical activities; veterinary activities);
- Water supply; sewerage, waste management and remediation activities (NACE E) use the A*88 NACE aggregation level.

⁽²¹⁾ What ESA 2010 calls "LKAU" SNA 2008 calls "establishment" (ESA 2010, § 2.148)

Table 1: Mandatory and voluntary reporting by NACE

Section/Division	Description
A	Agriculture, forestry and fishing
B	Mining and quarrying
C	Manufacturing
C10_C12	Manufacture of food products, beverages and tobacco products
C13_C15	Manufacture of textiles, wearing apparel, leather and related products
C16_C18	Manufacture of wood and paper products, and printing
C19	Manufacture of coke and refined petroleum products
C20	Manufacture of chemicals and chemical products
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
C22_C23	Manufacture of rubber and plastic products, and other non-metallic mineral products
C24_C25	Manufacture of basic metals and fabricated metal products, except machinery and equipment
C26	Manufacture of computer, electronic and optical products
C27	Manufacture of electrical equipment
C28	Manufacture of machinery and equipment n.e.c.
C29_C30	Manufacture of transport equipment
C31_C33	Manufacture of furniture; other manufacturing; repair and installation of machinery and equipment
D	Electricity, gas, steam and air conditioning supply
E	Water supply; sewerage, waste management and remediation activities
E36	Water collection, treatment and supply
E37	Sewerage
E38	Waste collection, treatment and disposal activities; materials recovery
E39	Remediation activities and other waste management services
F	Construction
G	Wholesale and retail trade
H	Transportation and storage
I	Accommodation and food service activities
J	Information and communication
K	Financial and insurance activities
L	Real estate activities
M	Professional, scientific and technical activities
M69_M70	Legal and accounting activities; activities of head offices; management consultancy activities
M71	Architectural and engineering activities; technical testing and analysis
M72	Scientific research and development
M73-M75	Advertising and market research; other professional, scientific and technical activities; veterinary activities
N	Administrative and support service activities
O	Public administration and defence, compulsory social security
P	Education
Q	Human health and social work activities
R	Arts, entertainment and recreation
S	Other service activities
T	Activities of households as employers; undifferentiated goods and services producing activities of households for own use
U	Activities of extraterritorial organizations and bodies

Note: mandatory items in **bold** characters

Annex 3 reports the correspondence between the 39 voluntary categories in the EGSS questionnaire and the NACE groupings for National Accounts A*21 and A*64.

CEPA AND CREMA

EGSS accounts also require that data are reported broken down by purpose-based classifications of environmental activities e.g. whether the purpose is the protection of ambient air and climate, wastewater management or the management of water resources. More specifically, Regulation (EU) No 691/2011 requires that EGSS data are cross-classified by NACE and classifications of environmental activities.

EP is described in detail in the Classification of Environmental Protection Activities (CEPA 2000) and RM in the Classification of Resource Management Activities (CReMA). Table 2 shows the classes of the two classifications and Table 3 the grouped classes for mandatory reporting.

CEPA 2000, adopted as an international standard at the meeting of the UN Statistical Commission held in March 2002, is a generic, multi-purpose, functional classification for EP. It is used for classifying EP

activities but also products. It covers nine classes: protection of ambient air and climate (CEPA 1), wastewater management (CEPA 2), waste management (CEPA 3), protection and remediation of soil, groundwater and surface water (CEPA 4), noise and vibration abatement (CEPA 5), protection of biodiversity and landscapes (CEPA 6), protection against radiation (CEPA 7), environmental research and development (CEPA 8) and other environmental protection activities (CEPA 9). A detailed description of the CEPA classification is available in Annex 4 (also available in the SEEA-CF 2012, Annex I and in Eurostat's Reference And Management Of Nomenclatures database (RAMON⁽²²⁾)).

CReMA is also a generic, multi-purpose, functional classification. CReMA was developed by Eurostat Task Forces.⁽²³⁾ It distinguishes seven main classes: management of water (CReMA 10), management of forest resources (CReMA 11), management of wild flora and fauna (CReMA 12), management of energy resources (CReMA 13), management of minerals (CReMA 14), research and development activities for resource management (CReMA 15) and other resource management activities (CReMA 16). Annex 5 presents definitions and explanatory text for the activities of the CReMA.

CEPA and CReMA are expected to be mutually exclusive so that an identified environmental activity should fit into one and only one of the classes.

If it is not possible to make a clear-cut objective allocation to one and only one environmental class, not even at the most detailed level available (because an activity may in fact serve two environmental purposes), the activity should be allocated to the class deemed to represent the main purpose. The box below shows examples of environmental activities that may be relevant for more than one CEPA or CReMA class. Annex 6 further elaborates recommendations and operational rules for the treatment of borderline cases.

⁽²²⁾ http://ec.europa.eu/eurostat/ramon/index.cfm?TargetUrl=DSP_PUB_WELC

⁽²³⁾ Important contributions to develop the CReMA were published by Ardi, C. and Falcitelli, F. (2007)

Table 2: Classifications of environmental activities

CEPA class:	Classification of Environmental Protection Activities
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
6	Protection of biodiversity and landscapes
7	Protection against radiation
8	Environmental research and development
9	Other environmental protection activities
CReMA class	Classification of Resource Management Activities
10	Management of water
11	Management of forest resources
11 A	Management of forest areas
11 B	Minimisation of the intake of forest resources
12	Management of wild flora and fauna
13	Management of energy resources
13 A	Production of energy from renewable sources
13 B	Heat/Energy saving and management
13 C	Minimisation of the intake of fossil resources as raw material
14	Management of minerals
15	Research and development for resource management
16	Other resource management activities

Sources: Eurostat: RAMON - Reference And Management Of Nomenclatures; Regulation (EU) No 691/2011

Table 3: Grouped CEPA and CReMA classes for mandatory reporting

Class	Description
CEPA 1	Protection of ambient air and climate
CEPA 2	Wastewater management
CEPA 3	Waste management
CEPA 4	Protection and remediation of soil, groundwater and surface water
CEPA 5	Noise and vibration abatement
CEPA 6	Protection of biodiversity and landscapes
CEPA 7+8+9	Protection against radiation, R&D for EP, Other EP activities
CReMA 10	Management of water
CReMA 11	Management of forest resources
CReMA 12+15+16	Management of wild flora and fauna, R&D for RM, Other RM activities
CReMA 13	Management of energy resources
CReMA 13 A	Production of energy from renewable sources
CReMA 13 B	Heat/Energy saving and management
CReMA 13 C	Minimisation of the intake of fossil resources as raw material
CReMA 14	Management of minerals

PRODUCT CLASSIFICATIONS

Product classifications are not used in EGSS for reporting breakdowns, but play a role in the compilation of EGSS accounts. Therefore they are briefly explained here, too. At European level there are three main classifications of products – CPA, PRODCOM and CN:

- The Statistical Classification of Products by Activity (CPA 2008) is a complete product classification covering goods and services. Each type of product distinguished in the CPA is defined in such a way that it is normally produced by only one activity as defined in the NACE classification. CPA and NACE classification are linked: The first four digits of any CPA code correspond to the four-digit code of the corresponding NACE level. CPA distinguishes ca. 3100 products.
- The lists of products for statistics on the production of manufactured goods (the PRODCOM list) and its codes are used to classify products from mining and quarrying (NACE section B) and manufacturing (NACE section C). To keep it manageable, similar products are grouped into single items. The list is updated every year and currently contains ca. 3900 items. Each heading has an eight-digit code based on the first four digits of NACE sections B and C in which the producing enterprise is normally classified and the first six digits of the CPA supplemented by additional two digits. Going into more detail than CPA, the PRODCOM can allow for the identification of EP and RM output which is not singled out by CPA codes.
- The Nomenclature governed by the Convention on the Harmonized Commodity Description and Coding System, commonly known as HS Nomenclature, is an international multipurpose nomenclature which was elaborated under the auspices of the World Customs Organization. The HS Nomenclature comprises about 5000 commodity groups which are identified by a 6-digit code and arranged according to a legal and logical structure based on fixed rules. The Combined Nomenclature (CN) of the EU integrates the HS Nomenclature and comprises additional (8-digit) subdivisions and legal notes specifically created to address the needs of the EU. The trade classifications are used mainly for recording trade activities. Their items and sub-items are the fundamental terms on which industrial goods are identified in product classifications e.g. CPA and PRODCOM⁽²⁴⁾. The codes can be linked to

⁽²⁴⁾ Most PRODCOM headings correspond to one or more CN codes

other classifications (products or economic activities) via correspondence tables.

2.4. Main data sources

Whereas the ideal approach to compile EGSS accounts is to have dedicated, comprehensive supply-side surveys on the EGSS, in practice those surveys are too costly. EGSS must be estimated combining data from different sources.

The main sources for deriving EGSS statistics can be roughly divided into two groups: supply side sources and demand side sources.

Supply side sources comprise specific surveys on EGSS as well as standard supply side sources such as business registers, structural business statistics (SBS), statistics on the production in manufactured goods (PRODCOM), and the production and generation of income accounts and supply tables of the national accounts (NA). Certain elements of the environmental protection expenditure accounts (EPEA) are also supply side source data because they provide information on the production of EP services.

Demand side sources include EPEA and national accounts (data on gross fixed capital formation and use tables).

EGSS SURVEYS

Specific EGSS surveys can be useful to provide comprehensive information. However, they can also be time-consuming and resource intensive, both for respondents and national statistical institutes. A compromise is to add supplementary questions to already existing surveys. The part of a survey related to EGSS can be sent to all units or to a sub-sample of those units that receive the main survey. The sub-sample survey can be totally integrated in the mother survey or be in a form of a separate leaflet. The main advantage of this method is the use of an existing survey process, which reduces the cost for the statistical institutes. Furthermore, it is often simpler to add an extra variable to an existing survey than to launch an entirely new survey.

The main disadvantage of specific EGSS surveys is that the questionnaire is generally filled by bookkeeping clerks who are not specialists in the production processes and who may not have the necessary information, knowledge or interest to answer the survey or to report accurate EGSS variables. There is a clear risk that lower priority is given to the EGSS part of the survey.

NATIONAL ACCOUNTS

National accounts (NA) are an important source for compiling EGSS statistics. Particularly important are its production and generation of income accounts and supply tables. One advantage is that the definitions and valuation principles for the characteristics (e.g. output, gross value added, employment) in NA are the same as in the EGSS accounts. NA apply important conceptual adjustments to statistical source data to comply with ESA concepts.⁽²⁵⁾ Another advantage of using NA data is that they normally have been integrated into a supply-use-framework and balanced from a supply and use perspective to achieve a high level of consistency and exhaustiveness. Reconciliation of inconsistent estimates and generate reliable datasets by using information on production, expenditure and income in the construction of supply and use tables, which balance supply and use at the product level. Exhaustivity adjustments regard for example when the basic statistical source data are limited in scope, do not report on activities in the black economy or do not correct for other types of underreporting.

Using NA data for EGSS producers which are classified in specific NACE industries that are characteristic for environmental protection (e.g. sewerage and waste collection, treatment and disposal) or resources management is relatively easy. For some other areas such as organic farming and renewable energy national accounts data may be combined with sector specific statistics (e.g. agricultural and energy statistics), physical data, information from trade associations, business reports and engineering information to derive estimates for EGSS producers within the relevant broader industries. NA data are also very useful when income data or productivity indicators are needed to compile gross value added and employment data for the EGSS module. It is advisable to rely as much as possible on NA data.

⁽²⁵⁾ For example, in Chapter 3 we discussed conceptual differences between output according to ESA and turnover and production in the SBS

STRUCTURAL BUSINESS STATISTICS

Structural Business Statistics (SBS) covers all activities of enterprises for sections B to N and division S95 of NACE Rev.2. The two SBS variables of interest for the compilation of EGSS market output are annual turnover and the production value. These variables are available at NACE class level (four digits). The SBS also collects data on the gross value added and on input related variables (number of employees, personnel costs and gross fixed capital formation), which can be useful for the compilation of EGSS accounts.

There are, however, conceptual differences between SBS and national accounts (NA). The reasons for these differences can be manifold:

- SBS uses the enterprise as statistical unit⁽²⁶⁾, and the production value measures the amount actually produced by the unit, based on sales, including changes in stocks and the resale of goods and services (see also Box 5 in section 2.2.1). The SBS production value is therefore a concept closely related with market output and output for own final use (except for products retained for own final consumption). In NA the statistical unit for the output measurement is, however, the establishment (LKAU), and output also covers non-market output.
- To make the data from the two sources more comparable we can deduct the part of non-market output from NA output figures. Even after this deduction for most countries the output data (P1 less P13) of national accounts are bigger than the production value in SBS. One possible reason for this is that in NA deliveries between LKAUs of the same institutional unit are included in the output measure (see ESA 2010, § 3.14).
- In NA some institutional units within the general government sector or the sector of non-profit institutions serving households may have establishments that are market producers or produce market output as a secondary activity (see ESA 2010, §§ 3.39-3.40). Market output by the general government sector may not be fully covered by SBS.

The use of SBS for EGSS accounts requires adjustments to meet the definition and valuation principles for market output. In particular it is recommended to adjust turnover (e.g. adding subsidies on products and subtracting taxes on products) whenever taxes and subsidies may constitute a significant part of the EGSS output value and the sources to estimate them were available. From a conceptual point of view the SBS production value might be preferred to SBS turnover as a better approximation for market output. However, even when using the SBS production value, some adjustments could be necessary to come conceptually closer to the market output definition of the EGSS accounts (e.g. excluding capitalised production and adding subsidies on products).

More important than those conceptual differences is the fact that SBS provides little indication on the share of environmental output in turnover and production value. Only for very few NACE divisions or classes we can assume that they consist almost entirely of environmental activities (e.g. NACE 37-39).

However, even for NACE divisions which can be assumed to almost entirely represent EGSS (e.g. NACE 37-39) SBS may not fully cover EGSS market output. Complementary information is necessary to estimate the share of EGSS in other industries. In the following we examine the PRODCOM-statistics as a possible source for this.

PRODCOM

The main difference between SBS and PRODCOM is that SBS relate to economic activities (e.g. the activity of the producers) whereas PRODCOM relate to products (e.g. the output delivered by the producers).

PRODCOM statistics (PRODUCTION COMMUNAUTAIRE) provide data on the physical volume of production and the monetary value of the production of manufactured goods from NACE sections B (Mining and quarrying) and C (Manufacturing) sold during the survey period. The National Statistical Institutes conduct surveys on enterprises to collect the data using the PRODCOM lists of products. Data on the value of the production sold is published.

The use of the PRODCOM variable 'value of production sold' as a proxy for market output has already been discussed earlier and conceptual differences were identified.

⁽²⁶⁾ The enterprise is the smallest combination of legal units that is an organizational unit producing goods or services, which benefits from a certain degree of autonomy in decision-making, especially for the allocation of its current resources. An enterprise carries out one or more activities at one or more locations. An enterprise may be a sole legal unit (Council Regulation (EEC) No 696/93 of 15 March 1993 on the statistical units for the observation and analysis of the production system in the Community)

Besides conceptual differences with the market output concept of EGSS accounts, PRODCOM can have a limited coverage of units. The PRODCOM Regulation⁽²⁷⁾ does not require to survey enterprises with less than 20 employees. Using sold production as an approximation for EGSS market output can result in underestimation due to enterprises not covered.

As a conclusion PRODCOM can be used to estimate EGSS market output for product positions that are (almost) entirely environmental goods (such as wind powered generating sets). There can be other PRODCOM position that may include certain shares of environmental products. To identify these shares the PRODCOM statistics can be combined with supplementary information such as extended lists of environmental products and EGSS surveys.

2.5. Top-down compilation approach

Two main EGSS compilation approaches can be distinguished according to the use of sources:

- *Micro data* (i.e. data on single producer units) can be used to identify a population of EGSS producers and then aggregate their data to compile EGSS data. This approach may require conducting special EGSS surveys to collect data (on the turnover or output in environmental products) or construct specific registers based on other types of information (e.g. yellow pages, sector specific lists, etc.). The data could also be combined at a later stage with already existing registers, databases and statistics. Such an approach may be called **bottom-up approach**.
- *Meso data* and *macro data* (i.e. aggregated data for groups of producers or for groups of products) from existing statistical data sources can also be used. Such an approach may be called **top-down approach** or **integrative approach** as it generally needs to identify the environmental share of a broader activity or product group. It then integrates data from different sources (e.g. structural business statistics, statistics on the production of manufactured goods, agricultural and energy statistics, and national accounts).

These approaches are described in some detail in the *EGSS handbook*, Chapter 4. The rest of the present document focuses on the top-down approach only. This approach is particularly recommended whenever comprehensive EGSS surveys are not available e.g. due to resource constraints.

The main feature of this approach is that it starts with data that are already aggregated representing totals for economic activities, sectors, products or product groups. Important sources for this approach are national accounts broken down by industries, products and sectors, SBS data on turnover and production by industries, PRODCOM data on production sold, data on environmental expenditure, sector specific statistics for energy and agriculture and trade statistics.

The top-down approach aims to determine the part of a product, activity or employment aggregate that is related to the production of environmental products, through a suitable combination of existing statistics. For example, national accounts estimate the output of units that produce electricity as their principal activity. To determine the part of electricity output produced from renewable sources (which is part of CReMA 13A) national accounts data can be combined with data from physical energy statistics (MWh produced from renewable and non-renewable sources) and information on the price and costs differences between electricity from renewable and non-renewable sources.

2.5.1. Using data sources and data maps

As explained above, the sources for EGSS can be classified in supply side sources and demand side sources.

USE OF STANDARD SUPPLY SIDE SOURCES

The main supply-use side sources for the top-down approach are SBS, PRODCOM statistics and national accounts (NA) data, in particular the production and generation of income accounts, the supply and use tables and the employment data.

The top-down approach often requires applying shares of environmental activities and products when the

⁽²⁷⁾ Council Regulation (EEC) No 3924/91

industry and product breakdown are not sufficiently detailed to identify the EGSS activities and products. Estimation of shares is possible by combining statistical sources on physical data and prices from sector specific statistics (e.g. for agriculture and energy) with economic data. Estimates of EGSS shares using sector specific statistics data may, however, be less precise than estimates based on micro data (e.g. from specific EGSS surveys) since existing statistical sources are not designed to specifically identify EGSS activities and products.

Whenever possible the estimates based on the top down approach should be supplemented with information from trade associations and business reports to verify the shares of EGSS characteristics within the relevant broader industries.

Engineering information and specialised studies may also help to identify EGSS activities and products. For example, existing statistical data on construction activities and investment for the modernisation of buildings is a good starting point to estimate the output of environmental goods and services for energetic refurbishment. However, those sources may not allow determining the share of energetic refurbishment in the modernisation activities. Specialised studies and expert knowledge from civil engineers and architects may help to fill the information gap.

Whenever EGSS characteristics are based on national accounts, it is useful to consider types of producers depending on their industrial classification:

- EGSS producers classified in typical EGSS industries: sewerage (NACE 37), waste collection, treatment and disposal activities and materials recovery (NACE 38) and remediation activities and other waste management services (NACE 39). Using national accounts to estimate EGSS output, gross value added and employment for those industries is straightforward because they produce almost entirely environmental products. The non-EGSS output of those industries can be singled out using data from the supply tables as far as they provide information on the producers' non-EGSS, secondary activities;⁽²⁸⁾
- EGSS producers classified in NACE industries that are not typical for EP or RM but which can be identified as relatively homogenous subgroups within a specific NACE category: This includes, for example, producers of organic farm products within the agricultural industry (NACE 01) and producers of electricity from renewable sources classified within NACE 35.11 (production of electricity). Their output may also be identified using national accounts data. However, national accounts must be combined with data that allow deriving EGSS shares of industries that mainly perform non-environmental activities. Such shares may be estimated using physical production and price data from sector specific statistics and accounts;
- EGSS producers which are neither classified in typical EGSS industries nor can be identified as relatively homogenous subgroups within specific NACE categories: This includes, for example, manufacturing and construction enterprises engaged in the supply and installation of environmental technologies or in eco-construction. For these establishments, consulting further supply side sources such as business registers, SBS, PRODCOM and information from trade associations and specialised business association may help to estimate their EGSS shares. Some environmental services (e.g. the wastewater treatment) provided by these producers as secondary output may be identified using the supply tables of the national accounts.

Another source of supply side data relevant for the compilation of EGSS are the *Environmental Protection Expenditure Accounts (EPEA)*. The EPEA are also governed by Regulation (EU) No 691/2011 establishing mandatory reporting on market, non-market and ancillary output of EP services broken down by separate CEPA classes and groups of CEPA classes.⁽²⁹⁾ Moreover, Eurostat asks Member States to report output and labour input by all single CEPA classes on a voluntary basis. It is advisable that compilers of EGSS and EPEA accounts coordinate with each other to avoid double work and ensure mutual consistency.

Resource Management Expenditure Accounts (ReMEA) can provide information similar to EPEA but cover resource management activities. So far, however, ReMEA are not yet generally available or published. In some cases data from pilot studies may be available.

External trade and balance of payment statistics can be used as a source for identifying that part of EGSS output that is exported. Using external trade statistics for EGSS compilation is, however, not without difficulties:

⁽²⁸⁾ Likewise, supply tables also provide data on the secondary activities of non-typical industries resulting in some production of CPA 37, 38 and 39. This output and the related exports, gross value added and employment are also to be included in the EGSS accounts

⁽²⁹⁾ Mandatory reporting starts 24 months after the end of the first reference year (2015)

- Generally they do not have explicit information as to whether products are part of EGSS;
- The data of the external trade in goods statistics can include the resale of an imported good to a non-resident (such a transaction is called merchanting in ESA 2010, § 3.164.d), whereas EGSS accounts do not include the exports of an imported good to non-residents. Exports as defined by Regulation No 691/2011 is an 'of-which' item of output (see also section 3.1.2);
- In external trade in goods statistics exports are valued at FOB prices, whereas in EGSS accounts exports – being an 'of-which' item of output - should be valued at basic prices.

Sector-specific statistics can be used to estimate shares of the EGSS in broader industries, for example organic farming within agriculture and production of renewable energies within electric power generation. Agricultural statistics allow to calculate physical shares of organic farming in total farming (in terms of production quantities, land use, number of animals), and energy statistics can be used to calculate ratios between the physical amounts of electricity generated from renewable and non-renewable sources. Such shares and ratios are useful proxies to split the output of the broader industries into EGSS and non-EGSS output. Estimates based on physical shares or ratios may be improved when specific output price data or production cost data are available. Physical production data (quantities) and price data can also provide a direct estimate of the environmental output. This is called a 'quantity-times-price' approach.

USE OF DEMAND SIDE SOURCES

Demand side sources are particularly relevant to capture EGSS producers which are not classified in typical EGSS NACE industries nor can be identified as relatively homogenous subgroups within specific NACE categories.

For example, investment in waste management, in the generation of electricity from renewable sources or in energetic refurbishment of dwellings consists of EP and RM goods and services produced by the manufacturing industries, by construction companies or by architects and engineering units. Data on EP investments are available from the EPEA.⁽³⁰⁾ Data for RM investments may be available from the *ReMEA* (countries' pilot studies). An important source is also the *national account data on gross fixed capital formation* cross-classified by type of asset and investor industry.

Intermediate consumption and final consumption of EP services are available from the mandatory part of EPEA.⁽³¹⁾ Moreover, environmental expenditure accounts report also on the intermediate consumption, compensation of employees, gross fixed capital formation and the consumption of fixed capital for the production of environmental products.

Demand side data pose conceptual and practical problems, which, however, can be overcome:

- Demand side data generally include expenditure on imported products but they exclude exports, whereas EGSS output should include exports and exclude imports. This must be adjusted. Export and import data from national accounts and trade statistics can be used.
- The valuation of demand side data differs from supply side data. Expenditure valued at purchasers' prices must be converted to basic prices for the estimation of the EGSS output. For this conversion trade and transport margins and data on taxes and subsidies on products from the national accounts supply table can be useful.
- Data on environmental expenditure (e.g. investment for environmental purposes) are broken down from the demand perspective. In order to use these data for the compilation of EGSS output they must be allocated to the producer industries. For example, EPEA report on investments made by producers of EP services but not on the industries supplying the capital goods and services used for these investments.
- Expenditure account data on the intermediate consumption and gross fixed capital formation for the production of environmental products also includes uses of non-environmental products.

DATA MAPS

The top-down approach should mainly integrate data produced regularly by the statistical system.

⁽³⁰⁾ Where the 2015 version of the *Practical Guide* refers to data on EP expenditure, it uses, however, data transmitted by countries on the OECD/Eurostat Environmental Protection Expenditure and Revenues Joint Questionnaire as the first official data transmission of EPEA data to Eurostat took place only in December 2015

⁽³¹⁾ This is, however, not covered by mandatory reporting. Eurostat asks Member States to report these data on a voluntary basis

Whenever possible this approach may be combined with results of EGSS surveys and data from business associations to improve the coverage and data quality.

The integration model combines different statistical sources. Each source may cover only subsets of the EGSS. The sources may be partly overlapping (e.g. data from environmental protection expenditure statistics and investment data from national accounts) or have different scopes. Definitions, classifications and valuation principles in the sources may differ from those of the EGSS accounts. A careful integration is therefore needed to achieve a sufficient coverage of the EGSS while avoiding overlaps and double-counting as far as possible. Data maps assist in this task.

Eurostat has set up a data map integrating data collections from Eurostat's website and a few other international sources publicly available (see Table 4).

Each white and grey shaded cell in the Eurostat data map should be estimated. However, for the grey shaded cells no suitable data have yet been identified or tested by Eurostat. Some of them are likely to be small. Dark shaded cells are empty by definition of the main categories.

The Eurostat data map distinguishes the following pragmatic categories:


- Market and non-market production of EGS: wastewater, waste and water management services;
- Market production of EGS: other than wastewater, waste and water management services: non-capital goods and services;
- Market production of EGS: capital goods and services;⁽³²⁾
- Non-market production of EGS: other than wastewater, waste and water management services;
- Ancillary production of EGSS.


⁽³²⁾ Capital goods and services are generally durable products that become (part of) the fixed assets that are used in production for more than one year. Typical capital products for EP and RM purposes are, for example, gas scrubbers, setting basins for sewerage, refuses collection vehicles, wind turbines, noise and heat insulating building materials and their installation

Table 4: Eurostat data map for compilation of EGSS accounts

		Market and non-market production of EGS: waste-water, waste and water management services	Market production of EGS other than waste-water, waste and water management services: non-capital goods and services	Market production of EGS: capital goods and services	Non-market production of EGS: other than waste-water, waste and water management services	Ancillary production of EGS
EP	Protection of ambient air and climate		EPE, NA_64, NA_SUT, LFS		EPE, NA_64, LFS	
	Wastewater management	EPEA, NA_64, NA_SUT, LFS	likely to be small			
	Waste management					
	Protection of soil, ground-water and surface water		EPE, NA_64, NA_SUT, LFS, AGRI (for organic farming)	EPE, NA_64, NA_SUT, NA_GFCF, LFS		EPE, NA_64, LFS
	Noise and vibration abatement		EPE, NA_64, NA_SUT, LFS		EPE, NA_64, LFS	
	Protection of biodiversity and landscape					
	Other EP (protection against radiation, env. R&D and other env. Protection)					
RM	Management of forest resources		IEEAF, NA_64, NA_SUT, LFS		IEEAF, NA_64, NA_SUT, LFS	
	Management of waters		likely to be small	NA_64, NA_SUT, NA_GFCF, LFS		
	Production of energy from renewable sources		NA_64, NA_SUT, SBS, LFS, ENSTAT, IEEAF, IEA, FAO/OECD	NA_64, NA_SUT, NA_GFCF, PRODCOM, LFS	likely to be small	
	Heat/energy savings		likely to be small			
	Other RM		as far as material recovery is recorded in national accounts under NACE/CPA E28 it is included in waste management			

Legend

 = empty cell by definition

 = suitable data not identified yet by Eurostat

NA_64: National accounts aggregates by industry (up to 64 industries) (production and generation of income accounts and employment)

NA_SUT: National accounts supply and use tables (output and intermediate consumption by industries / products, final use and external trade)

NA_GFCF: Gross capital formation by industry (up to 64 industries) (by industry and type of asset)

SBS: Structural Business Statistics

PRODCOM: Statistics on the production of manufactured goods

LFS: Labour Force Survey

ENSTAT: Energy statistics (production quantities and capacities, prices)

IEEAF: Integrated environmental and economic accounting for forests

IEA: International Energy Agency: levelised costs and investment costs for electric power stations

FAO/OECD: Biofuel prices

AGRI: Agricultural statistics: land use, farm accountancy

It has to be stressed that this data map reflects pragmatic considerations for the compilation of EGSS data from sources available from Eurostat's website and points to simple calculation approaches that can be implemented with a limited number of resources and in short time. The Eurostat data map is only an example of a data map; a data map integrating additional data available in the NSIs may be different and provide more complete and better estimates.

Market and non-market production of wastewater, waste and water management services mainly covers, for example, the provision of sewerage services and of collection, treatment and disposal services for non-hazardous and hazardous waste, the desalination of water and collection of rainwater, the maintenance of water mains for reducing water losses, and the provisions of related engineering, consulting and administrative services. Regarding output, exports, gross value added and employment, this category can be based on national accounts at current prices and national accounts employment, both broken down by industries. Data are generally available at A*64 detail level. The most relevant economic activities are NACE 36, which covers water collection, treatment and supply and NACE 37-39, which groups together sewerage, waste collection, treatment and disposal activities, material recovery, remediation activities and other waste management services. National accounts supply tables, which classify output by producer industries, can be used to identify secondary output not falling under wastewater, waste and water management services and - if applicable - to add secondary output of these services recorded in other industries.

If the national accounts data are available at a more detailed level than A*64, EGSS compilers should use it. Additional detail improves in particular the split into wastewater management (CEPA 2) and waste management (CEPA 3). EPEA data can also be used as they provide data on the output of EP services in CEPA 2 and 3 and on the inputs used to produce this output. Data on resource management expenditure can provide information on the management of waters (CReMA 10); so far, however, such data are not yet generally available or published.

National accounts data are often not published at a sufficient detail to distinguish the market and non-market breakdown on wastewater, waste and water management services. EPEA and data on general government expenditure by function (COFOG) can then be useful sources for making this breakdown.

Market production of non-capital products other than wastewater, waste and water management services mainly covers the production of products for EP in the areas of air and climate, soil, groundwater and surface water, landscape, biodiversity, noise and vibration, radiation and environmental protection R&D as well as the production of energy from renewable sources.

A main source for this category is EPEA, in particular data on the market output of corporations in EP services and on the inputs for this production (intermediate consumption, compensation of employees, consumption of fixed capital, labour input). Compilers of EGSS accounts may not have all this information available, in particular because mandatory reporting of EPEA characteristics is limited to a subset of these data.⁽³³⁾ National accounts can be used as a complementary source in order to calculate EGSS output classified by industries and EGSS employment.

Output of this category can also be estimated from the demand side using data on the intermediate and final consumption of EP services.⁽³⁴⁾ The demand side data must then be bridged in order to estimate output of EP services: for this purpose the EPEA also collect data on imports and exports of services. If import and export data for EP services are missing also data from the NA supply and use tables can provide information on imports and exports ratios.

Agricultural statistics can be combined with national or agricultural economic accounts to estimate output, gross value added and employment in organic farming. Similarly, energy statistics on physical production

⁽³³⁾ Reporting on the market output of EP services is mandatory, however, not all CEPA classes are covered by mandatory reporting. Mandatory reporting on the market output of corporations only covers CEPA 2, 3 and 4. The collection of data broken down by all CEPA classes is voluntary as well as the collection of data on intermediate consumption, compensation of employees, consumption of fixed capital and labour input for this production

⁽³⁴⁾ Reporting is mandatory for final consumption of EP services and for intermediate consumption of environmental protection services by specialist producers. The reporting of intermediate consumption of EP services of the general government and NPISH and for corporations that are not specialist producers of EP services is voluntary

and capacities can be combined with national accounts data to estimate the EGSS characteristics for the production of renewable energy. If price data are available also price-times-quantity approaches can be used.

As far as material recovery is recorded in the national accounts under CPA/NACE 37-39 the Eurostat data map covers it under the category *market and non-market production of wastewater, waste and water management services* as part of CEPA 3.

Market production of capital goods and services covers the production of goods used for gross fixed capital formation (investment) and associated services, in activities linked with the protection of the environment and the management of resources. This is a very wide range of activities: e.g. manufacture of electric and more resource efficient transport equipment, of exhaust pipes and their parts (also particles filters), of instruments, machinery and apparatus for analysis of pollutants, of septic tanks and pumps for use in wastewater treatment, of vehicles for wastewater collection and sewer cleaning, of lead containers for radioactive waste, of goods for thermal and noise insulation, of specific equipment for the production of energy from renewable sources. It also includes construction work, e.g. for renewable energy power plants including installation of photovoltaic panels, for low energy consumption and passive buildings and for energetic refurbishment of existing buildings. It also can include related engineering and architectural services.

The products covered under this category are mainly produced by producers of machinery and transport equipment, construction companies, architects and engineering service providers as well as producers of computers, electronic products and software.

This category can be estimated using demand side data, in particular data on investments for environmental protection. Also national accounts data on gross fixed capital formation can be used to estimate the supply of EGSS capital goods and services. When these data are available cross-classified by type of asset they can map the investment broken down by investing industries to industries that produce the capital products. National accounts supply and use tables and trade statistics provide data to bridge the gap (exports, imports and valuation differences) between demand side sources and output.

The change in energy producing capacities collected by energy statistics in combination with information obtained from energy agencies is a useful information to derive estimates of the production of equipment and installations for the generation of renewable energy and heat/energy savings. Whenever available these data should be supplemented and balanced with PRODCOM statistics (e.g. for wind powered generating sets).

Non-market output other than wastewater, waste and water management services can be based on environmental expenditure. That source also has information on the intermediate consumption, compensation of employees, consumption of fixed capital, labour input used in its production. Compilers of EGSS accounts may not have all the detail available from the EPEA, in particular as mandatory reporting of EPEA characteristics is limited to a subset of these data.⁽³⁵⁾ National accounts data can be used as a complementary source in order to classify EGSS characteristics for non-market activities by industries.

Ancillary production is not measured in national accounts. A source for ancillary EP output is environmental expenditure data. The EPEA provide information on the ancillary output of corporations and on the intermediate consumption, compensation of employees, consumption of fixed capital, and labour input used for this production. However, reporting of ancillary output in EPEA is not mandatory in full CEPA breakdown.⁽³⁶⁾ National accounts data broken down by activity may be used for a more detailed split of ancillary output by industry.

The rest of this guide (Chapters 3 to 5) develops in detail the calculations corresponding to the boxes of the data map in Table 4. The methods described in Chapters 3 to 5 have been compiled integrating mainly data available in the [database on Eurostat's website](#).⁽³⁷⁾ This does not mean that it is proposed to use data

⁽³⁵⁾ Reporting the non-market output of EP services is mandatory, however, not all CEPA classes must be reported in full breakdown. Mandatory reporting covers CEPA 2, CEPA 3, CEPA 6 and groups together CEPA 1, 4, 5 and 7 as well as CEPA 8 and 9. The collection of data broken down by all CEPA classes is voluntary as well as the collection of data on intermediate consumption, compensation of employees, consumption of fixed capital and labour input for this production

⁽³⁶⁾ Reporting the ancillary output of EP services is mandatory, however, not all CEPA classes must be reported in full breakdown. Mandatory reporting covers CEPA 1, CEPA 2, CEPA 3 and groups together CEPA 4, 5, 6, 7, 8 and 9. The collection of data broken down by all CEPA classes is voluntary as well as the collection of data on intermediate consumption, compensation of employees, consumption of fixed capital and labour input for this production

⁽³⁷⁾ To some extent also national and international sources have been used. For an overview of the sources used see also annex F

downloaded from this database only; national EGSS compilers should use data from their own databases, which may have additional and more detailed information. However, if national compilers use Eurostat's database and other publicly and freely accessible sources, they should be able to achieve at least the same minimum standards as proposed by this guide. Depending on other sources available at national level (e.g. specific EGSS survey among manufacturing and service industries) additional categories or breakdowns may be possible and useful.

3

Methods to compile EGSS output and exports

This chapter describes in detail the data sources and methods as well as the results obtained for EGSS output and exports. The scope of the Eurostat calculations described in the following chapters is as follows:

- The period of year covered starts in 2000 (the tables in this guide only show the period 2007-2013). The variables compiled are output, exports, gross value added and employment. Whereas the reporting requirements of Regulation (EU) No 691/2011 cover market activities only, the Eurostat calculations also cover non-market and ancillary activities;
- The breakdown by CEPA classes (EP activities) corresponds to the reporting requirements of Regulation (EU) No 691/2011, i.e. CEPA 1, 2, 3, 4, 5, 6 and one aggregate covering CEPA 7, 8, 9;
- The breakdown by CReMA classes (RM activities) in the calculation does not fully comply with the reporting requirements of Regulation (EU) No 691/2011. The calculations cover CReMA 10 (management of water) as well as CReMA 13A (production of energy from renewable sources) and 13B (heat/energy savings and management). If material recovery to be recorded under CReMA 11B (management of the intake of forest resources), CReMA 13C (minimisation of the intake of fossil resources as raw material) or CReMA 14 (management of materials) are included in the sources used to estimate waste management activities they will be reported in the test calculations under CEPA 3. Estimation approaches for the other CReMA classes not yet covered in the test calculations will be developed in parallel with the developments for the Resource Management Expenditure Accounts (ReMEA);
- Reporting is cross classified by CEPA/CReMA and by 39 NACE industry categories. However, the calculations did not manage to identify EGSS activities in all of these 39 NACE categories either due to lack of data or sources not distinguishing any relevant activities in the categories (e.g. the supply tables).

This chapter follows the structure of the pragmatic categories of activities of the data map presented in the previous chapter (Table 4). At the end of the sections there are proposals for future improvements.

3.1. Market and non-market production of wastewater, waste and water management services

This category can be identified from national accounts (NA) data for NACE section E (water supply; sewerage, waste management and remediation activities). In this specific NACE section producers whose principal activity is the production of environmental services are found.

Alternatively, data on wastewater and waste management services can also be taken from the environmental protection expenditure accounts (EPEA), which provide data on market and non-market output in CEPA 2 and CEPA 3. However, in the following we show how the estimates can be produced from national accounts data. The approach shown may also be used for estimates based on EPEA.

3.1.1. SUPPLY SIDE APPROACH FOR WASTEWATER MANAGEMENT AND WASTE MANAGEMENT SERVICES

Output of wastewater and waste management services can be compiled from NA data broken down by industries and from supply tables. The core matrix of a supply table provides information on the output of the economy broken down by industries (table columns classified by NACE) and products (table rows classified by CPA), whereby the classifications of industries and products are fully aligned to each other.⁽³⁸⁾

The calculations start from Eurostat's collections 'National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)'⁽³⁹⁾ and 'Supply table - current prices (NACE Rev. 2) (naio_cp15_r2)'. The first collection provides output data by 64 industries. The supply tables provide output data cross-classified by 64 industries and 64 products from which shares of the relevant CPA category E37-39 in the total output of each of the 64 industries can be derived.

The national accounts data by 64 industries are mapped to the 39 NACE categories of the EGSS module (see NACE categories in Annex 3). Then, output for each of the 39 NACE industries can be calculated multiplying the output values from the mapped data with CPA E37-39 output shares derived from the supply tables CPA E37-39.⁽⁴⁰⁾ This is the approach shown in the next paragraphs for deriving the EGSS output.

Output of wastewater management (CEPA 2) and waste management (CEPA 3) services in these collections are covered by the product group CPA E37-39, so that sums of CEPA 2 and CEPA 3 output for each industry can be calculated:

$$EGSS_P1_Serv_{CEPA\ 2,NACE} + EGSS_P1_Serv_{CEPA\ 3,NACE} = NA_P1_{CPA\ E37-39,\ NACE}$$

With:

$NA_P1_{CPA\ E37-39,\ NACE}$: Output of product group CPA E37-39 by industries (NA)

$EGSS_P1_Serv_{CEPA\ 2,NACE}$: Output of wastewater management services by industries (EGSS)

$EGSS_P1_Serv_{CEPA\ 3,NACE}$: Output of waste management services by industries (EGSS)

⁽³⁸⁾ See also Statistics Explained Article: [Building the System of National Accounts - supply and use tables](#)

⁽³⁹⁾ For countries for which the ESA 2010 data were not available the collection 'annual National Accounts by 64 branches at current prices (nama_nace64_c)' has been used

⁽⁴⁰⁾ For the test calculations supply tables are not available for all years in all countries. If supply table data are missing for certain years some gap-filling is applied based on the observation that the output shares are rather stable over time. In such cases the time trends for CPA E37-39 output by the 39 industries follow the changes in the total output by industries

The division of CPA E37-39 relevant for CEPA 2 is CPA E37 (sewerage) whereas CPA E38 (waste collection, treatment and disposal activities; material recovery) and CPA E39 (remediation activities and other waste management services) are relevant for CEPA 3. The split of CPA E37-39 into wastewater and waste management is based on a share approach. The shares ($s_{CEPA\ 2}$ and $s_{CEPA\ 3}$) are estimated using data on internal current expenditure on wastewater management and waste management by specialised producers of EP services from the Environmental Protection Expenditure Accounts (EPEA).⁽⁴¹⁾

Applying these shares to CPA E37-39 gives an estimate of the production of wastewater management and waste management services in each relevant industry:

$$EGSS_P1_Serv_{CEPA\ 2,NACE} = NA_P1_{CPAE37-39,nace} * s_{CEPA\ 2}$$

$$EGSS_P1_Serv_{CEPA\ 3,NACE} = NA_P1_{CPAE37-39,nace} * s_{CEPA\ 3}$$

For the sake of simplicity, it is assumed that all wastewater management output of the group NACE E37-39 is produced by NACE E37 and that all waste management output of the group NACE E37-39 is produced by NACE E38 and NACE E39. Such simplification can be avoided if national accounts data are available with a more detailed industry breakdown for the group NACE E37-39 or if additional data can be used for the split. Eurostat has tested such a split using the same factors as already used for the split of output into CEPA 2 and CEPA 3.⁽⁴²⁾ However, the result of this test did not seem plausible, since output of wastewater management services in industry NACE E37 (sewerage) would be lower than in industry NACE E38 (waste collection, treatment and disposal activities). Eurostat concluded that the simplified assumption is less problematic than the splitting approach unless additional information confirmed otherwise. In this context it is to be noted that the reporting requirements of Regulation (EU) No 691/2011 are less detailed: the required A*21 NACE groups the activities in question within NACE E36-39.

Table 5: Market and non-market output of wastewater management services, Germany (million EUR)

	2007	2008	2009	2010	2011	2012	2013
Total NACE	15 333	15 298	15 033	15 060	16 725	17 008	17 024
D	342	369	446	437	351	361	345
E36	892	914	747	670	745	726	744
E37	14 099	14 015	13 840	13 953	15 628	15 921	15 934

Table 6: Market and non-market output of waste management services, Germany (million EUR)

	2007	2008	2009	2010	2011	2012	2013
Total NACE	24 946	25 972	24 214	26 535	29 467	29 967	29 994
D	557	627	719	770	619	637	609
E36	1 451	1 552	1 203	1 181	1 313	1 279	1 311
E38	20 645	21 414	20 063	22 125	24 782	25 246	25 267
E39	2 294	2 379	2 229	2 458	2 754	2 805	2 807

⁽⁴¹⁾ For example, for Germany the shares vary slightly over the years around the approximate values of $s_{CEPA\ 2} \approx 0.4$ and $s_{CEPA\ 3} \approx 0.6$. For more details on the used source see section 3.5 on ancillary output

⁽⁴²⁾ In order to split NACE E37-39 into E37 and E38-39 the shares $s_{CEPA\ 2}$ and $s_{CEPA\ 3}$ were used in a test calculation for Germany. For the further split of NACE E38-39 into NACE E38 and NACE E39 a ratio of 9:1 was assumed. This approach ensures consistency of the split data with the overall totals for NACE/CPA E37-39

The approach described above identifies wastewater and waste management services as principal output of NACE E37-39 and secondary output of other industries. For Germany, wastewater management services output is identified as principal output of NACE E37 and as secondary output in NACE D (electricity, gas steam, and air conditioning supply) and NACE E36 (water collection, treatment and supply). Waste management services output is identified as principal output of NACE E38 and NACE 39 and as secondary output in NACE D (electricity, gas steam, and air conditioning supply) and NACE E36 (water collection, treatment and supply). The breakdown of wastewater and waste management output by industry as shown in the table above is specific for Germany and may not be indicative for other countries. Using the same compilation method for other countries may identify wastewater management services also in other industries such as mining and quarrying, in manufacturing industries, construction, wholesale and retail trade and for public administration (depending on the information in the supply tables).

When supply tables are not available, a simpler alternative approach is using total output figures of NACE E37-39 (not broken down by CPA), which are available in the collection 'National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)':

$$EGSS_P1_Serv_{CEPA\ 2,\ NACE\ E37} = NA_P1_{NACE\ E37-39} * S_{CEPA\ 2}$$

$$EGSS_P1_Serv_{CEPA\ 3,\ NACE\ E38} = NA_P1_{NACE\ E37-39} * S_{CEPA\ 3}$$

With:

$NA_P1_{NACE\ E37-39}$: Total output of industry group NACE E37-39 (NA)

This simplified estimation of wastewater and waste management may, however, include some secondary output of NACE E37-39 that is not related to wastewater and waste management and does not include any secondary wastewater and waste management services produced by other industries.

Regulation (EU) No 691/2011 requires reporting on market output. Therefore output of wastewater and waste management services needs to be split into market output and non-market output using share estimates ($share_{non-market, NACE}$):

$$EGSS_P11_Serv_{CEPA\ 2,\ NACE,\ market} = EGSS_P1_Serv_{CEPA\ 2,\ nace} * (1 - share_{non-market, NACE})$$

$$EGSS_P13_Serv_{CEPA\ 2,\ NACE,\ non-market} = EGSS_P1_Serv_{CEPA\ 2,\ nace} * share_{non-market, NACE}$$

$$EGSS_P11_Serv_{CEPA\ 3,\ NACE,\ market} = EGSS_P1_Serv_{CEPA\ 3,\ nace} * (1 - share_{non-market, NACE})$$

$$EGSS_P13_Serv_{CEPA\ 3,\ NACE,\ non-market} = EGSS_P1_Serv_{CEPA\ 3,\ nace} * share_{non-market, NACE}$$

With:

$EGSS_P11_Serv_{CEPA\ 2,\ NACE}$: Market output of wastewater management services by industry (EGSS)

$EGSS_P11_Serv_{CEPA\ 3,\ NACE}$: Market output of waste management services by industry (EGSS)

$EGSS_P13_Serv_{CEPA\ 2,\ NACE}$: Non-market output of wastewater management services by industry (EGSS)

$EGSS_P13_Serv_{CEPA\ 3,\ nace}$: Non-market output of waste management services by industry (EGSS)

The main source used to calculate this split is the national accounts supply tables. Shares of non-market output in the total output of the single industries can be estimated as follows:

$$\text{share}_{\text{non-market, NACE}} = \text{NA_P1}_{\text{P13, NACE}} / \text{NA_P1}_{\text{CPA_Total, NACE}}$$

However it must be noted that the supply tables available at Eurostat do not provide information on this split cross-classified by products and industries. Data available in the national statistical offices may not have these limitations and allow further refinement of the approach.

In the past, availability of non-market government output data was an issue. It can be expected that it will improve with the upcoming mandatory transmissions of Environmental protection expenditure accounts (EPEA), in particular for CEPA 2 and CEPA 3. The question for the purpose of EGSS estimates is the NACE to which this output should be allocated: should it be NACE E37-39 or NACE O? As a practical approach it is proposed to allocate output to NACE 37-39 unless it is known that the units providing these services are classified in NACE O in national accounts. The supply tables also shed information on whether there is CPA37-39 produced in NACE O. Unless it is produced under NACE O, nothing would speak against classifying government non-market output in CEPA 2 and 3 under NACE 37-39.

Furthermore, when using this approach it is also recommended to cross-check the results obtained with data available in the COFOG statistics.

Table 7: Split between market and non-market output of wastewater management services, France (million EUR)

	2007	2008	2009	2010	2011	2012	2013
Non-market	2 632	2 825	2 911	429	444	3 487	3 672
Market	9 604	10 073	8 777	12 955	13 431	10 098	10 412

Table 8: Split between market and non-market output of waste management services, Spain (million EUR)

	2007	2008	2009	2010	2011	2012	2013
Non-market	2 654	2 786	5 026	6 030	5 941	5 799	5 644
Market	9 417	9 856	6 780	8 068	7 952	7 743	7 545

Areas for possible future development

The estimates may be further refined and complemented as follows:

- The simplifying assumption on the allocation of wastewater and waste management services to the producing NACE divisions within the grouping NACE E37-39 should be reviewed. Additional data may be found for this purpose. For example, it could be explored whether an improved split of these services among the divisions could be made by using SBS data, company data or simply by more detailed national accounts data available in the national statistical institutes.
- The recovery of sorted materials recorded under NACE E38 may include resource management activities such as minimisation of the intake of forest resources, minimisation of the intake of fossil resources as raw material for use other than energy production, management of minerals. Allocating material recovery to resource management requires separating the activities by materials. A split of the NACE-based data may be possible using additional data (e.g. physical data on the quantities of materials recovered) from extra sources (e.g. information from business associations or from the Eurostat [Environmental Data Centre on Waste](#)). However, making this split is likely to be time consuming and it is not made in the current phase of the model development.
- Waste management should also include street cleaning. Street cleaning is part of cleaning NACE N81.29 (other cleaning activities). It may therefore be identified from detailed NA or SBS data in

combination with additional information on the share of street cleaning within the class. Alternatively, it may be explored whether street cleaning can be identified from other sources e.g. from government expenditure data classified under COFOG group 05.1 waste management.

- Since NACE E39 production may also include activities related to the protection and remediation of soil, groundwater and surface water that fall under CEPA 4, it should be considered to separate out these activities in the future.

3.1.2. SUPPLY SIDE APPROACH FOR WATER MANAGEMENT SERVICES

Management of water is a resource management activity and comprises activities aimed at the minimisation of inland waters intake through in-process modification as well the reduction of water losses and leaks or reduction of the intake by substituting the resources with alternative resources, the installation and construction of facilities for water reuses and savings, shower heads and taps. The *2016 EGSS handbook* (Annex 5) recommends excluding the collection, treatment and distribution of water. However, if the available data sources does not allow separating them out, they may be included and an explanation should be given in the metadata.

On the basis of data available in Eurostat's database it is not possible to derive an estimate from the demand side. Data on government expenditure by function (COFOG) have no separate group for management of water and the satellite accounts for resource management expenditure (ReMEA) are still under development.

Principal producers of water management services can be found under NACE E36 (water collection, treatment and supply) and the characteristic product under the corresponding CPA E36 category. Following the recommendations of the *2016 EGSS handbook* only a part of NACE/CPA E36 is included under CReMA 10.

Based on those data, it is difficult to narrow the scope of water management from NACE/CPA 36 to the definition of resource management which would have to exclude the collection, treatment and distribution of water. Estimations for France (Greffet, Mauroux, Ralle, & Randriambololona, 2012) show that employment for production and distribution of water is five times higher than for the resource management of water. That publication considers resource management of water as part of the "eco-activities" whereas the production and distribution of water is included in the broader definition of "green economy activities". Future development of the resource management expenditure accounts (ReMEA) may lead to an improved data availability that may help to overcome data gaps for the estimation of water resource management activities. An important area to focus on in the future is water management (Eurostat, 2013c).

Output of water management services can be estimated using a similar approach as for wastewater and waste management services. Eurostat's calculations start from Eurostat's collections 'National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)'⁽⁴³⁾ and 'Supply table - current prices (NACE Rev. 2) (naio_cp15_r2)'. The first collection provides output data by 64 industries. From the supply tables shares of the relevant CPA category E36 in the total output of each of the 64 industries can be derived. Before using the data of 'nama_nace64_c', its 64 industries must be mapped to the 39 NACE categories of the EGSS module. Next, output for each of the 39 NACE industries of the EGSS module can be calculated multiplying the output values from the mapped data with the CPA E36 output shares CPA E36. A factor f may take into account that the water management (CReMA 10) is only a fraction of CPA 36 output (see above). This is the basis for deriving the EGSS output variables as it is shown in the next paragraphs.

The output of CPA E36 by the 39 industries is then allocated to CReMA 10:

$$EGSS_P1_Serv_{CReMA\ 10, NACE} = NA_P1_{CPA\ E36, NACE} * f$$

⁽⁴³⁾ For countries for which the ESA 2010 data were not available collection 'annual National Accounts by 64 branches at current prices (nama_nace64_c)' is used

With:

NA_P1_{CPA E36, NACE}: Output of product CPA E36 by industries (NA)

EGSS_P1_Services_{CR&MA 10, NACE}: Output of water management services by industries (EGSS)

Similarly to the simplification made for wastewater and waste management, it is assumed that all CPA36 output of the group NACE E37-39 is allocated to NACE E37. In this context, it is noted that the reporting requirements of Regulation (EU) No 691/2011 are less detailed: NACE A*21 groups management of water in NACE E36-39.

Table 9: Market and non-market output of water management services, France (million EUR)

	2007	2008	2009	2010	2011	2012	2013
Total NACE	1 849	1 909	1 984	2 192	2 145	2 089	2 192
E36	1 845	1 905	1 979	1 965	1 906	1 843	1 942
O	4	4	5	225	238	245	249
P	0	0	1	1	1	1	1

The approach described above identifies water management as principal output of NACE E36 and secondary output of other industries. For France, water management output is identified as principal output of NACE E36 and to some minor extent as secondary output in other industries. This breakdown of water management output by industry is specific for France (based on the supply tables). It may not be indicative for other Member States. For example, using the same approach for the United Kingdom did not estimate any water management services outside NACE E36.

In case that supply tables are not available a simpler alternative approach would be to use the total output of NACE E36, which is available in collection '(nama_10_a64)':

$$EGSS_P1_Services_{CR\&MA\ 10, NACE\ E36} = NA_P1_{NACE\ E36} * f$$

With:

NA_P1_{NACE E36}: Total output of industry NACE E36 (NA)

This alternative estimate of water management services may include some secondary output of the NACE E36 that is not related to water management (e.g. sewerage) and does not include any secondary water management produced by other industries. Therefore using this alternative estimate for water management services can lead to double counting of secondary sewerage services by NACE E36 if for wastewater management services the more detailed approach using supply table information (see section 3.1.1) is used; in this case secondary output of sewerage may be reported twice as wastewater management and management of water. It is thus recommended using either the more detailed approach (using supply table information) for both, wastewater management and management of water, or the simplified approach for both, wastewater management and management of water.

Regulation (EU) No 691/2011 requires reporting market output. Therefore the output of water management services needs to be split into market and non-market output. Basically, Eurostat did split using an approach analogous to the one already described for wastewater and waste management services (see section 3.1.1). However, since resource management expenditure statistics are still less developed than environmental protection expenditure statistics, the calculation approach for wastewater management uses only information available in the supply tables.

Whenever this source sheds no information on the non-market output it is assumed that all water management services are market production. Data available in the national statistical offices may help to overcome these limitations of the approach.

Table 10: Split between market and non-market output of water management services, Spain (million EUR)

	2007	2008	2009	2010	2011	2012	2013
Non-market	42	43	375	419	439	422	436
Market	2 111	2 180	1 962	2 190	2 297	2 202	2 278

Areas for possible future development

- Some management of water activities may also be found under CPA/NACE categories other than those belonging to NACE section E. For example, installation of water efficient irrigation systems should be recorded under NACE A01.61 (support activities for crop production) and R&D and education services related to management of water under NACE M72 and NACE P85, respectively. Identifying water management services under these and other NACE/CPA categories may be possible with more detailed breakdowns than those available for the test calculations. But even at CPA 6-digits breakdown they normally cannot be identified so that even more detailed information (e.g. based on specific surveys among providers of architectural and engineering services, R&D and education services) would be needed. It would be sufficient to observe such more detailed data in longer intervals, e.g. every 5 years, and interpolate the interim years by using constant shares.
- With resource management expenditure accounts being further developed and future pilot data collections in this area, it would be possible to improve estimation of water management services. Possible areas that could be improved using more detailed information are the exclusion of water services not related to resource management and the split into market and non-market output.

3.2. Market production of EGSS other than wastewater, waste and water management services: non-capital goods and services

A supply side approach using data on the output of environmental services based on EPEA is shown in section 3.2.1 for the following environmental protection activities: protection of ambient air and climate (CEPA 1), protection and remediation of soil, groundwater and surface water (CEPA 4), noise and vibration abatement (CEPA 5), protection of biodiversity and landscapes (CEPA 6) and other environmental protection activities (CEPA 7+8+9). Alternatively, a demand side approach also based on EPEA can be applied, as shown in section 3.2.2.

According to the EGSS indicative compendium, output of organic farming is within the scope of EGSS and contributes to CEPA 4. Supply side data can be used to estimate output of organic farming. Details on the approach are shown in section 3.2.3.

Supply side data is also used to estimate the production of electricity from renewable sources as part of CReMA 13A (for details see section 3.2.4). Estimates for other forms of renewable energy (such as biofuels and biogas) are based on price times quantity approaches (for details see section 3.2.5 and 3.2.6). Following the recommendation of the Eurostat Task Force on the resource management expenditure account (ReMEA) (Eurostat, 2013d) this guide excludes the production of biomass (e.g.

maize and wood) that is converted into other energy products (e.g. biogas and wood pellets) from the scope of CReMA 13A. However, fuel wood that is not converted into such other energy products but intended for direct burning should be covered by EGSS (see Annex 1).

Summary results for this category market and non-market production of other EGSS than wastewater, waste and water management services (non-capital goods and services) are shown in section 3.2.7.

The methods proposed in this section may be combined with other approaches based on surveys, SBS data and lists of PRODCOM codes.

3.2.1. SUPPLY SIDE APPROACH FOR THE PRODUCTION OF ENVIRONMENTAL PROTECTION SERVICES

A new potential data source for EGSS is the environmental protection expenditure accounts (EPEA), which is compiled with a new questionnaire since 2015. The previous Joint Eurostat/OCED questionnaire on environmental protection expenditure (JQ-EPER) was less suitable as data source for EGSS, because it offered less supply-side information (e.g. output) and it was conceptually less aligned to EGSS.

EPEA has the potential to offer information for EGSS both from the supply and demand side. On the supply side, EPEA has information on output and intermediate consumption, from which gross value added can be obtained; on the demand side it has information on final consumption, gross fixed capital formation and exports. The supply-side approach is, *ceteris paribus*, preferable because it allows for a direct estimation of EGSS output. However it requires that the information from EPEA about output is sufficiently complete, which may be feasible after the production of EPEA under Regulation (EU) No 691/2011 is mature. At the time of this writing EPEA is still a voluntary data collection.

EPEA has some limitations as EGSS source, though. The scope of EPEA is environmental protection, and it does not shed information on resource management, which are relevant for EGSS. EPEA has the same definition of output as EGSS, and it comprises market, non-market, ancillary activities.

Besides, EPEA does not have a breakdown by NACE. Therefore, for the purpose of compiling EGSS, the expenditure data must be mapped to the producing NACE industries. EPEA output on CEPA 4 corresponds to NACE 39, which is part of the output covered in section 3.1 and therefore it is not included in this section. In this phase of model development it is assumed for simplicity that output of non-capital EGSS products for EP other than wastewater and waste management services only exists in a few industries. More specifically, production other than for wastewater, waste and water management services are assumed to be for services produced in NACE section M (professional, scientific and technical activities):

$$EGSS_P1_Serv_{CEPA, NACE\ M} = EPEA_P1_{CEPA}; CEPA = CEPA\ 1, CEPA\ 5, CEPA\ 6, CEPA\ 7-9$$

With:

$EGSS_P1_Serv_{CEPA, NACE\ M}$: Output of EP services of NACE section M by CEPA classes (EGSS)

$EPEA_P1_{CEPA}$: Output on EP by CEPA classes (EPEA)

The split into NACE divisions (NACE M69_70, M71 etc.) is based on the shares of each division (s) out of the total NACE M output from national accounts, e.g. with NACE group M69-70 used as an example:

$$EGSS_P1_Serv_{CEPA, NACE\ M69_70} = EPEA_P1_{CEPA} \cdot S_{NACE\ M69_70, NACE\ M}$$

with:

$$S_{\text{NACE M69}_70, \text{NACE M}} = \text{NA_P1}_{\text{NACE M69}_70} / \text{NA_P1}_{\text{NACE M}}$$

and:

$\text{EGSS_P1_Serv}_{\text{CEPA, NACE M69}_70}$: Output of EP services of NACE group M69_70 by CEPA classes (EGSS)

$\text{NA_P1}_{\text{NACE M69}_70}$: Total output of NACE group M69_70 (NA)

$\text{NA_P1}_{\text{NACE M}}$: Total output of NACE section M (NA)

3.2.2. DEMAND SIDE APPROACH FOR THE PRODUCTION OF ENVIRONMENTAL PROTECTION SERVICES ⁽⁴⁴⁾

The previous section 3.2.1 explained the use of EPEA from the supply side. EPEA can also be used for a demand-side estimation of production. This is an indirect approach. This consists of using the balancing equation between supply and demand:

$$\text{Production} - \text{Intermediate consumption} + \text{Imports} + \text{VAT and other taxes less subsidies} = \text{Final consumption} + \text{GFCF} + \text{Exports}$$

EPEA has information on final consumption (EPEA variable P3_EPS), intermediate consumption (P2_EPS), exports & imports (P6 & P7) and VAT and other taxes less subsidies (D21-D31). EPEA does not collect GFCF in the equation above. The GFCF in the equation is the GFCF of (capitalised) EPS, .e.g. R&D services. EPEA collects instead the GFCF of producers of EPS.

It might be possible to calculate capitalised R&D EPS as a residual if other amounts are known, namely: output, intermediate consumption, final consumption and net exports. Alternatively, in some cases it may be assumed to be zero.

Areas for possible future development

- The allocation of output to the producing industries needs to be further investigated. In particular, the contribution to EGSS by units that repair and install machinery and equipment (NACE 33).
- Establishing a demand side estimate based on non-capital EP goods from EPEA Table 5, final consumption of adapted and connected goods.

3.2.3. SUPPLY SIDE APPROACH FOR ORGANIC FARMING PRODUCTS

A very simple estimate of organic farming output may be compiled by multiplying the share of land use for organic farming in total used agricultural area with national accounts (NA) data on agricultural

⁽⁴⁴⁾ The Working Group document 'EGSS Practical Guidelines', which was the basis for this publication, included in this section explanations about adjustment coefficients (f) necessary when using JQ-EPER as data source. Those coefficients were used for two purposes: first, to adjust for valuation differences between purchasers' prices (expenditure) and basic prices (output); secondly, to adjust for the fact that expenditure data includes exports but not imports. With EPEA becoming available as a new data source instead of JQ-EPER, those adjustments are not necessary for EPS, and correspondingly those explanations are removed from this section. However they are still useful for capital goods, because capital goods have trade margins whereas EP services don't. The explanations about adjustment coefficients (f) have been correspondingly moved to the section 3.3

output. The data on land use are available in Eurostat's agricultural statistics, namely in the collections 'organic crop area by agricultural production methods and crops (org_cropar)' and 'Crop statistics (from 2000 onwards) (apro_acs_a)'.

$$EGSS_P1_FarmProd_{CEPA\ 4, NACE\ A} = NA_P1_{NACE\ A01} * Land_{org}/Land_{total}$$

With:

$EGSS_P1_FarmProd_{CEPA\ 4, NACE\ A}$: Output of organic farm products by NACE section A (EGSS)

$NA_P1_{NACE\ A01}$: Total output of crop and animal production, hunting and related service activities (NACE A01) (NA)

$Land_{org}$: Land use for organic farming

$Land_{total}$: Total utilised agricultural area

Whenever available, more detailed accounting information on organic farming can be integrated into the approach. For example, instead of assuming that the output value of farming is distributed between organic and conventional farming simply according to land shares, specific bookkeeping information on organic and conventional agriculture may be used to reflect different productivities and prices for the two types of farming. For the test calculations for Germany it was assumed that the ratio between per-ha turnover of organic farming and conventional is approximately $r \approx 0.7$ ⁽⁴⁵⁾

Using this information and combining it with national accounts data on agricultural output, total agricultural area used and land use for organic farming, allows deriving indicators of output per ha for conventional and organic farming:

$$Prod_{conv}/ha = NA_P1_{NACE\ A01} / [(Land_{total} - Land_{org}) + Land_{org} * r]$$

$$Prod_{org}/ha = Prod_{conv}/ha * r$$

With:

$Prod_{conv}/ha$: Output per hectare in conventional farming

$Prod_{org}/ha$: Output per hectare in organic farming

r : ratio 'per-ha turnover of organic farming / per-ha turnover of conventional farming'

Table 11: Output of organic and conventional farming, Germany (EUR/ha)

⁽⁴⁵⁾ For the test calculation for Germany the results of a special examination of bookkeeping data from the German Farm Accountancy Data Network carried out by a German research agency (Thünen-Institut, 2013) were further analysed to derive ratios of turnover per ha between organic and conventional farming. The data suggest that even though turnover per ha in organic farming is higher than in conventional farming for dairy and fodder production, it is overall lower than in other farm types. From the bookkeeping data it may be derived that turnover per ha in the period 2008/09 to 2011/12 was only up to 10% lower in organic farming than in conventional farming. However, the comparison is driven by the underlying purpose "to deduce what profit the organic farms would make if they were managed conventionally" (Offermann, Sanders, & Nieberg). A press release by the Federal Ministry Food, Agriculture and Consumer Protection (Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz, 2012b) informs that in 2010 average turnover per ha of organic farming was 40% lower than for conventional farms. For the test calculations it was assumed that the ratio between per-ha turnover of organic farming and conventional is approximately $r \approx 0.7$

	2007	2008	2009	2010	2011	2012	2013
organic farming	2 469	2 841	2 572	2 851	3 273	3 112	3 202
conventional farming	2 405	2 626	2 268	2 369	2 651	2 667	2 749

Finally, output of organic farm products is then calculated by multiplying output per ha in organic farming by the surface area of organic farmland. Output of organic farming is allocated to NACE section A (agriculture, forestry and fishing) and to CEPA 4 (protection and remediation of soil, groundwater and surface water).

$$EGSS_P1_FarmProducts_{CEPA\ 4, NACE\ A} = Prod_{org}/ha * Land_{org}$$

Areas for possible future development

- An alternative source of total farming output to national accounts NACE A01 is the Economic Accounts for Agriculture (EAA) (Eurostat, 2000). Some definitional differences between them that may be relevant for EGSS data compilation should be considered:
 - Output in EAA includes intra-unit consumption of fodder, whereas intra-unit deliveries are not included in output by the national accounts.
 - EAA excludes the separable non-agricultural secondary output of holdings, whereas the national accounts division A01 includes all support activities to agriculture and post-harvest crop activities (NACE A01.6) such as for example, the provision of agricultural machinery with operators and crew, agricultural activities on a fee basis (e.g. activities related to artificial insemination), the preparation of crops for primary markets as well as seed processing for propagation.
 - EAA includes parts of the processing of agricultural goods (mainly grapes to wine and olives to olive oil) if this is carried out by groups of producers (e.g. co-operatives), whereas in national accounts this activity is to be recorded under NACE C10 (manufacture of food products) and NACE C11 (manufacture of beverages).

Whether the scope of national accounts NACE A01 or EAA is more relevant for EGSS on organic farming cannot be decided a-priori and depends on the relative importance of the various scope differences elements. If EAA data are used, must intra-unit consumption of fodder be excluded from the EGSS estimate of organic farming as well as output from non-agricultural secondary output of holdings and any processing of primary agricultural products to food and beverages? Should, on the other hand, support activities to agriculture and post-harvest crop activities be included in EGSS if they serve a primary EP or RM purpose? The EAA as a satellite account should be detailed enough to provide a good approximation to what is needed to estimate output from organic farming.

- The approach sketched above and applied in the Eurostat calculation for Germany is an implicit 'quantities times prices' approach. An explicit quantity times price approach would multiply quantities of organic farm products with the respective prices of the organic farm products. Data on the quantities of organic farm production are available in Eurostat's collections 'Certified organic crop production and yields from fully converted areas (food_in_porg2)' and 'Certified production of organic animal products (food_pd_dmorg)'. The main challenge with this explicit approach is collecting representative prices for organic farm products. The data in Eurostat's collections 'Selling prices of crop products (absolute prices) - annual price (from 2000 onwards) (apri_ap_crpouta)' and 'Selling prices of animal products (absolute prices) - annual price (from 2000 onwards) (apri_ap_anouta)' do not distinguish between conventional and organic farm products.

3.2.4. SUPPLY SIDE APPROACH FOR ELECTRICITY PRODUCED FROM RENEWABLE SOURCES

The production of electricity from renewable sources is part of CReMA 13 A (production of energy from renewable sources). Electricity production from renewable sources can be estimated top-down starting from national accounts data broken down by industries and accounts supply tables and then integrating information stepwise on the physical production of electricity by the various available technologies and data on maintenance and operational costs (compare also with Voram & van Rossum, 2013).

The core matrix of a supply table provides information on the output of the economy broken down by industry (table columns classified by NACE) and products (table rows classified by CPA). Firstly, the NACE/CPA codes that cover production of electricity from renewable sources must be identified. Next the share of electricity production from renewable sources needs to be estimated using additional information from other sources such as energy statistics. Next we show details of the approach used in the Eurostat calculations.

We start from Eurostat's collections 'National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)'⁽⁴⁶⁾ and 'Supply table - current prices (NACE Rev. 2) (naio_cp15_r2)'. Before using the data of 'nama_nace10_a64' its 64 industries must be mapped to the 39 NACE categories of the EGSS module so that the total output values for each of the 39 industries can be compiled. Next, output of electricity, gas, steam and air conditioning supply (CPA D35) can be calculated for each of the 39 NACE industries ($NA_P1_{CPA\ D35, nace}$) by multiplying with CPA D35 output shares based on the data in the supply tables. This is the basis for deriving the EGSS output variables as it is shown in the next paragraphs.

Combining the national accounts data for CPA D35 (electricity, gas steam and air condition supply) with the shares of electricity output, of electricity generation in electricity output⁽⁴⁷⁾ and of electricity generation from renewable sources in total electricity generation provides an estimate of the output of electricity from renewable sources:

$$EGSS_P1_Elec_{CREMA\ 13A, NACE} = NA_P1_{CPA\ D35, NACE} * s_{elec} * s_{gene} * s_{renw}$$

With:

$EGSS_P1_Elec_{CREMA\ 13A, NACE}$: Output of electricity from renewable sources by industries (EGSS)

$NA_P1_{CPA\ D35, NACE}$: Output of product CPA D35 by industries (NA)

s_{elec} : share of electricity output in total output of product CPA D35

s_{gene} : share of electricity generation in electricity output

s_{renw} : share of electricity generation from renewable sources in total electricity generation

The share of electricity output over total output of CPA D35 can be estimated using more detailed industry data. Eurostat used the collections 'Annual detailed enterprise statistics on electricity, gas and water supply (NACE Rev. 1.1., E) (sbs_na_2a_el) and 'Annual detailed enterprise statistics for industry (NACE Rev. 2, B-E) (sbs_na_ind_r2)', which consist of SBS data, to estimate a proxy for this share by relating the output of NACE D35.1 (electric power generation, transmission and

⁽⁴⁶⁾ For countries for which the ESA 2010 data are not available collection 'annual National Accounts by 64 branches at current prices (nama_nace64_c)' is used

⁽⁴⁷⁾ The EGSS should not include any downstream activities such as transmission, distribution and trade of electricity that is included in CPA D35. The Eurostat Task Force on the resource management expenditure account (ReMEA) (Eurostat, 2013d) confirmed that the distribution of energy from renewable sources should remain excluded from the scope of the environmental monetary accounts

distribution) to the output of NACE D35. ⁽⁴⁶⁾

Table 12: Share of electricity output (power generation, transmission and distribution) in total output of CPA 35 (s_{elec}), selected countries (%)

	2007	2008	2009	2010	2011	2012	2013
Germany	77.9	79.5	82.9	85.3	86.2	87.1	87.1
France	66.1	63.4	64.2	63.5	65.4	64.0	63.7
Italy	70.4	68.0	70.9	67.3	69.5	67.4	67.7
United Kingdom	74.3	76.7	76.8	76.8	77.2	75.7	74.4

The share of electricity generation in electricity output (s_{gene}) may be derived from SBS data, namely the turnover of NACE D35.11 (production of electricity). If turnover data at such detailed level are not available, other sources may be used in particular sources on cost structures or the components of electricity prices.

Eurostat combined data from the collections 'Electricity prices components for domestic consumers, from 2007 onwards - annual data (nrg_pc_204_c)' and 'Electricity prices components for industrial consumers, from 2007 onwards - annual data (nrg_pc_205_c)' with German data on electricity retail price data published in the monitoring report of the Federal Grid Agency and the Federal Anti-trust Office (Bundesnetzagentur; Bundeskartellamt, 2012). These sources provide electricity retail price data by type of user (e.g. households and industrial user for the various consumption bands) broken down by the price components: fees for energy and supply, distribution (network), taxes and levies and marketing. Consumption weights by type of users can be derived for example from Eurostat's collection 'Supply, transformation, consumption - electricity - annual data (nrg_105a)'. Information on household electricity consumption by consumption band is published on Eurostat's dedicated website on energy statistics (see Eurostat, 2013g). Data on industrial consumers by consumption band are not published by Eurostat.

Based on those data it is possible to estimate the shares of energy purchase in retail prices net of concessions, taxes and apportionments, which are used in the test calculation as a proxy for s_{gene} . The estimated value for s_{gene} is between 0.4 and 0.6 in most countries.

It is to be mentioned that these shares are only applied to NACE D35 electricity output, whereas for all other industries it is assumed that $s_{gene}=1$ (i.e. electricity output in industries other than NACE D35 is only due to the generation of electricity and these do not transmit or distribute electricity).

Table 13: Share of electricity generation in electricity output (s_{gene}), selected countries (%)

	2007	2008	2009	2010	2011	2012	2013
Germany	49.9	53.1	51.2	51.3	49.6	48.6	47.1
France	41.0	41.0	41.0	41.0	41.0	41.0	43.9
Italy	64.0	64.0	57.1	53.6	53.5	57.2	57.7
United Kingdom	58.8	65.4	64.4	71.9	68.3	69.3	70.2

Source: own calculation based on Eurostat data and Bundesnetzagentur, Bundeskartellamt (2012)

The share of electricity from renewable sources in total electricity generation (s_{renew}) can be based on energy statistics. Eurostat used the collection 'Supply, transformation, consumption - electricity - annual data (nrg_105a)'. The share is calculated from data on net electricity generation as main

⁽⁴⁶⁾ Where time series from the SBS are not complete the ratios may be completed by using the corresponding final consumption ratios which, for example, can be calculated using the Eurostat collections 'Supply, transformation, consumption - electricity - annual data (nrg_105a)' and 'Supply, transformation, consumption - gas - annual data (nrg_103a)

activity and net electricity generation auto-produced⁽⁴⁹⁾ taking into account the following renewable sources: hydro, geothermal, geothermal combined heat power (CHP) plants, solar, tide and waves and wind.⁽⁵⁰⁾

$$s_{\text{renew}} = \text{PROD}_{\text{electricity from renewable sources}} / \text{PROD}_{\text{electricity from all sources}}$$

Table 14: Physical shares of electricity generation from renewable sources in total electricity generation (s_{renew}), selected countries (%)

	2007	2008	2009	2010	2011	2012	2013
Germany	11.7	11.8	12.4	12.8	15.8	17.6	18.6
France	12.3	13.4	13.6	14.3	11.9	15.2	17.5
Italy	15.7	18.5	23.1	24.0	25.0	28.0	34.2
United Kingdom	3.7	4.4	5.0	4.6	6.9	8.5	11.1

These shares are based on physical data on electricity generation and do not properly represent the value of renewable electricity since prices for electricity from renewable and non-renewable sources normally differ. Price differences can be due to different production costs, premiums that consumer might be willing to pay for “green” electricity or subsidies.⁽⁵¹⁾

When using physical shares it is implicitly assumed that prices of electricity from renewable and non-renewable source are identical. Therefore, taking price differences into account would be an improvement. If the price ratio between electricity from renewable and non-renewable resources (f) is known, the above formula can be extended to take it into account:

$$\text{EGSS_P1_Elec}_{\text{CREMA 13A, NACE}} = \text{NA_P1}_{\text{CPA D35, NACE}} * s_{\text{elec}} * s_{\text{gene}} * (s_{\text{renew}} * f) / (1 + s_{\text{renew}} * (f - 1))$$

The term $(s_{\text{renew}} * f) / (1 + s_{\text{renew}} * (f - 1))$ in this formula represents the share of electricity from renewable sources in total electricity generation in price terms. It can be easily seen that for $f=1$ the term collapses to s_{renew} which is the physical share implying no price differences between the two types of electricity. For the calculations Eurostat derived estimates of the price ratios between electricity from renewable and non-renewable sources (f) from production costs (levelised costs of electricity, LCOE) data from the International Energy Agency (IEA) and the OECD Nuclear Energy Agency (NEA). More details and results of the calculation of the price ratio f are shown in Annex 7.

The monetary shares calculated by combining the physical shares with the price ratio estimates are shown in the following table.

Table 15: Monetary shares of electricity generation from renewable sources in total electricity generation, selected countries (%)

	2007	2008	2009	2010	2011	2012	2013
Germany	16.6	17.4	19.2	21.4	28.2	31.9	34.3
France	13.2	14.5	15.0	16.0	14.7	19.1	21.7
Italy	18.4	21.4	26.8	28.8	36.3	43.9	50.6
United Kingdom	4.6	5.6	6.6	6.3	9.6	12.7	17.0

Note: calculated with the following formula: $(s_{\text{renew}} * f) / (1 + s_{\text{renew}} * (f - 1))$

⁽⁴⁹⁾ If data on auto-produced electricity is available

⁽⁵⁰⁾ The production of electricity from biomass is not included to avoid double counting with the estimates for biogas production (see section 3.2.6)

⁽⁵¹⁾ The Eurostat Task Force on the resource management expenditure account (ReMEA) (Eurostat, 2013d) acknowledged that attention should be paid to the prices since the market prices could be inflated by support from government

Eurostat applied these shares to all NACE industries but NACE A, for which it is assumed that practically all electricity production is from renewable sources.

It is also worth noting that in principle the above measurement of electricity from renewable sources includes electricity produced for own use. The 2016 *EGSS handbook* (section 3.1.1) gives the following recommendations on the recording of energy produced for own use:

- Electricity generated by households: the part of the electricity output that is not fed into the electricity grid (i.e. sold at so-called feed-in tariffs) but is directly consumed by the household or stored for later use in the same household (e.g. by using modern accumulator technology) falls under output for own final use. Other forms of energy production for own final consumption may include, for example, fuel wood and heat from heat pumps.
- Many producers pertaining to various industries produce electricity or heat for their own internal needs. In order to ensure a maximum of comprehensiveness and comparability of the data it is recommended to include this EGSS output as the same type of output as in national accounts i.e., market output, non-market output or ancillary output. Therefore production of energy from renewable sources for own use (as intermediate consumption) may be recorded in EGSS either as secondary output (if accounted for in the national accounts) or as ancillary output (if not accounted for in the national accounts). The secondary output should be classified as market or non-market according to the classification of the producer as market or non-market producer.

Areas for possible future development

- The estimates of the monetary shares of electricity generation from renewable sources in total electricity generation are based on physical electricity production data and on levelised costs under standard assumptions for load factors, fuel prices, carbon prices, discount rates etc., which can have a strong impact on the relative costs of the different electricity production technologies and their competitiveness. The IEA/NEA study has carried out sensitivity analyses of the main factors impacting the costs. A possible future improvement of the approach sketched above is to estimate price ratios depending on such factors, e.g. to integrate elasticities of LCOE with respect to fuel prices in the calculation of the price ratios.
- Alternatively, EGSS compilers may use information on the feed-in tariffs for electricity from renewable sources in comparison with producer prices for electricity from conventional sources. Such feed-in tariffs may be different not only by type of energy source (wind, solar etc.) but also by type of installation, e.g. for photovoltaic there may be different tariffs depending on whether it is an installation on roof or on open area and on the capacity of the power plant. Potential sources for such price data and the corresponding physical production weights may be available at the national energy agencies or be obtained from large electricity providers.

3.2.5. PRICE TIMES QUANTITY APPROACH FOR BIOFUELS

The production of biofuel is part of the renewable sources energy production (CReMA 13 A). This guide proposes to use the price times quantity approach for biogasoline, biodiesel and other liquid biofuels.

Data on produced quantities are available in Eurostat's collection 'Supply, transformation, consumption – renewable energies - annual data (nrg_107a)'. For the calculations, price data are taken from an agricultural outlook study which includes a chapter on biofuels (FAO, OECD, 2011). This study shows German producer prices for biodiesel net of tariff and Brazilian producer prices for bioethanol (Sao Paulo, ex distillery). The price data in USD per tonne are converted to EUR per Terajoule (TJ) using technical coefficients from a German industry association (Bundesverband der deutschen Bioethanolwirtschaft e.V., 2013) and Eurostat data on exchange rates.

The biodiesel price is multiplied by biodiesel production and the bioethanol price by biogasoline and other liquid biofuels production to estimate the output value for biofuels. Output of biofuels is

attributed to NACE C20 (manufacture of chemicals and chemical products).

Table 16: Output of biofuels, Germany

	2007	2008	2009	2010	2011	2012	2013
Production, Biogasoline (TJ)	8 640	12 167	15 504	16 662	14 969	16 482	16 986
Price, Biogasoline (EUR/TJ)	14 150	15 004	15 220	21 642	29 496	23 716	22 087
Output, Biogasoline (million EUR)	122	183	236	361	442	391	375
Production, Biodiesel (TJ)	110 243	93 640	90 371	114 552	113 960	104 335	111 692
Price, Biodiesel (EUR/TJ)	21 260	26 914	18 120	22 058	29 118	27 836	25 939
Output, Biodiesel (million EUR)	2 344	2 520	1 638	2 527	3 318	2 904	2 897
Production, other liquid biofuels (TJ)	34 911	23 118	19 391	15 421	5 147	3 798	3 459
Price, other liquid biofuels (EUR/TJ)	21 260	26 914	18 120	22 058	29 118	27 836	25 939
Output, other liquid biofuels (million EUR)	742	622	351	340	150	106	90

Areas for possible future development

- It should be investigated whether the price used to value biogasoline and other liquid biofuels is a proxy sufficiently close to European producer prices. Some additional research may be necessary to improve the valuation of biofuels.
- Another potential data source to value biofuel production is published by DG Energy of the Commission (European Commission, 2013): from the [Market Observatory & Statistics](#) website historical time series on fuel prices at consumer level with and without VAT and indirect taxes can be downloaded. The data set includes prices for Euro-super 95, automotive gas oil and LPG motor fuel from 2005 onwards for the EU and the Eurozone.

3.2.6. PRICE TIMES QUANTITY APPROACH FOR BIOGAS

The production of biogas also belongs to the production of energy from renewable sources (CReMA 13 A). This guide proposes using the price times quantity approach for biogas.

Data on produced quantities of biogas are available in Eurostat's collection 'Supply, transformation, consumption – renewable energies - annual data (nrg_107)'.

The calculations used price data from Eurostat's energy statistics: collection 'Gas - domestic consumers - bi-annual prices - new methodology from 2007 onwards (nrg_pc_202)'. The price data in this collection do not fully meet the requirements to value biogas production at producer prices. They are price data for natural gas and are expressed in EUR per GJ gross calorific value. If the quantities are expressed in net calorific values the price can be adjusted to take into account the latent heat of vaporisation of the water vapour produced during combustion. From the manual on energy statistics it can be derived that the net calorific value of a gas is approximately 9% lower than its gross calorific value (OECD, IEA, Eurostat, 2004). Moreover, the data collection reports consumer prices. In order to meet the producer price definition as close as possible the prices excluding all taxes for consumer in the consumption band > 200 GJ are used.

Table 17: Output of biogas, Poland

	2007	2008	2009	2010	2011	2012	2013
Production, Biogas (TJ)	2 708	4 026	4 104	4 797	5 732	7 033	7 593
Price, Biogas (EUR/TJ)	9 108	9 690	9 670	10 418	10 899	12 040	11 652
Output, Biogas (million EUR)	25	39	40	50	62	85	88

Output of biogas is attributed to NACE D (electricity, gas, steam and air conditioning supply).

Areas for possible future development

- It should be investigated whether the price used to value biogas is a sufficiently good proxy for European biogas producer prices. Some additional research may be necessary to improve the valuation of biogas.

3.2.7. SUMMARY RESULTS

The table below summarises the market output of EGSS non-capital goods and services other than wastewater, waste and water management services derived by Eurostat using the methods described in sections 3.2.1 to 3.2.6.

Table 18: Market production of EGSS other than wastewater, waste and water management services: non-capital goods and services, EU28 (million EUR)

CEPA/CR _e MA	2007	2008	2009	2010	2011	2012	2013
Protection of ambient air and climate	7 489	7 945	7 409	7 201	7 317	7 090	7 396
Wastewater management	25 535	27 200	26 877	25 931	25 219	24 555	23 871
Waste management	14 064	15 004	13 649	14 881	14 309	15 125	15 552
Protection and remediation of soil, groundwater and surface water	1 877	2 017	1 956	2 160	2 076	1 995	2 047
Noise and vibration abatement	1 153	1 271	1 234	1 179	930	980	999
Protection of biodiversity and landscapes	4 678	4 888	4 855	4 491	4 481	4 119	4 392
Other environmental protection	2 658	3 415	2 843	2 845	2 826	2 874	3 164

These estimates are to be considered as lower thresholds due to the following main reasons:

- Material recovery recorded in the national accounts under CPA/NACE E37-39 is included in the estimates for *market and non-market production of wastewater, waste and water management services* as part of CEPA 3 (see section 3.1.1). However, any material recovery not recorded by national accounts under CPA/NACE E37-39 is not included in the EGSS calculations.
- The part of energy production by households that is not delivered to the electricity grid (e.g. heating energy produced by geo thermal or solar thermal installations in private dwellings for own-consumption) is not accounted for in the national accounts. Extra efforts are therefore needed to estimate this output and include it in EGSS as production of energy from renewable sources.

3.3. Market production of EGSS: capital goods and services

The production of EGSS capital goods and services can be estimated on the basis of supply side sources such as SBS and PRODCOM. Demand side data on gross fixed capital formation (investments) can also be used. This guide proposes the demand side approach. Environmental investment expenditure data are available for EP activities from the EPEA. For RM national accounts investment data are combined with other data sources such as energy statistics or information from specific studies.

3.3.1. DEMAND SIDE APPROACH FOR ENVIRONMENTAL PROTECTION: CAPITAL GOODS AND SERVICES

It is proposed to calculate output of EGSS capital goods and services for EP using demand side data on investments from the EPEA dataset. Investment expenditure includes all outlays in a given year (purchases and own-account production) for machinery, equipment, plant, buildings and land used

for environmental protection purposes. Total investments in a sector or industry are the sum of two categories:

- (1) end-of-pipe investments (or pollution treatment investments⁽⁵²⁾);
- (2) investments in integrated technologies (or pollution prevention investments⁽⁵³⁾).

For EGSS purposes, investment expenditure from the EPEA broken down by environmental activities and industries must be mapped to the producing NACE industries. It is proposed to use national account data on gross fixed capital formation (investment) cross-classified by industries and types of asset for this mapping.

In the Eurostat calculations national accounts collection 'Gross capital formation by industry (up to NACE A*64) (nama_10_a64_p5)'⁽⁵⁴⁾ is used. It provides data on gross fixed capital formation by investing NACE section and type of asset.

First, shares of each asset type out of the total investments by investing NACE sections ($s_{\text{nace, asset type}}$) are calculated:

$$S_{\text{NACE, asset type}} = \text{NA_P51G}_{\text{NACE, asset type}} / \sum_{\text{asset type}} \text{NA_P51G}_{\text{NACE, asset type}}$$

With:

$\text{NA_P51G}_{\text{NACE, asset type}}$: Gross fixed capital formation by industries and types of assets (NA)

Next, investments in each asset type are mapped to producing NACE divisions: 'other machinery and equipment'⁽⁵⁵⁾ is assumed to be produced by NACE C26 (manufacture of computer, electronic and optical products), NACE C27 (manufacture of electrical equipment) and NACE C28 (manufacture of machinery and equipment n.e.c.), 'transport equipment' by NACE C29_30 (manufacture of motor vehicles, trailers and semi-trailers and other transport equipment), 'total construction' by NACE F (construction), 'computer software' by NACE J (information and communication) and 'intangible fixed assets' by NACE M71 (architectural and engineering activities; technical testing and analysis):

$$S_{\text{NACE C26}} = S_{\text{NACE C27}} = S_{\text{NACE C28}} = S_{\text{other machinery and equipment}} / 3$$

$$S_{\text{NACE C29_30}} = S_{\text{transport equipment}}$$

$$S_{\text{NACE F}} = S_{\text{total construction}}$$

$$S_{\text{NACE J}} = S_{\text{computer software}}$$

$$S_{\text{NACE M71}} = S_{\text{intangible fixed assets}}$$

Eurostat then multiplies these shares by the investment data (source EPEA) to obtain proxies for EGSS output of EP capital products broken down by the producing industries, e.g. with CEPA 3 and NACE F as an example:

$$\text{EGSS_P1_CapProd}_{\text{CEPA 3, NACE F}} = \sum_{\text{NACE}} S_{\text{NACE}} * \text{EPEA_P51G_NP}_{\text{CEPA 3, NACE}}$$

With:

$\text{EGSS_P1_CapProd}_{\text{CEPA 3, NACE F}}$: Output of capital products for waste management by the construction industry (EGSS)

$\text{EPEA_P51G_NP}_{\text{CEPA 3, NACE}}$: Gross fixed capital formation for waste management by industries

⁽⁵²⁾ For the collection and removal of pollutants (e.g. air emissions, effluents or solid waste), for the prevention of the spread of pollution, for the measurement of the level of the pollution

⁽⁵³⁾ Modified or adapted production processes

⁽⁵⁴⁾ For countries for which the ESA 2010 data are not yet available the corresponding ESA95 collection 'nama_pi22_21_c' is used

⁽⁵⁵⁾ Other than transport equipment and including office machinery, hardware, radio, TV and communication equipment

(EPEA)

This approach implicitly assumes that the investment structure by type of asset of a NACE section as derived from national accounts also applies to the investments in environmental protection for this NACE section.

An issue not reflected in this use of investment data is that of upstream links. A producer satisfying the final demand for an EGSS product may use upstream EGSS products from another EGSS producer as a component of his own product (e.g. parts of hydraulic turbines delivered by a component producer to a hydraulic turbine producer). Following the concepts of national accounts also the upstream EGSS output should be accounted for. Without accounting the upstream EGSS output EGSS employment estimates that would be based on demand side data could systematically underestimate the number of direct employment in EGSS. However, accounting for such upstream links is not a trivial task because, firstly, the production chains within the EGSS are not easy to identify on the basis of existing statistical data and, secondly, such upstream links may exist in practice over several steps.

For the calculations, Eurostat made an attempt to derive estimates of the first round upstream links using the national accounts use tables available in Eurostat's collection 'Use table - current prices (NACE Rev. 2) (naio_cp16_r2)'. These use tables provide information on intermediate inputs by 64 CPA product categories used in the production of 64 NACE industries. The data on the main diagonal of the 64x64-matrix inform on the intermediate use of a CPA product within the same characteristic industry, e.g. $NA_P2_{CPA\ C28, NACE\ C28}$ would be the intermediate consumption of product CPA C28 (machinery and equipment) in industry NACE 28 (manufacturing of machinery and equipment). This is considered as the value of (components of) machinery delivered as upstream products to the machinery manufacturing industry. These diagonal elements can be related to the total output of the respective industry to derive multipliers (m) for the first round upstream link in EGSS production, e.g. with NACE C28 as an example:

$$m_{NACE\ C28} = NA_P2_{CPA\ C28, NACE\ C28} / \sum_{cpa} NA_P1_{CPA, NACE\ C28} + 1$$

With:

$NA_P2_{CPA\ C28, NACE\ C28}$: Intermediate consumption of CPA product C28 by industry C28 (national accounts - use table)

$NA_P1_{CPA, NACE\ C28}$: Output of industry C28 by CPA products (national accounts - supply table).

Table 19: First round multipliers (m) for upstream links in EGSS production, Czech Republic, selected industries

NACE	2007	2008	2009	2010	2011	2012	2013
C28	1.035	1.030	1.032	1.030	1.033	1.031	1.019
F	1.367	1.365	1.355	1.358	1.357	1.332	1.330
J	1.251	1.252	1.275	1.284	1.277	1.278	1.265
M71	1.098	1.127	1.153	1.175	1.193	1.195	1.194

For example, in Table 19 the factor 1.035 for NACE C28 means that 1 € of final expenditure on products produced by NACE C28 has an additional output impact on NACE C28 of approximately 0.03 € due to the production of upstream output (CPA C28 products used as components in the production by NACE C28). Applying the multipliers m in the following compilation of output from demand side data, e.g. with CEPA 1 and NACE C28 used as an example:

$$EGSS_P1_CapProd_{CEPA\ 1,\ NACE\ C28} = m_{NACE\ C28} * \sum_{NACE} s_{NACE,\ NACE\ C28} * EPEA_P51G_NP_{CEPA\ 1,\ NACE}$$

Another problem when mapping expenditure into EGSS output is that expenditure excludes exports but includes imports and expenditure is valued at purchasers' prices whereas output should be valued at basic prices. The problem of export-import adjustment may be tackled by an analysis of detailed trade data. However, in this first phase of model development a less time consuming approach is preferred: using structures from the national accounts supply and use tables to derive a correction factor (f) for the output estimated based on expenditure data.

The national accounts use tables provide data on the use of products for intermediate consumption (IC), final consumption (FC), gross capital formation (GCF) and exports (EX), whereas the supply table columns provide information on imports (IM), trade and transport margins (TM) and taxes less subsidies on products (TS) broken down by CPA product. To adjust expenditure based data correction factors (f) can be compiled:

$$f = 1 + (EX - IM - TM - TS) / (IC + FC + GCF)$$

These factors can be used to re-scale supply side and demand side data.

Table 20: Correction factors (f) for expenditure based data to correct for exports, imports and valuation differences, Czech Republic

CPA	2007	2008	2009	2010	2011
F	0.979	0.975	0.977	0.983	0.984
J	0.942	0.945	0.934	0.944	0.944
M71	0.999	1.048	1.039	1.045	1.041

For example, f=1.048 for M71 in 2008 means that any expenditure allocated to the producing branch M71 is inflated by 4.8% in order to account for international trade and the basic price valuation of output.

Applying the multiplier m results in the following compilation of output from demand side data, e.g. with CEPA 2 and NACE C28 used as an example:

$$EGSS_P1_CapProd_{CEPA\ 2,\ NACE\ C28} = m_{NACE\ C28} * f_{CPA\ C28} * \sum_{NACE} s_{NACE,\ NACE\ C28} * EPEA_P51G_NP_{CEPA\ 2,\ NACE}$$

Areas for possible future development

- The allocation of investment expenditure to asset types and to the asset producing NACE branches may be further investigated and improved.
- The results from specific EGSS surveys may be used for this purpose. To reduce the financial burden of statistical production as well as the burden to survey respondents and at the same time to maintain a high level of quality, detail and coverage in the EGSS statistics it may be meaningful to combine the survey based approach with the data integration approach. For example, in important areas (e.g. manufacture of machinery and equipment, construction, architectural and engineering services) producers may be surveyed only every two to five years and for the interim years the survey data could be linked with the result from the data integration approach.
- The first round multipliers (m) and the correction factors (f) for international trade and valuation differences may need further research. In particular, multipliers and correction factors based on NACE/CPA aggregates may not be sufficiently representative for EGSS producers within these industries.

3.3.2. DEMAND SIDE APPROACH FOR WATER MANAGEMENT: CAPITAL GOODS AND SERVICES

A demand side approach is proposed to estimate EGSS capital products for water management using data from national accounts on gross fixed capital formation (investment) cross-classified by industries and types of asset and output by industry. The basic assumption is that the water supply industry is mature and thus shows a relatively stable relationship between investment and output in the longer run.

Eurostat's collection 'Gross capital formation by industry (up to NACE A*64) (nama_10_a64_p5)'⁽⁵⁶⁾ provides data on gross fixed capital formation by type of asset and investing NACE section that can be used for the EGSS calculations. The NACE section mainly relevant for water management is section E (water supply, sewerage, waste management and remediation activities). This information can be combined with output data (NA_P1) from the collection 'National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)'⁽⁵⁷⁾ to estimate investment factors per unit of output for section E by type of asset ($i_{\text{asset type}}$):

$$i_{\text{asset type}} = \text{NA_P51G}_{\text{NACE E,asset type}} / \text{NA_P1G}_{\text{NACE E}}$$

With:

$\text{NA_P51G}_{\text{NACE E,asset type}}$: Gross fixed capital formation of NACE section E by type of asset (NA)

$\text{NA_P1}_{\text{NACE E}}$: Output of NACE section E (NA)

These investment factors by type of asset, which are ratios between gross fixed capital formation and output of NACE section E, are mapped to the asset producing industries: 'other machinery and equipment' to NACE C26 (manufacture of computer, electronic and optical products), NACE C27 (manufacture of electrical equipment) and NACE C28 (manufacture of machinery and equipment n.e.c.), 'transport equipment' to NACE C29_30 (manufacture of motor vehicles, trailers and semi-trailers and other transport equipment, 'total construction' to NACE F (construction), 'computer software' to NACE J (information and communication) and 'intangible fixed assets' to NACE M71 (architectural and engineering activities; technical testing and analysis):

$$i_{\text{NACE C26}} = i_{\text{NACE C27}} = i_{\text{NACE C28}} = i_{\text{other machinery and equipment}} / 3$$

$$i_{\text{NACE C29_30}} = i_{\text{transport equipment}}$$

$$i_{\text{NACE F}} = i_{\text{total construction}}$$

$$i_{\text{NACE J}} = i_{\text{computer software}}$$

$$i_{\text{NACE M71}} = i_{\text{intangible fixed assets}}$$

The investment factors thus allocated are then multiplied by the EGSS output of water management services to obtain proxies for the output of capital products for water management broken down by industries, e.g. for NACE F (construction) as an example:

$$\text{EGSS_P1_CapProd}_{\text{CReMA 10, NACE F}} = i_{\text{NACE F}} * \sum_{\text{NACE}} \text{EGSS_P1_Serv}_{\text{CReMA 10, NACE}}$$

With:

$\text{EGSS_P1_CapProd}_{\text{CReMA 10, NACE F}}$: Output of capital products for the management of water by NACE F (EGSS)

⁽⁵⁶⁾ For countries for which the ESA 2010 data are not yet available the corresponding ESA95 collection 'nama_pi22_21_c' is used

⁽⁵⁷⁾ For countries for which the ESA 2010 data are not available collection 'annual National Accounts by 64 branches at current prices (nama_nace64_c)' is used

EGSS_P1_Serv_{CR&MA 10, NACE}: Output of water management services by industries (EGSS)

The approach shown above implicitly assumes that the investment factors for NACE section E are also representative for water management services produced in any other industry. In practice, however, the production of water management services outside of NACE E should be very small.

In addition, an attempt has been made to derive an estimate for the first round upstream multipliers (m) and to calculate correction factors (f) to take into account international trade and valuation differences (for details on the multipliers and factors, see the description of the test calculations made for capital products for environmental protection). Applying these multipliers and factors gives the following formula:

$$EGSS_P1_CapProd_{CR\&MA\ 10,\ NACE\ F} = m_{NACE\ F} * f_{CPA\ F} * i_{NACE\ F} * \sum_{NACE} EGSS_P1_Serv_{CR\&MA\ 10,\ NACE}$$

Areas for possible future development

- The first round multipliers (m) and the correction factors (f) for international trade and valuation differences may need further research. In particular, multipliers and correction factors based on NACE/CPA aggregates may not be representative for EGSS producers within those NACE industries.

3.3.3. DEMAND SIDE APPROACH FOR ELECTRICITY FROM WIND, SOLAR AND HYDRO POWER: CAPITAL GOODS AND SERVICES

A demand side approach is proposed to estimate EGSS capital products for the production of electricity from wind, solar and hydro power.⁽⁵⁸⁾ This involves using data from national accounts on gross fixed capital formation (investment) cross-classified by industry and by type of asset. Those data are combined with specific data on power plant investments (e.g. ministerial data, IEA data) and production capacities (Eurostat energy statistics), as explained below.

Eurostat's collection 'Gross capital formation by industry (up to NACE A*64) (nama_10_a64_p5)'⁽⁵⁹⁾ provides data on gross fixed capital formation (NA_P51G) by type of asset and investing NACE sections. The NACE section most relevant for electricity production is D35 (electricity, gas, steam and air conditioning supply). There are no data in this collection which identify investments for the production of electricity from renewable sources so that this source must be combined with more specific sources on renewable energies.

First, shares of each asset type in the total investments by NACE D35 ($s_{NACE\ D35,\ asset\ type}$) are calculated:

$$s_{NACE\ D35,\ asset\ type} = NA_P51G_{NACE\ D35,\ asset\ type} / \sum_{asset\ type} NA_P51G_{NACE\ D35,\ asset\ type}$$

NA_P51G_{NACE D35, asset type}: Gross fixed capital formation by industry D35 and type of asset (NA)

Next, investments by asset types are mapped to producing NACE divisions: 'other machinery and equipment' is assumed to have been produced by NACE C26 (manufacture of computer, electronic and optical products), NACE C27 (manufacture of electrical equipment) and NACE C28 (manufacture of machinery and equipment n.e.c.), 'transport equipment' by NACE C29_30 (manufacture of motor vehicles, trailers and semi-trailers and other transport equipment), 'total

⁽⁵⁸⁾ Investments in the production of electricity from biomass are covered under the heading "electricity and heat from biomass"

⁽⁵⁹⁾ For countries for which the ESA 2010 data are not yet available the corresponding ESA95 collection 'nama_pi22_21_c' is used

construction' by NACE F (construction), 'computer software' by NACE J (information and communication) and 'intangible fixed assets' by NACE M71 (architectural and engineering activities; technical testing and analysis):

$$S_{\text{NACE D35, NACE C26}} = S_{\text{NACE D35, NACE C27}} = S_{\text{NACE D35, NACE C28}} = S_{\text{NACE D35, oth. mach. and equip}} / 3$$

$$S_{\text{NACE D35, NACE C29_30}} = S_{\text{NACE D35, transport equipment}}$$

$$S_{\text{NACE D35, NACE F}} = S_{\text{NACE D35, total construction}}$$

$$S_{\text{NACE D35, NACE J}} = S_{\text{NACE D35, computer software}}$$

$$S_{\text{NACE D35, NACE M71}} = S_{\text{NACE D35, intangible fixed assets}}$$

These shares can then be multiplied by the investments in renewable electricity production capacity ($inv_{\text{renewElec}}$) to estimate proxies for the EGSS output of capital products for renewable electricity production broken down by the producing NACE branches, e.g. with NACE F (construction industry) used as an example:

$$EGSS_P1_CapProd_{\text{CReMA 13A, NACE F}} = S_{\text{NACE D35, NACE F}} \cdot inv_{\text{renewElec}}$$

With:

$EGSS_P1_CapProd_{\text{CReMA 13A, NACE F}}$: NACE F output of capital products for the production of electricity from renewable sources (EGSS)

For the Eurostat calculation for Germany, the investment data for renewable electricity production capacity are taken from publications on the website of the Federal Ministry for environment, nature protection and nuclear safety.⁽⁶⁰⁾ Any missing years are estimated using ratios of 'investments in renewable electricity production capacity' to positive⁽⁶¹⁾ year-on-year changes in renewable electricity production capacity (main producers and auto-producers). These year-on-year changes are derived from Eurostat's collection 'Infrastructure - electricity - annual data (nrg_113a)' taking into account capacities installed by main and auto-producers. Both, the year-on-year changes and the investment data are shown in the two tables below.

Table 21: Positive year-on-year changes in renewable electricity production capacity, Germany (MW)

	2007	2008	2009	2010	2011	2012	2013
Wind	1 615	1 632	1 877	1 488	1 880	2 244	3 356
Hydro	38	0	690	0	218	0	0
Solar	1 271	1 950	4 446	6 988	7 485	7 604	3 694

Table 22: Test calculation: Investments in renewable electricity production capacity, Germany (million EUR)

	2007	2008	2009	2010	2011	2012	2013
Wind	2 500	2 600	3 000	2 600	3 000	3 900	7 060
Hydro	200	300	500	300	300	300	250
Solar	5 300	8 000	13 600	18 400	15 000	11 200	4 240

The ratios of investments divided by the changes in renewable electricity production capacity (see

⁽⁶⁰⁾ Edler, Blazejczak, Wackerbauer, Rave, Legler, & Schasse (2009), Edler & Blazejczak, (2012), Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, (2012a), Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, 2012b, Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2013)

⁽⁶¹⁾ Where year-to-year changes of the capacities are negative zero investments were assumed

table below) can be compared with sources on the investments costs for newly installed capacities in order to check the plausibility of the data used. "Overnight costs" ⁽⁶²⁾ for electric capacity from European on-shore wind power stations amount to approximately 1.9-3.7 million USD/MW (International Energy Agency; Nuclear Energy Agency, 2010). According to the same source, the investment costs for electric capacity from European photovoltaic power stations range from 3.2 million USD/MW to 7.4 million USD/MW. A study by Prognos AG on investments costs for renewable energies in Germany makes the following assumption (based on literature analysis) on the specific investments costs for the year 2010: 1.1-1.3 million EUR/MW for onshore wind power stations, 3.5 million EUR/MW for off-shore wind power stations and 3.0 million EUR/MW for photovoltaic (Prognos AG, 2010).

Table 23: Ratio investments in renewable electricity production capacity to change in renewable electricity production capacity, Germany (million EUR/MW)

	2007	2008	2009	2010	2011	2012	2013
Wind	1.548	1.593	1.598	1.747	1.596	1.738	2.104
Hydro	5.263	0.000	0.725	0.000	1.376	0.000	0.000
Solar	2.700	4.103	3.059	2.633	2.004	1.473	1.148

For countries for which investment data for electricity from renewable sources are not available, investments can be estimated as a first approximation using the above ratios for Germany multiplied by the positive year-on-year changes in renewable electricity production capacity. Another option could be to use country specific overnight cost data.

Eurostat made an attempt to estimate the first round upstream multipliers (m) and to calculate correction factors (f) taking into account international trade and valuation differences (for details on the multipliers and factors, see the description of the test calculations made for capital products for environmental protection). Applying these multipliers and factors gives the following formula, e.g. with NACE F (construction industry) used as an example:

$$EGSS_P1_CapProd_{CReMA\ 13A,\ NACE\ F} = S_{NACE\ D35,\ NACE\ F} * inv_{renewElec} * m_{NACE\ D35} * f_{CPA\ D35}$$

The results obtained by this approach were compared with production data extracted from PRODCOM statistics (Eurostat collection 'Statistics on the production of manufactured goods (prom)') for relevant product categories (e.g. hydraulic turbines and water wheels, wind powered generating sets). If the production estimate based on PRODCOM statistics was higher than the estimate based on the demand side approach, the calculations based on PRODCOM statistics were used for EGSS.

Areas for possible future development

- Some additional research may be needed to estimate investments in the electricity grid that are specifically needed to transport electricity from renewable sources to the users. For example, the development of off-shore wind power stations requires the construction of additional transport capacities.
- The first round multipliers (m) and the correction factors (f) for international trade and valuation differences may need further research. In particular, multipliers and correction factors based on NACE/CPA aggregates may not be representative for EGSS producers within those NACE industries.

⁽⁶²⁾ "Overnight costs" are the sum of pre-construction, construction and contingency costs. Data for 190 power stations in 21 countries have been published. Overnight costs data are available for the following EU countries: Belgium (only on-shore wind), Czech Republic, France, Germany, Italy and the Netherlands

3.3.4. DEMAND SIDE APPROACH FOR BIOFUELS: CAPITAL GOODS AND SERVICES

The estimate concerns production plants to produce biofuels. To estimate EGSS capital products for the production of biofuels a demand side approach is proposed using data from national accounts on gross fixed capital formation (investment) cross-classified by industry and by type of asset, combined with output by industry.

Eurostat's collection 'Gross capital formation by industry (up to NACE A*64) (nama_10_a64_p5)'⁽⁶³⁾ provides data on gross fixed capital formation by type of asset and investing NACE sections. The NACE section mainly relevant for the production of biofuels is section C (manufacturing). This collection has no data to identify investments for the production of biofuels so that this source must be combined with more specific sources on renewable energies.

First, shares of each asset type in the total investments by NACE C ($S_{NACE\ C, asset\ type}$) are calculated:

$$S_{NACE\ C, asset\ type} = \frac{NA_P51G_{NACE\ C, asset\ type}}{\sum_{asset\ type} NA_P51G_{NACE\ C, asset\ type}}$$

With:

$NA_P51G_{NACE\ C, asset\ type}$: Gross fixed capital formation by industry C and type of asset (NA)

Next, investments by asset types are mapped to producing NACE divisions: 'other machinery and equipment' is assumed to be produced by NACE C26 (manufacture of computer, electronic and optical products), NACE C27 (manufacture of electrical equipment) and NACE C28 (manufacture of machinery and equipment n.e.c.), 'transport equipment' by NACE C29_30 (manufacture of motor vehicles, trailers and semi-trailers and other transport equipment), 'total construction' by NACE F (construction), 'computer software' by NACE J (information and communication) and 'intangible fixed assets' by NACE M71 (architectural and engineering activities; technical testing and analysis):

$$S_{NACE\ C, NACE\ C26} = S_{NACE\ C, NACE\ C27} = S_{NACE\ C, NACE\ C28} = S_{NACE\ C, other\ machinery\ and\ equipment} / 3$$

$$S_{NACE\ C, NACE\ C29_30} = S_{NACE\ C, transport\ equipment}$$

$$S_{NACE\ C, NACE\ F} = S_{NACE\ C, total\ construction}$$

$$S_{NACE\ C, NACE\ J} = S_{NACE\ C, computer\ software}$$

$$S_{NACE\ D35, NACE\ M71} = S_{NACE\ D35, intangible\ fixed\ assets}$$

These shares are then multiplied by investments in biofuel production capacity ($inv_{Biofuel}$) to estimate a proxy for the EGSS output of capital products broken down by the producing NACE branches, e.g. with NACE J (information and communication) used as an example:

$$EGSS_P1_CapProd_{CReMA\ 13A, NACE\ J} = S_{NACE\ C, NACE\ J} * inv_{Biofuel}$$

With:

$EGSS_P1_CapProd_{CReMA\ 13A, NACE\ J}$: NACE J output of capital products for the production of biofuels (EGSS)

$inv_{Biofuel}$ can be derived from the positive⁽⁶⁴⁾ year-on-year changes of biofuel capacities derived from Eurostat's collection 'Infrastructure - biofuel production capacity - annual data (nrg_114a)'. The year-on-year changes are shown in the table below.

⁽⁶³⁾ For countries for which the ESA 2010 data are not yet available the corresponding ESA95 collection 'nama_pi22_21_c' is used

⁽⁶⁴⁾ Whenever year-to-year changes of biofuel production were negative, zero investments were assumed

Table 24: Positive year-to-year change in biofuel production capacities, Germany (1000 t)

2007	2008	2009	2010	2011	2012	2013	2014
322	254	1 584	0	0	158	0	0

The changes in capacity are then multiplied with an estimate of the investment costs per tonne.⁽⁶⁵⁾

Table 25: Investments in biofuel production capacity, Germany (million EUR)

2007	2008	2009	2010	2011	2012	2013	2014
145	114	713	0	0	71	0	0

Eurostat made an attempt to estimate the first round upstream multipliers (m) using the national accounts and to calculate correction factors (f) which take into account international trade and valuation differences (for details on the multipliers and factors, see the description of the test calculations made for capital products for environmental protection). Applying these multipliers and factors gives the following formula:

$$EGSS_P1_CapitalProducts_{CR\&MA\ 13A, NACE\ J} = S_{NACE\ C, NACE\ J} * INV_{Biofuel} * m_{NACE\ J} * f_{CPA\ J}$$

Areas for possible future development

- Additional research is needed to compile more reliable investment data for biofuel production. The estimate of the investments as proposed above do not take into account varying degrees of capacity utilisation, tear and wear of production capacities and price changes for newly installed capital products. Also using data on installed production capacity (if available) and its annual change could be a better basis for the calculations than then used proxies derived from changes in biofuel production.
- The first round multipliers (m) and the correction factors (f) for international trade and valuation differences may need further research. In particular, multipliers and correction factors based on NACE/CPA aggregates may not be representative for EGSS producers within those NACE industries.

3.3.5. DEMAND SIDE APPROACH FOR BIOGAS: CAPITAL GOODS AND SERVICES

A demand side approach is proposed to estimate EGSS capital products for the production of biogas, using data from national accounts on gross fixed capital formation (investment) cross-classified by industry and type of asset and output by industry.

Eurostat's collection 'Gross capital formation by industry (up to NACE A*64) (nama_10_a64_p5)⁽⁶⁶⁾ provides data on gross fixed capital formation by type of asset and investing NACE sections which can be used for the EGSS calculations. The NACE section mainly relevant for the production of biofuels is section D35. There are no data in this collection which identify investments for the production of biofuels so that this source must be combined with more specific sources on renewable energies.

First, shares of each asset type in the total investments by NACE D35 ($s_{NACE\ D35, asset\ type}$) are

⁽⁶⁵⁾ Based on a study carried out by Prognos AG (2010) it was assumed in the test calculations for Germany that investment cost were 450 EUR/t

⁽⁶⁶⁾ For countries for which the ESA 2010 data are not yet available the corresponding ESA95 collection 'nama_pi22_21_c' is used

calculated:

$$S_{\text{NACE D35, asset type}} = \text{NA_P51G}_{\text{NACE D35, asset type}} / \sum_{\text{asset type}} \text{NA_P51G}_{\text{NACE D35, asset type}}$$

$\text{NA_P51G}_{\text{NACE D35, asset type}}$: Gross fixed capital formation by industry D35 and type of asset (NA)

Next, investments by asset type are mapped to producing NACE divisions: 'other machinery and equipment' is assumed to be produced by NACE C26 (manufacture of computer, electronic and optical products), NACE C27 (manufacture of electrical equipment) and NACE C28 (manufacture of machinery and equipment n.e.c.), 'transport equipment' by NACE C29_30 (manufacture of motor vehicles, trailers and semi-trailers and other transport equipment), 'total construction' by NACE F (construction), 'computer software' by NACE J (information and communication) and 'intangible fixed assets' by NACE M71 (architectural and engineering activities; technical testing and analysis):

$$S_{\text{NACE D35, NACE C26}} = S_{\text{NACE D35, NACE C27}} = S_{\text{NACE D35, NACE C28}} = S_{\text{NACE D35, oth. mach. and equip}} / 3$$

$$S_{\text{NACE D35, NACE C29_30}} = S_{\text{NACE D35, transport equipment}}$$

$$S_{\text{NACE D35, NACE F}} = S_{\text{NACE D35, total construction}}$$

$$S_{\text{NACE D35, NACE J}} = S_{\text{NACE D35, computer software}}$$

$$S_{\text{NACE D35, NACE M71}} = S_{\text{NACE D35, intangible fixed assets}}$$

These shares are next multiplied by proxy data for the investments in biogas production capacity ($\text{inv}_{\text{Biogas}}$) to estimate the EGSS output of capital products for biogas production broken down by the producing NACE branches, e.g. with NACE C29 (manufacture of motor vehicles, trailers and semi-trailers) used as an example:

$$\text{EGSS_P1_CapProd}_{\text{CReMA 13A, NACE C29}} = S_{\text{NACE D35, NACE C29}} \cdot \text{inv}_{\text{Biogas}}$$

Eurostat used investment data from the German Federal Ministry for environment, nature protection and nuclear safety in the calculations for Germany. These investment data cover installations that use biomass for electricity production. Missing years were estimated using ratios of investments to positive year-on-year changes in electricity generating capacity from biogas. The year-on-year changes in the electricity generating capacity were derived from Eurostat's collection 'Infrastructure - electricity - annual data (nrg_113a)'. With these sources ratios between investments and year-on-year capacity changes can be estimated for Germany. These ratios are then used to estimate investments in the test calculation for other countries.

Table 26: Investments in electricity from biogas, Germany (million EUR)

2007	2008	2009	2010	2011	2012	2013
985	1 555	1 350	1 150	2 200	2 550	1 420

Sources: Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2011, 2012) and own calculations

Eurostat made an attempt to estimate the first round upstream multipliers (m) using the national accounts and to calculate correction factors (f) which take into account international trade and valuation differences (for details on the multipliers and factors, see the description of the test calculations made for capital products for environmental protection). Applying these multipliers and factors gives the following formula:

$$\text{EGSS_P1_CapProd}_{\text{CReMA 13A, NACE C29}} = S_{\text{NACE D35, NACE C29}} \cdot \text{inv}_{\text{Biogas}} \cdot m_{\text{NACE C29}} \cdot f_{\text{CPA C29}}$$

Areas for possible future development

- Additional research may be needed to compile investment data for biogas production.
- The first round multipliers and correction factors as shown above can only be regarded as a first approximation. The interrelations (internationally and domestic) for the total of a NACE industry may not be representative for EGSS producers within those NACE industries. Further research is therefore necessary in a later step of the model development.

3.3.6. DEMAND SIDE APPROACH FOR HEAT AND ENERGY SAVINGS: CAPITAL GOODS AND SERVICES

A demand side approach is proposed to estimate EGSS capital products for heat and energy savings. It involves using data from national accounts on gross fixed capital formation (investment) cross-classified by industry and type of asset as well as other sources such as ad-hoc studies.

Eurostat's collection "Cross-classification of gross fixed capital formation by industry and by non-financial fixed asset - current prices (nama_pi22_21_c)" provides data on gross fixed capital formation (NA_P51G) in dwellings.

There are no statistical data on the share of energy and heat savings investments in the total investments in dwellings. Some information may, however, be obtained from ad-hoc studies and agencies, for example:

- Studies carried out by Naturschutzbund Deutschland (NABU) e.V. (2011) and Deutsche Energieagentur (dena) (2010) indicate that 30-40% of all building investments in Germany were for the restoration of energetic relevant parts of existing building and that around 30-50% of the investments in energetic relevant parts were additional costs due to energy savings.⁽⁶⁷⁾ These ratios are based on a combination of market research data, statistical data, data reported by participants of a low energy house restoration model project for the years 2007 and 2009. Combining this information leads to estimate that around 10-20 % of all building investments were heat and energy saving investments. Another study commissioned by Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2013) mentions that gross investments in buildings in the year 2005 amounted to EUR 197 billion in 2005 of which EUR 40 billion had an emission reducing impact, which is equivalent to a share of 20%. Information on data on subsidies and public loans for energetic renovation can also be used to assess ratios and estimates of energy and heat savings investments. The promotional KfW Bank Group joins the commercial banks in the lending process and closes financing gaps to make the investment in energy-efficient refurbishment or particularly energy-efficient houses affordable. KfW data (KfW Bankengruppe, 2011 and KfW Bankengruppe, 2013) indicate that in 2010 a credit volume of EUR 5.2 billion was provided for energy efficient refurbishment which had promoted investments of EUR 7.3 billion. For energy-efficient construction a credit volume of EUR 3.7 billion had been provided with a promoted investment of EUR 14.3 billion. KfW promoted investments in energy-efficient refurbishment and energy efficient construction together amounted to approximately 16% of total investments in dwellings in 2010 (2008: 10%; 2009: 15%; 2011: 13%⁽⁶⁸⁾). Based on this information a share of 15% has been benchmarked for the year 2010 for Germany assuming a 1 percentage point increase each year.
- The French Environmental and Energy Agency (Agence de l'Environnement et de la Maîtrise de l'Energie – ADEME) has published data on expenditure on energetic refurbishment of existing dwellings. According to these data, almost 35% of all expenditure on dwelling renovation in 2011

⁽⁶⁷⁾ The relatively wide range of this share (30-50%) depends on the energy saving standards to be reached by the restoration measure. The Deutsche Energieagentur (dena) (2010) estimates that a share of 30% would apply for restoration measures for the "Effizienzhaus 100", whereas a share of 50% would apply for measures to reach the "Effizienzhaus 55" standard. The numbers "55" and "100" indicate the primary energy consumption of a house in percent of the primary energy consumption of a reference building according to the German energy efficiency decree (Energieeffizienzverordnung – ENEV)

⁽⁶⁸⁾ Data on total investments in dwellings are from national accounts data in Eurostat's online database

had an energetic impact (doors, windows, heating, facade and others) (Agence de l'Environnement et de la Maîtrise de l'Energie, 2013).

The Eurostat calculations allocate investments to the producing branches construction (NACE F) and architectural and engineering services (M71) in order to derive estimates on the production of goods and services for heat and energy savings. To make the split national accounts output data by 64 branches can be used. However, in the case of Germany it was felt that the output share of NACE M71 in the total output of NACE F and NACE M71 (around 17-20% in period 2000-2011) is too high to represent architectural and engineering services in energy and heat saving dwelling investment. The NACE M71 category is somewhat too broad since it also includes technical testing and analysis. Based on the German architectural fee table for dwellings⁽⁶⁹⁾ in the relevant investment range from 25,000 EUR to 500,000 EUR a share of 8-15% of the chargeable investments costs appears to be more realistic. The Eurostat calculations assume that 10% of the energy and heat saving investments for the restoration of dwellings is capitalised architectural and engineering services (NACE M71), whereas 90% of the investments is invoiced by the construction industry (NACE F).

Combining all this information the formulas applied in the test calculations are (for the year 2010):

$$EGSS_P1_CapProd_{CReMA\ 13B, NACE\ F} = NA_P51G_{dwellings} * 0.15 * 0.9$$

$$EGSS_P1_CapProd_{CReMA\ 13B, NACE\ M71} = NA_P51G_{dwellings} * 0.15 * 0.1$$

With:

$EGSS_P1_CapProd_{CReMA\ 13A, NACE\ F}$: NACE F output of capital products for the energy/heat saving (EGSS)

$NA_P51G_{dwellings}$: Gross fixed capital formation in dwellings (NA)

Eurostat attempted to estimate the first round upstream multipliers (m) and to calculate correction factors (f) which take into account international trade and valuation differences (for details on the multipliers and factors, see the description of the test calculations made for capital products for environmental protection). Applying these multipliers and factors gives the following formula (for year 2010):

$$EGSS_P1_CapProd_{CReMA\ 13B, NACE\ F} = NA_P51G_{dwellings} * 0.15 * 0.9 * m_{NACE\ F} * f_{CPA\ F}$$

$$EGSS_P1_CapProd_{CReMA\ 13B, NACE\ M71} = NA_P51G_{dwell.} * 0.15 * 0.1 * m_{NACE\ M71} * f_{CPA\ M71}$$

Some methodological clarification is needed as concerns the estimate of building materials for energy and heat saving investments (e.g. thermal insulation composite systems). Such materials are normally invoiced by the construction companies to the investors. In national accounts the purchase of such material by construction companies is intermediate consumption. Therefore in the total output measure of the economy the material is accounted twice as output of the industries that manufacture the material and implicitly as part of the output of the construction industry. With a view towards estimating also "green jobs" such upstream links should be accounted for also in the EGSS module.

For energetic refurbishment the construction industries use capital goods that are environmental goods (e.g. thermal insulating materials and equipment, heat exchangers, heat pumps). These goods are mainly produced by the manufacturing industry and mainly fall under the CPA categories C16 (products of wood and cork), C22 (rubber and plastic products), C23 (non-metallic mineral

⁽⁶⁹⁾ Verordnung über die Honorare für Architekten- und Ingenieurleistungen (HOIA): Honorartafel zu § 16 Abs. 1 HOAI (Objektplanung Gebäude), <http://www.hoai.de/online/Euro-Honorartafeln/Honorartafel16Abs1.php>

products) and C28 (machinery and equipment).

The production of these goods may be determined using specific input coefficients (i) for the construction industry:

$$EGSS_P1_CapProd_{CReMA\ 13B, NACE\ C23} = EGSS_P1_CapProd_{CReMA\ 13B, NACE\ F} \cdot i_{CPA\ C23, NACE\ F} \cdot m_{NACE\ C23} \cdot f_{CPA\ C23}$$

Potential sources to derive these specific input coefficients can be the systematic analysis of invoices for refurbishment measures as well as expert knowledge (engineering information). A first estimate of these coefficients may, however, also be made by exploiting information available in the national accounts supply and use tables. Eurostat used input coefficients calculated from the supply and use tables.

A potential limitation of this approach is that the coefficients for the construction industry as a whole may not be representative for the energetic refurbishment activities of that industry. Therefore the results obtained by this approach are compared with production data extracted from PRODCOM statistics (Eurostat collection 'Statistics on the production of manufactured goods (prom)') for relevant product categories (e.g. multiple-walled insulating units of glass, heat pumps). If the production estimate based on PRODCOM statistics is higher than the estimate based on the supply and use tables (or if the latter cannot be produced because of missing data), the PRODCOM statistics were retained for EGSS estimates.

Areas for possible future development

- The Eurostat Task Force on the resource management expenditure account (ReMEA) (Eurostat, 2013d) agreed on insulation as priority in the area of heat and energy savings.

The estimate proposed in this guide is based on a share of heat and energy saving investment for existing buildings in total building investments. Some research may be necessary to find information for other countries and to regularly update the shares over time. A way forward could be to use information on the production or use of certain energy saving building materials (e.g. isolation material such as mineral fibre) that could be used to develop a proxy for the dynamics in this area.

- Refined estimation approaches may be based on data on subsidies paid by governments for energetic renovation. Using subsidy data may, however, underestimate energetic renovation for those parts of renovation for which investors have – for various reasons – not received or asked for subsidies.
- The first round multipliers (m) and the correction factors (f) for international trade and valuation differences may need further research. In particular, multipliers and correction factors based on NACE/CPA aggregates may not be representative for EGSS producers within those NACE industries.
- Other heat and energy saving investments such as energy saving modernisations of buildings other than dwellings or the construction of new houses according to highest energy savings standards are not yet taken into account. Practical experience exists for heat and energy savings investments for new buildings, for example the Netherlands uses a model that applies a cost factor to new dwellings (Eurostat, 2013d). Future research is necessary to define methods that are widely applicable to other Member States, too.

3.3.7. SUMMARY RESULTS

Time series on the market production of EGSS capital goods and services were derived using the methods described in the previous sections. Results at aggregate EU level are shown below.

Table 27: Market production of EGSS: capital goods and services by environmental activity, EU28 (million EUR)

CEPA/CreMA	2007	2008	2009	2010	2011	2012	2013
Protection of ambient air and climate	7 489	7 945	7 409	7 201	7 317	7 090	7 396
Wastewater management	25 535	27 200	26 877	25 931	25 219	24 555	23 871
Waste management	14 064	15 004	13 649	14 881	14 309	15 125	15 552
Protection and remediation of soil, groundwater and surface water	1 877	2 017	1 956	2 160	2 076	1 995	2 047
Noise and vibration abatement	1 153	1 271	1 234	1 179	930	980	999
Protection of biodiversity and landscapes	4 678	4 888	4 855	4 491	4 481	4 119	4 392
Other environmental protection	2 658	3 415	2 843	2 845	2 826	2 874	3 164
Management of water	4 229	4 799	4 433	4 429	4 616	4 547	4 434
Energy from renewable sources	32 503	50 071	54 475	66 937	92 485	76 291	64 408
Heat/energy savings and management	91 476	96 358	90 330	98 878	109 482	116 047	122 617

Table 28: Market production of EGSS: capital goods and services by economic activity, EU28 (million EUR)

NACE	2007	2008	2009	2010	2011	2012	2013
Total NACE	185 663	212 967	208 063	228 932	263 741	253 624	248 878
of which:							
C26	10 120	14 014	12 990	16 291	16 183	11 566	9 589
C27	8 562	10 828	10 382	13 061	14 813	12 730	12 052
C28	20 188	26 414	23 791	27 292	31 670	31 209	30 369
F	100 303	108 831	113 547	121 093	147 682	143 470	143 319

These estimates are to be considered as a lower threshold: some important RM activities are not yet covered such as the production of heat by solar thermal installations and the minimisation of the intake of fossil resources as raw material.

3.4. Non-market production other than wastewater, waste and water management services

This category covers all EGSS government output other than output of characteristic environmental services. The EPEA can be used as a data source for the public sector. EGSS government output in characteristic environmental services (wastewater management, waste management and water management) is not covered in this category, but it is estimated under the category 'Market and non-market (government) production of wastewater, waste and water management services'.

'Internal current expenditure' reported in the EPEA should include the costs of material used and compensation of employees for in-house environmental protection activities, and exclude payments for bought environmental services.

Data on internal current expenditure on the following EP activities can be used: protection of ambient air and climate (CEPA 1), protection and remediation of soil, groundwater and surface water (CEPA 4), noise and vibration abatement (CEPA 5), protection of biodiversity and landscapes (CEPA 6) and other environmental protection activities (CEPA 7+8+9).

EPEA sheds information on non-market output by General Government (P.13). These figures can be used directly. However, the figures must be mapped to NACE (under M). The table below shows

results aggregated at EU level.

Table 29: Non-market (government) production other than wastewater, waste and water management services, EU28 (million EUR)

	2007	2008	2009	2010	2011	2012	2013
Protection of ambient air and climate	1 373	1 199	1 165	1 040	1 006	1 050	1 086
Protection of soil, groundwater, and surface water	1 211	1 201	1 303	1 241	1 222	1 220	1 372
Noise and vibration abatement	854	861	896	802	824	848	842
Protection of biodiversity and landscapes	7 253	7 357	7 634	7 868	7 887	7 880	8 107
Other environmental protection	11 051	11 024	10 824	11 504	11 721	12 175	11 925

Areas for possible future development

- In the methods proposed, all EGSS government (non-market) output other than wastewater management, waste management and water management is allocated to NACE section O (public administration and defence; compulsory social security). Government finance statistics available at Eurostat do not allow for a further breakdown of government expenditure by economic activity. If a breakdown of government data by NACE is available at national level (e.g. data available in the national account teams of the national statistical institutes) it should be used to improve the industry allocation.
- Resource management activities are not covered in the EPEA. Future developments of the resource management expenditure accounts (ReMEA) should lead to improved data availability that may help to overcome data gaps for resource management (Eurostat, 2013c).

3.5. Ancillary output

An ancillary activity is distinguished from principal and secondary activities in that its output is only intended for use within the enterprise to enable the principal and secondary activities to be carried out. Ancillary production of environmental services is an internal activity of a producer unit (non-purchased from other units) that produces services whose primary purpose is to protect the environment or natural resources against the damaging or depleting impact of this unit's activity.

In ESA2010 (national accounts), output generated by ancillary activities is not a recorded separately, but its value may be implicitly included in total output through the application of the ESA valuation principles (basic prices or production costs). All inputs consumed by ancillary activities are treated as inputs to the production of principal and secondary output which they support. Therefore in ESA there is no gross value added attributed to ancillary activities.

For further explanations about the concepts, see the *2016 EGSS handbook*, chapter 3.1.1.

In the EGSS data collection Eurostat asks Member States to separately transmit data on ancillary output by EP activity and total output is defined as including output of ancillary activities. Because ancillary activities are produced and used in the same production unit, supply and demand of ancillary activities is the same by definition. Ancillary output therefore is equivalent to the sum of production costs for the ancillary activities. These inputs comprise the use of intermediate consumption, wages, and the consumption of fixed capital linked to the production of ancillary output. Such information is normally not readily available (in existing bookkeeping systems and supply side oriented statistical data) and it is therefore recommended to use existing demand side sources.

The EPEA can be used as source to compile ancillary output. 'Internal current expenditure' reported in the EPEA should include the costs of material used and compensation of employees for in-house environmental protection activities, and exclude payments for bought environmental services.

The EPEA provides figures broken down by sector/industry and EP activities. It distinguishes between the following types of sectors/industries:

- General government and NPISH
- Corporations as specialist and secondary producers of market EP services
- Corporations: other (also covering producers of ancillary EP services): total
 - Corporations: other (also covering producers of ancillary EP services): NACE Rev. 2 B
 - Corporations: other (also covering producers of ancillary EP services): NACE Rev. 2 C
 - Corporations: other (also covering producers of ancillary EP services): NACE Rev. 2 D
 - Corporations: other (also covering producers of ancillary EP services): NACE Rev. E36
 - Corporations: other (also covering producers of ancillary EP services): other NACE
- Households

The EPEA questionnaire foresees that expenditure by total manufacturing is further broken down by 19 groups of industries.

Table 30: EPEA questionnaire, breakdown by industries (sheet 3b_Add)

NACE	Literal
10-12	Manufacture of food, beverages and tobacco products
13-15	Manufacture of textiles, wearing apparel, leather and related products
16	Manufacture of wood, wood products, except furniture; articles of straw and plaiting articles
17	Manufacture of paper and paper products
18	Printing and reproduction of recorded media
19	Manufacture of coke and refined petroleum products
20	Manufacture of chemicals and chemical products
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
22	Manufacture of rubber and plastic products
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
25	Manufacture of fabricated metal products, except machinery and equipment
26	Manufacture of computer, electronic and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment n.e.c.
29	Manufacture of motor vehicles, trailers and semi-trailers
30	Manufacture of other transport equipment
31-32	Manufacture of furniture; other manufacturing
33	Repair and installation of machinery and equipment

The mandatory breakdown of the EPEA by EP activities is not the same for all types of sectors/industries: For all of them protection of ambient air and climate, wastewater management and waste management are separately identified. In addition, for the public sector, the business sector and the households, protection and remediation of soil, groundwater and surface water, noise and vibration abatement and protection of biodiversity and landscapes are separately covered by the questionnaire. An 'other' category allows entering figures for those remaining EP activities that are not separately identified. However the voluntary breakdown in EPEA is by CEPA class.

Member States deliver annual data on EPEA. However, because of partial non-response, it may be

necessary to first gap-fill this dataset before using it for the compilation of the EGSS module.⁽⁷⁰⁾

It is noted that the estimation of ancillary EGSS output as part of total EGSS output may result in some double counting if the ancillary activity serves a principal or secondary activity to produce environmental goods and services. In theory, only ancillary EGSS output used in the production of non-EGSS output should be taken into account to avoid double counting. However, this distinction may be very difficult to implement in surveys and other EGSS estimation approaches. In practice, the possible double counting is likely to be very small.

The EPEA data for ancillary output (EPEA P.1_ANC) must be mapped to the 39 NACE categories in the EGSS questionnaire. For example, the ancillary output on total manufacturing may be distributed to the 13 manufacturing aggregates of the EGSS using relative output shares based on national accounts data by 64 branches (Eurostat collection 'National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)'⁽⁷¹⁾, e.g. for CEPA 1 and NACE C26 used as an example:

$$EGSS_P1_Anc_{CEPA\ 1,\ NACE\ C26} = EPEA_P.1_ANC_{CEPA\ 1,\ NACE\ C} * NA_P1_{NACE\ C26} / NA_P1_{NACE\ C}$$

With:

$EGSS_P1_Anc_{CEPA\ 1,\ NACE\ C26}$: Ancillary output of ambient air and climate protection in NACE C26 (EGSS)

$EPEA_P.1_ANC_{CEPA\ 1,\ NACE\ C}$: Ancillary output on ambient air and climate protection by the manufacturing industry (EPEA)

$NA_P1_{NACE\ C26}$: Output of manufacturing of computer, electronic and optical products (NA)

$NA_P1_{NACE\ C}$: Output of total manufacturing (NA)

The results could be double-checked against the detailed ancillary output data of the manufacturing sector from EPEA.

Since ancillary output reported in EPEA should only include the costs of material used and compensation of employees for in-house environmental protection activities, it is only a lower threshold estimate of ancillary output of environmental protection services. A comprehensive estimation of ancillary output would have to include the consumption of fixed capital used for the production of ancillary output as well as a component reflecting the net operating surplus and mixed income. The gross operating surplus is the sum of these two components. A simple approximation is to estimate ratios of gross operating surplus to output (gop) from national accounts data on consumption of fixed capital (NA_P51C) and net operating surplus and mixed income (NA_B2A3N) preferably by an industry breakdown and to apply them to the figures based on EPEA, e.g.:

$$EGSS_P1_Anc_{CEPA\ 1,\ NACE\ C20} =$$

$$EPEA_P.1_ANC_{CEPA\ 1,\ NACE\ C} * NA_P1_{NACE\ C20} / NA_P1_{NACE\ C} * (1 + gop_{NACE\ C20})$$

With:

$$gop_{NACE\ C20} = (NA_P51C_{NACE\ C20} + NA_B2N_B3_{NACE\ C20}) * NA_P1_{NACE\ C20}$$

This approach assumes that the ratio gop estimated for the totality of a NACE industry is the same as for the in-house environmental protection activities of that industry.

⁽⁷⁰⁾ For the purpose of calculating EU aggregates the gaps are filled by an approach developed by a contractor to Eurostat over the recent years. However, the gap-filled dataset on environmental protection expenditure is somewhat less detailed than the voluntary EPEA, as it only focuses on the mandatory part of EPEA

⁽⁷¹⁾ For countries for which the ESA 2010 data were not available collection 'annual National Accounts by 64 branches at current prices (nama_nace64_c)' has been used

In order to estimate the gross operating surplus of ancillary wastewater and waste management activities, Eurostat used ratios of gross operating surplus to output of specialist sewerage and waste collection, waste treatment and waste management producers (NACE E37-39) derived from Eurostat's collection 'National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)' are used, e.g.:

EGSS_P1_Anc_{CEPA 2, NACE C26} =

$$EPEA_P.1_ANC_{CEPA\ 2,\ NACE\ C} * NA_P1_{NACE\ C26} / NA_P1_{NACE\ C} * (1 + gop_{NACE\ E37-39})$$

Table 31: Ratios of gross operating surplus to output (gop) for selected industries based on national accounts 64 industries breakdown, Netherlands (%)

NACE	2007	2008	2009	2010	2011	2012	2013
C20	0.177	0.160	0.130	0.130	0.118	0.106	0.100
D	0.295	0.240	0.347	0.319	0.297	0.308	0.317
E36	0.397	0.379	0.384	0.389	0.377	0.410	0.398
O	0.174	0.172	0.166	0.171	0.178	0.180	0.185

The tables below show the results of the calculations aggregated at EU level.

Table 32: Ancillary EGSS output by economic activity, EU28 (million EUR)

NACE	2007	2008	2009	2010	2011	2012	2013
Total NACE	19 122	19 215	19 324	20 804	21 816	22 425	22 425
of which:							
B	1 450	1 416	1 185	1 594	1 443	1 528	1 518
C10-C12	1 786	1 731	1 801	1 861	1 921	1 996	2 052
C22_C23	1 007	937	883	928	961	946	949
C24_C25	1 857	1 760	1 446	1 665	1 791	1 730	1 676
C28	1 297	1 272	1 156	1 227	1 313	1 317	1 313
C29_C30	1 928	1 747	1 607	1 863	1 950	1 959	1 991
D	4 003	4 824	5 913	5 852	6 398	6 927	6 946

Table 33: Ancillary EGSS output by environmental activity, EU28 (million EUR)

CEPA	2007	2008	2009	2010	2011	2012	2013
Protection of ambient air and climate	5 310	5 311	4 992	5 852	6 131	5 980	5 968
Wastewater management	5 441	6 058	6 500	5 932	6 328	7 247	7 142
Waste management	4 168	4 274	4 145	4 562	4 713	4 657	4 698
Protection and remediation of soil, groundwater and surface water	817	927	902	868	863	853	862
Noise and vibration abatement	501	507	562	845	515	498	493
Protection of biodiversity and landscape	735	708	708	718	985	910	862
Other environmental protection	2 150	1 430	1 515	2 027	2 282	2 281	2 400

Areas for possible future development

- The (gap-filled) EPEA dataset used in the test calculation includes data on ancillary output on environmental protection for NACE A and the various service industries, but at very aggregated NACE level. If these data are available the ancillary output for these industries can be mapped to

ancillary output as well.

- Whenever countries report expenditure for the manufacturing industry in a more detailed breakdown by nine groups of industries, the allocation of internal current expenditure to the NACE groups may be improved. In particular it may be considered that most probably those industries that have potentially strong negative impacts on the environment have a relatively a high level of ancillary EP output in order to comply with environmental laws.⁽⁷²⁾
- More specific information may be used to estimate the consumption of fixed capital in ancillary environmental activities. At national level surveys may provide detailed information on the consumption of fixed capital by the operation of environmental protection equipment (Statistisches Bundesamt (DESTATIS), 2010).
- Ancillary output of in-house resource management activities is not covered in the EPEA. Future developments of the resource management expenditure accounts (ReMEA) should lead to improved data availability that may help to overcome data gaps for resource management (Eurostat, 2013c).

3.6. EGSS exports

Regulation (EU) No 691/2011 requires to estimate that part of EGSS market output that is exported (export is an “of which”-characteristic) broken down by economic activity and classes of the classifications of environmental activities and resource management activities.

The breakdown by NACE is a challenge since most data sources for trade are broken down by products instead of economic activities. For example, Eurostat disseminates detailed trade data according to the Combined Nomenclature (CN8), whose first six digit codes coincide with the Harmonized Commodity Description and Coding System (HS), whereas the Standard International Trade Classification (SITC) or the Broad Economic Categories (BEC) is used for aggregated data (Eurostat, 2013f). These are classifications for commodities (goods) and do not include services nor apply to economic activities.⁽⁷³⁾

3.6.1. Existing data sources

Trade in goods data is available from Eurostat’s online database collection ‘EU28 trade since 1988 by CN8 (DS_016890)’ or from Eurostat’s traditional international trade database access (ComExt). Some examples of international trade codes relevant to identify environmental goods exports from the CN-8-digit-classification are shown in Table 34. Some of the examples in this list can be regarded as close to 100% EGSS goods (e.g. generating sets, wind powered – CN 8502.31.00). Other codes of the CN-8-digit classification may include some EGSS products but their share of EGSS would have to be determined using additional information.

⁽⁷²⁾ The results of the test calculation compared to the data transmitted with EPEA show that in particular the estimate of ancillary output by the coke and refinery industry and the chemical industry are likely to be underestimated when using simply national accounts output shares for the distribution, whereas the ancillary output of other manufacturing industries are likely to be overestimated

⁽⁷³⁾ Nomenclatures and correspondence tables are available from the Eurostat’s classification server [RAMON](#)

Table 34: Example of trade codes for environmental goods (CN 2013)

CEPA/CReMA		Description	CN 2016
CEPA 1	Protection of ambient air and climate	Machinery a. apparatus f. filtering or purifying air (excl. isotope separators and intake air filters for internal combustion engines)	8421.39.20
		Machinery and apparatus for filtering or purifying gases other than air by a catalytic process (excl. isotope separators)	8421.39.60
		Machinery and apparatus for filtering and purifying gases other than air (excl. those which operate using a catalytic process, and isotope separators)	8421.39.80
		Parts of machinery and apparatus for filtering or purifying liquids or gases, n.e.c.	8421.99.00
		Electronic gas or smoke analysis apparatus	9027.10.10
		Non-electronic gas or smoke analysis apparatus	9027.10.90
CEPA 2	Wastewater management	Activated carbon (excl. medicaments or deodorant products for fridges, vehicles etc., put up for retail sale)	3802.10.00
		Submersible pumps, single-stage	8413.70.21
		Machinery and apparatus for filtering or purifying liquids (excl. such machinery and apparatus for water and other beverages, oil or petrol-filters for internal combustion engines)	8421.29.00
CEPA 3	Waste disposal	Panels, boards, tiles, blocks and similar articles of vegetable fibre, of straw or of shavings, chips, particles, sawdust or other waste of wood, agglomerated with cement, plaster or other mineral binders	6808.00.00
		Industrial or laboratory furnaces, incl. incinerators, non-electric (excl. for the roasting, melting or other heat treatment of ores, pyrites or metals, bakery ovens, ovens and furnaces for firing ceramic products, ovens and furnaces for firing cement, glass or chemical products)	8417.80.70
		Parts of industrial or laboratory furnaces, non-electric, incl. incinerators, n.e.c.	8417.90.00
CEPA 7	Protection against radiation	Instruments and apparatus for measuring or detecting ionising radiations	9030.10.00
CReMA 11	Management of forest resources	Pulps of fibres derived from recovered waste and scrap paper or paperboard	4706.20.00
CReMA 13	Management of energy resources	Undenatured ethyl alcohol of an alcoholic strength by volume of 80 % vol or higher; ethyl alcohol and other spirits, denatured, of any strength	2207
		Biodiesel and mixtures thereof, not containing or containing less than 70 % by weight of petroleum oils or oils obtained from bituminous minerals	3826
		Natural rubber latex, whether or not prevulcanised	4001.10.00
		Reclaimed rubber in primary forms or in plates, sheets or strip	4003.00.00
		Fuel wood, in logs, in billets, in twigs, in faggots or in similar forms; wood in chips or particles; sawdust and wood waste and scrap, whether or not agglomerated in logs, briquettes, pellets or similar forms	4401
		Wood charcoal (including shell or nut charcoal), whether or not agglomerated	4402
		Slag-wool, rock-wool and similar mineral wools; exfoliated vermiculite, expanded clays, foamed slag and similar expanded mineral materials; mixtures and articles of heat-insulating, sound-insulating or sound absorbing mineral materials (other than headings 8611 and 6812 and those of Chapter 69)	6806
		Multiple-walled insulating glass consisting of two panels of glass sealed around the edges by an airtight joint and separated by a layer of air, other gases or vacuum	7008.00.81
		Multiple-walled insulating glass: other	7008.00.89
		Panels comprising two walls of profiled (ribbed) sheet with an insulating core	7308.90.51
		Hydraulic turbines, water wheels, and regulators therefor	8410
		Heat pumps other than air conditioning machines of heading 8415)	8418.61.00
		Generating sets, wind-powered	8502.31.00
		Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light-emitting diodes	8541.4
CReMA 14	Management of minerals	Macadam of slag, dross or similar industrial waste, whether or not incorporating the materials cited in subheading 2517 10	2517.20.00

Source: OJ of the EU, L 304, Vol. 55, 31 October 2012

A source for *trade in services* is the balance of payment statistics (BoP). For example the [World Trade Organization](#) publishes on its website data on exports of environmental services derived from statistics on international service transactions. BoP provide information on international trade in services. These data can be downloaded from Eurostat's online database collection 'International trade in services (1985-2003) (bop_its_deth)' and 'International trade in services (since 2004) (bop_its_det)'. For example, the BoP-code 282 for Waste treatment and depollution includes the treatment of radioactive and other waste; stripping of contaminated soil; cleaning up of pollution including oil spills; restoration of mining sites; and decontamination and sanitation services. Also included are all other services that relate to the cleaning or restoring of the environment. However, the classification of services in the BoP (see [metadata on international trade in services statistics](#)) is mostly not detailed enough to identify 100% environmental services so that EGSS shares for the relevant codes would have to be estimated.

A source for *exports broken down by economic activity* is the structural business statistics (SBS). For example, statistical data on the manufacturing industry in Germany (DESTATIS, 2014) contains data on foreign turnover ("Auslandsumsatz").

Another source of relatively detailed data is the supply and use tables from national accounts. Export data from the use tables are available in a breakdown by CPA product codes which also includes goods and services. These export data can be related to the output of the products in the supply tables. In the Eurostat database the figures are available in a breakdown by 64 CPA categories.

3.6.2. Calculating EGSS exports

If EGSS export data cannot be identified with sufficient detail by economic activity, this guide recommends using sources that report export data broken down by product.

Whenever feasible it is recommended to use national accounts data since the environmental accounts are a satellite of the national accounts. Using national accounts data should ensure that the correct valuation method for EGSS exports is used. For each CPA product of the national accounts' supply and use tables the ratio of exports to output can be calculated and multiplied with EGSS output in the corresponding NACE activity (with CPA product E37 serving as an example in the formula below):

EGSS_P6_{CEPA 2, NACE E37} =

$$\text{EGSS_P1}_{\text{CEPA 2, NACE E37}} * \text{NA_P6}_{\text{CPA E37}} / \sum_{\text{NACE}} \text{NA_P1}_{\text{NACE, CPA E37}}$$

With:

EGSS_P6_{CEPA 2, NACE E37} : Exports of CEPA 2 products of industry NACE E37 (EGSS)

EGSS_P1_{CEPA 2, NACE E37} : Output of CEPA 2 products of industry NACE E37 (EGSS)

NA_P6_{CPA E37} : Exports of product CPA E37 (national accounts use tables)

NA_P1_{NACE, CPA E37} : Output of product CPA E37 by industry (national accounts supply tables)

This formula assumes that the exports share for a CPA category is an indicator for the export shares of environmental goods and services in the corresponding NACE category.⁽⁷⁴⁾ Based on this assumption, this approach provides a first estimate of EGSS exports by economic activity. It is

⁽⁷⁴⁾ The export shares also include exports and output produced as secondary output in NACE categories other than the corresponding CPA category (e.g. CPA 37 produced by NACE 36). Such a simplifying assumption has already been proposed for the calculation of EGSS output from demand side data (see for example section 3.2.1)

expected to work fairly well for industries with a high share of EGSS production (e.g. estimation of wastewater and waste management services). However, if the supply and use tables have a product and activity breakdown more detailed than A*64, it is recommended to use it.

Unfortunately, for industries with a very low share of EGSS production the approach based on A*64 supply and use tables may not produce reliable results. In those cases an analysis based on trade statistics is needed.⁽⁷⁵⁾ Table 34 shows that some trade codes corresponding relatively closely to EGSS goods can be identified.

Eurostat's calculations for EGSS exports mainly use export shares by CPA category derived from national accounts supply and use tables. However, for the exports of capital goods for the production of energy from renewable sources (CreMA 13A) and energy savings (CreMA 13B) the results obtained by this approach were compared with export data extracted from trade on goods statistics for relevant product categories (mainly wind powered generating sets, hydraulic turbines, photovoltaic cells, heat pumps, insulating units, multiple-walled insulating glass). If exports based on trade on goods statistics were higher than those based on the supply and use tables, Eurostat used the trade statistics.

Some additional collections from Eurostat's international trade statistics ('International trade of EU, the euro area and the Member States by SITC product group (ext_lt_intertrd)') and from Eurostat's data collections on the balance of payments ('Balance of payments by country - quarterly data (BPM6) (bop_c6_q)') are used to complete the trade data for goods and services.

Based on the those calculations, the EGSS exports for the Member States EU28 exports (extra-EU exports) are estimated to amount 6 - 8 % of EGSS output

Linking the CN codes of the trade in goods statistics with the PRODCOM codes of the 'Statistics on the Production of Manufactured goods (prom)' may also provide relevant information on the export shares. In particular, if supply and use tables are not available for all reporting years shares based on CN and PRODCOM codes may be compiled to complete the times series.

3.6.3. Use of micro databases

Some countries have established a micro database of businesses producing environmental goods and services. It may be possible for those countries to combine micro data with trade in goods and services data by merging business identification numbers to survey data on international trade so that environmental EGSS export shares for individual trade codes can be determined. This approach may be supplemented by expert opinion on EGSS specialisation of the businesses included in the database (e.g. some businesses in the database may also produce and export non-EGSS products). Collecting data on EGSS exports with specifically designed surveys or additional questions in existing surveys can also be helpful to quantify EGSS exports, shares of EGSS exports and specialisation factors if the administrative and financial burden is acceptable. Using survey data every few years (e.g. for every third to fifth reporting year) may further limit this burden. In those cases, the survey data may be used as benchmark in the years surveyed and years between two benchmarks can be interpolated.

3.6.4. Expert opinions

Some areas may depend heavily on opinions or guesses by experts. For example, it is very difficult to trace international trade in electricity from wind, hydro or photovoltaic power because it is not a

⁽⁷⁵⁾ Results of analyses of a limited number of trade codes relevant for environmental products have been published in various studies commissioned by the European Commission (E.g. ECOTEC (1999), Ernst & Young Environment and Sustainability Services (2006)). The ECORYS (2012) study covering Brazil, China, EU27, India, Japan, Russia, USA and Canada analysed that the EU27 share in exports of machines and equipment for air pollution control, hydropower, environmental monitoring, photovoltaic, waste disposal and water pollution control amounted to 14 % in 2010 (whereas its share in imports was 55 %). The analysis of case studies (e.g. Steenblik & Geloso Grosso, 2011) can help to enlarge existing trade codes lists for EGSS, to assess the potential relevance of the various types of environmental services (e.g. business services, R&D, computer related services, education services) that are exported and to assess the plausibility of the results obtained by simpler methods

distinct product category in official trade classification systems. In such cases the above describe approach based on the supply and use tables may also work as an alternative to expert guesses (e.g. with the basic assumption the export share for total electricity output is an indicator for the export share for renewable electricity output).

4

Methods to compile EGSS employment

EGSS accounts report data on employment directly linked with the production of EGSS output. Indirect employment due to the production of non-EGSS products should not be covered.

A relatively simple method to compile employment figures is to combine the estimates of EGSS output by industry with national accounts data on wages and employment by industry. Industry specific labour intensity coefficients can be multiplied with EGSS output figures to estimate EGSS employment. This approach seems to be satisfactory for all industries whose major part of production is environmental goods and services. However, the smaller the share of environmental goods and services in the total production of an industry, the bigger is the uncertainty about the representativeness of the industry's labour intensities for the EGSS. The representativeness may then depend on how similar the technologies used in the industry for the production of EGS and non-EGS output are. For example, the labour intensity in the production of low air emission cars may be not much different from the one in the production of normal cars, whereas different technologies used in the production of electricity from renewable and non-renewable sources may result in different intensities.

4.1. Basic model for estimating EGSS employment

The model for EGSS employment uses the same framework as the model for EGSS output.

For better international comparability, employment should be measured in full-time equivalent (FTE) rather than in number of persons employed. EGSS employment broken down by industries and environmental activities is estimated from EGSS output linked with national accounts information on the ratios between compensation of employees and output (these ratios are called hereafter 'c-ratios') and labour compensation rates per FTE (these ratios are called hereafter 'w-ratios'):

$$EGSS_Emp_{CEPA/CReMA, NACE} = EGSS_P1_{CEPA/CReMA, NACE} * c\text{-ratio}_{NACE} / w\text{-ratio}_{NACE}$$

With:

$$c\text{-ratio}_{NACE} = NA_D1_{NACE} / NA_P1_{NACE}$$

$$w\text{-ratio}_{NACE} = NA_D1_{NACE} / FTE_{NACE}$$

and:

$EGSS_Emp_{CEPA/CReMA, NACE}$: Employment cross-classified by industries and environmental activities (EGSS)

$EGSS_CEPA/CReMA, NACE$: Output cross-classified by industries and environmental activities (EGSS)

NA_D1_{NACE} : Compensation of employees by industries (NA)

NA_P1_{NACE} : Output by industries (NA)

FTE_{NACE} : Employment by industries in full-time equivalents

This approach assumes that the average labour compensation rates and intensities for an industry are sufficiently good indicators for the EGSS activities within that industry. Some limitations of this basic assumption are discussed below in sections 4.2 and 4.3 as well as proposals for refinement to overcome some of the limitations (see also Annex 7).

The quotient of c- and w-ratios in the above formula could be replaced by the ratio ' FTE_{NACE}/NA_P1_{NACE} '. However, for data plausibility checks it is easier to interpret the c- and w-ratios than the ratio FTE to output. Moreover, in case that the employment data have gaps it is easier to estimate the c- and w-ratios separately than to estimate their ratio directly.

In the following sections the compilation of the c- and w-ratios is described in more detail.

4.2. Ratios: labour compensation to production value

Information on compensation of employees engaged in the production of EGS output is not readily available in existing statistical sources. A proxy for the ratio of labour compensation to output (c-ratio) has therefore to be obtained. The Eurostat calculations use c-ratios derived from national accounts data: Eurostat's collection on 'National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)'⁽⁷⁶⁾ provides data on the compensation of employees and output from which c-ratios for industries can be derived.

⁽⁷⁶⁾ For countries for which the ESA 2010 data were not available collection 'annual National Accounts by 64 branches at current prices (nama_nace64_c)' has been used

Table 35: Ratios of labour compensation to output (c-ratios) for selected industries and countries, year 2008

NACE	Belgium	Germany	Italy	Greece	Slovakia	Finland	UK
A	0.263	0.361	0.344	0.635	0.524	0.546	0.172
B	0.16	0.272	0.114	0.368	0.205	0.144	0.079
C26	0.255	0.239	0.2	0.204	0.041	0.116	0.266
C27	0.28	0.264	0.154	0.139	0.147	0.178	0.283
C28	0.216	0.228	0.163	0.288	0.196	0.163	0.291
D	0.174	0.111	0.055	0.155	0.041	0.097	0.068
E36	0.318	0.21	0.206	0.42	0.309	0.181	0.164
E38	0.137	0.185	0.164	0.211	0.219	0.155	0.208
F	0.158	0.278	0.137	0.13	0.094	0.23	0.203
J	0.251	0.244	0.171	0.196	0.196	0.293	0.347
M69_M70	0.139	0.275	0.127	0.153	0.243	0.366	0.345
M71	0.24	0.314	0.098	0.112	0.158	0.37	0.387
M72	0.525	0.319	0.458	0.328	0.475	0.577	0.547
O	0.662	0.553	0.521	0.528	0.442	0.401	0.401

Using c-ratios derived from national accounts implicitly assumes that the average compensation-output ratios for the single industries are representative for the production of EGS within these industries. This assumption may be justified by a certain similarity of the processes and technologies used in the production of the goods and services within a given industry. C-ratios obtained from national accounts for specific industries such as sewerage and waste management industries (which mainly produce EGS output) can be very good proxies.

On the other hand, for some EGS producing industries, c-ratios based on national accounts data are less representative due to specific socio-economic conditions. For example, agriculture has a very high share of self-employed persons and family workers so that compensation of employees is less suitable to calculate the c-ratio.⁽⁷⁷⁾ Therefore, in the Eurostat calculation for Germany the c-ratios for agriculture are estimated using bookkeeping data from the German Farm Accountancy Data Network (Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz, 2012a) on “income” and production value of organic farm holdings. The “income” variable includes employees’ salaries and profits. The inclusion of profit in the estimate of the c-ratio covers elements corresponding to the remuneration of work carried out by the owners of the holdings and members of their families. A further refinement of this approach would be to correct the income variable used to calculate the c-ratio for the remuneration of capital and agricultural land to better represent compensation of labour.

4.3. Ratios: labour compensation per full-time equivalent

Information on labour compensation rates per FTE (w-ratios) in the EGSS is not readily available in existing statistical sources. Therefore proxies for the w-ratios also must be estimated. The Eurostat calculations use the compensation of employees from Eurostat’s collection ‘National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)’⁽⁷⁸⁾ for most of the industries. This information is combined with national accounts employment data from Eurostat’s collection ‘National

⁽⁷⁷⁾ Compensation of employees is a variable relevant only for employees. Self-employed persons received mixed income. The latter is conceptually half-way between a salary (compensation of employee) and a business profit (gross operating surplus)

⁽⁷⁸⁾ For countries for which the ESA 2010 data are not available collection ‘annual National Accounts by 64 branches at current prices (nama_nace64_c)’ is used

Accounts employment data by industry (up to NACE A*64) (nama_10_a64_e)⁽⁷⁹⁾, which provides employment broken down by employees and self-employed persons. It measures employment in terms of hours worked, number of jobs, number of persons and FTE. The calculations used total employment (employees plus self-employed).

However, employment data measured in FTE are often missing in this source (because FTE is a voluntary variable in the ESA2010 Transmission Programme), so that figures on the number of persons employed have to be converted into FTE. Using the number of persons employed instead of FTE would probably result in some overestimation because of the existence of part-time workers. A simple approach to convert the number of employees using information on the share of part-time work and hours worked has been developed. This approach provides an estimate of FTE per person employed broken down by industries. Using Labour Force Survey data from Eurostat data collections 'Average number of usual weekly hours of work in main job, by sex, professional status, full-time/part-time and economic activity (from 2008 onwards, NACE Rev. 2) - hours (lfsa_ewhun2)' and 'Average number of usual weekly hours of work in main job, by sex, professional status, full-time/part-time and economic activity (1983-2008, NACE Rev. 1.1) - hours (lfsa_ewhuna)' it is possible to calculate the ratios between hours worked per employee in part-time and full-time jobs (hereafter called 'p-ratios'). From Eurostat's collection 'Full-time and part-time employment by sex and economic activity (from 2008 onwards, NACE Rev. 2) - 1 000 (lfsq_epgan2)' and 'Average number of usual weekly hours of work in main job, by sex, professional status, full-time/part-time and economic activity (1983-2008, NACE Rev. 1.1) - hours (lfsa_ewhuna)' it is possible to estimate ratios of the number of persons working part-time to the total number of employees. Combining this information results in an estimate of the FTE per employed person by economic activity:

$$FTE_{NACE} / \text{employed persons}_{NACE} = \text{part-time employment}_{NACE} / \text{total employment}_{NACE} * (p - 1)_{NACE} + 1$$

whereby $0 < p < 1$

Analysing the above formula it becomes obvious that FTE per employed person increases with a higher share of part-time employment and a lower p-ratio (see also table below).

Table 36: Full-time equivalent (FTE) per employed person depending on the share of part-time employment and the ratio between hours worked per employee in part-time and in full-time jobs (p-ratio), illustrative example

FTE per employed person	Share of part-time employment in total employment	p-ratio
1.000	0.0	any value
0.995	0.1	0.5
0.993	0.1	0.3
0.900	0.2	0.5
0.860	0.2	0.3
0.850	0.3	0.5
0.790	0.3	0.3

Based on the formula described above the ratios of FTE per employed person are calculated for the NACE groups of the EGSS module.

⁽⁷⁹⁾ Where the ESA 2010 collection was not available the corresponding ESA95 collection 'nama_nace64_e' was used

Table 37: FTE per employed person for selected industries and countries, year 2008

NACE	Belgium	Germany	Italy	Greece	Slovakia	Finland	UK
A	0.924	0.845	0.942	0.922	0.987	0.874	0.857
B	1.000	0.966	0.976	1.000	1.000	1.000	0.962
C26	0.963	0.939	0.968	0.988	0.997	0.977	0.952
C27	0.963	0.939	0.968	0.988	0.997	0.977	0.952
C28	0.967	0.926	0.969	0.988	0.996	0.971	0.949
D	0.976	0.961	0.984	0.988	1.000	0.977	0.951
E36	0.974	0.937	0.946	0.977	0.879	0.977	0.952
E38	0.974	0.937	0.946	0.977	0.879	0.977	0.952
F	0.970	0.936	0.974	0.989	1.000	0.976	0.947
J	0.956	0.838	0.951	0.980	1.000	0.951	0.937
M69_M70	0.931	0.847	0.927	0.981	0.984	0.936	0.892
M71	0.931	0.847	0.927	0.981	0.984	0.936	0.892
M72	0.931	0.847	0.927	0.981	0.984	0.936	0.892
O	0.919	0.916	0.972	0.993	0.981	0.976	0.914

The w-ratios (labour compensation rates per FTE) can then be estimated using the above mentioned national accounts data:

$$w\text{-ratio}_{NACE} = NA_D1_{NACE} / FTE_{NACE} =$$

$$(NA_D1_{NACE} / \text{employed persons}_{NACE}) / (FTE_{NACE} / \text{employed persons}_{NACE})$$

Table 38: Labour compensation per FTE (w-ratio) for selected industries and countries, year 2008 (EUR)

NACE	Belgium	Germany	Italy	Greece	Slovakia	Finland	UK
A	34 699	33 114	20 751	15 269	36 189	27 643	28 988
B	51 935	50 076	42 710	47 725	13 746	37 188	78 732
C26	72 070	59 253	41 272	21 999	10 767	63 280	50 493
C27	58 104	55 462	35 800	22 185	10 124	43 804	50 820
C28	58 463	52 225	42 107	21 478	13 187	48 060	50 832
D	111 804	59 500	56 596	51 962	19 614	55 247	61 060
E36	68 032	47 144	43 991	37 665	14 430	33 870	48 871
E38	52 581	38 321	36 128	38 087	10 369	35 167	61 898
F	35 265	28 601	19 815	12 206	7 554	39 045	28 270
J	66 897	53 405	38 746	31 926	17 242	51 065	61 556
M69_M70	19 347	40 820	14 187	10 373	10 372	43 301	37 280
M71	41 381	32 627	10 219	6 779	11 018	47 601	41 816
M72	83 874	55 391	56 287	25 858	12 467	50 612	61 960
O	52 566	44 671	51 442	32 964	16 570	41 003	47 135

As explained above in this chapter, the basic assumption of the estimation approach is that the labour compensation rates and intensities in an industry are sufficiently good indicators for the EGSS activities within the same industry. The method described above may therefore be supplemented by

information that allows capturing differences in the labour compensation rates and intensities. Such specific estimates have been made for organic farming and the production of electricity from renewable sources:

- For organic farming in Germany the w-ratios are directly derived from the aforementioned bookkeeping data from the German Farm Accountancy Data Network (Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz, 2012a).
- The generation of electricity from renewable sources and non-renewable sources are different in terms of labour input needed or operating and maintenance (International Labour Organisation (ILO, 2013)). The test calculations include mark-up factors for the w-ratios to reflect that operating and maintenance costs (O&M) for electricity generation from renewable sources can differ from those for electricity generation from non-renewable sources. At international level data on O&M and levelised costs of electricity (LCOE) by type of technology have been collected for 21 countries and 190 power plants (International Energy Agency; Nuclear Energy Agency, 2010). Based on this source the mark-up factors can be calculated (for more details see Annex D).

4.4. Results on EGSS employment

EGSS direct employment by environmental activities and industries was compiled combining all the calculation steps described above in sections 4.1 to 4.3. Aggregating estimates for most of the Member States it possible to produce estimates of EGSS time series for EU28.⁽⁸⁰⁾ In the tables below EGSS employment is broken down by environmental activities and by industries. All these data are also simultaneously classified by environmental activities and industries.

Table 39: Total EGSS employment by environmental activities, EU28 (1000 FTE)

CEPA/CreMA	2007	2008	2009	2010	2011	2012	2013
Protection of ambient air and climate	110	108	113	101	105	99	103
Wastewater management	573	584	623	584	594	584	589
Waste management	949	994	1 019	1 090	1 095	1 107	1 108
Protection and remediation of soil, groundwater and surface water	241	246	258	275	285	299	309
Noise and vibration abatement	26	25	26	24	22	23	23
Protection of biodiversity and landscapes	128	127	130	128	129	123	126
Other environmental protection	182	182	176	182	180	189	185
Management of water	140	145	141	141	144	143	143
Energy from renewable sources	341	442	576	662	830	768	717
Heat/energy savings and management	665	694	698	734	773	812	852

⁽⁸⁰⁾ The EU28 estimates are available in Eurostat's website > database > data by themes > environment and energy > environment (env) > environmental goods and services sector (env_egs) > Employment in the environmental goods and services sector (env_ac_egss1)

Table 40: Total EGSS employment by industries, EU28 (1000 FTE)

NACE	2007	2008	2009	2010	2011	2012	2013
Total NACE	3 355	3 547	3 761	3 921	4 156	4 148	4 154
of which:							
A	237	237	252	278	298	313	319
C26	47	68	74	77	79	66	55
C27	53	64	74	82	81	76	74
C28	106	136	146	154	152	151	143
D	87	98	109	117	128	142	164
E36	158	160	161	172	173	175	176
E37	280	273	285	275	295	286	297
E38	588	615	632	670	680	682	680
E39	65	68	70	74	76	76	76
F	823	882	1 017	1 057	1 194	1 167	1 154
M71	123	130	143	145	172	171	170
O	402	392	389	390	390	390	390

The approach described above was tested for all Member States of the EU (Croatia missing as of this writing) and results are shown in the following table.

Table 41: Total EGSS employment by 27 EU Member States (1000 FTE)

	2007	2008	2009	2010	2011	2012	2013
Belgium	51	53	60	79	75	85	80
Bulgaria	50	56	72	65	73	104	89
Czech Republic	83	90	119	164	105	114	109
Denmark	51	58	53	52	53	56	62
Germany	624	656	746	748	754	790	805
Estonia	10	11	10	8	13	12	10
Ireland	30	28	30	29	28	20	24
Greece	64	71	72	76	78	90	88
Spain	247	282	251	252	242	236	222
France	509	526	541	573	594	603	612
Italy	400	415	459	484	665	548	481
Cyprus	4	5	5	10	8	7	7
Latvia	23	25	23	21	22	25	24
Lithuania	31	29	37	34	32	36	38
Luxembourg	5	5	5	5	5	5	6
Hungary	59	61	62	65	68	66	65
Malta	3	3	2	2	2	2	2
Netherlands	146	150	143	143	141	144	147
Austria	98	94	99	105	119	113	142
Poland	218	241	253	247	271	296	300
Portugal	73	77	86	90	91	74	74
Romania	143	147	142	179	187	171	205
Slovenia	15	20	23	20	20	22	22
Slovakia	31	30	30	29	34	31	30
Finland	35	36	38	40	41	43	46
Sweden	70	73	82	84	91	93	89
United Kingdom	271	294	303	303	331	349	362

The methods described above also make it possible to identify the part of EGSS employment involved in market activities, which is the reporting requirement of Regulation (EU) No 691/2011.

Table 42: EGSS employment in EU28 by type of activity (1000 FTE)

	2007	2008	2009	2010	2011	2012	2013
Market	2 739	2 934	3 109	3 369	3 592	3 485	3 500
Non-market	525	514	554	455	465	558	548
Ancillary	92	99	98	97	99	105	107

Areas for possible future development

- Ratios wage to output and wages per employee or full-time equivalents for a certain industry may not always be a good proxy for EGSS related employment within the same industry. Therefore additional information may be needed to improve the estimates.
- The results of specific surveys on EGSS that collect the wages, number of employees, full-time equivalents may be used for this purpose. Survey approaches are often considered to be the best method since existing classifications are not structured to differentiate EGSS employment from other employment in the same industries. However, surveys can be costly in terms of financial burden for statistical offices and burden for respondents. To reduce the financial burden of statistical production as well as the response burden and at the same time to maintain a high level of quality, detail and coverage in the EGSS statistics it may be meaningful to combine the survey based approach with the data integration approach. For example, in some areas (e.g. manufacture of machinery and equipment, construction, architectural and engineering services) producers may be surveyed only every two to five years and for the intermediate years the survey data could be linked with the result from the data integration approach. Such an approach may significantly reduce the statistical burden while maintaining a high level of statistical quality and detail in the EGSS module.
- Engineering analysis may also be useful to improve the employment estimates in certain areas. For example, a study carried out by ECOTEC Research & Consulting Limited (1999) for the Commission's DG Environment provides information on the breakdown of operating expenditure related to environmental protection by cost categories (see Table 6). However before using such information it must be ensured that conceptual differences are properly taken into account and that the information is updated to reflect the most important technological and economic trends. By using information on the ratios 'gross operating surplus/output' the ECOTEC ratios 'wage/operating expenditure' may be converted into proxies for 'compensation of employees/output'. For example, with a 40% share of gross operating surplus in output the ECOTEC ratios would convert to ratios 'compensation of employees/output' of approximately 0.3 for wastewater management and 0.4 for waste management. By contrast, national accounts for Germany show that wage to output ratios have strongly declined over the last 10 years, e.g. in NACE E37-39 from 0.23 in 2000 down to 0.17 in 2010.
- Data on production costs structure can be useful additional information for a better representation of EGSS specific conditions regarding wages and employment. An example for the use of such additional data for the EGSS employment estimates is provided in Annex 7 and has been implemented in the test calculations for energy from renewable sources.

5

Methods to compile EGSS gross value added

5.1. Basic model for estimating EGSS gross value added

The model for EGSS gross value added (GVA) uses the same framework as the models for EGSS output and employment.

EGSS GVA broken down by industries and environmental activities is estimated from EGSS output combined with national accounts information on the ratios between gross value added and output. Gross value added encompasses compensation of employees, net operating surplus and mixed income and consumption of fixed capital:

$$\text{EGSS_B1G}_{\text{CEPA/CReMA,NACE}} = \text{EGSS_P1}_{\text{CEPA/CReMA,NACE}} * \frac{(\text{NA_D1}_{\text{NACE}} + \text{NA_B2NB3N}_{\text{NACE}} + \text{NA_P51C})}{\text{NA_P1}_{\text{NACE}}}$$

With:

$\text{EGSS_B1G}_{\text{CEPA/CReMA,NACE}}$: Gross value added cross-classified by industries and environmental activities (EGSS)

$\text{EGSS_P1}_{\text{CEPA/CReMA,NACE}}$: Output cross-classified by industries and environmental activities (EGSS)

$\text{NA_D1}_{\text{NACE}}$: Compensation of employees by industries (NA)

$\text{NA_B2NB3N}_{\text{NACE}}$: Net operating surplus and net mixed income by industries (NA)

$\text{NA_P51C}_{\text{NACE}}$: Consumption of fixed capital by industries (NA)

$\text{NA_P1}_{\text{NACE}}$: Output by industries (NA)

The basic assumption made is that the average shares of gross value added to output in an industry are sufficiently good indicators of the EGSS activities within that industry. The only exemption from this general rule is made in the test calculations for Germany for the GVA of NACE A. Instead of the national accounts data on compensation of labour and net operating surplus and mixed income the

GVA calculations for NACE A are based on an “income” variable derived from bookkeeping data from the German Farm Accountancy Data Network. This “income” variable includes employees’ salaries and profits in organic farming (see section 4.2 for details). Consumption of fixed capital derived from national accounts is added to obtain a proxy for the GVA in organic farming.

5.2. Results on EGSS gross value added

The approach described above to calculate EGSS GVA has been tested for all Member States of the EU except for Croatia. Aggregating estimates for most of the Member States it is possible to produce estimates for EU28 (European Union with 28 Member States).⁽⁸¹⁾

Table 43: Total EGSS gross value added by environmental activities, EU28 (million EUR)

CEPA/CreMA	2007	2008	2009	2010	2011	2012	2013
Protection of ambient air and climate	6 631	6 420	6 170	6 457	6 614	6 405	6 591
Wastewater management	38 396	39 597	38 938	39 751	41 319	41 251	41 387
Waste management	64 338	66 699	64 193	72 519	74 335	75 914	75 160
Protection and remediation of soil, groundwater and surface water	12 702	13 526	13 493	15 155	16 655	18 168	18 712
Noise and vibration abatement	1 506	1 538	1 572	1 680	1 361	1 422	1 420
Protection of biodiversity and landscapes	7 589	7 758	7 954	8 000	8 211	8 024	8 287
Other environmental protection	10 442	10 387	9 687	10 423	10 623	10 974	11 156
Management of water	9 197	9 459	9 093	9 648	9 995	10 271	10 669
Energy from renewable sources	29 689	39 441	45 083	51 737	62 691	61 669	63 315
Heat/energy savings and management	34 758	36 543	35 042	38 646	42 269	44 864	47 762

⁽⁸¹⁾ The EU28 estimates are available in Eurostat’s website > database > data by themes > environment and energy > environment (env) > environmental goods and services sector (env_egs) > production, value added and exports in the environmental goods and services sector (env_ac_egss2)

Table 44: Total EGSS gross value added by industries, EU28 (million EUR)

NACE	2007	2008	2009	2010	2011	2012	2013
Total NACE	215 247	231 368	231 225	254 017	274 074	278 961	284 460
of which:							
A	11 947	12 657	12 591	14 979	17 092	18 521	18 938
C26	3 882	5 242	5 165	6 335	6 350	4 595	4 023
C27	2 935	3 664	3 789	4 724	5 004	4 485	4 506
C28	7 199	9 155	8 480	10 034	11 078	10 845	11 024
D	15 655	19 469	22 739	23 754	24 716	28 925	33 243
E36	10 111	10 282	9 767	10 829	11 319	11 738	12 378
E37	23 048	23 405	22 546	23 688	25 273	25 209	25 227
E38	42 567	43 976	42 217	47 119	48 568	49 422	48 517
E39	4 730	4 886	4 691	5 235	5 396	5 491	5 391
F	37 758	40 566	42 908	46 205	54 906	54 301	55 206
M71	7 425	7 920	8 152	8 490	10 212	9 961	10 170
O	23 249	23 500	23 847	24 910	25 585	26 017	26 313

Relating EGSS GVA to GDP makes it possible to compare the results obtained for the different countries.

Table 45: Total EGSS gross value added by 27 EU Member States

	2007		2009		2011		2012	
	million EUR	% of GDP	million EUR	% of GDP	million EUR	% of GDP	million EUR	% of GDP
Belgium	4 040	1.2	4 764	1.4	6 732	1.8	7 798	2.0
Bulgaria	384	1.2	637	1.7	752	1.8	1 212	2.9
Czech Republic	2 198	1.6	3 374	2.3	3 659	2.2	3 805	2.4
Denmark	4 330	1.9	4 703	2.0	5 437	2.2	5 866	2.3
Germany	46 177	1.8	53 470	2.2	61 342	2.3	63 542	2.3
Estonia	293	1.8	265	1.9	437	2.6	448	2.5
Ireland	1 961	1.0	1 595	0.9	1 714	1.0	1 664	1.0
Greece	4 855	2.1	5 350	2.3	3 952	1.9	5 041	2.6
Spain	16 100	1.5	19 625	1.8	19 141	1.8	18 463	1.8
France	35 704	1.8	37 081	1.9	44 015	2.1	45 017	2.2
Italy	23 947	1.5	28 608	1.8	40 402	2.5	35 568	2.2
Cyprus	175	1.0	215	1.2	355	1.8	330	1.7
Latvia	414	1.8	519	2.8	519	2.6	608	2.8
Lithuania	568	2.0	629	2.3	814	2.6	865	2.6
Luxembourg	356	1.0	372	1.0	387	0.9	426	1.0
Hungary	1 254	1.2	1 334	1.4	1 630	1.6	1 533	1.5
Malta	83	1.4	86	1.4	82	1.2	88	1.2
Netherlands	12 616	2.1	12 777	2.1	13 052	2.0	13 526	2.1
Austria	8 399	3.0	8 343	2.9	10 278	3.3	9 934	3.1
Poland	4 631	1.5	5 538	1.8	7 571	2.0	8 051	2.1
Portugal	2 795	1.6	3 291	1.9	3 548	2.0	3 264	1.9
Romania	1 874	1.5	2 236	1.9	3 945	3.0	3 285	2.5
Slovenia	548	1.6	795	2.2	736	2.0	789	2.2
Slovakia	943	1.7	1 018	1.6	1 176	1.7	1 221	1.7
Finland	3 773	2.0	4 182	2.3	5 055	2.6	5 227	2.6
Sweden	5 608	1.6	5 360	1.7	7 347	1.8	7 654	1.8
United Kingdom	30 488	1.4	24 207	1.5	29 067	1.6	32 825	1.6

The methods explained in the previous sections also allow identifying the part of EGSS GVA due to market activities, which is the reporting requirement of Regulation (EU) No 691/2011.

Table 46: EGSS gross value added in EU28 by type of activity (million EUR)

	2007	2008	2009	2010	2011	2012	2013
Market	153 141	169 383	168 409	191 407	209 350	209 624	215 646
Non-market	28 626	28 213	29 757	27 405	27 793	32 367	31 428
Ancillary	6 386	6 160	6 482	7 077	7 055	7 283	7 514

Annex 1: Indicative compendium of environmental goods and services and of the economic activities to be covered by Regulation (EU) No 691/2011, Annex V

ENVIRONMENTAL GOODS AND SERVICES

- Organic agricultural (plant and livestock) and aquaculture products and supporting services
- Fuel wood; other wood when complying with sustainability measures
- Rehabilitation of mining sites services
- Drainage water capturing services to prevent groundwater contamination
- Electric and more resource efficient transport equipment; exhaust pipes and their parts (also particles filters)
- Instruments, machinery and apparatus for analysis of pollutants, filtering or purifying gases and liquid
- Septic tanks, perforated buckets and similar articles used to filter water at the entrance to drains; pumps for use in wastewater treatment, vehicles for wastewater collection and sewer cleaning, activated carbon for water-filtering purposes
- Tubes and pipes for wastewater treatment plants as well as for water management
- Sacks and bags for replacing plastic bags; bins, boxes, containers and other receptacles for storing and transporting waste; boards, blocks and similar articles of vegetable fibre, straw or wood waste, agglomerated with mineral binders; incinerators and machinery for waste treatment (e.g. used at landfilling sites)
- Lead containers for radioactive waste
- Maintenance and repair services for reducing water losses
- Specific equipment for the production of energy from renewable sources: e.g. storage systems for biogas, wood fired boilers and other appliances, solar panels and photovoltaic cells, hydraulic turbines and water wheels, wind turbines
- Biofuels
- Charcoal when complying with sustainability measures
- Goods for thermal and noise insulation mainly in buildings: e.g. cork products, windows with three insulating layers, insulation materials for facades, roofs and other elements of buildings such as materials made of glass fibre, rock wool, cellulose, polymers and polyurethane and others
- Reconditioned wooden containers
- Specific equipment produced for environmental protection and resource management products: e.g. thermostats for heating and cooling regulation, thermostatic valves, heat pumps, condensing boilers, solar water heaters
- Discharge lamps as low pressure lamps (e.g. compact fluorescent lamps) and the most efficient

domestic appliances

- Reclaimed rubber in primary forms or in plates, sheets or strip, bio-plastic sacks and bags
- Machinery for metal recovery
- Maintenance, repair and installation services for environmental goods
- Electricity, gas and heat from renewable sources
- Desalinated water and collected rainwater; maintenance of water mains for reducing water losses
- Sewerage services: e.g. collecting, transporting and treating wastewater, operation, maintenance and cleaning of sewer systems
- Collection, treatment and disposal services for non-hazardous and hazardous waste
- Nuclear waste treatment and disposal services
- Materials recovery services; secondary raw materials
- Remediation and clean-up services for soil, groundwater and surface water
- Remediation and clean-up services for air
- Other remediation and specialised pollution control services
- Low energy consumption and passive buildings and energetic refurbishment of existing buildings
- Maintenance and repair of water networks
- Wastewater and waste treatment plants and sewage systems
- Renewable energy power plants including installation of photovoltaic panels
- Noise insulation works
- Engineering and architectural services for low energy consumption and passive buildings and energetic refurbishment of existing buildings
- Engineering and architectural services for renewable energy projects
- Engineering and architectural services for water, wastewater and waste management projects
- Technical inspection services of road transport vehicles regarding air emissions
- R&D services for environmental protection and resource management
- Environmental consulting services
- Public litter and collection of garbage from the street
- Administration services for environmental protection and resource management purposes
- Training services in environmental protection and resource management
- Environmental services furnished by membership organisation
- Nature reserve services including wildlife preservation

ENVIRONMENTAL ECONOMIC ACTIVITIES

- Organic agricultural (plant and livestock) and aquaculture activities and supporting services
- Fuel wood; other wood production when complying with sustainability measures
- Rehabilitation of mining sites
- Capturing drainage water to prevent groundwater contamination
- Manufacture of electric and more resource efficient transport equipment; exhaust pipes and their parts (also particles filters)

- Manufacture of instruments, machinery and apparatus for analysis of pollutants, filtering or purifying gases and liquid
- Manufacture of septic tanks, perforated buckets and similar articles used to filter water at the entrance to drains; pumps for use in wastewater treatment, vehicles for wastewater collection and sewer cleaning, activated carbon for water filtering purposes
- Manufacture of tubes and pipes for wastewater treatment plants as well as for water management
- Manufacture of sacks and bags for replacing plastic bags; bins, boxes, containers and other receptacles for storing and transporting waste; boards, blocks and similar articles of vegetable fibre, straw or wood waste, agglomerated with mineral binders; incinerators and machinery for waste treatment (e.g. used at land-filling sites)
- Manufacture of lead containers for radioactive waste
- Maintenance and repair services for reducing water losses
- Manufacture of specific equipment for the production of energy from renewable sources: e.g. storage systems for biogas, wood fired boilers and other appliances, solar panels and photovoltaic cells, hydraulic turbines and water wheels, wind turbines
- Manufacture of biofuels
- Manufacture of charcoal complying with sustainability measures
- Manufacture of goods for thermal and noise insulation mainly in buildings: e.g. cork products, windows with three insulating layers, insulation materials for facades, roofs and other elements of buildings such as materials made of glass fibre, rock wool, cellulose, polymers and polyurethane and others
- Reconditioning of wooden containers
- Manufacture of specific equipment produced for environmental protection and resource management: e.g. thermostats for heating and cooling regulation, thermostatic valves, heat pumps, condensing boilers, solar water heaters
- Manufacture of discharge lamps as low pressure lamps (e.g. compact fluorescent lamps) and the most efficient domestic appliances
- Manufacture of reclaimed rubber in primary forms or in plates, sheets or strip, bio-plastic sacks and bags
- Manufacture of machinery for metal recovery
- Maintenance, repair and installation activities for environmental goods
- Production of electricity, gas and heat from renewable sources
- Desalination of water and collection of rainwater; maintenance of water mains for reducing water losses
- Provision of sewerage services: e.g. collecting, transporting and treating wastewater, operation, maintenance and cleaning of sewer systems;
- Provision of collection, treatment and disposal services for non-hazardous and hazardous waste
- Provision of nuclear waste treatment and disposal services
- Provision of materials recovery services; production of secondary raw materials
- Provision of remediation and clean-up services for soil, groundwater and surface water
- Provision of remediation and clean-up services for air
- Provision of other remediation and specialised pollution control services
- Constructing low energy consumption and passive buildings and energetic refurbishment of

existing buildings

- Maintenance and repair of water networks
- Construction work for wastewater and waste treatment plants and sewage systems
- Construction work for renewable energy power plants including installation of photovoltaic panels
- Noise insulation works
- Engineering and architectural services for low energy consumption and passive buildings and energetic refurbishment of existing buildings
- Engineering and architectural services for renewable energy projects
- Engineering and architectural services for water, wastewater and waste management projects
- Technical inspection services of road transport vehicles regarding air emissions
- R&D services for environmental protection and resource management
- Environmental consulting services
- Public litter and collection of garbage from the street
- Administration services for environmental protection and resource management purposes
- Training services in environmental protection and resource management
- Environmental services furnished by membership organisation
- Nature reserve services including wildlife preservation

Annex 2: Operational EGSS list of activities (excerpt)

Note: the full operational lists of EGSS activities and products are made available to EGSS compilers with every data collection round. The operational list of EGSS products, which provides relevant CPA and CN codes, has a similar layout.

Environmental activities in indicative compendium	NACE Rev. 2			Class of environmental activity (CEPA/CReMA)					
	CODE	DESCRIPTION	Share of EGSS (h=100%, v=% to be determined)	1	2	...	13A	13B	...
Manufacture of instruments, machinery and apparatus for filtering or purifying gases and liquid	28.25; 28.29	Manufacture of non-domestic cooling and ventilation equipment; Manufacture of other general purpose machinery n.e.c.	v	X	X	X			
Manufacture of tubes and pipes for wastewater treatment plants as well as for water management	22.21; 23.61; 24.51	Manufacture of plastic plates, sheets, tubes and profiles; Manufacture of concrete products for construction purposes; Casting of iron	v		X				
Manufacture of biofuels	20.14	Manufacture of other organic basic chemicals	v				X		
Provision of sewerage services: e.g. collecting, transporting and treating wastewater; operation, maintenance and cleaning of sewer systems	37	Sewerage	h		X				
Construction low energy consumption and passive buildings and energetic refurbishment of existing buildings	16.23; 41; 43	Manufacture of other builder's carpentry and joinery; Construction of buildings; Specialised construction activities	v					X	
Installation of photovoltaic panels	43.21	Electrical installation	v				X		
Environmental consulting services	74.9	Other professional, scientific and technical activities n.e.c.	v	X	X	X	X	X	X

Annex 3: NACE aggregation levels

The national accounts data used in the calculations are mostly available at the A*64 industry breakdown. This aggregation level has to be grouped into the 39 industries of the EGSS voluntary data transmission. Regulation (EU) 691/2011 requires a A*21 breakdown.

NACE Rev.2 sections	NACE Rev. 2 divisions	A*21 label	EGSS questionnaire	NACE Rev. 2 divisions	A*64 label	
A	01-03	Agriculture, forestry and fishing	01-03 Agriculture, forestry and fishing	01	Crop and animal production, hunting and related service activities	
				02	Forestry and logging	
				03	Fishing and aquaculture	
B	05-09	Mining and quarrying	05-09 Mining and quarrying	05-09	Mining and quarrying	
C	10-33	Manufacturing	10-12	Manufacture of food products, beverages and tobacco products	10-12	Manufacture of food products, beverages and tobacco products
			13-15	Manufacture of textiles, wearing apparel and leather products	13-15	Manufacture of textiles, wearing apparel and leather products
			16-18	Manufacture of wood and paper products, and printing	16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
					17	Manufacture of paper and paper products
					18	Printing and reproduction of recorded media
			19	Manufacture of coke and refined petroleum products	19	Manufacture of coke and refined petroleum products
			20	Manufacture of chemicals and chemical products	20	Manufacture of chemicals and chemical products
			21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
			22-23	Manufacture of rubber and plastic products, and other non-metallic mineral products	22	Manufacture of rubber and plastics products
					23	Manufacture of other non-metallic mineral products
			24-25	Manufacture of basic metals and fabricated metal products, except machinery and equipment	24	Manufacture of basic metals
					25	Manufacture of fabricated metal products, except machinery and equipment
			26	Manufacture of computer, electronic and optical products	26	Manufacture of computer, electronic and optical products
			27	Manufacture of electrical equipment	27	Manufacture of electrical equipment
			28	Manufacture of machinery and equipment n.e.c.	28	Manufacture of machinery and equipment n.e.c.
			29-30	Manufacture of transport equipment	29	Manufacture of motor vehicles, trailers and semi-trailers
					30	Manufacture of other transport equipment
31-32	Manufacture of furniture; other manufacturing; repair and installation of machinery and equipment	31-32	Manufacture of furniture; other manufacturing			
		33	Repair and installation of machinery and equipment			
D	35	Electricity, gas, steam and air conditioning supply	35	Electricity, gas, steam and air conditioning supply		
E	36-39	Water supply, sewerage, waste management and remediation activities	36	Water collection, treatment and supply		
			37	Sewerage		
			38	Waste collection, treatment and disposal activities; materials recovery		
			39	Remediation activities and other waste management services		
F	41-43	Construction	41-43 Construction	41-43	Construction	

NACE Rev.2 sections	NACE Rev. 2 divisions	A*21 label	EGSS questionnaire	NACE Rev. 2 divisions	A*64 label	
G	45-47	Wholesale and retail trade; repair of motor vehicles and motorcycles	45-47 Wholesale and retail trade; repair of motor vehicles and motorcycles	45	Wholesale and retail trade and repair of motor vehicles and motorcycles	
				46	Wholesale trade, except of motor vehicles and motorcycles	
				47	Retail trade, except of motor vehicles and motorcycles	
H	49-53	Transportation and storage	49-53 Transportation and storage	49	Land transport and transport via pipelines	
				50	Water transport	
				51	Air transport	
				52	Warehousing and support activities for transportation	
				53	Postal and courier activities	
I	55-56	Accommodation and food service activities	55-56 Accommodation and food service activities	55-56	Accommodation; food and beverage service activities	
J	58-63	Information and communication	58-63 Information and communication	58	Publishing activities	
				59-60	Motion picture, video and television programme production, sound recording and music publishing activities; programming and broadcasting activities	
				61	Telecommunications	
				62-63	Computer programming, consultancy and related activities; information service activities	
K	64-66	Financial and insurance activities	64-66 Financial and insurance activities	64	Financial service activities, except insurance and pension funding	
				65	Insurance, reinsurance and pension funding, except compulsory social security	
				66	Activities auxiliary to financial services and insurance activities	
L	68	Real estate activities	68 Real estate activities	68	Real estate activities of which: imputed rents of owner-occupied dwellings	
M	69-75	Professional, scientific and technical activities	69-70	Legal and accounting activities; activities of head offices;	69-70	Legal and accounting activities; activities of head offices; management consultancy activities
			71	Architecture and engineering activities; technical testing and analysis	71	Architecture and engineering activities; technical testing and analysis
			72	Scientific research and development	72	Scientific research and development
			73-75	Advertising and market research; other professional, scientific and technical activities; veterinary	73	Advertising and market research
			74-75	Other professional, scientific and technical activities; veterinary activities	74-75	Other professional, scientific and technical activities; veterinary activities
N	77-82	Administrative and support service activities	77-82 Administrative and support service activities	77	Rental and leasing activities	
				78	Employment activities	
				79	Travel agency, tour operator reservation service and related activities	
				80-82	Security and investigation activities; services to buildings and landscape activities; office administrative, office support and other business support	
O	84	Public administration and defence; compulsory social security	84 Public administration and defence; compulsory social security	84	Public administration and defence; compulsory social security	
P	85	Education	85 Education	85	Education	
Q	86-88	Human health and social work activities	86-88 Human health and social work activities	86	Human health activities	
				87-88	Social work activities	

NACE Rev.2 sections	NACE Rev. 2 divisions	A*21 label	EGSS questionnaire	NACE Rev. 2 divisions	A*64 label
R	90-93	Arts, entertainment and recreation	90-93 Arts, entertainment and recreation	90-92	Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities
				93	Sports activities and amusement and recreation activities
S	94-96	Other service activities	94-96 Other service activities	94	Activities of membership organisations
				95	Repair of computers and personal and household goods
				96	Other personal service activities
T	97-98	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	97-98 Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	97-98	Activities of households as employers of domestic personnel and undifferentiated goods and services production of households for own use
U	99	Activities of extra-territorial organisations and bodies	99 Activities of extraterritorial organisations and bodies	99	Activities of extraterritorial organizations and bodies

Annex 4: CEPA – definitions, explanations of environmental protection activities

This annex presents definitions and explanatory of environmental protection activities for the classes of the Classification of Environmental Protection Activities (CEPA). CEPA it is a generic, multi-purpose, functional classification. CEPA is included in SEEA-CF, Annex I.

CEPA 1: PROTECTION OF AMBIENT AIR AND CLIMATE

Code	Description
1	Protection of ambient air and climate
1.1	Prevention of pollution through in-process modifications
1.1.1	for the protection of ambient air
1.1.2	for the protection of climate and ozone layer
1.2	Treatment of exhaust gases and ventilation air
1.2.1	for the protection of ambient air
1.2.2	for the protection of climate and ozone layer
1.3	Measurement, control, laboratories and the like
1.4	Other activities

Protection of ambient air and climate comprises measures and activities aimed at the reduction of emissions into the ambient air or ambient concentrations of air pollutants as well as to measures and activities aimed at the control of emissions of greenhouse gases and gases that adversely affect the stratospheric ozone layer.

Excluded are measures undertaken for cost saving reasons (e.g. energy saving).

CEPA 2: WASTEWATER MANAGEMENT

Code	Description
2	Wastewater management
2.1	Prevention of pollution through in-process modifications
2.2	Sewerage networks
2.3	Wastewater treatment
2.4	Treatment of cooling water
2.5	Measurement, control, laboratories and the like
2.6	Other activities

Wastewater management comprises activities and measures aimed at the prevention of pollution of surface water through the reduction of the release of wastewater into inland surface water and seawater. It includes the collection and treatment of wastewater including monitoring and regulation activities. Septic tanks are also included.

Excluded are actions and activities aimed at the protection of groundwater from pollutant infiltration and the cleaning up of water bodies after pollution (see CEPA 4).

Wastewater is defined as water that is of no further immediate value for the purpose for which it was used or in the pursuit of which it was produced because of quality, quantity, or time of its occurrence.

CEPA 3: WASTE MANAGEMENT

Code	Description
3	Waste management
3.1	Prevention of pollution through in-process modifications
3.2	Collection and transport
3.3	Treatment and disposal of hazardous waste
3.3.1	Thermal treatment
3.3.2	Landfill
3.3.3	Other treatment and disposal
3.4	Treatment and disposal of non-hazardous waste
3.4.1	Incineration
3.4.2	Landfill
3.4.3	Other treatment and disposal
3.5	Measurement, control, laboratories and the like
3.6	Other activities

Waste management refers to activities and measures aimed at the prevention of the generation of waste and the reduction of its harmful effect on the environment. Includes the collection and treatment of waste, including monitoring and regulation activities. It also includes recycling and composting, the collection and treatment of low level radioactive waste, street cleaning and the collection of public litter.

Waste are materials that are not prime products (that is, products made for the market) for which the generator has no further use for own purposes of production, transformation, or consumption, and which he wants to dispose of. Wastes may be generated during the extraction of raw materials, during the processing of raw materials to intermediate and final products, during the consumption of final products, and during any other human activity. Residuals recycled or reused at the place of generation are excluded. Also excluded are waste materials that are directly discharged into ambient water or air.

Hazardous waste is waste that due to its toxic, infectious, radioactive, flammable or other character defined by the legislator poses a substantial actual or potential hazard to human health or living organisms. For the purposes of this definition, "hazardous waste" comprises for each country all those materials and products which are considered to be hazardous in accordance with that country's practices. Low level radioactive waste is included, whereas other radioactive waste is excluded (see CEPA 7).

Low level radioactive waste is waste that, because of its low radionuclide content, does not require shielding during normal handling and transportation.

Treatment and disposal of waste

Treatment of waste refers to any process designed to change the physical, chemical, or biological character or composition of any waste to neutralise it, render it non-hazardous, safer for transport, amenable for recovery or storage, or to reduce it in volume. A particular waste may undergo more than one treatment process.

Composting and recycling activities for the purpose of environmental protection are included. Often composting is a waste treatment method and the resulting compost provided free of charge or at a very low price. The manufacture of compost classified in division 24 of ISIC/NACE (Manufacture of fertilisers and nitrogen compounds) is excluded.

Division 37 of ISIC/NACE defines recycling as "the processing of waste, scraps whether or not used, into a form feasible to be transformed in new raw materials. Typical is that, in terms of commodities, both input and output consist of waste and scrap, the input being sorted or unsorted but always unfit for further direct use in an industrial process whereas the output is made fit for further processing and is to be considered then as an intermediate good. A process is required, either mechanical or chemical". The main purpose of activities classified in division 37 of ISIC/NACE is the manufacture of secondary raw materials but there may be important secondary waste management activities.

Compost and secondary raw materials (as well as products made of secondary raw materials) are not

considered environmental protection products. Their use is excluded.

Disposal of waste is the final deposition of waste on or underground in controlled or uncontrolled fashion, in accordance with the sanitary, environmental or security requirements.

CEPA 4: PROTECTION AND REMEDIATION OF SOIL, GROUNDWATER AND SURFACE WATER

Code	Description
4	Protection and remediation of soil, groundwater and surface water
4.1	Prevention of pollutant infiltration
4.2	Cleaning up of soil and water bodies
4.3	Protection of soil from erosion and other physical degradation
4.4	Prevention and remediation of soil salinity
4.5	Measurement, control, laboratories and the like
4.6	Other activities

Protection and remediation of soil, groundwater and surface water refers to measures and activities aimed at the prevention of pollutant infiltration, cleaning up of soils and water bodies and the protection of soil from erosion and other physical degradation as well as from salinisation. Monitoring, control of soil and groundwater pollution is included.

Excluded are wastewater management activities (see CEPA 2), as well as activities aimed at the protection of biodiversity and landscape (see CEPA 6).

CEPA 5: NOISE AND VIBRATION ABATEMENT (EXCLUDING WORKPLACE PROTECTION)

Code	Description
5	Noise and vibration abatement (excluding workplace protection)
5.1	Preventive in-process modifications at the source
5.1.1	Road and rail traffic
5.1.2	Air traffic
5.1.3	Industrial and other noise
5.2	Construction of anti noise/vibration facilities
5.2.1	Road and rail traffic
5.2.2	Air traffic
5.2.3	Industrial and other noise
5.3	Measurement, control, laboratories and the like
5.4	Other activities

Noise and vibration abatement refers to measures and activities aimed at the control, reduction and abatement of industrial and transport noise and vibration. Activities for the abatement of neighbourhood noise (soundproofing of dancing halls, etc.) as well as activities for the abatement of noise in places frequented by the public (swimming pools, etc.), in schools, etc., are included.

Excluded is the abatement of noise and vibration for purposes of protection at the workplace.

CEPA 6: PROTECTION OF BIODIVERSITY AND LANDSCAPES

Code	Description
6	Protection of biodiversity and landscapes
6.1	Protection and rehabilitation of species and habitats
6.2	Protection of natural and semi-natural landscapes
6.3	Measurement, control, laboratories and the like
6.4	Other activities

Protection of biodiversity and landscape refers to measures and activities aimed at the protection and rehabilitation of fauna and flora species, ecosystems and habitats as well as the protection and rehabilitation of natural and semi-natural landscapes. The separation between 'biodiversity' and 'landscape' protection may not always be practical. For example, maintaining or establishing certain landscape types, biotopes, eco-zones and related issues (hedgerows, lines of trees to re-establish 'natural corridors') have a clear link to biodiversity preservation.

Excluded is the protection and rehabilitation of historic monuments or predominantly built-up landscapes, the control of weed for agricultural purposes as well as the protection of forests against forests fire when this predominantly responds to economic reasons. The establishment and maintenance of green spaces along roads and recreational structures (e.g. golf courses, other sports facilities) are also excluded.

Actions and expenditure related to urban parks and gardens would not normally be included but may be related in some cases to biodiversity – in such cases the activities and expenditure should be included.

CEPA 7: PROTECTION AGAINST RADIATION (EXCLUDING EXTERNAL SAFETY)

Code	Description
7	Protection against radiation (excluding external safety)
7.1	Protection of ambient media
7.2	Transport and treatment of high level radioactive waste
7.3	Measurement, control, laboratories and the like
7.4	Other activities

Protection against radiation refers to activities and measures aimed at the reduction or elimination of the negative consequences of radiation emitted from any source. Included is the handling, transportation and treatment of high level radioactive waste, i.e. waste that, because of its high radionuclide content, requires shielding during normal handling and transportation.

Excluded are activities and measures related to the prevention of technological hazards (e.g. external safety of nuclear power plants), as well as protection measures taken at workplaces. Also excluded are activities related to collection and treatment of low-level radioactive waste (see CEPA 3).

Definition of radioactive waste

Any material that contains or is contaminated with radionuclides at concentrations or radioactivity levels greater than the "exempt quantities" established by the competent authorities, and for which no use is foreseen. Radioactive wastes are produced at nuclear power plants and at associated nuclear fuel cycle facilities as well as through other uses of radioactive material, for example, the use of radionuclides in hospitals and research establishments. Other important wastes are those from mining and milling of uranium and from the reprocessing of spent fuel.

CEPA 8: RESEARCH AND DEVELOPMENT

Code	Description
8	Research and development
8.1	Protection of ambient air and climate
8.1.1	Protection of ambient air
8.1.2	Protection of atmosphere and climate
8.2	Protection of water
8.3	Waste
8.4	Protection of soil and groundwater
8.5	Abatement of noise and vibration
8.6	Protection of species and habitats
8.7	Protection against radiation
8.8	Other research on the environment

Research and development (R&D) comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge and the use of this knowledge to devise new applications (see Frascati manual, OECD 1994) in the field of environmental protection.

The class regroups all R&D activities and expenditure oriented towards environmental protection: identification and analysis of sources of pollution, mechanisms of dispersion of pollutants in the environment as well as their effects on human beings, the species and the biosphere. This heading covers R&D for the prevention and elimination of all forms of pollution, as well as R&D oriented towards equipment and instruments of pollution measurement and analysis. When separable all R&D activities even when referring to a specific class have to be classified under this position.

Environmental R&D is further classified in accordance with the 1993 NABS (Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets, Eurostat 1994).

Excluded are R&D activities related to the management of natural resources.

CEPA 9: OTHER ENVIRONMENTAL PROTECTION ACTIVITIES

Code	Description
9	Other environmental protection activities
9.1	General environmental administration and management
9.1.1	General administration, regulation and the like
9.1.2	Environmental management
9.2	Education, training and information
9.3	Activities leading to indivisible expenditure
9.4	Activities not elsewhere classified

Other environmental protection activities refers to all environmental protection activities which take the form of general environmental administration and management activities or training or teaching activities specifically oriented towards environmental protection or which consist of public information, when they are not classified elsewhere in CEPA. It also includes activities leading to indivisible expenditure, as well as activities not elsewhere classified.

Annex 5: CReMA – definitions, explanations, examples of resource management activities

This annex presents definitions, explanatory notes and examples of resource management activities for the classes of the Classification of Resource Management Activities (CReMA). The examples are the result of task force and working group discussions, as well as data collection experiences in the countries.

Like CEPA it is a generic, multi-purpose, functional classification. CReMA has been developed by Eurostat Task Forces.⁽⁸²⁾

CReMA is devoted to the description of measures and activities carried out to preserve, maintain and enhance the stock of natural resources and safeguard those resources against depletion.

The classification has been developed consistently with the classification principles of the CEPA. CReMA cross classifies the different kinds of activities carried out to manage natural resources. Categories are built complementarily with CEPA but without any overlapping with CEPA classes.

CREMA 10: MANAGEMENT OF WATER

Management of water comprises activities aimed at the minimisation of inland waters intake through in-process modifications, the reduction of water losses and leaks or reduction of the intake by substituting the resource with alternative resources, water reuse and savings. Restoration activities (recharge of groundwater bodies) are included as well as the measurement, control, laboratories and the like and education, training and information and general administration activities linked to the management of inland waters and water saving.

Activities related with the maintenance of the quality of water bodies are excluded (see CEPA 4). Collection, treatment and distribution of water should be in principle excluded. However, if the available data sources do not allow separating them out, they can be included under CReMA 10 and an explanation should be given in the metadata supplied with the statistics.

Reduction of the intake of water resources

Activities aimed at the reduction of the intake through in-process modifications related to the reduction of the water input for the production process. This includes all the kinds of replacement or adjustment of production processes aiming at reducing the water input needed for producing a certain output. Desalination of seawater as well a rainwater recovery is included.

Reduction of water losses and leaks, water reuse and savings

Activities aimed at the reduction of water use through the reduction of water losses and leaks or the installation of facilities, systems and equipment for water reuse and savings, etc.

Replenishment of water resources

Activities aimed at increasing water available in water stocks. The following activities are included: recharge of groundwater bodies to increase/restore water stocks; land improvement, development of vegetal cover in order to increase water infiltration and recharge underground water bodies. If any such activities are, however, performed for the main purpose of improving water quality, fighting water salinity or protection of soil against erosion, they should be classified under CEPA 4.

Measurement, control, laboratories and the like related to water resources

Activities aimed at measuring, controlling and monitoring the use and the level of water stocks. The following activities are excluded: measurement, monitor and control of the concentration of pollutants in wastewater and the quality of the inland water and marine water at the place wastewater is discharged (CEPA 2); measurement, monitor and control of the quality of surface water and groundwater (CEPA 4).

⁽⁸²⁾ Important inputs to develop the CReMA also came from work by Istat (Ardi, C. and Falcitelli, F., The Classification of Resource Use and Management Activities (CRUMA) and Expenditure, Istat, Rome, 2007) and the interim classification of RM activities as described in the SEAA-CF 2012

Other activities for the management of water resources

All other activities and measures aimed at the management of water resources. These include regulation, administration, education, and training and information activities specific to the class when they can be separated from other activities related to the same class and from similar activities related to other classes. They include, for example: information campaigns to encourage water savings; release of licences for water abstraction; and general government units or parts thereof that administer and regulate the use of water resources or are responsible for water saving policies.

CREMA 11: MANAGEMENT OF FOREST RESOURCES

The management of forest resources as natural resources should in theory only deal with “non-cultivated forest areas and related timber stocks, i.e. forests areas not available for wood supply (either because they are protected or because the harvest is uneconomic due to the low productivity or to high harvesting and transport cost) and natural forest areas and corresponding timber.

However there are few natural forests in European Union countries. Furthermore activities related with protected forest are included in the CEPA 6 protection of biodiversity and landscape.

Therefore it has been decided by the ReMEA Task Force⁽⁸³⁾ to extend the scope of management of forest resources to both naturally regenerated forests and planted forests and to focus on timber resources.

Collection of wood (logging) and wild growing non wood forest products is excluded; however production of fuel wood is included in CReMA 13A.

CREMA 11A: MANAGEMENT OF FOREST AREAS

It includes restoration or replenishment activities or development of new forest areas (reforestation and afforestation) as well as the prevention and control of forest fires, diseases, pests, and weeds, etc. Activities and products aimed at measuring, controlling and monitoring forest areas and timber stocks, laboratories and the like are also included as well as education, training and information and general administration activities linked to the management of forests.

Activities concerning the protection and restoration of forests as habitats, ecosystems and landscapes are excluded, in particular protection of forests against forest fires for landscape protection purpose (see CEPA 6).

CREMA 11B: MINIMISATION OF THE INTAKE OF FOREST RESOURCES

Reduction of the intake through in-process modifications related to the reduction of the input of timber resources for the production process. This includes all the kinds of replacement or adjustment of production processes aimed at reducing the input of forest-related products (wood and non-wood) needed for producing a certain output. It also includes the recovery, reuse or savings of forest products and by-products as well as the substitution of forest products with other materials and substances. Non wood forest products are mushrooms, truffles, berries, nuts, balata and other rubber-like gums, cork, lac and resins, balsams, vegetable hair, eelgrass, acorns, horse chestnuts, mosses and lichens.

CREMA 12: MANAGEMENT OF WILD FLORA AND FAUNA

Management of wild flora and fauna comprises activities aimed at the minimisation of the intake of wild flora and fauna (wild growing forest products are excluded) through in-process modifications as well as withdrawals reduction and regulation measures. Restoration activities are included (replenishment of wild flora and fauna stocks). Activities and products concerning measurement, control, laboratories and the like are also included as well as education, training and information and general administration activities linked to the management of wild flora and fauna.

The focus is on wild flora and fauna and all the activities carried out for their maintenance and management. Often the management of game reserves, e.g. in the case of birds, has the purpose of maintaining the stock of wild fauna, even if for hunting purposes. What is relevant is that the flora and fauna concerned are wild and the activities are aiming mainly at maintaining the resource functions (SEEA concept) of wild flora and fauna.

CEPA 6 relates to the protection of biodiversity which concerns essentially threatened species. In the field

⁽⁸³⁾ Eurostat (2013): Minutes of the meeting of the task force on the resource management expenditure account (ReMEA)

of flora and fauna resources (CREMA 12), what is relevant is the stock of e.g. fish and wild animals.

CREMA 13: MANAGEMENT OF ENERGY RESOURCES

Management of energy resources comprises activities aimed at the minimisation of the intake of fossil resources through the production of energy from renewable sources, heat/energy saving and management and the minimisation of the intake of fossil resources for raw materials for uses other than energy production.

Exploitation, management and maintenance of the stocks of non-renewable energy sources (including exploration and discovery of new reserves) are not included in the scope of the EGSS. Also excluded are measures that improve the efficiency of energy resources extraction.

CREMA 13A: PRODUCTION OF ENERGY FROM RENEWABLE SOURCES

It includes the production of energy from renewable sources, as well as related measurement, control, inventories and the like, administration, formation, information, etc. activities.

The directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources lists the following sources for the production of renewable (non fossil) energy: wind, solar, aero-thermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases. Bio-fuels are included under biomass; biomass means the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste.

It includes the production of energy from burning biomass waste when the purpose is energy recovery. However if the main purpose of waste incineration is the thermal treatment of waste in waste treatment facilities then the activity is included in CEPA 3.

Production of electricity and heat from renewable sources: it includes production of electricity from wind, production of heat from geothermal sources (either for industrial uses or for heating of dwellings), production of bio-fuels for transport, production of biogas, etc. According to the ReMEA guidelines fuel wood production when complying with sustainability measures e.g. Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC) standards, could be included. Wood pellets and other wood or vegetal based energy products are also included. Production of renewable energy as non-market output for own use by households and as secondary output by producers classified in other industries is also included.⁽⁸⁴⁾

Measurement, control, laboratories and the like related to renewable energy. This group includes activities aimed at measuring, controlling and monitoring the production of renewable energy. It includes for example inventories and assessments of renewable energy potentials.

Other activities for renewable energy management include all other activities and measures aimed at the management of renewable energy. It includes regulation, administration, education, training and information activities specific to renewable energy when they can be separated from other activities related to the same RM class and from similar activities related to other RM classes.

CREMA 13B: HEAT/ENERGY SAVING AND MANAGEMENT

Activities aiming at the minimisation of the intake of non-renewable energy sources through in-process modifications as well as the minimisation of heat and energy losses and through energy savings; activities and products concerning measurement, control, laboratories and the like are also included as well as education, training and information and general administration activities linked to the management and saving of heat and energy.

Energy savings through in-process modifications: this includes all the kinds of replacement or adjustment of production processes, including energy production processes, aiming at reducing the use of energy for producing a certain output. These activities are mainly carried on as ancillary (own account) activities. They also include heat and electricity co-generation, reducing losses in energy transportation, improvement of energy efficiency, etc.

⁽⁸⁴⁾ According to NACE Rev. 2 (see paragraph 53 d): production of energy [...] even if the whole output is consumed by the parent unit is not to be considered as ancillary production. Therefore renewable energy production of enterprises for auto consumption should be accounted for as secondary production

Insulation activities: they include all activities aimed at reducing the need of energy for lighting, heating and cooling buildings.

Energy recovery: it includes energy recovery from non-renewable sources (e.g. non-biodegradable waste); production of energy from renewable sources is excluded as well as the direct production of energy from fossil fuels.

Measurement, control, laboratories and the like related to energy saving. This group includes activities aimed at measuring, controlling and monitoring the reduction in the use of energy. It includes for example audit, production of energy performance certificates and assessments of energy savings potentials.

Other activities for energy savings include all other activities and measures aimed at the reduction of the use of energy such as regulation, administration, education, training and information activities specific to the class when they can be separated from other activities related to the same class and from similar activities related other classes. This includes also actions and activities aimed at reducing energy consumption through modal shift and transport behavioural/organisational changes.

CREMA 13C: MINIMISATION OF THE INTAKE OF FOSSIL ENERGY RESOURCES AS RAW MATERIAL

Activities aiming at the minimisation of the intake of fossil energy resources for uses other than energy production (e.g. the production of plastics, chemicals, rubber); activities and products concerning measurement, control, laboratories and the like are also included as well as education, training and information and general administration activities linked to the management and saving of fossil resources used as input for productions other than energy production.

Savings through in-process modifications: this includes all the kinds of replacement or adjustment of production processes, aiming at reducing the use of fossil energy resources for uses other than energy production. These activities are mainly carried on as ancillary (own account) activities.

Recovery of non-energetic fossil fuels based materials: it includes the processing of petro-based materials waste and scrap and other articles into secondary raw.

Production of substitute for fossil fuels based materials: it includes production of bio materials, bio plastics, etc.

Measurement, control, laboratories and the like related to the reduction of the use of fossil fuel for uses other than energy production. This group includes activities aimed at measuring, controlling and monitoring the reduction of the use of fossil fuel for uses other than energy production.

Other activities include all other activities and measures aimed at the reduction of the use of fossil fuel for uses other than energy production such as regulation, administration, education, training and information activities specific to the class when they can be separated from other activities related to the same class and from similar activities related other classes.

CREMA 14: MANAGEMENT OF MINERALS

A mineral is a naturally occurring substance generally solid, inorganic and a-biogenic. Excluded from the management of minerals are activities related to the management of biological natural resources, water, and fossil energy resources.

Management of minerals comprises activities aimed at the minimisation of the intake of minerals through in-process modifications as well as the reduction of scraps and the production of minerals secondary raw materials. Activities and products concerning measurement, control, laboratories and the like are also included as well as education, training and information and general administration activities linked to the management of minerals.

Exploitation, management and maintenance of the stocks of mineral resources (including exploration and discovery of new reserves) are excluded from the scope of the EGSS. Also excluded are measures and activities that improve the efficiency of mineral resources extraction.

Savings through in-process modifications: this includes all the kinds of replacement or adjustment of production processes, aiming at reducing the use of mineral resources. These activities are mainly carried on as ancillary (own account) activities.

Recovery of mineral based materials: it includes the processing of metallic and non-metallic mineral

materials waste and scrap and other articles into secondary raw materials.

- mechanical crushing of metal waste from used cars, washing machines, bikes etc.
- mechanical reduction of large iron pieces such as railway wagons
- shredding of metal waste, end-of-life vehicles etc.
- other methods of mechanical treatment as cutting, pressing to reduce the volume
- reclaiming metals out of photographic waste, e.g. fixer solution or photographic films and paper
- crushing, cleaning and sorting of glass
- crushing, cleaning and sorting of other waste such as demolition waste to obtain secondary raw material

Production of substitute for minerals based materials: manufacturing of vegetal substitutes for cement, stone and plaster.

Measurement, control, laboratories and the like related to the reduction of the use of minerals. This group includes activities aimed at measuring, controlling and monitoring the reduction of the use of minerals.

Other activities include all other activities and measures aimed at the reduction of the minerals such as regulation, administration, education, training and information activities specific to the class when they can be separated from other activities related to the same class and from similar activities related other classes.

CREMA 15: RESEARCH AND DEVELOPMENT ACTIVITIES FOR RESOURCE MANAGEMENT

Research and development activities for natural resource management comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge and the use of this knowledge to devise new applications in the field of natural resource management and savings: R&D for renewable energy, for energy and minerals savings, for timber and other biological resources savings, etc.

Excluded are R&D activities related to environmental protection (see CEPA 8)

CREMA 16: OTHER RESOURCE MANAGEMENT ACTIVITIES

Natural resource management activities not classified in the previous classes, i.e. general administration, education, training and information activities that relate to two natural resources or more, as well as other kinds of activities leading to indivisible output.

Excluded are general administration, education, training and information activities related mainly to environmental protection (see CEPA 9).

General administration of natural resources

It includes any identifiable activity that is directed towards the general support of decisions taken in the context of natural resource management whether by governmental or by nongovernmental units.

General administration, regulation and the like: any identifiable activity within general government and NPISH units that is directed towards regulation, administration of the environment and the support of decisions taken in the context of natural resource management activities. When possible, such activities should be allocated to CREMA classes 10-14. If this is impossible, they should be included under this position of the classification

Environmental management: any identifiable activity of corporations that is directed towards the general support of decisions taken in the context of natural resource management activities. This includes the preparation of declarations or requests for permission, internal environmental management, and environmental certification processes (ISO 14000; EMAS), as well as the recourse to environmental consultancy services. Activities of units specialized in environmental consultancy, supervision and analysis are included. When possible, such activities should be allocated to CREMA classes 10-14. If this is impossible, they should be included under this position of the classification.

If the general administration activities concern both environmental protection and management of natural resources, they should be broken down between this position and the corresponding category of the CEPA. If this is impossible, they should be classified in this position or, alternatively, in the one of the CEPA group according to the main purpose criterion; if this is impossible as well, they should be classified within the

corresponding category of the CEPA group.

Education, training and information

It includes activities that aim at providing general environmental education or training and disseminating information on natural resource management. Included are high school programmes, university degree programmes or special courses specifically aimed at training for natural resource management. Activities such as the production of environmental reports and environmental communication are also included. When possible, such activities should be allocated to CEPA classes 10-14. If this is impossible, they should be included under this position of the classification.

If the general education, training and information activities concern both environmental protection and management of natural resources, they should be broken down between this position and the corresponding category of the CEPA 9.2. If this is impossible, they should be classified in this position or, alternatively, in the one of the CEPA group according to the main purpose criterion; if this is impossible as well, they should be classified within the corresponding category of the CEPA group 9.2.

Activities leading to indivisible expenditure

Natural resource management activities that lead to indivisible expenditure, i.e., that cannot be allocated to any other class of the RM group.

Activities not elsewhere classified

This class comprises all resource management activities that cannot be classified under other classes of the RM group.

Annex 6: CEPA/CRema: operational rules for the treatment of borderline cases

CEPA 1 / CREMA 13B

Cleaner versus more resource efficient transport and other equipment

As concerns the production of cleaner and more resource efficient transport and other equipment, it may be difficult to determine whether the equipment is cleaner (EP: e.g. less emissions of air pollutants or noise) or more resource efficient (RM: e.g. less consumption of energy).

This guide proposes the following rule:

If the equipment is specifically designed for reducing air and noise emissions (e.g. electric cars) its production should be recorded under EP. In this case, if it is not possible to identify CEPA 5 (noise and vibration abatement) as main EP purposes, it should be allocated to CEPA 1.

If the equipment reduces the emission of air pollutants because it is designed to use less energy than normal equipment of similar utility (energy saving domestic devices) it should be recorded under RM and therefore be classified under the CReMA activities.

CEPA 2 / CREMA 13B – CREMA 14

Sewage sludge

Sewage sludge is a residual of wastewater cleaning. Sewage sludge can be used for RM. When used as fertilizer in agriculture it may save mineral resources as the nutrients contained in the sludge can substitute nutrients from mineral fertilisers and also save energy that would be used to produce the mineral fertilizers. Sludge may also be an input to biogas production.

This guide proposes the following operational rules:

- If sewage sludge is processed before being used in agriculture (e.g. decontamination, special processing to increase the nutrient availability for crops) this treatment activity may be recorded as RM and classified under CReMA 13B (saving of energy that would otherwise be used for producing mineral fertilizer) or CREMA 14 (reducing the depletion of mineral resources) if it can be demonstrated that the value of the processed sludge (either sold or for own use) covers more than 90% of the processing costs on a multiannual average.
- In all other cases the value of processed sewage sludge (either sold or for own use) should be recorded under CEPA 2. Also the value of unprocessed sewage sludge (either sold or for own use) should be recorded under CEPA 2.

CEPA 3 / CREMA 11B – CREMA 13B – CREMA 14

There are some activities closely related with waste management, which, however, contribute to RM. Such activities are the recovery of raw materials from waste, the production of energy from waste (by incineration or the production of biogas and biofuels from waste) and composting.

In line with the Annex I, section A.I of the SEEA-CF 2012 composting and the recovery of materials may be carried out for the purpose of EP. For example, if the main purpose of these activities is avoiding other forms of waste disposal, these activities should fall under CEPA 3.

As an operational rule, *recovery of raw materials from waste and composting*:

- should be recorded as RM and therefore be classified under the CReMA 11B, 13B, or 14 if laws or programs (public or private) governing these activities mention resource management as their single main objective,
- may be recorded as RM and therefore be classified under the CReMA activities if it can be demonstrated that the value of the recovered materials or compost (either sold or for own use) covers more than 90% of the costs of these activities on a multiannual average,
- are to be recorded under CEPA 3 in all other cases.

Waste incineration which transforms energy fixed in combusted matters into thermal energy helps avoiding other forms of waste disposal and should therefore, in general, be part of CEPA 3 (see also Annex I, section A.I). In addition, the production of thermal energy from waste can also help avoiding the depletion of fossil energy resources. Therefore, as an operational rule waste incineration:

- should be recorded as RM and therefore be classified under CReMA 13A (from bio-degradable waste) or CReMA 13B (from non-biodegradable waste) if laws or programs (public or private) governing these activities mention resource management as their single main objective,
- may be recorded as RM and therefore be classified under the CReMA activities if it can be demonstrated that the value of the recovered thermal energy (either sold or for own use) covers more than 90% of the costs of waste incineration on a multiannual average,
- is to be recorded under CEPA 3 in all other cases.

Similarly, as an operational rule, the production of biogas and biofuels from waste

- should be recorded as RM and therefore be classified under CReMA 13A if laws or programs (public or private) governing these activities mention resource management as their single main objective or if the waste only complements other forms of biomass (manure, maize, etc.) in the production of biogas,
- may be recorded as RM and therefore be classified under CReMA 13A if it can be demonstrated that the value of the biogas or biofuels (either sold or for own use) covers more than 90% of the costs of these activities on a multiannual average.
- are to be recorded under CEPA 3 in all other cases.

An exception to the above rules applies when existing data and modelling approaches do not allow separating out these activities from data on waste collection and treatment activities. In such cases the recovery of raw materials, composting and the production of biogas, biofuels and other forms of energy from waste are to be included in CEPA 3 (even if the above conditions for recording them under RM hold). If, for example, material recovery is performed by a unit classified under NACE 38.2 (waste treatment and disposal) it may not be possible to separate out the output value of materials recovery.

Likewise, when existing data and modelling approaches do not allow separating out these activities from data on resource management, these activities are to be recorded under RM (even if the above conditions for recording them under RM do not hold). If, for example, the production of biogas from waste is performed by a unit classified under NACE 35.21 (manufacture of gas) it may not be possible to separate out the output value of biogas produced from waste.

In EGSS accounts also the production of specific equipment used for these activities and their installation are recorded. In principle the allocation of this equipment and installation works to CEPA and CReMA activities should follow the allocation of the underlying EP and RM activities using them. If due to data limitations this principal rule cannot be followed, the following operational rules are recommended:

- Special equipment and installation for waste incineration (including parts that serve the recuperation of energy) fall under CEPA 3.
- Special equipment and installation for composting fall under CEPA 3.
- Special equipment and installation for producing biogas and biofuels fall under CReMA 13A.

CEPA 5 / CREMA 13B

Noise abatement versus heat/energy saving

Some activities can serve both, noise abatement and heat and energy saving. Such activities are, for example, insulation works for buildings and the production and installation of triple glazed windows. Only if noise abatement is the main purpose these activities should be recorded under CEPA 5.

As an operational rule these activities are classified in CEPA 5 only if the environmental laws or environmental programs (public or private) governing these activities mention noise abatement as their single main objective. In all other cases they should be recorded as RM classified under the CReMA 13B; this may also include cases where existing statistical sources do not allow separating out the CEPA 5 related measures from insulation works.

Annex 7: Using cost information for electricity from renewable sources

A) PRICE RATIOS BETWEEN ELECTRICITY FROM RENEWABLE AND NON-RENEWABLE SOURCES

Estimates of price ratios between electricity from renewable and non-renewable sources (f-ratios) can be used when output of electricity from renewable sources is estimated with a top-down approach combining figures on total electricity generation with shares of electricity from renewable sources. This annex explains the approach used in the Eurostat calculations for Germany to estimate f.

Those calculations derived estimates of the price ratio between electricity from renewable and non-renewable sources (f) from information on production costs. Data on the costs of electricity production by type of technology have been collected for 21 countries and 190 power plants (International Energy Agency; Nuclear Energy Agency, 2010).⁽⁸⁵⁾ A wide variety of different kinds of power stations are covered: nuclear, coal fired, gas-fired power, on- and off-shore wind, hydro, solar, geothermal and biomass. Levelised costs of electricity (LCOE) 'equal to the present value of the sum of discounted costs divided by total production adjusted for its economic time value' and are regarded as indicators for the electricity prices that would equalise the two discounted cash-flows. The cost calculations cover investments costs, operating and maintenance, fuel, carbon and decommission costs in a static world. 'Levelised' means that some assumptions were made in order to render the cost data comparable, for example load factors are 'at the upper limit of what is technically feasible'. Some costs were not taken into account. The impact of a power plant on the electricity system and grid as a whole is disregarded, which means that back-up costs for variable energy supplies such as wind and solar are not included. Also the costs of activities to capture and store carbon in power stations and any externalities of electricity generation are not included. Based on the IEA/NEA data relative electricity productions costs by type of technology can be compiled for the EU:

Ratios 'LCOE from renewable sources: LCOE from non-renewable sources (nuclear, coal-fired, gas-fired)' (at 5% discount rate)

Hydro	1.0
Wind	1.6
Solar	4.6
Geothermal	2.1
Solid biomass and biogas	1.4
Wave	2.1

Source: own calculations based on IEA/NEA (2010)

The cost ratios for the different renewable electricity types are weighted with the production quantities from Eurostat's energy statistics to estimate the f-ratios:

f-ratios, Germany

2007	2008	2009	2010	2011
150.8	156.8	167.7	188.6	208.0

In the Eurostat calculations for Germany the strong increase in the price ratio f over time is mainly caused by the growing share of the relatively expensive solar energy in the total electricity from renewable sources.

⁽⁸⁵⁾ Information on electricity generation costs can as well be found in national sources (e.g. Department of Energy & Climate Change, 2013)

B) MARK-UP FACTORS FOR WAGE TO OUTPUT RATIOS

For the test calculations for Germany, mark-up factors for wage to output ratios were calculated to reflect that operating and maintenance costs (O&M) for electricity production from renewable sources differ from those from non-renewable sources. Based on the IEA/NEA data indicators of the share of O&M in LCOE by type of production technology can be compiled:

Ratios "O&M : LCOE" (at 5% discount rate)

Non-renewable (nuclear, gas, coal)	0.165
Hydro	0.165
Wind	0.176
Solar	0.276
Geothermal	0.161
Solid biomass and biogas	0.115
Wave	0.217

Source: own calculations based on IEA/NEA (2010)

Weighted by the physical energy production (from Eurostat's energy statistics) average 'O&M : LCOE' ratios for electricity from renewable sources can be derived.

Ratios 'O&M : LCOE' (at 5% discount rate) for electricity from renewable sources, Germany

2007	2008	2009	2010	2011
0.176	0.178	0.182	0.188	0.194

Using the spread of the 'O&M : LCOE' ratios for renewable and non-renewable sources a spread for the 'wage : output'-ratios can be derived.

Ratios 'wage: output' for electricity production, Germany

	2007	2008	2009	2010	2011
National accounts D	0.136	0.128	0.13	0.121	0.125
Electricity from renewable sources	0.144	0.137	0.141	0.136	0.143
Electricity from non-renewable sources	0.134	0.127	0.128	0.119	0.121

The ratios can then be used to calculate mark-up factors to be applied to the NACE D 'wage : output'-ratios.

Mark-up factors for employment for electricity from renewable source, Germany

2007	2008	2009	2010	2011
1.06	1.07	1.087	1.123	1.146

The mark-up factor for 2011 of 1.146 means that the estimated share of wages in output for electricity from renewable sources is 14.6% higher than for the average of NACE D. Applying this mark-up increase the employment estimate for the production of electricity from renewable energies by 14.6%.

Annex 8: Data sources used

A) EUROSTAT DATA COLLECTIONS

Collection name	Acronym
National Accounts aggregates by industry (up to NACE A*64)	nama_10_a64
Annual National Accounts by 64 branches at current prices	nama_nace64_c
National Accounts employment data by industry (up to NACE A*64)	nama_10_a64_e
National Accounts by 64 branches - employment data	nama_nace64_e
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Environmental goods and services sector accounts

PRACTICAL GUIDE

The environmental goods and services sector (EGSS), sometimes called 'eco-industries' or 'environmental industry', comprises all entities in their capacity as environmental producers, i.e., undertaking the economic activities that result in products for environmental protection and resource management. The environmental goods and services sector accounts is one of the European environmental-economic accounts and it is the ideal framework to collect data on value added and employment for the environmental sector. This practical guide proposes compilation methods for the EGSS accounts using existing data sources, most of them EU-wide sources. In addition, this guide documents methods that Eurostat has been using to produce estimates for a number of years. This guide is meant to be a companion of the Eurostat EGSS handbook, 2016 edition.

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