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Background document

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A Practical Guide for the Compilation of Environmental Goods and Services (EGSS) Accounts

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Preface

Reference points to elaborate practical concepts for compiling Environmental Goods and Services Sector (EGSS) accounts are the definitions of scope, statistical classifications and the categories of products and producers referred to in the SEEA 2012 (European Commission, FAO, IMF, OECD, UN, World Bank, 2012) and in Eurostat's data collection handbook for EGSS (Eurostat, 2009).

The purpose of this "practical guide" is to

- provide an overview of the concepts, definitions and terminology, and to
- present methods towards compiling EGSS statistics using already existing data sources.

The guide provides methods to comply with annex V of the amended Regulation (EU) No 691/2011 on European environmental economic accounts. The Regulation requires that EGSS accounts record and present data on national economy production activities that generate environmental products in a way that is compatible with the data reported under ESA. EGSS accounts should make use of the already existing information from the national accounts, structural business statistics, business register and other sources. The solutions in this practical guide are oriented around already existing statistics and their use for compiling EGSS accounts. The guide offers simple approaches to compiling EGSS accounts as well as refinement methods

In chapter 2 a short overview of the concepts, definitions and classifications used in EGSS accounts is provided. The guide also offers simplifications of concepts and terms used in Eurostat's 2009 EGSS handbook. These simplifications are second-best solutions to implementing the international framework SEEA 2012 and as such are non-perfect alignments to international standards. They are summarised in annex C of this guide.

Chapter 3 proposes an integrative approach towards compiling EGSS data. It gives an overview of categories of data sources available for EGSS accounts from the supply and demand side focusing on already existing sources, discusses problems related to classifications and operational rules for data compilation and presents an data map that supports EGSS compilers to carefully integrate the various sources to reach a sufficient coverage of the EGSS while avoiding overlaps and double-counting as far as possible.

The test calculations presented in chapter 4 (output), 5 (employment) and 6 (gross value added) have been compiled by Eurostat through an integration of data mostly available in Eurostat's database (environmental protection expenditure, national accounts, structural business statistics, energy statistics and other). This stands as a minimum standard in EGSS compilation. The practical guide does not propose to Member States to use exactly the data from this database; Member States should, of course, use the data from their own databases, in particular if they provide more detailed or additional information. However, if EGSS accounts can be compiled with data in Eurostat's database and other freely accessible information, Member States should at least be able to achieve the same standard in EGSS compilation.

The approach has been tested for all EU countries (except for Croatia). Where EU28 results are shown, they are an aggregate of 27 Member States using a grossing-up factor based on Croatia's GDP share. The numerical examples reflect the status of compilation as of 22 December 2014.

The practical guide emerged from a peer review process and integrates comments from the members of the Working Group on Environmental Expenditure Statistics. Eurostat thanks all who have contributed with their much valued advice and encouragement. As development of monetary environmental accounts is on-going this practical guide is undergoing revisions. In particular the test calculation described in chapters 4 to 6 were improved during 2014. This revised version of the practical guide includes these improvements and the results shown reflect those available as of January 2015.

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LIST OF ABBREVIATIONS

CEPA	Classification of Environmental Protection Activities
CN	Combined Nomenclature
COFOG	Classification of the Functions of Government
CPA	Classification of Products by Activity
CreMA	Classification of Resource Management Activities
EAA	Economic Accounts for Agriculture
EGSS	Environmental Goods and Services Sector
EP	environmental protection
EPEA	Environmental Protection Expenditure Accounts
ESA	European System of National and Regional Account
EU	European Union
EUR	Euro
FAO	Food and Agriculture Organization of the United Nations
FTE	full-time equivalent
GDP	gross domestic product
GJ	gigajoule
GVA	gross value added
HS	Harmonized System
IEA	International Energy Agency
IMF	International Monetary Fund
JQ-EPER	Joint Eurostat/OECD Questionnaire on Environmental Protection Expenditure and Revenues
LCOE	levelised costs of electricity
NA	National Accounts
NSI	national statistical institute
MW	megawatt
NACE	Classification of Economic Activities in the European Community
NEA	Nuclear Energy Agency
OECD	Organisation for Economic Co-operation and Development
PRODCOM	Statistics on the Production in Manufactured Goods
O&M	operating and maintenance costs
R&D	research and development
ReMEA	Resource Management Expenditure Accounts
RM	resource management
SBS	Structural Business Statistics
SEEA	System of Environmental-Economic Accounting
SNA	System of National Accounts
TJ	terajoule
UN	United Nations

1. INTRODUCTION

1.1. Demand for data on the environmental goods and service sector

There has been increasing demand for statistical data describing the environmental situation and the impact of human activity on natural resources.

This demand is best satisfied by a system of physical flow and stock data that describe the pollution of the environment through environmentally harmful substances released by the productive and consumptive activities of humans (e.g. air emission accounts) and the use and depletion of natural resources (e.g. material balances).

Another demand for statistical data related to environmental protection and resource management is how economic actors (including governments and final consumers) react on pressures that arise from environmental and natural resource constraints. What is their level of spending that is caused by the needs to protect the environment and the natural resources; and how much of the economies' production factors are engaged in producing goods and services that are used in environmental protection activities and resource management domestically or abroad? Does the internalisation of environmental concerns in economic decisions impede economic growth or does it stimulate economic development through higher investment, more jobs, higher incomes and better quality of life? What is the role of environmental and resource management considerations in the creation of technical progress and for the global technology transfer?

In assessing the contribution of EGSS to the total economy and its employment potential, still a lack of systematic collection of data on the development of eco-industries is observed and there is a need for a less fragmented and more complete database that allows calculating EU aggregates. To monitor perspectives and barriers to growth long and coherent time series on EGSS in the EU are needed.

The environmental goods and services sector (EGSS) module of the European Statistical System aims to collect data on the output, employment, exports and value added generated in the production of goods and services that are used to measure, prevent, limit, minimise and correct environmental damage and manage natural resources in a sustainable way. The data can be used for example to analyse the relationships between environmental policies and economic development. In the EU the economic opportunities related to environmental protection and resource management have moved into the centre of interest.

As part of the Central Framework of the System of Environmental-Economic Accounting (SEEA 2012)[1] the EGSS module is broadly compatible with the System of National Accounts (SNA 2008)[2] and its European version, the European System of Account (ESA 2010)[3]. The EGSS module has similar system boundaries and

[1] European Commission, FAO, IMF, OECD, UN, World Bank, 2012

[2] European Commission, IMF, OECD, UN, World Bank, 2008

[3] Eurostat, 2013e

consists of all environmental goods and services produced within these system boundaries[4].

The environmental goods and services sector is also called 'eco-industries' or 'environmental industry'. The 'Employment Package' launched in April 2012 identified the "green economy" as a key source of job creation in Europe.[5] The EGSS domain of the European Statistical System is the ideal framework to collect data on employment that directly depends on the production of outputs intended to protect the environment and to manage natural resources. Due to its compatibility with the boundaries and definitions used in the national accounts the EGSS database is an indispensable input to microeconomic and macroeconomic analysis of the green economy, environmental and resource policy analysis and the monitoring of policy targets. For most of the countries the EGSS is important for analysing issues related to green growth and green employment. The main demands for EGSS data come from various Commission Directorates General and international organisations, national governments (e.g. ministries of environment, finance and economy), but also from business associations, workers' unions, environmental protection agencies, non-profit organisations and the research community.

1.2. The EU's legal base for data collection

Annex V of the amended Regulation (EU) No. 691/2011 on European environmental economic accounts sets up the obligatory transmission of data from Member States to Eurostat for the EGSS accounts. The data are to be compatible with the data reported under ESA.

Environmental goods and services according to the Regulation fall within the following categories: environmental specific services, environmental sole purpose products (connected products), adapted goods and environmental technologies. Member States shall produce EGSS accounts on the following characteristics: market output, of which exports, value added of market activities and employment of market activities. The statistics will have to be compiled and transmitted on a yearly basis within 24 months of the end of the reference year 2015.

In order to meet user needs for complete and timely datasets on the EGSS, the Commission (Eurostat) shall produce, as soon as sufficient country data becomes available, estimates for the EU-28 totals for the main aggregates of this module. The Commission (Eurostat) shall also, wherever possible, produce and publish estimates for data that have not been transmitted by Member States.

Whereas the obligatory data transmission for the Regulation covers market activities only Eurostat will continue to collect additional data from the Member States on a voluntary basis needed to compile EU-28 economy-wide output and employment data for the EGSS, which will have to cover also the non-market and ancillary environmental activities. Furthermore the voluntary data collection foresees a more detailed breakdown: 39 NACE activities or groups of NACE activities.

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4 The scope of output is in the EGSS statistics larger than in ESA by also including the output from ancillary activities.

5 This Employment package is a set of policy documents looking into how EU employment policies intersect with a number of other policy areas in support of smart, sustainable and inclusive growth (European Commission, 2012).

2. SCOPE, DEFINITIONS AND CLASSIFICATIONS USED

Definitions of scope, statistical classifications and the categories of products and producers referred to in the SEEA 2012 and in Eurostat's data collection handbook for EGSS (Eurostat, 2009) are reference points to elaborate practical concepts for compiling EGSS statistics.

2.1. Scope of the environmental goods and services sector

Eurostat's data collection handbook for EGSS (hereafter referred to as the '2009 EGSS handbook') describes the scope of EGSS as a heterogeneous set of producers of technologies, goods, and services that measure, control, restore, prevent, treat, minimize, research and sensitise environmental damages to air, water and soil, problems related to waste, noise, biodiversity and landscapes and resource depletion. Analogously, the SEEA 2012 describes the EGSS as consisting of producers of all goods and services produced, designed and manufactured for purposes of environmental protection and resource management.

Regulation No. 691/2011 describes the 'environmental goods and services sector' as the production activities of a national economy that generate environmental products. Environmental products are products that have been produced for the purpose of environmental protection and resource management. It also defines 'environmental protection' and 'resource management':

- Environmental protection (EP) includes 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. Those activities and actions include all measures taken in order to restore the environment after it has been degraded. Activities which, while beneficial to the environment, primarily satisfy the technical needs or the internal requirements for hygiene or safety and security of an enterprise or other institution are excluded from this definition.
- Resource management (RM) includes the preservation, maintenance and enhancement of the stock of natural resources and therefore the safeguarding of those resources against depletion.

These definitions make it necessary to clarify more precisely what is considered as an environmental good or service. According to the 2009 EGSS handbook the delimitation between environmental and non-environmental goods and services would be based on the 'main purpose' criterion:

- The first and most important criterion for a product to be an environmental good or service is that its 'main purpose' (the terms 'prime objective' or 'primary purpose' or 'end purpose' are used with the same meaning) is environmental protection or resource management, whereby the main purpose is mainly determined by the technical nature of the product (2009 EGSS handbook, p. 29-31).

- The producer's intention should be the criterion for handling boundary cases. Producers' intention means awareness of the producer about the environment-friendly characteristic, awareness of the producer about the use of the product and awareness of the producer about the environment-related markets to which the output is addressed (2009 EGSS handbook, p. 32). In practice, in particular

the case of EGSS surveys, the intention of the producer may be the main criterion for identifying environmental goods and services.

Depending on the sources used for the compilation of EGSS statistics it may be rather difficult to strictly adhere to the technical nature and producer intention criteria, for example when EP and RM expenditure data (e.g. gross fixed capital formation for the production of EP services and for RM activities) are used to compile EGSS accounts. To translate the environmental expenditure concepts into the concepts of EGSS a bridge table would be necessary that details out differences in coverage and valuation[6]. If not all information is available for this bridge table - to the extent that data on EGSS are compiled from such demand-side information – the compiled EGSS data may include some goods and services that are not environmental products but which are used for EP and RM activities[7]. This is a deviation from the 2009 EGSS handbook and it is proposed by this practical guide only in order to simplify the use of EP and RM expenditure statistics in the compilation of EGSS statistics. This simplification and other scope issues relevant for simplifying EGSS compilation are summarised in annex C (review issue no. 2), which details out potential issues for revising the EGSS handbook.

2.2. Environmental and economic activities classifications

For the characteristics referred to in Regulation No. 691, data shall be reported cross-classified the Classification of Economic Activities in the European Community (NACE Rev. 2) and groups of classes based on the Classification of Environmental Protection Activities (CEPA) and the Classification of Resource Management Activities (CReMA).

The CEPA[8] is a generic, multi-purpose, functional classification for environmental protection. It is used for classifying environmental protection activities but also products, expenditure and other transactions. 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). For the data transmission foreseen to be obligatory in the framework of the Future Regulation No. 691 CEPA 7, 8 and 9 will have to be reported as one aggregate (on a voluntary basis these 3 classes may be also transmitted separately to Eurostat).

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6 The coverage and valuation differences between the Environmental Protection Expenditure Accounts (EPEA) and the EGSS statistics are detailed out in the SEAA 2012 (Table 4.3.6, p. 106).

7 Environmental expenditure data cover besides expenditure on environmental goods and services also expenditure on other goods and services for environmental protection purposes.

8 A detailed description of the CEPA classification including examples of environmental protection activities is available in the SEEA 2012, in the 2009 EGSS handbook and on Eurostat's metadata server.

For the breakdown of RM activities a separate classification is used. The CReMA[9] 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). For the data transmission foreseen to be obligatory in the framework of the Future Regulation No. 691 CReMA 12, 15 and 16 will have to be reported as one aggregate (on a voluntary basis these 3 classes may be also transmitted separately to Eurostat).

The Future Regulation requires that also the CReMA sub-classes 13A (Production of energy from renewable sources), 13B (Heat/Energy saving and management) and 13C (Minimisation of the intake of fossil resources as raw material) are to be reported separately, whereas the sub-classes 11A (Management of forest areas) and 11B (Minimisation of the intake of forest resources) may be separately reported to Eurostat on a voluntary basis.

Both classifications, CEPA and CReMA, are supposed to be mutually exclusive so that all production in EGSS should fit into one and just one of the classes.

Box 1: Classification 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 activities for resource management
16	Other resource management activities

[9] A detailed description of the CReMA classification including examples of resource management activities is available in the 2009 EGSS handbook.

The NACE Rev. 2[10] is a classification of economic activities that is used to classify producers according to the similarity of processes, technologies and characteristics of the produced goods and services. The classification of producer units is based on the share in value added of each activity of a producer to identify the relevant NACE class of the producer which is the activity representing the largest share.

Obligatory reproting in the framework of Regulation No. 691 requires reporting by the A*21 aggregation level of NACE REV. 2 as set out in ESA. On a voluntary basis data may be transmitted to Eurostat with a more detailed NACE breakdown: 39 NACE activities or groups of NACE activities have been distinguished in the EGSS data collection questionnaire 2013.

Problems related to classifications and their use in the EGSS accounts are dealt with in section 3.4 of this guide.

2.3. Categories of environmental products

In the 2009 EGSS handbook the following categories of environmental products may are distinguished*:* environmental specific (or "characteristic") products, connected (or environmental "sole–purpose") products, adapted (or "cleaner and resource-efficient") products, end-of-pipe technologies, integrated (or "cleaner and resource-efficient") technologies.

Annex C of *this practical guide proposes to review some of the definitions of these categories (see annex C revision items 3):*

- The 2009 handbook defines environmental specific services as consisting of EP and RM 'characteristic' (or typical) activities. It is to be reviewed whether the category of characteristic products should be extended also to goods such as energy from renewable sources.
- Also the definition of adapted goods may be reviewed, i.e. whether also goods should be included that are cleaner when produced (e.g. goods made of alternative materials requiring in the production stage no or less hazardous surface treatment than conventional materials while the final good is providing the same utility to consumers).[11]
- The 2009 handbook defines adapted goods only; it should be reviewed whether there could also be some cleaner or resource efficient services (adapted services such as improved car-washing services that produce less effluent and run-off from vehicles while offering the same cleaning utility to the consumer).

[10] Regulation (EU) No. 1893/2006 establishing NACE Rev. 2 was adopted in December 2006. NACE Rev. 2 is to be used, in general, for statistics referring to economic activities performed from 1 January 2008 onwards.

[11] Note that the EPEA and the 2009 EGSS handbook define adapted goods for environmental protection in a more restricted way as products that are more environmentally friendly when used or scrapped (see also Annex A for problems related to the categorisation of environmental products). In practice, however, the 2009 EGSS handbook proposes to record organic farming goods under adapted goods in the environmental protection domain, although they are clearly not cleaner when used but when produced. An alternative categorisation would be to treat organic farm products as characteristic goods , i.e. goods produced by characteristics activities (organic farming).

The categorisation of environmental products is subject to delimitation problems, consistency problems in comparison to definitions used in the Environmental Protection Expenditure Accounts (EPEA) and poses identification challenges to compilers of statistics. An overview of the main problems related to the categorisation of environmental products is provided in annex A. In summary, these issues make the product categories less useful for EGSS accounts. *This practical guide recommends that these product categories need not to be identified separately for EGSS data compilation and reporting, if existing data available for the compilation of EGSS statistics do not allow their separate identification.* As some countries saw difficulties in terms of detailed reporting by environmental products the Regulation No. 691 does not require the data to be cross-classified by environmental product categories (Eurostat, 2012c).

In the framework of the voluntary data transmission Eurostat asks Member States to provide output, exports, value added and employment of market activities cross-classified by these product categories (in addition to cross classifications by environmental activity and economic activity), if the sources allow for this separate reporting.

Separate reporting of the product categories can improve the comparability of the results in particular with respect to the coverage of adapted goods which is not likely to be the same across the reporting Member States. The Eurostat minimum list of EGSS products guiding the 2013 data collection contains adapted goods in 9 two-digit CPA code categories, whereas the full list of EGSS products contains adapted goods in 17 two-digit CPA code categories.

Box 2: Categories of environmental products (definitions from 2009 EGSS handbook)

Environmental specific (or "characteristic") products: goods and services produced in principal, secondary or ancillary activities that are typical for EP and RM[12], e.g. waste and wastewater services, energy and water saving, organic farming, production of energy from renewable sources, management of pollution, repair of environmental damages, measurement, control, R&D, education, training.
Connected (or environmental "sole–purpose") products: goods or services directly serving an EP or RM purpose and having no other use than EP or RM, but not being output of characteristic EP and RM activities, e.g. catalytic converters, rubbish containers, septic tanks, installation of environmental technologies and products, components of resource management technologies. These products are often classified under broader categories than the environmental specific products, which can often be identified as specific categories of the economic activity and product classifications.
Adapted (or "cleaner and more resource-efficient") products: more environmental-friendly or less polluting products when used or scrapped than equivalent normal products which furnish a similar utility (e.g. mercury free batteries, vehicles with lower air emissions), or less resource depleting, more resource-efficient products when produced or used than equivalent normal products which furnish a similar utility (e.g. resource-efficient appliances).
End-of-pipe technologies: mainly technical installations and equipment for control, measurement, treatment, restoration of pollution, degradation and resource depletion, e.g. facilities for specific environmental services such as sewage and waste treatment facilities, filters, incinerators, equipment for the recovery of materials, for measuring air pollution, or resource depletion, containments of high-level radioactive filters.
Integrated (or "cleaner" and "resource efficient") technologies: technical processes, methods, knowledge used in less polluting and less resource intensive technology than the equivalent average technology used by national producers, e.g. facilities that allow the production of renewable energy such as wind and hydroelectric turbines, solar panels, combined heat and power, dry ovens in the cement industry, etc..

2.4. Categories of environmental producers

The EGSS consists of producers of environmental technologies, goods, and services. SEAA 2012 mentions that in order to identify the output of environmental protection and resource management activities it can be useful to distinguish between different types of producers: specialist producers (whose principal activity is the production of environmental goods and services), non-specialist producers and own account producers (see box 3 below).

[12] The principal activity of a producer unit is the activity where the value added of such activity exceeds that of any other activity carried out with same producer unit, whereas a secondary activity is carried out in addition to the principal activity. An ancillary activity is distinguished from the 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.

Box 3: Categories of environmental producers as defined by SEEA 2012

Specialist producers are producers that produce goods and services for EP and RM as principal activity. This category of producers may be split into the two following sub-categories: government specialist producers and specialist producers in the sector of Non-profit Institutions Serving Households (non-market producers) that provide the environmental products for free or at economically insignificant prices[13] to other units (e.g. administration and control for EP and RM, research on air pollution control or on biodiversity protection by a governmental research agency), and other specialist producers (market producers[14]) that provide the environmental products at economically significant prices to other units (e.g. a wastewater treatment company).
Non-specialist producers that produce products for environmental protection and resource management as secondary activity (e.g. a manufacturing company also producing and selling metallic catalytic converters for the cleaning of wastewater), or as ancillary activity[15] (e.g. a chemical manufacturing company treating its own waste, the production of renewable energy for own internal use); or
Own-account producers that produce products for environmental protection and resource management for own account only (own account production of capital goods for environmental protection and resource management not sold on the market but retained for investment).

Source: European Commission, FAO, IMF, OECD, UN, World Bank, 2012, pp. 92, 85

One advantage of this categorisation of producers is that specialist producers may be closely related to specific sections, division and classes of the NACE industry classification, which may help to identify environmental producers and production for environmental purposes.

It may be difficult, however, to identify all specialist producers which are not in 'specialist' NACE categories. The 2009 EGSS handbook does not distinguish EGSS producers by the categories listed in box 3. Also this practical guide does not consider specialist and non-specialist producers as useful categories for EGSS compilation. The practical approach to look rather at 'specialist' NACE categories is further outlined in chapter 3.2.2 of this guide[16]. An overview of the main problems related to the categorization of environmental producers is provided in Annex B.

[13] Economically insignificant prices are likely to be charged to raise some revenue or achieve some reduction in the excess demand that may occur when services are provided completely free. Economically significant prices are sufficiently high to provide incentives to producers to adjust supply in order to make profits in the long run or at least to cover their capital and other costs. See also ESA 2010, paragraphs 3.19.

[14] The delimitation between market and non-market producers is checked through a quantitative criterion that is conceptually linked with the notion of economically significant prices. A market producer unit shall cover at least 50% of production costs by sales over a sustained multi-year period. For details on this criterion and the concepts of sales and production costs see ESA 2010, paragraphs 3.19 and 3.33.

[15] An ancillary activity results in the production for own use other than for investment.

[16] To limit the concept of 'specialist' to NACE categories is recommended if no use is made of detailed enterprise databases. However, when such micro databases can be used for EGSS

Regulation No. 691 does not oblige to report data separately for the various categories of producers of environmental goods and services.

2.5. Variables

The variables of the EGSS module are output[17], value added, employment and exports related to the production of environmental goods and services. The SEEA 2012 (p. 92) recommends to focus on environmental goods and services, "wherever they occur in the economy"; this includes market production, production for own final use, non-market production and ancillary production.

With EGSS statistics being a part of environmental accounting and environmental accounts being satellite accounts to the core national account the definitions and scope of the EGSS variables are broadly consistent with those commonly used in the national accounts. Since EGSS data are to meet specific needs the definitions and scope of output deviate from the central national accounts concepts in some aspects. Important conceptual differences between EGSS and the national accounts are explained in Annex C.

Regulation No. 691 requires Member States to transmit to Eurostat the EGSS output, of which exports, value added and employment data only for the market activities. The transmission to Eurostat of EGSS output, value added and employment data for other activities than market is voluntary. Nevertheless, this guide proposes the additional (voluntary) production and transmission of EGSS data for non-market and ancillary activities in order to represent the total EGGS and to ensure a better comparability of the results across countries.

In the ESA 2010, output (P.1) consists of market output (P.11), output produced for own final use (P.12) and non-market output (P.13)[18]. The 2009 EGSS handbook also distinguishes between market output and non-market output, whereby the distinction between non-market and market is made according to the same basic principle as applied in the national accounts. Ancillary activities of a producer unit comprise the in-house production of services that are consumed within the unit to make the operation of the business possible and to achieve the company's objectives (e.g. bookkeeping and internal market research). The definition of EGSS ancillary output is similar: it is all services and goods produced and consumed in the same unit that make the business environmentally more friendly and more resource efficient. Such ancillary EGSS output is part of EGSS output measure.

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statistics the distinction between specialist and non-specialist producers may remain useful, since specialist producers may be found in many different NACE categories.

[17] The 2009 EGSS handbook proposes "turnover" as a useful concept to measure the size of EGSS (p. 124). Turnover covers market sales only, whereas output according to the national accounts definition also covers output produced for own final use, goods entering in the inventories and non-market output. The EGSS module should use the output definition of the national accounts supplemented by the inclusion of output from ancillary environmental activities. It is recommended that turnover data are adjusted to the output concept where this is relevant and sources (e.g. detailed national accounts data, SBS data) allow for this.

[18] The ESA 2010 uses the same definitions as its predecessor version ESA 1995, however the terminology has changed somewhat: in ESA 1995 output produced for own final use (P.12) and "other non-market output" (P.13) together formed the "non-market output" category.

The ESA definition of employment covers all persons engaged in productive activity that falls within the production boundary of the national accounts (employees and self-employed persons). EGSS employment may be defined as 'employment' for the production of EGSS output (2009 EGSS handbook, pp. 132-135). In case that a unit's output of EGSS is not 100% of its total output EGSS employment may be approximated by the share of the unit's EGSS output in total output. Regulation No. 691 foresees that for the characteristic 'employment' the reporting unit should be full-time equivalent (FTE).

EGSS employment also covers employment linked to ancillary EGSS activities. However, it is to be noted that the inclusion of employment due to ancillary EGSS activities may result in some double counting if the ancillary EGSS activities serves principal or secondary activities that produce environmental goods and services and if the two types of employment are measured independently through different sources. In theory, only ancillary EGSS employment for the production of non-EGSS output should be separately taken into account in order to avoid any such double counting. In practice, however, this distinction may be difficult to implement fully in surveys and other approaches to estimate the EGSS employment. Therefore, for simplicity, it may be assumed that all ancillary EGSS activities of specialist NACEs (e.g. wastewater and waste management) serve exclusively to make their EGSS production environmentally more friendly and resource efficient, whereas all ancillary EGSS activities in other NACEs (e.g. manufacturing) serve primarily to make their non-EGSS production environmentally more friendly and resource efficient. In the first case (the specialist NACEs) any EGSS employment measure derived from standard statistics should already include employment linked to EGSS ancillary activities and no separate estimate would be needed. In the second case (the other NACEs) a separate estimate of the employment linked to ancillary EGSS activities has to be added to the overall EGSS employment measure.

Any indirect employment due to the production of intermediary non-EGSS products used in the production of EGSS products should remain excluded from the EGSS employment variable. Also excluded from EGSS employment is any employment induced by the demand for non-EGSS products due to the income generated in the production of EGSS products.

3. An Integrative approach towards Compiling Environmental Goods and Services Sector statistics

3.1. Overview

To identify the best method or combination of methods for the collection and compilation of EGSS statistics, OECD and Eurostat suggested that the methods be evaluated on a set of criteria taking into account the magnitude of business activities constituting the EGSS, the extent and level of detail of information needed for the analysis of the EGSS, the strengths and weaknesses of the methods in delivering information on specific economic variables and the relative costs in terms of resources, time needed and burden on survey respondents to collect the data (OECD, Eurostat, 1999, p. 17).

As far as data coverage and quality are concerned a comprehensive supply-side survey is seen as the best method to compile EGSS statistics data (OECD, Eurostat, 1999). Survey approaches are often considered to be the best method since existing classifications are not structured to differentiate EGSS output and employment from other output and employment in the same industries (see for example Workforce Information Council, Green Jobs Study Group, 2009). However, such EGSS surveys can be time- and resource- intensive. As an alternative to comprehensive EGSS surveys it is therefore proposed to combine already existing supply side sources, demand sides sources as well as physical output data to compile EGSS accounts (OECD, Eurostat, 1999 (p. 18-20).

This idea of compiling EGSS statistics from already existing sources through an integrative approach[19] is further pursued in this practical guide: when comprehensive supply-side surveys on EGSS are not feasible because of time or resource constraints, this practical guide recommends that an integrative approach is used, depending on already existing statistical information and information sources. In general, the compilation of EGSS statistics through an integrative approach should follow a progression from a minimum set of estimates based on statistical data regularly produced to more detailed and exhaustive estimates to include data from a wider range of sources (ministries, agencies and producers associations). The approach must balance the needs for detail and exhaustiveness of the estimates with timeliness of the statistical production and the resources available.

Since the population of EGSS producers goes across existing statistical classifications and relevant data for the integration approach may be found in various existing statistics, particular attention should be paid to reaching a sufficient coverage of the EGSS while avoiding overlaps and double-counting as far as possible. For this purpose the practical guide proposes a map of statistical data usable for the integrative EGSS compilation approach. The map has been tested by Eurostat mainly integrating data publicly available on Eurostat's website in order to compile EGSS variables. The national EGSS data compilers may flexibly adapt this data map

[19] An example of EGSS statistics compiled on the basis of existing statistics is from the Netherlands (van Rossum, 2012). Data sources used are from national accounts (including supply and use tables), employment registers, environmental statistics and environmental expenditure statistics, energy statistics, agricultural statistics, production statistics and education statistics. The use of existing statistics is motivated by the pressure to reduce the administrative burden for survey respondents.

to accommodate country specific and more detailed data available to them (some data usable for EGSS compilation may only be available in the national statistical systems and institutes). This should improve the quality of the data (accurateness, exhaustiveness, up-to-date figures, timeliness) while maintaining comparability with other countries. The methods proposed in this guide are therefore regarded as a means to achieve a minimum level of quality for EGSS data compilation. It should be understood that EGSS compilers in the national statistical institutes are able to reach a coverage and data quality well above this minimum level since they have easier access to more detailed data sources and expert information specific for their countries.

Furthermore, it is stressed that data integration and specific EGSS surveys are not approaches that exclude each other. To reduce the financial burden of statistical production as well as the burden to survey respondents and at the same time to maintain sufficient quality, detail and coverage of the data EGSS surveys may be combined with the data integration approach. For example, in some areas (e.g. production and installation of equipment for renewable energy production) producers may be surveyed only every two to five years and for the interim years survey data could be projected using data obtained by the integration approach. Thus an important aspect of the method proposed in this practical guide is that it provides benchmarking for long time series: when data are surveyed at a detailed level for one year it allows to measure to which extent the surveyed data deviate from the minimum level compiled using the practical guide method.

The remainder of chapter 3 is organised as follows:

- In section 3.2 the use of the various types of statistical sources usable for the compilation of EGSS data will be described.
- Given that the different classifications applied for these sources do not always well align with the classification of environmental activities to be used for EGSS statistics some proposals for conventions are presented in section 3.3.
- Section 3.4 describes the map of existing statistical sources usable for the integrative EGSS compilation approach.

Eurostat's test calculations based on this data map are described and shown in detail in chapters 4, 5 and 6. The first phase of model development covered EGSS output (see chapter 4) and EGSS employment (see chapter 5) only. In a second phase estimates of gross value added (see chapter 6) were also compiled. Estimates for exports of EGSS goods and services are also covered by the test calculations.

3.2. Data 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). Important demand side sources are environmental protection expenditure accounts and data on gross fixed capital formation from the NA. For some specific areas such as organic farming, renewable energy and energy savings the aforementioned sources may be combined

with sector statistics (e.g. agricultural and energy statistics), physical data, information from trade associations, business reports and engineering information.

3.2.1. EGSS surveys

Work by the OECD/Eurostat Informal Working Group on the Environment Industry suggested that supply-side surveys are indispensable to provide comprehensive information on the EGSS (OECD, Eurostat, 1999, p. 18). Surveys can also provide reliable information on public and private R&D.

Two routes can be followed when compiling EGSS variables using surveys:

- Supplementary questions can be added to existing surveys in order to collect the data. 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 minimises the cost for the statistical institutes. Furthermore, it is often easier to add an extra variable to an existing survey than to launch an entirely new survey. The main disadvantage is that the questionnaire is generally answered by people who are not specialists in the field 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 less priority is given to the EGSS part of the survey.
- By using specific EGSS surveys, it is possible to provide detailed information covering the most relevant economic variables (output, exports, employment and gross valued added) broken down by environmental activities and industries. Well designed and properly implemented specific surveys of environmental goods and services enterprises may deliver the largest amount of information and the most precise results. A specific survey related to goods and services for environmental protection has been developed in Germany (Kleine, 2012). Core surveyed data is EP and RM related goods manufactured in the surveyed enterprises and revenue from sales of these goods in the local units surveyed. The scope of the survey has been stepwise widened towards producers in the areas of renewable energy and energy-efficiency increasing appliances as well as towards EP and RM related construction and services. Queries on the business register in combination with information on produced goods from the production statistics are used to identify the enterprises to be surveyed. Another example of a specific survey is one for the United States (Bureau of Labor Statistics (BLS), 2013a). The survey asks respondents to provide information on the shares of environmental product in total production or turnover. This information can be combined with existing data to estimate the variables of the eco-industries[20]. A similar approach based on shares of environmental goods and services in the total output of an industry is also used by Statistik Austria (2012, p. 15-20).

[20] For the United States a green goods and services survey on 325 detailed industries identified the potential producers of green goods and services. Establishments responding to the survey are asked to provide a share of revenue for their green goods or services or a share of employment involved in the production of green goods or green services if they do not have revenue. These shares are applied to the establishment's total employment from the Quarterly Census of Employment and Wages to obtain its green employment.

EGSS surveys may present some inconveniences. Firstly, they more easily survey information on production and labour employed in market activities so that they may not cover all secondary and ancillary production. Secondly, survey results often include information relating to secondary, non-environmental activities. Even if it is possible to exclude secondary, non-EGSS output, it may be difficult to separate out employment and production costs according to whether these are connected to the environmental or the non-environmental output. Thirdly, specific surveys are generally time and resource intensive, both for respondents and national statistical institutes.

Practical approaches and methods for data collection using surveys of the environmental goods and services industries have been described in OECD, Eurostat (1999) (p. 21-24) and Eurostat (2009) (p. 145-150). This guide does not offer advice on survey design or the building-up of registers for EGSS.

3.2.2. Standard supply side sources

To the extent that EGSS statistics cannot be based on specific surveys or censuses standard supply side statistical sources such as SBS and industrial production statistics (often called 'PRODCOM-statistics') can be used.

European examples for the use of SBS and PRODCOM data for the identification and/or measurement of EGSS are presented in Baud & Wegscheider-Pichler (2011), van Rossum (2012) and Gehrke & Schasse (2013):

- SBS describe the economy through the observation of producer units engaged in an economic activity. Demographic data on the enterprises as well as input related variables (e.g. number of employees, personnel costs and gross fixed capital formation) and output related variables (e.g. output and valued added) are collected for all market activities at enterprise level. If the database on the EGSS population is constructed at the same level of entities, a straightforward connection of the variables of interest is possible through the corresponding unique identification number used in all existing registers. Certain adjustments of the data must, however, be made such as calculating the shares of EP and RM in the variables for the entire enterprise.
- Also PRODCOM-statistics are helpful to identify EGSS output. The purpose of PRODCOM is to describe the industrial production or sales broken down by commodities. PRODCOM covers mining and quarrying, manufacturing, electricity, gas and water supply, though some areas are not currently available. At the EU level PRODCOM headings are coded using an eight-digit numerical code. Lists of EGSS goods can be compared with the product lists in PRODCOM so that the production of specific EGSS goods can be identified. Some of the products in such a list may be considered as 100 per cent EGSS. However, the 8-digit codes may not be detailed enough to identify environmental goods. At national level the PRODCOM statistics are often available at a more detailed level (e.g. 10 digits) which makes it easier to identify EP and RM goods. Nevertheless, even with a more detailed product breakdown it will generally be necessary to estimate shares of EGSS for the individual PRODCOM codes identified as potentially covering EGSS products. Specific technical knowledge on the properties and potentials of the products but also on their uses may be necessary for this. The list based approach may be complemented by research in internet and

magazines, consultation of organizations of producers, information obtained on industrial fairs etc..

- Merging information from PRODCOM statistics and from specific EGSS surveys can help to identify the relevant PRODCOM codes if both databases use identical identification numbers for the producer units. Such an approach has been tested in a study for the German Federal Environmental Agency to review the list of potential environmental goods (Gehrke & Schasse, 2013). Also EGSS shares for the identified PRODCOM codes may thus be calculated.

For the United States product codes in an Economic Census have been examined which resulted in a list of green products. This list was combined with the identification of green construction and green appliances using standards (e.g. energy star) and supplemental information on alternative fuel vehicles, hybrid cars and organic farm products (Economics and Statistics Administration, 2010b).

External trade statistics can be used as a source for identifying the part of EGSS output that is exported. In external trade statistics there is generally no explicit information as to whether the product is part of EGSS. Since it is an extensive job to identify exports of EGSS products simplifying assumptions may have to be used if no direct data (e.g. exports from supply side surveys) are available. Fortunately, as classifications of goods are internationally comparable it will normally be possible to exploit EGSS product lists from other countries and Eurostat when building a country-specific list. List of EGSS products can be compared with the product lists in the external trade statistics to identify exports of specific EGSS products. Import data on EGSS products can also be useful to compile other EGSS variables: for example, if demand side data are used for the compilation of EGSS output some correction for imports and exports of EGSS products is needed to establish the balance between output and domestic use.

An important source for compiling EGSS statistics is national accounts (NA), in particular its production and generation of income accounts and supply tables. The definitions and boundaries used for the NA are mainly also used for environmental accounts. This relieves EGSS compilers from some of the burden that would otherwise result from adjusting the basic statistics to national accounting concepts. 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. 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.

In order to compile the EGSS variables using supply side sources, it is useful to consider three types of producers depending on their industrial classification:

- EGSS producers which are classified in specialist NACE categories that are characteristic for EP or RM services: In this case most of the output of the relevant NACE industries can be considered as EGSS output. The industries mainly concerned are sewerage (NACE E37), waste collection, treatment and disposal activities and materials recovery (NACE E38) and remediation activities and other waste management services (NACE E39). The EGSS variables can be derived from NA data broken down by industries and SBS data. Some output of these NACE categories that is produced as secondary activity not falling under environmental specific services may be singled out using data from supply tables[21].
- EGSS producers which are classified in NACE industries that are not characteristic for EP or RM but which can be identified as relatively homogenous subgroups within a specific NACE category: This covers, for example, producers of organic farm products within the agricultural industry (NACE A01) and producers of electricity from renewable sources within the industry electric power generation, transmission and distribution (NACE D35.1). Their EGSS output may also be identified using NA data broken down by industries. However, the data for the relevant industries that cover such producers must be combined with data that allow deriving the EGSS shares within these industries. Such shares may be estimated using physical and monetary data on the production or by quantity times price calculations. For example, from Eurostat's agricultural statistics it is possible to calculate the share of land use for organic farming in total utilised agricultural area, which is considered a useful indicator to split agricultural output into output from organic farming and from conventional farming. Another example is Eurostat's energy statistics which contains data on electricity production broken down by energy sources, which allows identifying the share of electricity generation from renewable sources.
- EGSS producers which are neither classified in specific industries nor can be identified as relatively homogenous subgroups within specific NACE categories: This covers, for example, manufacturing and construction enterprises also engaged in the supply and installation of environmental technologies or in eco-construction. For these establishments the consultation of further supply side sources may be possible such as business registers, SBS, PRODCOM and information from trade associations and specialised business association to estimate their shares of EGSS. 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.

3.3. Demand side sources

In a couple of inter-related studies at EU-level estimates of the size of the eco-industries are based on operating and capital expenditure on environmental protection (ECOTEC Research & Consulting Limited, 1999, Ernst & Young Environment and Sustainability Services, 2006, GHK Consulting, 2007, ECORYS Research and Consulting, 2009, ECORYS, 2012). Environmental protection

[21] For example, when using the supply tables for the test calculations of the practical approach (see chapter 4) it was found that according the industry category NACE E37-39 may have some output outside the product category CPA E37-39. This was for example the case in the Dutch supply tables.

expenditure data come from statistical sources provided by ministries, national statistical institutes and Eurostat.

The use of demand side data is particularly relevant for including producers which are not classified in specific NACE industries characteristic for EP or RM. For example, investments for waste management or for the generation of electricity from renewable sources consist of EP and RM capital goods and services produced by the manufacturing industries, by construction companies or by engineering services. Data on investments are available in Eurostat's statistics on environmental protection expenditure and from national accounts data on gross fixed capital formation cross classified by types of asset and investing industries. Statistics on EP expenditure can also be used to estimate ancillary EGSS output if they identify the in-house expenditure for EP separately. The demand-side approach can help to provide and improve data on the EGSS. By using demand-side information, it is possible to estimate output for broad parts of the EGSS. Data on expenditures for pollution abatement and control can be adjusted by applying engineering estimates of typical cost structures, e.g. by estimating the share of construction and installation in total environmental investment expenditure to extract information on the environmental goods and services industry.

The use of demand side data poses, however, conceptual and practical problems:

- Demand side data generally include expenditure on imported products but they exclude exports, whereas EGSS output should include exported products but exclude imports. Therefore corrections for exports and imports should be made when EGSS is estimated from the demand side.
- Data on environmental expenditure (e.g. investment for environmental purposes) are mostly only available from the perspective of the user. In order to use these data for the compilation of EGSS output the environmental expenditure figures must be allocated to those industries that produce the environmental products on which this expenditure is made. For example, Eurostat's environmental protection expenditure statistics allow identifying investments made by producers for environmental protection purpose but it does not provide information on the industries supplying the capital goods and services used for the investments.
- Data on environmental expenditure can cover also expenditure on goods and services that are not environmental products but which are used for environmental purposes[22].
- The valuation principles for the demand side normally differ from those for the supply side. Expenditure valued at purchasers' prices must be converted to basic prices for the estimation of the EGSS output.

For the above reasons some modelling is necessary to use environmental expenditure data for the compilation of EGSS statistics. To translate the environmental expenditure concepts into the concepts of EGSS a bridge table would be necessary that details out differences in coverage and valuation[23]. If not all information is

[22] Environmental expenditure data cover besides expenditure on environmental goods and services also expenditure on other goods and services used for environmental protection purposes.

[23] The coverage and valuation differences between the Environmental Protection Expenditure Accounts (EPEA) and the EGSS statistics are shown in the SEAA 2012 (Table 4.3.6, p. 106).

available for this bridge table - to the extent that data on EGSS are compiled from demand-side information – the compiled EGSS data may include some goods and services that are not environmental products but which are used for environmental purposes[24]. This is a deviation from the 2009 EGSS handbook and it is proposed by this practical guide only in order to simplify the use of environmental protection expenditure statistics in the compilation of EGSS statistics (see also annex C, revision item 2a).

3.4. Problems and conventions related to classifications

Classifications used in the EGSS module or relevant in the main sources on the basis of which parts of the EGSS statistics can be compiled are: Classification of Environmental Protection Activities (CEPA) and the Classification of Resource Management Activities (CReMA), Classification of Economic Activities in the European Community (NACE Rev. 2), Classification of the Functions of Government (COFOG 1999), the product classifications Harmonized System (HS), Combined Nomenclature (CN), Statistical Classification of Products by Activity (CPA) and the classification used for PRODCOM. A more detailed overview of these classifications and their relevance for EP and RM is available in a Eurostat document (Eurostat, 2012b), which also mentions further relevant classifications[25].

The different classifications applied for the sources usable for EGSS compilation do not always well align with the classifications of environmental activities to be used for EGSS statistics.

Delimitation problems in CEPA and CReMA

It is often difficult to assign every EP activity to one and only one of the CEPA categories (Rørmose Jensen & Månsson, 2012); for example, measures to reduce fertiliser use may primarily fall under CEPA 4 (which covers the protection of groundwater), CEPA 2 (which covers the prevention of runoff to protect surface waters) or CEPA 6 (which covers the prevention of nutrient enrichment to protect biotopes) depending on the primary purpose of measures and policies.

A sub-group within the Eurostat task forces on environmental transfers and on the RM expenditure account has been created to review the environmental activity and expenditure classifications. The subgroup has identified potential delimitation difficulties between the EP and RM activities since activities may serve multiple purposes (Eurostat, 2012a). Areas where it can be difficult to distinguish between EP and RM are, for example, the production of renewable energy, the incineration of waste, material recovery and certain activities that may fall under the heading of protection of biodiversity, forest management or management of wild flora and

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[24] Environmental expenditure data cover besides expenditure on environmental goods and services also expenditure on other goods and services for environmental protection purposes.

[25] Other relevant classifications are: a) the International Standard Classification of Occupations (ISCO) classifying jobs according to tasks and duties with some categories of "environmental" identifiable at the 4-digits level, b) the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS) classifying government R&D funding by objectives with an entire group of R&D dedicated to the environment. Concerning resource management R&D, some other chapters of the NABS can be relevant.

fauna, research and development activities for environmental protection or for resource management. Pragmatic solutions are offered later in this practical guide.

A problem of the primary purpose criterion used for the classifications is that it may not be stable over time and create a degree of subjectivity and incomparability across countries. To ensure more stability over time and better comparability across countries it has been suggested to implement the primary purpose criterion by using the technical nature of the activity, which is defined as the objective nature of the activity irrespective of legislation or declarations (Eurostat, 2012a). Applying the technical nature implementation of the primary purpose criterion means that technically identical activities (e.g. the production of electricity from wind) would have to be classified in the same way in all countries irrespective of the country specific situations such as resource endowments, climatic conditions and public opinion.

Identifying EP and RM related activities in NACE Rev. 2

EP and RM activities can be carried out in all NACE industries. NACE provides the framework for collecting and presenting a large range of statistical data according to economic activity in the fields of economic statistics (e.g. production, employment, national accounts) and in other statistical modules.

There are some industries within the NACE classification whose principal activities are closely linked and should overlap to a great extent with the EP and RM activities defined by the CEPA and CReMA classifications:

- Units within the NACE division 'forestry and logging' (NACE A02) are expected to be the main contributors to CReMA 11A (management of forest areas). The 2009 EGSS handbook (p. 61) specifies that only activities for forests not available for wood supply and for uncultivated forests should fall under CReMA 11A, whereas cultivated forests for wood supply should be excluded. However, since it is difficult to separate cultivated from non-cultivated forests experts considered that for Europe the distinction between cultivated and non-cultivated forest should not be made (Eurostat, 2012a) (p. 9). If the distinction between cultivated and non-cultivated is not made, this does not automatically imply to consider the total output of NACE A02 as belonging to CReMA 11A. For example, one might exclude the output of roundwood, firewood, charcoal, Christmas trees and the gathering of wild growing mushrooms, berries etc. from CReMA 11A or consider that certain forestry services are part of CEPA 6 (protection of biodiversity and landscapes). The SEEA 2012 research agenda recommends that a review of the scope of resource management activities be undertaken. The Eurostat Task Force (TF) on the resource management expenditure account (ReMEA) (Eurostat, 2013d) pointed out that the scope of forest management is not well defined and indicated that it should focus on timber in both naturally regenerated forests and planted forests. In terms of data sources, the TF agreed to include both NACE A02.1 (silviculture and other forestry activities) and NACE A02.4 (support services to forestry) in forest management, but noted that the enterprises in the forestry sector are often involved in all the activities described in NACE 02 (thus including logging which should be excluded). The separation of NACE 02.1 and 02.4 activities would only be possible by analysing the costs of forestry producers. *This practical guide identifies as a review issue for the EGSS handbook (see annex C, revision item 7a) to not include the management of forest areas (CReMA*

11A) in the EGSS estimates if the actual definitions and available sources do not allow to separate CReMA 11A activities from the other forestry activities covered by NACE A02.

- Units within NACE section E should be the main producers of wastewater management services (CEPA 2), waste management services (CEPA 3) and water management services (CReMA 10). Within NACE section E four divisions are distinguished: water collection, treatment and supply (NACE E36), sewerage (NACE E37), waste collection, treatment and disposal activities and material recovery (NACE E38) and remediation activities and other waste management activities (NACE E39). However, it is normally not possible to establish straightforward n:1 relationships between these economic activities and their further breakdowns (NACE groups and NACE classes) and the three aforementioned environmental activities:

  - Companies may carry out relevant secondary activities, e.g. producers covered by NACE E36 that clean wastewater as a secondary activity.

  - The 2009 EGSS handbook (p. 61) stipulates to exclude the distribution, collection and potabilisation of water from CReMA 10 (management of water). Experts have concluded that there are substantial difficulties in separating water management from water supply (Eurostat, 2012a) (p. 7). It may be argued that the water supply industry (NACE E36) predominantly serves the resource management purpose of minimising inland water intake through adequate technical and managerial organisation of water collection and distribution and pricing of the resource. Different views on the role of water supply and distribution activity may result in different scopes of the activity management of water. The Eurostat Task Force (TF) on the resource management expenditure account (ReMEA) (Eurostat, 2013d) pointed out that the ideal option would be to establish estimation methods for the separation of water management activities from water use activities (extraction and distribution) and proposed as data sources COFOG, national accounts generation and distribution of income accounts or surveys. Given the difficulties of establishing estimation methods for calculating the share of water management in the water supply industry, and also of separating water management from water related activities aimed at e.g. natural hazards management, the TF concluded that this area should be a low priority domain. Water management should include the secondary output of water supply of NACE 37 ("recycled water") and the ancillary activities related to water management of NACE 36, not the whole NACE 36. *This practical guide identifies as a review issue for the EGSS handbook (see annex C, revision item 7b) to cover also the distribution, collection and potabilisation (i.e. the whole water supply activities) under CReMA 10 if the available sources do not allow separating them out and the metadata supplied with the statistics clearly indicate that this broad definition of water management has been applied.*

  - The recovery of sorted materials which is recorded under the economic activity NACE E38.32 can be waste management (CEPA 3) or the minimisation of the intake of forest resources (CReMA 11B), the minimisation of the intake of fossil resources as raw material for use other than energy production (CReMA 13C) or the management of minerals (CReMA 14). Allocating activities to recover materials to resource management classes requires separating the

activities by materials. A split of the NACE-based data may be possible using physical data on the quantities of materials recovered[26]. Concerning the split of expenditure between the environmental protection and resource management domains, most of the members of the Eurostat Task Force (TF) on the resource management expenditure account (ReMEA) (Eurostat, 2013d) clarified that they can separate data under NACE 38.3 (materials recovery) from the total NACE division 38[27]. However, making this split can be resource consuming and when there are quality concerns regarding the results (e.g. due to lack of data to make the split) it may be best to allocate materials recovery to one CReMA class using a predominance rule (Eurostat, 2012a) (p. 6). *This practical guide proposes to record the recovery of sorted materials under CEPA 3 if the available information does not allow separating it out of other activities of NACE E38. If, however, the recovery of sorted materials can be separated out, it may also be allocable to the respective RM activities (CReMA 11B, CReMA 13C or CReMA 14) based on information on the type of material. If such information is not available this practical guide proposes that recovery of sorted materials separated out of NACE 38 should be allocated to the main activity which may often be CReMA 14 (see also annex C, revision item 8b).*

- Right now Statistics Netherlands includes wholesale in waste and scrap in EGSS (for detail see: van Rossum, 2012). This activity is seen as an important link in the production chain of waste management since it brings together supply and demand for waste and scrap. Although not all countries are including NACE 46.77 (wholesale in waste and scrap which includes collection and sorting) in the scope of EGSS, the Eurostat Task Force (TF) on the resource management expenditure account (ReMEA) (Eurostat, 2013d) agreed this is in the scope. As a principle, the TF considered that activities that involve some processing should be included whereas pure distribution activities (e.g. second hand shops) should remain excluded. *This practical guide proposes that if the data available to the national statistical institutes (e.g. NA, SBS) are detailed enough to identify the principal output of NACE 46.77 it is to be considered as part of the materials recovery activities. The output of NACE 46.77 should be allocated to the respective RM activities (CReMA 11B, CReMA 13C or CReMA 14) based on information on the type of material. If such information is not available this practical guide proposes that NACE 46.77 output should be allocated to the main activity which may often be CReMA 14 (see also annex C, revision item 7d).*

- NACE E39 (remediation activities and other waste management activities) contains activities that fall under waste management (CEPA 3) or the protection and remediation of soil, groundwater and surface water (CEPA 4). *This practical guide proposes to record all NACE E39 activities under CEPA 3 if the available information does not allow separating out activities to protect*

[26] For example the Eurostat Environmental Data Centre on Waste published data on recovery rates for packaging waste.

[27] The use of detailed data on industry and construction (e.g. SBS data) could be useful in order to complement or split aggregates of the national accounts.

and remediate soil, groundwater and surface water[28] *(see also annex C, revision item 8c).*

- Street cleaning is an activity of some importance: in France about half of the waste management expenditure financed by local government is devoted to street cleaning and in Germany and the Netherlands many establishments classified in NACE Rev. 2 division 38 undertake both waste collection and street cleaning (Eurostat, 2012a) (p. 3). The changeover from NACE Rev.1.1 to Rev. 2 has made it more difficult to cover street cleaning for inclusion in waste management (CEPA 3). Street cleaning in NACE Rev. 1.1 was part of waste management, while in NACE Rev. 2 it is part of cleaning activities (NACE N81.2). One option is to identify street cleaning from COFOG expenditure data because in COFOG street cleaning is classified in 05.1 (waste management). *This practical guide proposes to include all street cleaning activities covered by the sources for NACE E38 in EGSS under CEPA 3, and if data are detailed enough to include also the street cleaning activities recorded under NACE 81.2.*

- Production of energy through incineration of waste is in NACE E38.2 (waste treatment and disposal). In the SEEA 2012 (p. 259) the production of energy from the combustion (incineration) of any kind of waste is included in RM (production of energy from renewable sources - CReMA 13A) except where the incineration is carried out for the main purpose of waste treatment and disposal. The 2009 EGSS handbook (p. 52 and 65) specifies that the incineration of the non-biodegradable part of the waste should not be recorded as RM since it is not considered as renewable energy and, in general, the incineration of waste is seen a part of waste management (CEPA 3). Due to different interpretation of the provisions in SEEA 2012 and Eurostat's handbook the classification of incineration may not be done in an internationally comparable manner. *This practical guide recommends including all waste incineration in CEPA 3, when data sources do not allow separating incineration of waste into incineration of renewable and non-renewable materials. If incineration of bio-degradable waste can be separated out it should be allocated to CReMA 13A. Also the processing of waste cooking oil into biofuels should be allocated to CReMA 13A (see annex C, revision item 8a).*

Several other NACE divisions can include producers that carry out environmental activities, for example: NACE A01 (Crop and animal production) covering the production of organic farm products, NACE C28.11 which includes the production of wind and hydraulic turbines, NACE D35 (Electricity and gas production) which may include major parts of the production of energy from renewable sources, NACE F43.29 (Other construction installation) which also classifies activities for reducing heat and energy losses by thermal insulation as well as vibration insulation, NACE M71.11 and M71.12 (Architectural and engineering services) which may include consulting, planning and design activities for building related energy management, NACE M71.20 (Technical testing and analysis) which includes vibration testing and the testing of the performance of materials and certification for environmental

[28] Where there is evidence that the largest part of NACE 39 is remediation of soil, groundwater and surface water CEPA 4 should be the adequate environmental activity category.

protection or resource management activities, NACE M72.19 (Other research and experimental development on natural sciences and engineering) in which also activities of R&D exclusively related to a natural resource are classified and NACE P85 (Education) which also includes environmental education.

Unless there are detailed data available that allow identifying the relevant EGSS units within the broader divisions conventions are needed to determine the share of EGSS. For example, the convention applied in this practical guide for organic farming is that its output share within NACE A01 is determined by its share in farmland and where possible adjusted using additional information on the relative per-hectare revenues (for more detail see section 4.2.2.).

Similarly, a convention for the compilation of output of electricity from renewable sources is that the output share in total electricity output is calculated by applying a physical share from energy statistics and where possible to adjust this share using additional information on price elements and price differences between electricity from the various sources (for more detail see section 4.2.3.).

Identifying EP and RM activities through COFOG

The COFOG is used to allocate governmental expenditure according to main purpose. COFOG includes a full division dedicated to environmental protection (division 5). Within this division 6 groups are distinguished: 05.1 - Waste management, 05.2 - Waste water management, 05.3 - Pollution abatement, 05.4 - Protection of biodiversity and landscape, 05.5 - R&D Environmental protection and 05.6 - Environmental protection n.e.c.. As all government expenditure should be classified under one and only one position of the COFOG, in some cases, environmental transactions may be classified under another item[29]. As a consequence, some other COFOG divisions may also be relevant for the identification of the environmental transactions. In particular, division 1 (general public services), will include expenditure related to international environmental aid, division 4 (economic affairs) expenditure related to renewable energy and/or material recovery and division 6 (housing and community amenities) expenditure related to low energy/passive buildings and measures to reduce the energy consumption of existing buildings. Given the multiplicity of functions of some government entities, the mapping between COFOG and CEPA is complex. This even holds for expenditure within the relevant COFOG division 5: for example, COFOG 5.6 (environmental protection n.e.c) is reserved for administration, regulation, supervision and similar activities for environmental protection. However, COFOG compilers may be tempted to allocate expenditure of all units with multiple environmental functions under COFOG 5.6. Therefore, to make an appropriate mapping between COFOG and CEPA it is necessary to consider the practice of COFOG compilation in the single countries.

[29] The manual on sources and methods for the compilation of COFOG Statistics recommends splitting an item of government expenditure if it relates to more than one function. If, however, indicators to split the total expenditure between two different functions are missing, the manual recommends using only one function – the main function (Eurostat, 2011).

Identifying EP and RM output using product classifications

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 5,000 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 Community. The trade classifications are used mainly for recording trade flows. Their items and sub-items are the fundamental terms on which industrial goods are identified in product classifications (e.g. CPA and PRODCOM, for details see below). The codes can be linked to other classifications (products or economic activities) via correspondence tables. The trade codes can be useful for the estimation of trade in environmental goods because they provide updated time series of exports. However there are also clear disadvantages: thresholds for reporting requirements, a limited number of product codes available for environmental goods and non-consideration of trade in services. Some examples of trade codes from the CN 2013 version that relate to environmental goods are shown in List 1 (see below). Some of these trade codes may be regarded as representing groups of goods that are almost entirely ("100 %") environmental goods (e.g. generating sets, wind powered – CN 8502.31.00), others may cover groups of products that are not entirely environmental and for which an EGSS share of less than 100% would apply (e.g. machinery a. apparatus f. filtering or purifying air excl. isotope separators and intake air filters for internal combustion engines - CN 8421.39.20)

The CPA 2008 is the European version of the Central Product Classification of the United Nations. This classification covers goods and services. Each type of good or service is defined as it is considered that it is produced by only one principal activity which is classified according to the NACE[30]. The link between CPA and NACE is visible as the first four digits of any CPA code are equivalent to the four-digit code of the corresponding NACE level.

Some CPA codes clearly identify EP and RM products. List 2 contains 22 products up to the 6-digit-level that are assumed to be 100% environmental. In contrast the CPA list of products that may represent some but not 100% EGSS output is considerably larger. For these products shares of EGSS have to be determined. Both, the "100% list" and the "share list", need regular updating. Such updated lists are sent together with the EGSS data collection questionnaires to national EGSS data compilers.

[30] E.g. CPA 37.0 (sewerage services) is produced as the principal activity of industry NACE 37 (sewerage). CPA 37.0 may also be produced as secondary output of other industries such as, for example, NACE 36.0 (water collection, treatment and supply).

List 1: Example of trade codes for environmental goods (CN 2013)

CEPA/CReMA		Description	CN 2013
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.s.	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.s.	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	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	3826.00
		Natural rubber latex, whether or not prevulcanised	4001.10.00
		Reclaimed rubber in primary forms or in plates, sheets or strip	4003.00.00
		Retreaded tyres of rubber	4012.11+ 4012.12+ 4012.13+ 4012.19
		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 vaccuum	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	8541.40
CreMA 14		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

List 2: Examples CPA 2008 codes that are 100% EGSS products

CPA 2008 Code	DESCRIPTION
01.29.1	Natural rubber
08.12.13	Mixtures of slag and similar industrial waste products, whether or not incorporating pebbles, gravel, shingle and flint for construction use
22.11.20	Retreaded pneumatic tyres, of rubber
22.19.1	Reclaimed rubber in primary forms or in plates, sheets or strip
23.65.11	Boards, blocks and similar articles of vegetable fibre, straw or wood waste, agglomerated with mineral binders
26.51.41	Instruments and apparatus for measuring or detecting ionising radiations
28.11.22	Hydraulic turbines and water wheels
28.11.24	Wind turbines
28.11.32	Parts of hydraulic turbines, water wheels including regulators
37.0	Sewerage services; sewage sludge
38.1	Waste; waste collection services
38.21	Treatment and disposal services of non-hazardous waste
38.22	Treatment and disposal services of hazardous waste
38.22.11	Nuclear waste treatment services
38.3	Materials recovery services; secondary raw materials
39.00.11	Remediation and clean-up services, soil and groundwater
39.00.12	Remediation and clean-up services, surface water
39.00.13	Remediation and clean-up services, air
39.00.23	Other specialised pollution control services
43.29.11	Insulation works
71.12.15	Engineering services for waste management projects (hazardous and non-hazardous)
74.90.13	Environmental consulting services

PRODCOM is the title of the EU production statistics for Mining, Quarrying and Manufacturing, i.e. Sections B and C of the Statistical Classification of Economic Activities in the European Community (NACE Rev. 2). The headings of the PRODCOM list are derived from the HS Nomenclature or the Combined Nomenclature, which thus enables comparisons to be made between production statistics and foreign trade statistics. At the EU level PRODCOM headings are coded using an eight-digit numerical code, the first six digits of which are, in general,

identical to those of the CPA code. The PRODCOM list is therefore linked to, and consistent with, the product classification (and thus with the NACE classification).

Going into more detail than CPA, the PRODCOM classification could allow for the identification of EP and RM output which is not singled out by CPA codes. For multiple walled insulating units of glass, that is glass used for double windows for heat saving or noise reduction purposes, are identified by PRODCOM 23.12.13.30, whereas CPA 23.12.12 also includes glass mirrors. Services are, however, not covered by PRODCOM. Some more examples of 8-digit PRODCOM goods relevant for EGSS are shown in List 3 (see below).

List 3: Examples of CPA and PRODCOM Codes relevant for EGSS

CPA 2008 Code/ PRODCOM 2008 CodeE	**DESCRIPTION**
…	…
23.12.13	Glass mirrors; multiple walled insulating units of glass
23.12.13.30	Multiple-walled insulating units of glass
…	…
23.99.19	Non-metallic mineral products n.e.c.
23.99.19.10	Slag wool, rock wool and similar mineral wools and mixtures thereof, in bulk, sheets or rolls
23.99.19.30	Mixtures and articles of heat/sound-insulating materials n.e.c.
…	…
28.25.13	Refrigeration and freezing equipment and heat pumps, except household type equipment
28.25.13.80	Heat pumps other than air conditioning machines
…	…
33.2	Installation services of industrial machinery and equipment
33.20.29.10	Installation of engines and turbines (excluding aircraft, vehicle and cycle engines)
…	…

The 6-digit-codes of CPA and even the 8-digt codes of PRODCOM may not be detailed enough to identify environmental goods. Then additional information is needed to estimate the EGSS shares within a code.

At national level the PRODCOM statistics may be available at a more detailed level and be used to identify EGSS production. For example, for Germany a list of 254 potential environmental goods has been established using the 9-digit German PRODCOM version (GP 2009) (Gehrke & Schasse, 2013).

3.5. A map of data integration for EGSS compilation

In the first phase of model development the focus should be on the main areas where EGSS output and employment can be expected. The estimates should be mainly based on an integration of data produced regularly by the statistical systems, in particular supply side statistics (e.g. from the national accounts, SBS and PRODCOM) as well as demand side data on environmental protection expenditure and if available on resource management expenditure. Where possible this approach may be combined with results of EGSS surveys to improve the coverage and quality of the data. Estimates of EGSS value added and employment can be based on ratios to output derived from national accounts data broken down by industry.

EGSS data cover market activities, non-market activities and ancillary activities and cover the production of all categories of environmental products. However, in line with the findings presented earlier the compilation methods proposed do not provide a cross-classification by environmental product categories. Instead, a pragmatic categorisation is used as an additional compilation layer to integrate the data. These categories combine some elements of the market/non-market distinction, the economic activity by NACE and a distinction between capital and non-capital products. This categorisation is flexible in accommodating the different sources for integration. In its basic form it distinguishes the following types of activities:

- Market and non-market production of wastewater, waste and water management services
- Market production of EGSS other than wastewater, waste and water management services: non-capital goods and services
- Market production of EGSS: capital goods and services[31]
- Non-market production other than wastewater, waste and water management services
- Ancillary production of EGSS

It has to be stressed that these categories are based on pragmatic considerations for compilation. The main categories match the source data that should be available for all countries. Depending on the extra sources available in a country (e.g. specific EGSS survey among manufacturing industries) additional categories or breakdowns may be useful.

The integration model combines different statistical sources that may each cover only subsets of the EGSS, may partly overlap each other (e.g. data from environmental protection expenditure statistics and investment data from national accounts) or whose scopes, definitions, classification and valuation principles are different from the ones needed in the EGSS statistical module. A careful integration approach is therefore needed to reach a sufficient coverage of the EGSS while avoiding overlaps and double-counting as far as possible. In Table 1 a map of data used for the integrative EGSS compilation approach is presented (the approach is described in detail in chapters 4 to 6 along with the test calculations carried out by Eurostat). This data map serves to support EGSS compilers solving a puzzle of available sources to be integrated into an as far as possible consistent picture of the EGSS. An explanation of the cells of the data map is provided as well.

[31] Capital goods and services are generally durable products that through gross fixed capital formation 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 1: EGSS data map

		Market and non-market production of wastewater, waste and water management services	Market production of EGSS other than wastewater, waste and water management services: non-capital goods and services	Market production of EGSS: capital goods and services	Non-market production other than wastewater, waste and water management services	Ancillary production of EGSS
EP	**Protection of ambient air and climate**		JQ_FP, NA_64, NA_SUT, LFS	JQ_INV, NA_64, NA_SUT, NA_GFCF, LFS	JQ_ICE, NA_64, LFS	JQ_ICE, NA_64, LFS
	Wastewater management	NA_64, NA_SUT, JQ_ICE, LFS	**data not yet identified, but largely not applicable**			
	Waste management					
	Protection of soil, ground-water, and surface water		JQ_FP, NA_64, NA_SUT, LFS, AGRI (for organic farming)		JQ_ICE, NA_64, LFS	
	Noise and vibration abatement		JQ_FP, NA_64, LFS, NA_SUT			
	Protection of biodiversity and landscape					
	Other EP (protection against radiation, env. R&D and other env. protection)					
RM	**Management of waters**	NA_64, NA_SUT, LFS	**data not yet identified, but largely not applicable**	NA_64, NA_SUT, NA_GFCF, LFS		**data not yet identified**
	Production of energy from renewable sources		NA_64,NA_SUT,SBS,LFS,ENSTAT IEA, FAO/OECD, VNAS (incl. auto-production)	NA_64, NA_SUT, NA_GFCF, LFS, VNAS	**data not yet identified, but likely to be small**	
	Heat/energy savings		**data not yet identified, but likely to be small**			
	Material recovery		**as far as material recovery is recorded in national accounts under NACE/CPA E38 it is included in waste management**			
	Other RM		**data/methods not yet identified or tested**			

Legend:

= empty cell by definition

= suitable data or methods not yet identified or tested by Eurostat

JQ_ICE: Joint Questionnaire Environmental Expenditure and Revenues: internal current expenditure

JQ_FP: Joint Questionnaire Environmental Expenditure and Revenues: fees and purchases

JQ_INV: Joint Questionnaire Environmental Expenditure and Revenues: investments

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

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

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

SBS: Structural Business Survey

LFS: Labour Force Survey

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

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

FAO/OECD: Biofuel prices

AGRI: Agricultural statistics - land use, farm accountancy

VNAS: Various national sources

Each white and grey shaded cell of the map should be covered with estimates. However, for the grey shaded cells no suitable data or methods have yet been identified and tested by Eurostat; in particular for most resource management areas suitable EGSS estimation methods need still to be developed in parallel with the on-going methodological developments for the Resource Management Expenditure Accounts (ReMEA). Dark shaded cells are empty by definition of the main categories.

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

Estimates on output, employment and value added of market and non-market production of wastewater, waste and water management services can be based on national accounts data in current prices and national accounts employment data both broken down by 64 industry groups (NA_64) in combination with information from the national accounts supply and use tables (NA_SUT) which provide more detailed information on output cross-classified by 64 product groups and 64 industry groups. For estimating employment detailed data from the Labour Force Survey may serve as an additional source.

The most relevant products/industries for this category are CPA/NACE E36 which covers water collection, treatment and supply and CPA/NACE E37-39 which groups together sewerage, waste collection, treatment and disposal activities, material recovery, remediation activities and other waste management services. Additional data on internal current expenditure on environmental protection (JQ_ICE) can be used for the separation of E37-39 into wastewater and waste management services if national accounts data are not detailed enough. Data from the national accounts supply tables, which present output cross classified by industries and products, can be used to separate out secondary production that does not fall 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 in the national statistical institutes (NSIs) are available at a finer industry and product detail national EGSS compilers should use these finer details, which could in particular improve the split into wastewater and waste management.

The reason for gathering non-market and market output in one category is that the split of the total output into non-market and market output is foreseen only as a secondary compilation step after compiling the total output using national accounts data. In the test calculations the split was made, but the used national accounts data available in Eurostat were not detailed enough to produce a satisfactory split. In order to comply with the amended future Regulation No. 691/2011 it is, however, necessary to estimate the market output. Therefore some additional investigation in data and methods sources usable for this split is necessary. Data on general government expenditure by function (COFOG) may be used as an additional source, but also more detailed national accounts data available in the NSIs could be useful.

More detail on the estimation of EGSS output under this category is presented in section 4.1.

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

Market production of EGSS non-capital products other than wastewater, waste and water management services mainly covers the production of services and goods used for intermediate and final consumption for environmental protection in the area 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.

For the EP activities CEPA 1, 3, 5, 6, 7-9 main data sources are the fees and purchases paid for environmental protection (JQ_FP). The demand side based approach requires that the data are combined with supply side information. In order to calculate output cross-classified by industries and to estimate EGSS employment national accounts data (NA_64) can be used. National accounts supply and use tables (NA_SUT) provide information on imports and exports by products. This data can be used to bridge the demand side data to the estimate of output. Agricultural statistics (AGRI) and farm accountancy data (FADN) in combination with national accounts data can be used to estimate output from organic farming which is to be recorded under protection of soil, groundwater and surface water (CEPA 4). For estimating employment detailed data from the Labour Force Survey may serve as an additional source.

Information on energy physical production and capacities collected by the energy statistics (ENSTAT) can be used in combination with national accounts data, price information and information obtained from energy agencies and various national sources to obtain output values for the production of electricity from renewable sources and the production of biofuels and biogas (CReMA 13A).

As far as material recovery is recorded in the national accounts under CPA/NACE E37-39 it is estimated under the category *market and non-market production of wastewater, waste and water management services* as part of CEPA 3 (see above).

The estimates for this category are, however, lower bounds estimates since some products are unlikely exhaustively covered or at not covered at all.

The demand side data may not fully cover all fees and purchases for EP. For example, if data on household expenditure are missing in this source some products are consequently not (exhaustively) covered such as the operation and maintenance of air pollution control devices for motor vehicles, sewage treatment facilities such as septic tanks and chemicals to operate them, goods used in connection with waste management such as bins, bags, composters etc. or low air emission cars or eco-tourism consumed by private households.

The part of household production of energy that is not delivered to the electricity grid (e.g. heating energy produced by biomass, 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 include this output in the estimates of the production of energy from renewable sources.

More detail on the estimation of EGSS output under this category is presented in section 4.2.

Market production of EGSS: capital goods and services

Market production of EGSS capital goods and services covers the production of services and goods that are used for gross fixed capital formation (investment) for the protection of the environment and for resource management. These products 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.

In the absence of specific EGSS surveys this category can be estimated using demand side data, in particular data on investments specifically for environmental protection (JQ_INV). Also data on gross fixed capital formation from the national accounts provide information which may be used to estimate the supply of EGSS capital goods and services, in particular investments by those industries that are characteristic or play an important role for environmental protection and resource management.

Information on investments by type of asset (NA_GFCF) can be useful in order to map the data broken down by investing industries to the industries that produce the capital products.

National accounts supply and use tables provide information on imports and exports by CPA product which can help to bridge the demand side data to the estimate of output.

Information on the change in energy producing capacities collected by energy statistics (ENSTAT) in combination with information obtained from energy agencies and various national sources are useful to derive estimates on investments in the area of renewable energy and heat/energy savings.

PRODCOM statistics may also be used if the EGSS shares of the PRODCOM codes are known. For some goods the EGSS shares may be assumed as close to 100% so that PRODCOM statistics may serve directly as a complementary source (e.g. for wind powered generating sets and multiple-walled insulating units of glass).

More detail on the estimation of EGSS output under this category is presented in section 4.3.

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

Non-market (government) production other than wastewater, waste and water management services can also be based on demand side data, in particular data on internal current expenditure on environmental protection (JQ_ICE) by the public sector. Conceptually, internal current expenditure provides a lower bound estimate of government output (which is to be measured using the cost approach). This lower bound estimate may be upgraded using factors derived from national accounts data to represent the cost share equivalent to the consumption of fixed capital.

More detail on the estimation of EGSS output under this category is presented in section 4.4.

Ancillary production of EGSS

Ancillary production is not measured within the national accounts framework. A source available to derive estimates of ancillary EGSS output is data on the internal current expenditure for environmental protection (JQ_ICE). National accounts data broken down by activity may, however, be used to provide a more detailed split of ancillary output by industry and to derive indicators of the employment linked with the production of ancillary output.

More detail on the estimation of EGSS output under this category is presented in section 4.5.

4. TEST CALCULATION FOR EGSS OUTPUT

The test calculations are described in some detail to provide methodological support to national EGSS compilers. The test calculations for EGSS output as well as those for EGSS employment (chapter 5) and EGSS gross value added (chapter 6) have been compiled by Eurostat through an integration of data mainly available in the database on Eurostat's website[32]. This does not mean that it is proposed to use data downloaded from this database only; the national statistical institutes should use data from their own databases, which may provide additional and more detailed information usable for EGSS compilation. However, if EGSS data can be compiled with data in Eurostat's publicly accessible database and other publicly and freely accessible sources, Member States should at least be able to achieve the same minimum standard in EGSS compilation as proposed by this guide.

The structure of this chapter follows the structure of the pragmatic categories of activities of the data map presented in section 3.4. The chapter describes in some detail the data sources and methods as well as results obtained. At the end of the sections proposals for improvements are also made.

The scope of the test calculations is as follows:

- They cover annual data for the years 2000-2012 (of which only the period 2007-2011 is shown in this guide). The variables compiled are output, exports, gross value added and employment. Whereas the reporting requirements of Regulation No. 691 cover market activities only, the test calculations also cover non-market and ancillary activities.
- The breakdown by CEPA classes (EP activities) corresponds to the reporting requirements of Regulation No. 691, i.e. CEPA 1, 2, 3, 4, 5, 6 and one aggregate covering CEPA 7, 8, 9.
- In the test calculation the reporting by CReMA classes (RM activities) does not fully comply with the reporting requirements of Regulation No. 691. The test 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 by the test calculations will be developed in parallel with the developments for the Resource Management Expenditure Accounts (ReMEA).
- The reporting by CEPA/CReMA is cross classified by those 39 NACE industry categories that have also been distinguished in the 2014 voluntary data collection[33]. However, in the test calculations it was not possible to identify EGSS activities in all of these 39 NACE categories either due to lack of data or because

[32] To some extent also national and international sources have been used. For an overview of the sources used see also annex F.

[33] Regulation No. 691/2011 requires a less detailed breakdown by 21 industries (NACE A*21). However, for the voluntary data transmission it is envisaged to maintain the more detailed breakdown. For details on the various aggregation levels see also annex E.

the sources used (e.g. the supply tables) did not signify any relevant activities in the categories.

4.1. 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.

4.1.1. 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[34].

The test calculations start from Eurostat's collections 'National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)'[35] 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 annex E). Then, in multiplying the output values from the mapped data with CPA E37-39 output shares derived from the supply tables CPA E37-39 output for each of the 39 NACE industries of the EGSS module can be calculated[36]. This is the basis for deriving the EGSS output variables as it is shown in the next paragraphs.

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:

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[34] See also Statistics Explained Article: Building the System of National Accounts - supply and use tables

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

[36] 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.

$EGSS\_P1\_Serv_{CEPA\ 2,nace} + EGSS\_P1\_Serv_{CEPA\ 3,nace} = NA\_P1_{CPA\ E37\text{-}39,\ nace}$

$NA\_P1_{CPA\ E37\text{-}39,\ nace}$: 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)

The division within 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 private and public specialised producers of EP services from the Joint Eurostat/OECD Questionnaire on Environmental Expenditure and Revenues (JQ-EPER)[37].

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

$EGSS\_P1\_Serv_{CEPA\ 2,nace} = NA\_P1_{CPAE37\text{-}39,nace} * s_{CEPA\ 2}$

$EGSS\_P1\_Serv_{CEPA\ 3,nace} = NA\_P1_{CPAE37\text{-}39,nace} * s_{CEPA\ 3}$

For 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 in a more detailed industry breakdown for the group NACE E37-39 or if additional data can be used for the split. In additional calculations such a split has been tested using the same factors as already used for the split of output into CEPA 2 and CEPA 3[38]. However, the result of this test seemed not be 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). Unless this result would be strongly confirmed by additional information it was felt that the simplified assumption is less problematic than the splitting approach. In this context it is to be noted that the reporting requirements of Regulation No. 691 are less detailed: within the required A*21 NACE grouping the activities in question would be grouped within NACE E36-39.

[37] 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 4.5 on ancillary output.

[38] 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.

Table 2a: Test calculation: Market and non-market output of wastewater management services, Germany (million EUR)

	2007	2008	2009	2010	2011
Total NACE	15333	15333	15333	15333	15333
D	342	369	447	454	449
E36	892	914	747	649	693
E37	14099	14016	13841	14004	15742

Table 3a: Test calculation: Market and non-market output of waste management services, Germany (million EUR)

	2007	2008	2009	2010	2011
Total NACE	24946	25974	24216	26617	29748
D	557	627	719	799	791
E36	1451	1552	1203	1144	1221
E38	20645	21415	20065	22206	24963
E39	2294	2379	2229	2467	2774

The approach described above identifies wastewater and waste management services are identified 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 identifies 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 not 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 an alternative, simpler approach is to use total output figures of NACE E37-39 (not broken down by CPA codes), which are available in the collection 'National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)':

$EGSS\_P1\_Serv_{CEPA\ 2,\ NACE\ E37} = NA\_P1_{NACE\ E37\text{-}39} * s_{CEPA\ 2}$

$EGSS\_P1\_Serv_{CEPA\ 3,\ NACE\ E38} = NA\_P1_{\ NACE\ E37\text{-}39} * s_{CEPA\ 3}$

$NA\_P1_{NACE\ E37\text{-}39:}$ 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 requires reporting on market output. Therefore output of wastewater and waste management services needs to be split into non-market and market output using share estimates ($share_{non\text{-}market,nace}$):

$EGSS\_P11\_Serv_{CEPA\ 2,nace,non\text{-}market} = EGSS\_P1\_Serv_{CEPA\ 2,nace,} * (1\text{-}share_{non\text{-}market,nace})$

$EGSS\_P13\_Serv_{CEPA\ 2,nace,non\text{-}market} = EGSS\_P1\_Serv_{CEPA\ 2,nace,} * share_{non\text{-}market,nace}$

$EGSS\_P11\_Serv_{CEPA\ 3,nace,non\text{-}market} = EGSS\_P1\_Serv_{CEPA\ 3,nace,} * (1\text{-}share_{non\text{-}market,nace})$

$EGSS\_P13\_Serv_{CEPA\ 3,nace,non\text{-}market} = EGSS\_P1\_Serv_{CEPA\ 3,nace,} * share_{non\text{-}market,nace}$

$EGSS\_P11\_Serv_{CEPA\ 2,nace}$: Market output of wastewater management services by industries (EGSS)

$EGSS\_P11\_Serv_{CEPA\ 3,nace}$: Non-market output of waste management services by industries (EGSS)

$EGSS\_P13\_Serv_{CEPA\ 2,nace}$: Non-market output of wastewater management services by industries (EGSS)

$EGSS\_P13\_Serv_{CEPA\ 3,nace}$: Non-arket output of waste management services by industries (EGSS)

For the test calculations the main source to calculate this split are the national accounts supply tables, from which shares of non-market output in the total output of the single industries can be estimated:

$share_{non\text{-}market,nace} = NA\_P1_{P13,nace} / NA\_P1_{CPA\_Total,nace}$

It is, however, to be noted that the supply tables available in Eurostat do not provide information on this split cross-classified by products and industries. Data available in the national statistical offices may help to overcome these limitations and allow further refinement of the approach.

A further limitation when estimating non-market shares is missing data: in the test calculations it was observed that data for non-market output by industries were not available in all countries' supply tables. As an additional source to separate non-market from market output data on government current internal expenditure on wastewater and waste management from the Joint Eurostat/OECD Questionnaire on Environmental Protection Expenditure and Revenues (JQ-EPER) is therefore used. The approach is to calculate the difference between internal current expenditure of government and non-market output of wastewater and waste management services in NACE O (as calculated by the approach described above), to allocate this difference to non-market output in NACE E37-39, and then to derive an alternative estimate for the non-market output share of NACE E37-39. If the alternative share is bigger than the non-market output share for NACE E37-39 obtained by using supply table information, the alternative share is used in the calculations. In situations where

supply tables do not include data on non-market output and do not allocate some part of CPA E37-39 to NACE O, the non-market share of wastewater and waste management is thus based on the information from the JQ-EPER.

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

Table 2b: Test calculation: Split between market and non-market output of wastewater management services, France (million EUR)

	2007	2008	2009	2010	2011
Non-market	2632	2825	2911	3119	3145
Market	9604	10073	8777	10366	10785

Table 3b: Test calculation: Split between market and non-market output of waste management services, Spain (million EUR)

	2007	2008	2009	2010	2011
Non-market	2742	2888	5112	5361	5363
Market	9713	10202	6892	7200	7192

Future improvements

At a later stage of the development of the compilation framework the estimates may be further refined and completed:

The simplifying assumption on the allocation of wastewater and waste management services to the producing NACE divisions within NACE group 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 which is recorded under NACE E38 may include activities that are 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 so that in the current phase of the model development this split is not made.

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 production recorded under NACE E39 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 as part of the future development of the approach.

4.1.2. 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 2009 EGSS handbook (p. 61) recommends not including the distribution, collection and potabilisation of water.

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. With the recommendations of the 2009 EGSS handbook being followed only a part of NACE/CPA E36 is included under CReMA 10.

Based on the data available in Eurostat it seems to be difficult to narrow the scope of water management from NACE/CPA 36 to the definition of resource management which would have to exclude the distribution, collection and potabilisation 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. In the cited above publication resource management of water is considered as being part of the "eco-activities" whereas the production and distribution of water is included in the broader definition of "green economy activities". Future developments 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 analogously to the approach used for wastewater and waste management services. The test 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. 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. Then, in multiplying the output values from the mapped data with the CPA E36 output shares

[39] For countries, for which the new ESA 2010 data were not available collection 'annual National Accounts by 64 branches at current prices (nama_nace64_c)' is used.

CPA E36 output for each of the 39 NACE industries of the EGSS module can be calculated. A factor f may take into 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:

$EGSS\_P1\_Serv_{CReMA\ 10,nace} = NA\_P1_{CPA\ E36,nace} * f$

$NA\_P1_{CPA\ E36,\ nace}$: Output of product CPA E36 by industries (NA)

$EGSS\_P1\_Services_{CReMA\ 10,nace}$: Output of water management services by industries (EGSS)

Analogously 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 to be noted that the reporting requirements of Regulation No. 691 are less detailed: within the A*21 NACE grouping management of water by NACE E36, E37, E38 and E39 would be grouped to NACE E36-39.

Table 4a: Test calculation: Market and non-market output of water management services, France (million EUR)

	2007	2008	2009	2010	2011
Total NACE	1849	1909	1984	1971	1911
E36	1845	1905	1979	1965	1906
O	4	4	5	4	5
P	0	0	1	1	1

Note that by applying the approach described above water management output is identified 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 is not indicative for other Member States. For example, in using the same approach for the United Kingdom no water management services outside NACE E36 is identified.

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

$EGSS\_P1\_Serv_{CReMA\ 10,NACE\ E36} = NA\_P1_{NACE\ E36} * f$

$NA\_P1_{NACE\ E36:}$ 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. It is therefore worth mentioning that 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 4.1.1) is used; in this case secondary output of sewerage may be reported twice as wastewater management and management of water. Therefore it is recommended to use 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 on market output. Therefore the output of water management services needs to be split into non-market and market output. Basically, in the test calculations, to make this split, an approach analogous to the one already described for wastewater and waste management services (see section 4.1.1) is used. However, since resource management expenditure statistics are still less developed than environmental protection expenditure statistics, the calculation approach for wastewater management uses information available in the supply tables only. When there is no information in this source 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 4b: Test calculation: Split between market and non-market output of water management services, Spain (million EUR)

	2007	2008	2009	2010	2011
Non-market	43	44	385	402	404
Market	2150	2242	2015	2101	2115

Future improvements

At a later stage of the development of the compilation framework the estimates may be further refined and completed.

Some activities of management of water 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. The identification of water managements services under these and other NACE/CPA categories may be possible with more detailed breakdowns than those available for the test calculations. But even with a CPA breakdown by 6-digits 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 greater intervals (e.g. every 5 years) in order to 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 further 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.

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

In this practical guide the use of demand side data on environmental protection expenditure collected from the JQ-EPER is proposed 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). Details on the approach are shown in section 4.2.1.

In accordance with the recommended approach of the 2009 EGSS handbook output of organic farming is considered to lie 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 4.2.2.

Supply side data is also used to estimate the production of electricity from renewable sources as part of CReMA 13A (for details see section 4.2.3). Estimates for other forms of renewable energy (such as biofuels and biogas) are based on price times quantity approaches (for details see section 4.2.4 *and 4.2.5). Following the recommendation of the Eurostat Task Force (TF) on the resource management expenditure account (ReMEA) (Eurostat, 2013d) this practical guide excludes the production of biomass (wood etc.) that is converted into other forms of energy which are then sold from the scope of CReMA 13A. The accounting for the biomass used for that part that is not converted into marketed energy products (e.g. wood or wood pellets used by households for own consumption) is not covered by this practical guide and is a potential area for future research (see also annex C, revision item 7c).*

Summarised results of the test calculations for this category are shown in section 4.2.6.

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

4.2.1. Demand side approach for the production of environmental protection services

Some production of EGSS non-capital services can be identified using demand side data on fees and purchases from the JQ-EPER dataset. Fees/purchases (JQ_FP_{cepa}) should include all purchases of environmental protection services, both from public and private producers. These payments are clearly linked with an environmental protection (EP) activity outside the enterprise and should exclude e.g. fines and penalties. Payments of taxes directly used for financing environmental protection expenditure and payments of general environmental or green taxes (such as energy taxes) are excluded.

For the compilation of EGSS data the expenditure must be mapped to the producing NACE industries. In this phase of model development it is assumed, for reasons of simplicity, that output of non-capital EGSS products for EP other than wastewater and waste management services is found in only a few industries. More specifically, fees/purchases 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):

$EGSS\_P1\_Serv_{cepa,NACE\ M} = JQ\_FP_{cepa}$; cepa = CEPA 1, CEPA, 4, CEPA 5, CEPA 6, CEPA 7-9

$EGSS\_P1\_Serv_{cepa,NACE\ M}$: Output of EP services of NACE section M by CEPA classes (EGSS)

$JQ\_FP_{cepa:}$ Fees/purchases for EP by CEPA classes (JQ-EPER)

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

$EGSS\_P1\_Serv_{cepa,\ NACE\ M69\_70} = JQ\_FP_{cepa} * s_{NACE\ M69\_70,\ NACE\ M}$

where $s_{NACE\ M69\_70,\ NACE\ M} = NA\_P1_{NACE\ M69\_70} / NA\_P1_{NACE\ M}$

$EGSS\_P1\_Serv_{cepa,NACE\ M69\_70}$: Output of EP services of NACE group M69_70 by CEPA classes (EGSS)

$NA\_P1_{NACE\ M69\_70}$: Total output of NACE group M69_70 (NA)

$NA\_P1_{NACE\ M}$: Total output of NACE section M (NA)

When mapping expenditure to EGSS output we must consider that expenditure excludes exports but includes imports and that expenditure is valued at purchase prices whereas output should be valued at basic prices. Hence some corrections need to be made. The problem of export-import adjustment may be tackled by an analysis of detailed external trade data. However, in this practical guide a less time consuming approach is proposed: to derive corrections factors using data from national accounts supply and use tables.

The use tables of the national accounts 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:

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

These factors form a bridge between the demand side and the supply side and capture also valuation differences.

Table 5: Test calculation: Correction factors (f) for expenditure based data to correct for exports, imports and valuation differences, Czech Republic

CPA	2007	2008	2009	2010	2011
M69_M70	0.944	0.977	0.948	0.988	0.995
M71	0.999	1.048	1.039	1.045	1.041
M72	0.866	0.915	0.754	0.790	0.806
M73-M75	0.974	0.997	1.017	1.006	0.982

In the above example for Czech Republic (see Table 5) f=1.232 for M72 (2008) means that any expenditure allocated to the producing branch M72 (scientific research and development) is inflated by 23.2% in order to account for international trade in services and the basic price valuation of output, e.g.:

$$EGSS\_P1\_Serv_{cepa,\ NACE\ M69\_70} = JQ\_FP_{cepa} * s_{NACE\ M72,\ NACE\ M} * f_{CPA\ M72}$$

Future improvements

The allocation of expenditure on 'fees/purchases' to the producing industries needs to be further investigated. In particular, it needs to be investigated how much units that repair and install machinery and equipment (NACE 33) contribute to EGSS.

The focus of the calculations shown above is on EP services. The demand side data may not fully cover all fees and purchases for EP. For example, if data on household expenditure in this source are missing some EGSS output is consequently not (exhaustively) covered such as the operation and maintenance of air pollution control devices for motor vehicles, sewage treatment facilities such as septic tanks and chemicals to operate them, goods used in connection with waste management such as bins, bags, composters etc. or low air emission cars or eco-tourism. It is obvious that the quality and exhaustiveness of the EGSS data obtained directly depends on the quality and exhaustiveness of the environmental expenditure data. It is expected that the future reporting requirements for environmental protection expenditure accounts in the framework of Regulation No. 691/2011 will improve the underlying data sources.

The results from specific EGSS surveys or PRODCOM statistics at detailed level may be used to improve and obtain more exhaustive estimates of the production of non-capital products for EP and RM. To reduce the costs of statistical production and the burden for survey respondents and at the same time to maintain a sufficient quality, detail and coverage such data may be combined with the data integration approach. For example, in important areas (e.g. technical testing and analysis 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.

Engineering information may also be useful to improve the allocation of the expenditure category to producing branches. For example, a study carried out by ECOTEC Research & Consulting Limited (1999) for the Commission's DG Environment provided coefficients for the breakdown of operating expenditure (in-

house expenditure and purchases) for environmental activities by compensation of employees, energy, intermediate goods, capital goods and private services and public services (see table below). However, before such coefficients can be used it must be examined whether they are still applicable for the country under study or whether they need to be updated using country specific engineering information.

Table 6: Engineering information on the breakdown of operating expenditure in environmental protection activities

Env. activity	Compensation of employees	Energy	Intermediate Goods	Capital Goods	Private Services	Public Services
Air pollution control	15%	35%	45%			5%
Wastewater treatment	40%	20%	20%	10%	10%	
Waste management	60%	10%	10%	10%	10%	
Remediation and Clean up of Contaminated	20%	30%	50%			
Noise and Vibration Control	65%	5%	30%			

Source: ECOTEC Research & Consulting Limited (1999), annex of the ECOTEC study

The correction factors (f) for international trade and valuation differences may need further investigation. In particular, factors based on A*64 NACE/CPA aggregates may not be sufficiently representative for EGSS producers within those industries. A more detailed analysis of external trade in EGSS products based on external trade statistics may be necessary.

4.2.2. Supply side approach for organic farming products

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

$EGSS\_P1\_FarmProd_{CEPA\ 4,\ NACE\ A} = NA\_P1_{NACE\ A01} * Land_{org}/Land_{total:}$

$EGSS\_P1\_FarmProd_{CEPA\ 4,\ NACE\ A}$: 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

The data on land use are available in Eurostat's agricultural statistics, namely in the collections 'certified organic crop area (food_in_porg1)' and 'Land use - 1 000 ha - annual data (apro_cpp_luse)'.

If 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 $r \approx 0.7$[40].

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

$$Prod_{conv}/ha = NA\_P1_{NACE\ A01} / [(Land_{total} - Land_{org}) + Land_{org} * r]$$

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

$Prod_{conv}/ha$: 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 7: Test calculation: Output per ha in organic and conventional farming, Germany (EUR/ha)

	2007	2008	2009	2010	2011
organic farming	1755	1921	1733	1941	2055
conventional farming	2507	2752	2386	2524	2797

Output of organic farm products is then calculated by multiplying output per ha in organic farming by the size of the organic farmland area. 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).

$$EGSS\_P1\_FarmProducts_{CEPA\ 4,\ NACE\ A} = Prod_{org}/ha * Land_{org}$$

[40] 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 turnover per ha in organic farming is higher than in conventional farming for dairy and fodder production, whereas it is lower for 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 $r \approx 0.7$.

Future improvements

An alternative source for total output of farming than national accounts NACE A01 is the Economic Accounts for Agriculture (EAA) (Eurostat, 2000). Some definitional differences between national accounts data and the EAA 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.
- The 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.
- The 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 national accounts scope of NACE A01 or the EAA scope is more relevant for deriving EGSS data on organic farming cannot be decided a-priori and depends on the relative importance of the various elements of scope differences. 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 test 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 would be to collect 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.

4.2.3. Supply side data approach for electricity produced from renewable sources

The production of electricity production from renewable sources is part of CReMA 13 A (production of energy from renewable sources). The estimation approach for

electricity production from renewable sources can be organised top-down starting with national accounts data broken down by industries and accounts supply tables and then stepwise integrating information 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 have to be identified. Then the share of electricity production from renewable sources needs to be estimated using additional information from other sources such as energy statistics. In what follows we show details of the approach used in the test calculations.

The test calculations start from Eurostat's collections 'National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)'[41] 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. Then, output of electricity, gas, steam and air conditioning supply (CPA D35) for each of the 39 NACE industries ($NA\_P1_{CPA\ D35,\ nace}$) can be calculated 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 information on the share of electricity output, the share of electricity generation in electricity output[42] and the share of electricity generation from renewable sources in total electricity generation provides an estimate of the output of electricity from renewable sources:

$$EGSS\_P1\_Elec_{CREMA\ 13A,\ nace} = NA\_P1_{CPA\ D35,\ nace} * s_{elec} * s_{gene} * s_{renw}$$

$EGSS\_P1\_Elec_{CREMA\ 13A,\ nace}$: 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 in total output of CPA D35 can be estimated using more detailed industry data. In the test calculations Eurostat's collections 'Annual

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

42 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 (TF) 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.

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 are part of the SBS data, are used to estimate a proxy for this share by relating the output of NACE D35.1 (electric power generation, transmission and distribution) to the output of NACE D35.[43]

Table 8a: Test calculation: Share of electricity output (power generation, transmission and distribution) in total output of CPA 35 (s_{elec}), selected countries

	2007	2008	2009	2010	2011
Germany	77.9%	79.5%	82.9%	85.3%	86.2%
France	66.1%	63.4%	64.2%	63.5%	65.4%
Italy	70.4%	68.0%	70.9%	67.3%	69.5%
United Kingdom	74.3%	76.7%	76.8%	76.8%	77.2%

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 or accessible other sources may be used, in particular sources that provide information on cost structures or the components of electricity prices.

In the test calculations data from Eurostat's 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)' are combined 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.

From these 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}. For most countries s_{gene} is estimated to lie between 0.4 and 0.6. It is to be mentioned that these shares are applied to electricity output in NACE D35 only, whereas for all other industries it is assumed that $s_{gene}=1$ (i.e. in other industries than NACE D35 electricity output is only due to the generation of electricity and these do not transmit or distribute electricity).

[43] 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).

Table 8b: Test calculation: Share of electricity generation in electricity output (s_{gene}), selected countries

	2007	2008	2009	2010	2011
Germany	49.9%	53.1%	51.2%	51.3%	49.6%
France	41.2%	41.2%	41.2%	41.2%	41.2%
Italy	64.0%	64.0%	57.1%	53.6%	53.5%
United Kingdom	58.8%	65.4%	64.4%	71.9%	68.3%

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

The share of electricity from renewable sources in total electricity generation (s_{renw}) can be estimated from energy statistics. In the test calculations Eurostat's collection 'Supply, transformation, consumption - electricity - annual data (nrg_105a)' is used. The share is calculated from data on net electricity generation as main activity and net electricity generation auto-produced[44] taking into account the following renewable sources: hydro, geothermal, geothermal combined heat power (CHP) plants, solar, tide and waves and wind.[45]

$$s_{renw} = PROD_{electricity\ from\ renewable\ sources} / PROD_{electricity from\ all\ sources}$$

Table 9: Test calculation: physical shares of electricity generation from renewable sources in total electricity generation (s_{renw}), selected countries

	2007	2008	2009	2010	2011
Germany	11.7%	11.8%	12.4%	12.8%	15.8%
France	12.4%	13.4%	13.6%	14.2%	11.9%
Italy	15.7%	18.5%	23.1%	24.0%	25.0%
United Kingdom	3.7%	4.4%	5.1%	4.6%	6.9%

These shares are calculated based on physical data on electricity generation and do not properly represent the share of renewable electricity in the output value of electricity generation 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[46].

[44] If data on auto-produced electricity is available.

[45] The production of electricity from biomass is not included to avoid double counting with the estimates for biogas production (see section 4.2.5).

[46] The Eurostat Task Force (TF) 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.

When using these physical shares it is implicitly assumed that prices of electricity from renewable and non-renewable source are identical. Therefore, in a further step of model development information on price differences should be taken into account. If the price ratio between electricity from renewable and non-renewable resources (f) is known the above formula can be extended to cover such price differences:

$$EGSS\_P1\_Elec_{CREMA\ 13A,\ nace} = NA\_P1_{CPA\ D35,\ nace} * s_{elec} * s_{gene} * (s_{renw} * f)/(1+s_{renw} * (f-1))$$

The term $(s_{renw}*f)/(1+s_{renw}*(f-1))$ in the above formula is to be interpreted as the share of electricity from renewable sources in total electricity generation in monetary terms. It can be easily seen that for f=1 the term collapses to s_{renw} which is the physical share implying no price differences between the two types of electricity. For the test calculations estimates of the price ratios between electricity from renewable and non-renewable sources (f) are derived from information on production costs (levelised costs of electricity, LCOE) 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 D of this document.

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

Table 10: Test calculation: monetary shares of electricity generation from renewable sources in total electricity generation, selected countries

	2007	2008	2009	2010	2011
Germany	16.6%	17.4%	19.2%	21.4%	28.2%
France	13.3%	14.5%	15.0%	16.0%	14.7%
Italy	18.4%	21.4%	26.8%	28.8%	36.3%
United Kingdom	4.6%	5.5%	6.6%	6.3%	9.6%

Remark: calculated by the following formula: $(s_{renw}*f)/(1+s_{renw}*(f-1))$

It needs to be mentioned that in the test calculations these shares are applied to all NACE industries except for 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 energy auto-produced:

- The 2009 EGSS handbook (p. 42) recommends recording auto-production of renewable energy as an ancillary activity. This, however, contradicts the NACE Rev. 2 guidelines, which recommend that energy production is not regarded as an ancillary activity even if the whole output is consumed by the parent unit (Eurostat, 2008, p. 22) and that separate units should be recognised as kind-of activity units if separate data are available. The SNA 2008 (European Commission, IMF, OECD, UN, World Bank, 2008) says in paragraph 6.120 that it is unusual to record goods and services used as intermediate consumption in the same establishment but that there are occasion where it may be desirable. If such

recording would be made, the goods and services in question add to both intermediate consumption and output so that value added is unaffected. ESA 2010 does not address this subject.

- ESA 2010 allows household production retained for own final consumption to be recorded as output. Electricity is not among the examples of products retained for own final consumption by the household sector as shown in paragraph 3.210 of ESA 2010.
- For the EGSS statistics it is important that all production of energy from renewable sources is recorded. Therefore *this practical guide recommends including also auto-production of renewable energy (whether used for intermediate or final consumption) in the EGSS output measure. Where relevant, auto-production should, however, be excluded from market output. The EGSS handbook should be revised accordingly (see annex C, revision items 6.a.ii and 6b).*

Future improvements

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 competiveness. 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 f 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 not only be different 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.

4.2.4. Price times quantity approach for biofuels

The production of biofuel is part of the production of energy from renewable sources (CReMA 13 A).

This practical 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 test calculations, price data are taken from an agricultural outlook study which contains 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 prices in

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 before multiplying them with the production quantities.

The biodiesel price is multiplied with biodiesel production and the bioethanol price with 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 11: Test calculation: Output of biofuels, Germany

	2007	2008	2009	2010	2011
Production, Biogasoline (TJ)	8640	12166	15504	16662	14969
Price, Biogasoline (EUR/TJ)	14148	14827	14820	21385	29460
Output, Biogasoline (million EUR)	180	230	356	441	389
Production, Biodiesel (TJ)	110243	93640	90371	114552	113960
Price, Biodiesel (EUR/TJ)	23384	31366	24632	28202	35756
Output, Biodiesel (million EUR)	2937	2226	3231	4075	3591
Production, other liquid biofuels (TJ)	34911	23118	19390	15421	5147
Price, other liquid biofuels (EUR/TJ)	23384	31366	24632	28202	35756
Output, other liquid biofuels (million EUR)	725	478	435	184	131

Future improvements

It needs to be investigated whether the price used to value biogasoline and other liquid biofuels is a sufficiently close proxy for European producer prices. Some additional research may be necessary to improve the valuation of biofuels.

Another potential source with data 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.

4.2.5. 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 to use 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)'.

For the test calculations, price data are taken 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. The price data in this collection are 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 price collection reports consumer prices. In order to meet as close as possible the producer price definition the prices excluding all taxes for consumer in the consumption band > 200 GJ are used.

Table 12: Test calculation: Output of biogas, Poland

	2007	2008	2009	2010	2011
Production, Biogas (TJ)	2708	4026	4104	4797	5732
Price, Biogas (EUR/TJ)	9108	4845	9670	10418	10899
Output, Biogas (million EUR)	25	20	40	50	62

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

Future improvements

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

4.2.6. Summarised results

In Eurostat's test calculations time series on the market production of EGSS non-capital goods and services other than wastewater, waste and water management services are derived using the methods described in sections 4.2.1 to 4.2.5.

Table 13: Test calculation: Market production of EGSS other than wastewater, waste and water management services: non-capital goods and services, EU28 (million EUR)

	2007	2008	2009	2010	2011
Protection of ambient air and climate	1887	1608	1428	1459	1762
Protection and remediation of soil, groundwater and surface water	16745	18694	18412	20865	23161
Noise and vibration abatement	597	557	558	523	540
Protection of biodiversity and landscapes	1600	1619	1608	1624	1859
Other environmental protection	2626	3025	2203	2033	1964
Production of energy from renewable sources	49294	65550	67729	76784	87108

These estimates are to be considered as a lower bound estimate due to a couple of reasons, mainly:

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 4.1.1.). However, any material recovery not recorded under national accounts' CPA/NACE E37-39 is not included in the test calculations.

The demand side data may not fully cover all fees and purchases for EP. For example, if data on household expenditure in this source are missing some EGSS output are consequently not (exhaustively) covered such as the operation and maintenance of air pollution control devices for motor vehicles, sewage treatment facilities such as septic tanks and chemicals to operate them, goods used in connection with waste management such as bins, bags, composters etc. or low air emission cars or eco-tourism.

The part of household production of energy 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 include this output in the estimates of the production of energy from renewable sources.

4.3. Market production of EGSS: capital goods and services

For estimating the production of EGSS capital goods and services supply side sources such as SBS and PRODCOM may be used. The production of EGSS capital goods and services may, however, also be identified using demand side data on gross fixed capital formation (investments).

This practical guide proposes the demand side approach. Environmental investment expenditure data are available for EP activities from the JQ-EPER. For RM national accounts investment data are combined with other data sources such as energy statistics or information from specific studies.

4.3.1. Demand side approach for environmental protection: capital goods and services

This practical guide proposes to calculate output of EGSS capital goods and services for EP using demand side data on investments from the JQ-EPER 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[47]) and (2) investments in integrated technologies (or pollution prevention investments[48]).

For the purpose of the EGSS module investment expenditure from the JQ-EPER 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.

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[47] 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

[48] modified or adapted production processes

In the test calculations Eurostat's national accounts collection 'Gross capital formation by industry (up to NACE A*64) (nama_10_a64_p5)'[49] is used, which provides data on gross fixed capital formation by investing NACE section and type of asset.

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

$$s_{nace,\ asset\ type} = NA\_P51_{nace,\ asset\ type} / \Sigma_{asset\ type}\ NA\_P51_{nace,\ asset\ type}$$

$NA\_P51_{nace,\ asset\ type}$: Gross fixed capital formation by industries and types of assets (NA)

Then investments in the asset types are mapped to producing NACE divisions: 'other machinery and equipment'[50] 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):

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

$$s_{nace,\ NACE\ C29\_30} = s_{nace,\ transport\ equipment}$$

$$s_{nace,\ NACE\ F} = s_{nace,\ total\ construction}$$

$$s_{nace,\ NACE\ J} = s_{nace,\ computer\ software}$$

$$s_{nace,\ NACE\ M71} = s_{nace,\ intangible\ fixed\ assets}$$

In the test calculations, these allocated shares are then multiplied with the JQ-EPER investment data to estimate proxies for EGSS output of capital products for EP broken down by the producing industries, e.g. with CEPA 3 and NACE F as an example:

$$EGSS\_P1\_CapProd_{CEPA\ 3,\ NACE\ F} = \Sigma_{nace}\ s_{nace,\ NACE\ F} * JQ\_P51_{CEPA\ 3,nace}$$

$EGSS\_P1\_CapProd_{CEPA\ 3,\ NACE\ F}$: Output of capital products for waste management by the construction industry (EGSS)

JQ_P51CEPA 3, nace: Gross fixed capital formation for waste management by industries (JQ-EPER)

[49] For countries, for which the new ESA 2010 data are not yet available the corresponding ESA95 collection 'nama_pi22_21_c' is used.

[50] Other than transport equipment and including office machinery, hardware, radio, TV and communication equipment.

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 that is not reflected by the use of investment data is that of upstream links. A producer satisfying the final demand for an EGSS product may use upstream EGSS products produced by 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 EGGS 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 test calculations, an attempt has been made 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:

$$m_{NACE\ C28} = NA\_P2_{CPA\ C28,\ NACE\ C28} / \Sigma_{cpa} NA\_P1_{cpa,\ NACE\ C28} + 1$$

$NA\_P2_{CPA\ C28,\ NACE\ C28}$: 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 14: Test calculation: First round multipliers (m) for upstream links in EGSS production, Czech Republic, selected industries

NACE	2007	2008	2009	2010	2011
C28	1.123	1.040	1.054	1.054	1.053
F	1.343	1.368	1.371	1.372	1.376
J	1.275	1.304	1.328	1.314	1.319
M71	1.108	1.156	1.174	1.181	1.192

For example, in table 14 the factor 1.123 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 0.12 € due to the production of upstream output (CPA C28 products used as components in the production by NACE C28). Applying the

multiplier m results in the following compilation of output from demand side data, e.g. with CEPA 1 and NACE C28 used as an example:

$$EGSS\_P1\_CapProd_{CEPA\ 1,\ NACE\ C28} = m_{NACE\ C28} * \Sigma_{nace} s_{nace,\ NACE\ C28} * JQ\_P51_{CEPA\ 1,\ nace}$$

Another problem when mapping expenditure into EGSS output is that expenditure excludes exports but includes imports and that expenditure is valued at purchase 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[51].

Table 15: Test calculation: 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=1.155 for C28 means that any expenditure allocated to the producing branch C28 is inflated by 15.5% 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:

$$EGSS\_P1\_CapProd_{CEPA\ 2,\ NACE\ C28} = m_{NACE\ C28} * f_{CPA\ C28} * \Sigma_{nace}\ s_{nace,\ NACE\ C28} * JQ\_P51_{CEPA\ 2,nace}$$

Future improvements

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.

[51] For the formula used see chapter 4.2.

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

4.3.2. Demand side approach for water management: capital goods and services

To estimate EGSS capital products for water management a demand side approach is proposed 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 a mature industry that shows a relatively stable relationship between investment and output in the longer run.

For the test calculations, Eurostat's collection 'Gross capital formation by industry (up to NACE A*64) (nama_10_a64_p5)'[52] provides data on gross fixed capital formation by type of asset and investing NACE section. 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)'[53] to estimate investment factors per unit of output for section E by type of asset ($i_{asset\ type}$):

$i_{asset\ type} = NA\_P51_{NACE\ E,asset\ type}/NA\_P1_{NACE\ E}$

$NA\_P51_{NACE\ E,asset\ type}$: Gross fixed capital formation of NACE section E by type of asset (NA)

$NA\_P1_{NACE\ E}$: 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):

[52] For countries, for which the new ESA 2010 data are not yet available the corresponding ESA95 collection 'nama_pi22_21_c' is used.

[53] For countries, for which the new ESA 2010 data are not available collection 'annual National Accounts by 64 branches at current prices (nama_nace64_c)' is used.

$i_{NACE\ C26} = i_{NACE\ C27} = i_{NACE\ C28} = i_{other\ machinery\ and\ equipment} / 3$
$i_{NACE\ C29\_30} = i_{transport\ equipment}$
$i_{NACE\ F} = i_{total\ construction}$
$i_{NACE\ J} = i_{computer\ software}$
$i_{NACE\ M71} = i_{intangible\ fixed\ assets}$

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

$$EGSS\_P1\_CapProd_{CReMA\ 10,\ NACE\ F} = i_{NACE\ F} * \Sigma_{nace}\ EGSS\_P1\_Serv_{CReMA\ 10,\ nace}$$

$EGSS\_P1\_CapProd_{CReMA\ 10,\ NACE\ F}$: Output of capital products for the management of water by NACE F (EGSS)

$EGSS\_P1\_Serv_{CReMA\ 10,\ nace}$: Output of water management services by industries (EGSS)

It is to be noted that the approach shown above implicitly assumes that the investment factors obtained 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, for the test calculation, 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:

$$EGSS\_P1\_CapProd_{CReMA\ 10,\ NACE\ F} = m_{NACE\ F} * f_{CPA\ F} * i_{NACE\ F} * \Sigma_{nace}\ EGSS\_P1\_Serv_{CReMA\ 10,\ nace}$$

Future improvements

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

4.3.3. Demand side approach for electricity from wind, solar and hydro power: capital goods and services

To estimate EGSS capital products for the production of electricity from wind, solar and hydro power[54] a demand side approach is proposed guide using data from national accounts on gross fixed capital formation (investment) cross-classified by industry and type of asset and integrating these data with specific data on power plant investments (e.g. ministerial data, IEA data) and production capacities (Eurostat energy statistics).

For the test calculations, Eurostat's collection 'Gross capital formation by industry (up to NACE A*64) (nama_10_a64_p5)'[55] provides data on gross fixed capital formation (NA_P51) by types of assets and investing NACE sections. The NACE section mainly relevant for electricity is section 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 ($s_{\text{NACE D35, asset type}}$) are calculated:

$s_{\text{NACE D35, asset type}} = NA\_P51_{\text{NACE D35, asset type.}} / \Sigma_{\text{asset type}} NA\_P51_{\text{NACE D35, asset type}}$

$NA\_P51_{\text{NACE D35, asset type}}$: Gross fixed capital formation by industry D35 and type of asset (NA)

Then investments in the 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 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 allocated shares are then multiplied with data on investments in renewable electricity production capacity ($INV_{\text{renewElec}}$) to estimate proxies for the EGSS output

[54] Investments in the production of electricity from biomass are covered under the heading "electricity and heat from biomass".

[55] For countries, for which the new ESA 2010 data are not yet available the corresponding ESA95 collection 'nama_pi22_21_c' is used.

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:

$$EGSS\_P1\_CapProd_{CReMA\ 13A,\ NACE\ F} = S_{NACE\ D35,\ NACE\ F} * INV_{renewElec}$$

$EGSS\_P1\_CapProd_{CReMA\ 13A,\ NACE\ F}$: NACE F output of capital products for the production of electricity from renewable sources (EGSS)

For the test 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[56]. Any missing years are estimated using ratios of 'investments in renewable electricity production capacity' to positive[57] 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 following two tables (below).

Table 16: Positive year-on-year changes in renewable electricity production capacity, Germany (MW)

	2007	2008	2009	2010	2011
Wind	1616	1633	1877	1509	1828
Hydro	38	0	690	0	218
Solar	1271	1950	4444	6988	7485

Table 17: Test calculation: Investments in renewable electricity production capacity, Germany (million EUR)

	2007	2008	2009	2010	2011
Wind	2276	2300	2650	2500	2950
Hydro	11	0	194	0	70
Solar	5211	7967	12000	19500	15000

Investments divided by the changes in renewable electricity production capacity (see table below) are ratios that can be compared with sources on the investments costs for newly installed capacities in order to check the plausibility of the used data. "Overnight costs"[58] for electric capacity from European on-shore wind power

[56] 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)

[57] Where year-to-year changes of the capacities are negative zero investments were assumed.

[58] "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.

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. In a study by Prognos AG on investments costs for renewable energies in Germany the following assumption derived from a literature anaylsis were made 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 18: Ratio: Investments in renewable electricity production capacity to change in renewable electricity production capacity, Germany (million EUR/MW)

	2007	2008	2009	2010	2011
Wind	1.408	1.408	1.412	1.657	1.614
Hydro	0.280	0.280	0.281	0.330	0.321
Solar	4.100	4.086	2.700	2.790	2.004

For countries for which investment data for electricity from renewable sources are not available the above ratios for Germany may be multiplied by the positive year-on-year changes in renewable electricity production capacity as a first approximation to estimate the investments. Alternatively, country specific overnight cost data can be used, which may be the more preferred option.

For the test calculations, 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, e.g. with NACE F (construction industry) used as an example:

$$EGSS\_P1\_CapProd_{CReMA\ 13A,\ NACE\ F} = s_{NACE\ D35,\ NACE\ F} * INV_{renewElec} * m_{NACE\ D35} * f_{CPA\ D35}$$

In the test calculations 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. hydraulic turbines and water wheels, wind powered generating sets. If the production estimate based on PRODCOM statistics is higher than the estimate based on the demand side approach, the test calculations use the PRODCOM statistics.

Future improvements

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 investigation. In particular, multipliers and correction factors based on NACE/CPA aggregates may not be representative for EGSS producers within those NACE industries.

4.3.4. Demand side approach for biofuels: capital goods and services

The estimate covers production plants to produce biofuels. To estimate EGSS capital products for the production of biofuels a demand side approach is proposed by this practical guide 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)'[59] 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). 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 C ($s_{\text{NACE C, asset type}}$) are calculated:

$s_{\text{NACE C, asset type}} = NA\_P51_{\text{NACE C, asset type.}} / \Sigma_{\text{asset type}} NA\_P51_{\text{NACE C, asset type}}$

$NA\_P51_{\text{NACE C, asset type}}$: Gross fixed capital formation by industry C and type of asset (NA)

Then investments in the 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 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):

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

$s_{\text{NACE C, NACE C29\_30}} = s_{\text{NACE C, transport equipment}}$

$s_{\text{NACE C, NACE F}} = s_{\text{NACE C, total construction}}$

$s_{\text{NACE C, NACE J}} = s_{\text{NACE C, computer software}}$

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

In the test calculations, these allocated shares are then multiplied with data on investments in biofuel production capacity (INV_{Biofuel}) to estimate a proxy for the

[59] For countries, for which the new ESA 2010 data are not yet available the corresponding ESA95 collection 'nama_pi22_21_c' is used.

EGSS output of capital products broken down by the producing NACE branches, e.g. with NACE J (information and communication) used as an example:

$EGSS\_P1\_CapProd_{CReMA\ 13A,\ NACE\ J} = s_{NACE\ C,\ NACE\ J} * INV_{Biofuel}$

$EGSS\_P1\_CapProd_{CReMA\ 13A,\ NACE\ J}$: NACE J output of capital products for the production of biofuels (EGSS)

$INV_{Biofuel}$ can be derived from the positive[60] 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 following table (below). The changes in capacity are then multiplied with an estimate of the investment costs per tonne[61].

Table 19: Positive year-to-year change in biofuel production capacities, Germany (1000 t)

2007	2008	2009	2010	2011
322	254	1584	0	0

Table 20: Test calculation: Investments in biofuel production capacity, Germany (million EUR)

2007	2008	2009	2010	2011
145	114	713	0	0

For the test calculation, an attempt has been made to derive an estimate for the first round upstream multipliers (m) using the national accounts 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:

$$EGSS\_P1\_CapitalProducts_{CReMA\ 13A,\ NACE\ J} = s_{NACE\ C,\ NACE\ J} * INV_{Biofuel} * m_{NACE\ J} * f_{CPA\ J}$$

Future improvements

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

[60] Where year-to-year changes of biofuel production were negative zero investments were assumed.

[61] 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

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 investigation. In particular, multipliers and correction factors based on NACE/CPA aggregates may not be representative for EGSS producers within those NACE industries.

4.3.5. Demand side approach for biogas: capital goods and services

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

For the test calculations, Eurostat's collection 'Gross capital formation by industry (up to NACE A*64) (nama_10_a64_p5)'[62] 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 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 ($s_{\text{NACE D35, asset type}}$) are calculated:

$s_{\text{NACE D35, asset type}} = NA\_P51_{\text{NACE D35, asset type.}} / \Sigma_{\text{asset type}} NA\_P51_{\text{NACE D35, asset type}}$

$NA\_P51_{\text{NACE D35, asset type}}$: Gross fixed capital formation by industry D35 and type of asset (NA)

Then investments in the 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 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):

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

$s_{\text{NACE D35, NACE C29\_30}} = s_{\text{NACE D35, transport equipment}}$

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

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

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

[62] For countries, for which the new ESA 2010 data are not yet available the corresponding ESA95 collection 'nama_pi22_21_c' is used.

These allocated shares are multiplied with proxy data for the investments in biogas production capacity (INV_{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:

$$EGSS\_P1\_CapProd_{CReMA\ 13A,\ NACE\ C29} = s_{NACE\ D35,\ NACE\ C29} * INV_{Biogas}$$

In the test calculations for Germany, investment data from the Federal Ministry for environment, nature protection and nuclear safety are used. These investment data cover installations that use biomass for electricity production. Missing years are 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 are 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 21: Test calculation: Investments in electricity from biogas, Germany (million EUR)

2007	2008	2009	2010	2011
985	1555	1350	1150	2200

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

For the test calculation, an attempt has been made to derive an estimate for the first round upstream multipliers (m) using the national accounts 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:

$$EGSS\_P1\_CapProd_{CReMA\ 13A,\ NACE\ C29} = s_{NACE\ D35,\ NACE\ C29} * INV_{Biogas} * m_{NACE\ C29} * f_{CPA\ C29}$$

Future improvements

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 investigation is therefore necessary in a later step of the model development.

4.3.6. Demand side approach for heat and energy savings: capital goods and services

To estimate EGSS capital products for heat and energy savings a demand side approach is proposed by this practical guide 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 specialised 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_P51) 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 specialised studies and agencies, for example:

- From studies carried out by Naturschutzbund Deutschland (NABU) e.V. (2011) and Deutsche Energieagentur (dena) (2010) it may be deducted 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[63]. 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. If we combine this information it could be estimated 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%[64]). Based on this information for the test

[63] 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 "Effzienzhaus 100", whereas a share of 50% would apply for measures to reach the "Effzienzhaus 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 effciency decree (Energieeffizienzverordnung – ENEV).

[64] Data on total investments in dwellings are from national accounts data in Eurostat's online database.

calculations for Germany a share of 15% has been benchmarked for the year 2010 assuming that there is an increase by 1 percentage point 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 in 2011 almost 35% of all expenditure on dwelling renovation had an energetic impact (doors, windows, heating, facade and others) (Agence de l'Environnement et de la Maîtrise de l'Energie, 2013).

For the test calculation the investments are allocated 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[65] 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. For the test calculations it is assumed 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):

$$EGSS\_P1\_CapProd_{CReMA\ 13B,\ NACE\ F} = NA\_P51_{dwellings} * 0.15 * 0.9$$

$$EGSS\_P1\_CapProd_{CReMA\ 13B,\ NACE\ M71} = NA\_P51_{dwellings} * 0.15 * 0.1$$

$EGSS\_P1\_CapProd_{CReMA\ 13A,\ NACE\ F}$: NACE F output of capital products for the energy/heat saving (EGSS)

$NA\_P51_{dwellings}$: Gross fixed capital formation in dwellings (NA)

For the test calculation, 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 (for year 2010):

[65] 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

$$EGSS\_P1\_CapProd_{CReMA\ 13B,\ NACE\ F} = NA\_P51_{dwellings} * 0.15 * 0.9 * m_{NACE\ F} * f_{CPA\ F}$$

$$EGSS\_P1\_CapProd_{CReMA\ 13B,\ NACE\ M71} = NA\_P51_{dwell.} * 0.15 * 0.1 * m_{NACE\ M71} * f_{CPA\ M71}$$

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 products) and C28 (machinery and equipment).

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

$$EGSS\_P1\_CapProd_{CReMA\ 13B,\ NACE\ C23} =$$

$$EGSS\_P1\_CapProd_{CReMA\ 13B,\ NACE\ F} * i_{CPA\ C23,\ NACE\ F} * m_{NACE\ C23} * f_{CPA\ C23}$$

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. For Eurostat's test calculations these input coefficients are calculated from the supply and use tables.

A potential limitation of this approach is that the coefficients for the construction industry as a total 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 test calculations use the PRODCOM statistics.

Future improvements

The Eurostat Task Force (TF) 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 practical 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 investigation. 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.

4.3.7. Summarised results

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

Table 22: Test calculations: Market production of EGSS: capital goods and services by environmental activity, EU28 (million EUR)

CEPA/CreMA	2007	2008	2009	2010	2011
Protection of ambient air and climate	7582	8020	7374	7169	7358
Wastewater management	37527	39585	36287	34042	34653
Waste management	19951	20238	18480	18677	19551
Protection and remediation of soil, groundwater and surface water	2190	2328	2209	2303	2164
Noise and vibration abatement	1044	1128	1097	1037	911
Protection of biodiversity and landscapes	4798	4963	4939	4327	4455
Other environmental protection	2948	4333	3143	3229	3510
Management of water	5696	6731	5799	5034	5375
Energy from renewable sources	33835	49981	50063	62537	68060
Heat/energy savings and management	93445	97382	90188	98569	109067

Table 23: Test calculations: Market production of EGSS: capital goods and services by economic activity, EU28 (million EUR)

NACE	2007	2008	2009	2010	2011
Total	209014	234688	219579	236926	255105
of which:					
C26	10345	13888	12068	13597	13521
C27	11624	14316	11960	15377	15016
C28	17417	21173	18436	23298	22930
F	126893	138008	133738	137402	153185

The estimate is to be considered as a lower bound estimate: 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.

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

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

'Internal current expenditure' reported on the JQ-EPER 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).

Since 'Internal current expenditure' reported on the JQ-EPER should only include the costs of material used and compensation of employees for in-house environmental protection activities, it conceptually produces a lower bound estimate of government output. A complete valuation of government output from the cost side would have to include the consumption of fixed capital. A simple approximation is to estimate ratios of consumption of fixed capital to output from national accounts data and to multiply them with the figures based on the JQ-EPER. In the test calculations, in order to estimate the consumption of fixed capital by government activities NACE specific ratios derived from Eurostat's collection National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)'[66] are used.

In the table below results of the test calculations aggregated at EU level are shown.

Table 24: Test calculation: Non-market (government) production other than wastewater, waste and water management services, EU28 (million EUR)

	2007	2008	2009	2010	2011
Protection of ambient air and climate	1405	1237	1208	1072	1065
Protection of soil, groundwater, and surface water	1230	1228	1331	1240	1228
Noise and vibration abatement	823	824	855	752	772
Protection of biodiversity and landscapes	7297	7408	7713	7931	7979
Other environmental protection	10669	10569	10422	11138	11499

Further improvements

In the compilation framework developed so far all government (non-market) EGSS 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) such data should be used to improve the industry allocation.

Resource management activities are not covered by the JQ-EPER source. 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).

4.5. 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

[66] For countries, for which the new ESA 2010 data were not available collection 'annual National Accounts by 64 branches at current prices (nama_nace64_c)' is used.

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 ESA (national accounts) all inputs consumed by ancillary activities are treated as inputs to the production of principal and secondary output which they support. Therefore output generated by ancillary activities is not a separately recorded output category in ESA, but its value may be implicitly included in total output through the application of the ESA valuation principles (basic prices or costs of production). With the EGSS data collection questionnaire 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.

Internal production of environmental services for own use means that by definition supply and demand are the same. Ancillary output therefore corresponds to the producers' inputs to the EGSS 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.

For compiling ancillary output the data from JQ-EPER can be used. 'Internal current expenditure' reported on the JQ_EPER 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 JQ-EPER provides numbers broken down by sector/industry and EP activities. It distinguishes between the following types of sectors/industries:

- PUBLIC SECTOR (government)
- BUSINESS SECTOR TOTAL
  - AGRICULTURE, FORESTRY AND FISHING
  - MINING AND QUARRYING
  - TOTAL MANUFACTURING
  - ELECTRICITY, GAS, STEAM, AIR CONDITIONING SUPPLY; WATER COLLECTION, TREATMENT AND SUPPLY
  - OTHER BUSINESS
- HOUSEHOLDS
- PRIVATE & PUBLIC SPECIALISED PRODUCERS OF EP SERVICES
  - PUBLIC SPECIALISED PRODUCERS OF EP SERVICES
  - PRIVATE SPECIALISED PRODUCERS OF EP SERVICES

The JQ-EPER questionnaire foresees that expenditure by total manufacturing is further broken down by nine groups of industries. This detail is filled in by most countries.

The breakdown of the JQ-EPER 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.

The Member States deliver annual data on the JQ-EPER. However, it may be necessary to first gap-fill this dataset before using it for the compilation of the EGSS module.[67]

It is to be 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 approaches to estimate the EGSS data, and, in practice, the possible double counting is likely to be very tiny.

Some simplifying assumptions are made when calculating ancillary EGSS output using the JQ-EPER:

- To avoid double counting internal current expenditure by private and public specialised producers of EP services is not counted towards ancillary output.
- To avoid double counting with the other EGSS output of government (which is calculated using the cost approach) internal current expenditure by the general government is not counted towards ancillary output.

The JQ-EPER data for internal current expenditure (JQ_ICE) must be mapped to the economic activities by 39 NACE categories (the same 39 categories as in the 2013 EGSS questionnaire). For example, the internal current expenditure for 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)'[68]', e.g for CEPA 1 and NACE C26 used as an example:

$$EGSS\_P1\_Anc_{CEPA\ 1,\ NACE\ C26} = JQ\_ICE_{CEPA\ 1,\ NACE\ C} * NA\_P1_{NACE\ C26}/NA\_P1_{NACE\ C}$$

$EGSS\_P1\_Anc_{CEPA\ 1,\ NACE\ C26:}$ Ancillary output of ambient air and climate protection in NACE C26 (EGSS)

$JQ\_ICE_{CEPA\ 1,\ NACE\ C}$: Internal current expenditure on ambient air and climate protection by the manufacturing industry (JQ-EPER)

$NA\_P1_{NACE\ C26}$: Output of manufacturing of computer, electronic and optical products (NA)

$NA\_P1_{NACE\ C:}$: Output of total manufacturing (NA)

[67] 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 JQ-EPER: it does not include the type 'other business' and does not separate specialised producers into public and private producers.

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

The results could be double checked against the detailed internal current expenditure data of the manufacturing sector from the JQ-EPER.

Since 'Internal current expenditure' reported on the JQ-EPER should only include the costs of material used and compensation of employees for in-house environmental protection activities, it conceptually produces a lower bound estimate of ancillary output of environmental protection services. A complete valuation 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 the JQ-EPER, e.g.:

$$EGSS\_P1\_Anc_{CEPA\ 1,\ NACE\ C20} =$$

$$JQ\_ICE_{CEPA\ 1,\ NACE\ C} * NA\_P1_{NACE\ C20}/NA\_P1_{NACE\ C} * (1+gop_{NACE\ C20})$$

with

$$gop_{NACE\ C20} = (NA\_K1_{NACE\ C20} + NA\_B2N\_B3_{NACE\ C20}) * NA\_P1_{NACE\ C20}$$

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

In the test calculations, in order to estimate the gross operating surplus of ancillary wastewater and waste management activities, 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.:

$$EGSS\_P1\_Anc_{CEPA\ 2,\ NACE\ C26} =$$

$$JQ\_ICE_{CEPA\ 2,\ NACE\ C} * NA\_P1_{NACE\ C26}/NA\_P1_{NACE\ C} * (1+gop_{NACE\ E37-39})$$

Table 25: Test calculation: ratios of gross operating surplus to output (gop) for selected industries based on national accounts 64 industries breakdown, Netherlands (%/100)

NACE	2007	2008	2009	2010	2011
C20	0.163	0.147	0.105	0.130	0.118
D	0.286	0.231	0.332	0.319	0.297
E36	0.398	0.381	0.384	0.389	0.377
O	0.174	0.172	0.166	0.171	0.178

In the table below results of the test calculations aggregated at EU level are shown.

Table 26: Test calculation: ancillary EGSS output by economic activity, EU28 (million EUR)

NACE	2007	2008	2009	2010	2011
Total NACE	19159	18598	18732	20744	21557
of which:					
B	1451	1390	1180	1696	1494
C10-C12	1798	1704	1779	1871	1938
C22_C23	1027	942	894	959	1000
C24_C25	1876	1755	1456	1677	1819
C28	1293	1258	1150	1225	1319
C29_C30	1951	1749	1615	1885	1983
D	4009	4416	5464	5651	5967

Table 27: Test calculation: ancillary output of EGSS by environmental activity, EU28 (million EUR)

CEPA	2007	2008	2009	2010	2011
Protection of ambient air and climate	5344	5278	4896	5559	5790
Wastewater management	5415	5636	6247	5932	6220
Waste management	4191	4191	3983	4170	4249
Protection and remediation of soil, groundwater and surface water	819	891	892	867	859
Noise and vibration abatement	502	481	562	854	530
Protection of biodiversity and landscape	737	658	682	715	994
Other environmental protection	2151	1463	1470	2647	2913

Further improvements

The gap-filled JQ-EPER dataset used in the test calculation does not include data on internal current expenditure on environmental protection for NACE A and the various service industries. If these data are available the internal current expenditure for these industries can be mapped to ancillary output as well.

When 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.[69]

More specific information may be used to estimate the consumption of fixed capital in ancillary environmental activities. At national level surveys may provide detailed

[69] The results of the test calculation compared to the data transmitted with the JQ-EPER 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.

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 by the JQ-EPER source. 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).

4.6. Total EGSS output

Using the methods described above total output of the EGSS can be compiled broken down by environmental activity, by economic activity and cross classified by environmental and economic activities. With estimates made for most of the Member States it is possible to compile estimates of EGSS time series for EU28 (European Union with 28 Member States)[70]. In the first table EGSS output is broken down by environmental activities, in the second table it is broken down by industries. All these data are also cross-classified by environmental and economic activity.

Table 28: Test calculation: total EGSS output by environmental activity, EU28 (million EUR)

CEPA/CreMA	**2007**	**2008**	**2009**	**2010**	**2011**
Protection of ambient air and climate	16217	16143	14906	15259	15975
Wastewater management	99681	102944	96876	98496	102864
Waste management	161821	168528	155900	177580	188584
Protection and remediation of soil, groundwater and surface water	20984	23141	22844	25275	27412
Noise and vibration abatement	2966	2990	3070	3165	2754
Protection of biodiversity and landscapes	14432	14648	14941	14597	15288
Other environmental protection	18394	19390	17238	19047	19887
Management of water	21107	22514	21404	20937	21750
Energy from renewable sources	83129	115531	117791	139321	155168
Heat/energy savings and management	93445	97382	90188	98569	109067

[70] 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 29: Test calculation: total EGSS output by industry, EU28 (million EUR)

NACE	2007	2008	2009	2010	2011
Total	532176	583211	555159	612245	658748
of which:					
A	15271	17269	17142	19546	21821
C26	11083	14531	12645	14256	14160
C27	12254	14933	12561	16037	15694
C28	18789	22515	19645	24592	24332
D	46141	58787	62547	68545	76341
E36	18876	19531	19242	19895	20647
E37	51104	51903	48681	52199	55608
E38	110506	115522	106571	122986	131469
E39	12278	12836	11841	13665	14608
F	127177	138296	134014	137689	153461
M71	16672	18112	17491	17993	20013
O	31851	32034	32335	33831	34463

The approach described in the previous sections has been tested for all Member States of the EU except for Croatia. Largely, the same sources and approaches are used for all countries. Therefore comparability of the estimates across countries is relatively high.

Table 30a: Test calculations: total EGSS output by 27 EU Member States (million EUR)

	2007	2008	2009	2010	2011
Belgium	10758	12103	12439	18243	19535
Bulgaria	1079	1538	1673	1753	1627
Czech	6491	8381	8946	11286	10459
Denmark	9786	10897	10442	10936	11808
Germany	110435	122542	124800	141887	153605
Estonia	557	767	565	649	809
Ireland	5467	5789	5136	4695	4999
Greece	7322	7847	7792	7404	7437
Spain	50619	60154	51024	50880	48755
France	78237	83952	80086	90666	95267
Italy	71371	77342	76650	82171	96500
Cyprus	377	446	472	636	644
Latvia	1086	1456	1284	1307	1368
Lithuania	1018	1149	1203	1469	1627
Luxembourg	743	937	853	842	951
Hungary	3063	3735	3510	3940	4279
Malta	156	169	203	279	272
Netherlands	24075	25689	24491	25789	26579
Austria	20239	23384	21744	22876	25038
Poland	11577	14719	13352	16208	17489
Portugal	8224	8657	8689	9775	11145
Romania	4749	5886	6478	8888	9075
Slovenia	1335	1589	1782	2378	1860
Slovakia	2521	3388	2913	3078	3511
Finland	6637	7491	6987	8000	8643
Sweden	13567	13285	12807	15153	17513
United	78875	77758	66794	68905	75716

Based on the detailed compilations described in the previous sections it is possible to identify also that part EGSS output which is due to market activities, which is the reporting requirement of Regulation amending Regulation (EU) No. 691/2011.

Table 30b: Test calculations: EGSS output in EU28 by type of activity (million EUR)

	2007	2008	2009	2010	2011
Market	452217	504433	472429	525014	569434
Non-	60801	60180	63998	66488	67757
Ancillary	19159	18598	18732	20744	21557

4.7. EGSS exports

Regulation No 691 requires to estimate that part of EGSS market output that is exported (export is an “of which”-characteristic) cross-classified by the classification

of economic activities and classes of the classifications of environmental activities and resource management activities.

The required classification by NACE is a challenge since most available data sources for trade are classified by products and not by 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 classifications are classifications for commodities (goods) and do not include services nor apply to economic activities[71].

Existing data sources

Trade in goods data can be downloaded from Eurostat's on-line 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 for identifying envrionmental goods exports from the CN-8-digit-classfication are shown in list 1 (see section 3.4). 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.

A source for *trade in services* is the balance of payment statistics. For example the World Trade Organization publishes on its website data on exports of environmental services derived from statistics on international service transactions. Balance of payment (BoP) statistics 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 activities* is 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 compiled in the framework of the 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.

[71] Nomenclatures and correspondence tables are available from the Eurostat's classification server RAMON.

Calculating EGSS exports

If EGSS export data cannot be identified at a sufficiently detailed economic activity breakdown, this practical guide recommends using sources that show export data broken down by product classifications.

Where 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):

$$EGSS\_P7_{CEPA\ 2,\ NACE\ E37} = EGSS\_P1_{CEPA\ 2,\ NACE\ E37} * NA\_P7_{CPA\ E37}/\Sigma_{nace} NA\_P1_{nace,CPA\ E37}$$

$EGSS\_P7_{CEPA\ 2,NACE\ E37}$: 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)

$NA\_P7_{CPA\ E37:}$ 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)

Behind the above formula stands the simplifying assumption 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[72]. This approach provides a first estimate of EGSS exports by economic activity. It is 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 a more detailed product and activity breakdown of the supply and use tables than A*64 is available using this more detailed breakdown may be preferred.

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. An analysis based on trade statistics is then to supplement this approach[73]. As shown in list 1

[72] 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 4.2.1).

[73] 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 (wherease 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,

(section 3.4) some trade codes are identifiable that correspond relatively closely to EGSS goods.

Eurostat's test calculations for EGSS exports are mainly based on the first approach (i.e. using 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 are 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 are higher than those based on the supply and use tables, the test calculations use 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' (bop_q_c)) are used to complete the trade data for goods and services.

Based on the test calculations for the Member States EU28 exports (extra-EU exports) are estimated to amount to 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.

Use of micro databases

For countries that have established a micro database on businesses active in the production of envrionmental goods and services it may be possible 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 guesses 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). Sending out specifically designed questionnaires to collect data on EGSS exports or additional questions to exisiting surveys can also be helpful for identifying EGSS exports, shares of EGSS exports and specialisation factors if the administrative and financial burden of doing so is acceptable. Limiting this burden may be achieved by using survey data for benchmark years (e.g. for every third to fifth reporting year) in order to calculate export shares and using interpolation methods for years between two benchmarks.

Expert guesses

Some areas may depend heavily on expert guesses. For example, it is very difficult to trace international trade in electricity from wind, hydro or photovoltaic power because it is not a distinct product category in official classification systems for

computer related services, education services) that are exported and to assess the plausibility of the results obtained by simpler methods.

trade. In such cases the above describve 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).

5. TEST CALCULATIONS FOR 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 used as intermediate inputs for EGSS production 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 in EGSS. However, the lower the share of EGSS in total production of an industry, the bigger is the uncertainty about the representativeness of the industries' labour intensities for the EGSS. The representativeness may then depend on the similarity between the technologies applied in the production of EGSS and non-EGSS output within an industry. 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.

5.1. The basic model for estimating EGSS employment

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

For better international comparison 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:

$$c\text{-}ratio_{nace} = NA\_D1_{nace}/NA\_P1_{nace} \quad \text{and} \quad w\text{-}ratio_{nace} = NA\_D1_{nace}/FTE_{nace}$$

$EGSS\_Emp_{cepa/crema,\ nace}$: Employment cross-classified by industries and environmental activities (EGSS)

$EGSS\_P1_{cepa/crema,\ nace}$: 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

The basic assumption in this approach is that the average labour compensation rates and intensities for an industry are sufficiently precise indicators for the EGSS activities within the same industry. Some limitations of this basic assumption are

discussed below in sections 5.2. and 5.3 as well as proposals for refinement to overcome some of the limitations (see also annex D).

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

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

5.2. Ratios: labour compensation to production value

Information on compensation of employees engaged in the production of EGSS 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 found. In the test calculations ratios derived from national accounts data are used: Eurostat's collection on 'National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)'[74] provides data on the compensation of employees and output from which c-ratios for industries can be derived.

Table 31: Test calculations: 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	0.160	0.272	0.114	0.368	0.205	0.144	0.079
C26	0.255	0.239	0.200	0.204	0.041	0.116	0.266
C27	0.280	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	0.210	0.206	0.420	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	0.130	0.094	0.230	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	0.240	0.314	0.098	0.112	0.158	0.370	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

By using c-ratios derived from national accounts it is implicitly assumed that the average compensation-output ratios for the single industries are representative for the production of EGSS within these industries. This assumption may be justified by a certain similarity of the processes and technologies used in the production of the

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

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 EGSS output) can be very good proxies.

On the other hand, for some EGSS 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. Therefore, in the test 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.

5.3. Ratios: labour compensation per full time equivalent

Information on labour compensation rates per FTE (w-ratios) in the EGSS is also not readily available in existing statistical sources. Therefore also proxies for the w-ratios need to be estimated. In the test calculations data on the compensation of employees from Eurostat's collection 'National Accounts aggregates by industry (up to NACE A*64) (nama_10_a64)'[75] are used for most of the industries. This information is combined with national accounts employment data from Eurostat's collection 'National Accounts employment data by industry (up to NACE A*64) (nama_10_a64_e)'[76], which provides statistical information on employment broken down by employees and self-employed and measures employment in terms of hours worked, number of jobs, number of persons and FTE. For the test calculation total employment (employees plus self-employed) is used.

However, in this source employment data measured in FTE are often missing, so that figures on the number of persons have to be converted. Given that part time work is a widespread characteristic of working contracts using the number of employees instead of FTE would probably result in some overestimation of the real employment. Therefore a simple approach has been developed to convert the number of employees using information on the share of part time work and hours worked. This approach provides an estimate of FTE per person employed broken down by industries. Using 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 in full time jobs (hereafter called 'p-ratios'). From

[75] For countries, for which the new ESA 2010 data are not available collection 'annual National Accounts by 64 branches at current prices (nama_nace64_c)' is used.

[76] Where the ESA 2010 collection was not available the corresponding ESA95 collection 'nama_nace64_e' was used.

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:

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

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 32: 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.

Table 33: Test calculations: 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:

$$\text{w-ratio}_{nace} = \text{NA\_D1}_{nace}/\text{FTE}_{nace} =$$

$$(\text{NA\_D1}_{nace}/\text{employed persons}_{nace}) / (\text{FTE}_{nace}/\text{employed persons}_{nace})$$

Table 34: Test calculation: labour compensation per FTE (w-ratio) for selected industries and countries, year 2008 (EUR)

NACE	Belgium	Germany	Italy	Greece	Slovakia	Finland	UK
A	34699	33114	20751	15269	36189	27643	28988
B	51935	50076	42710	47725	13746	37188	78732
C26	72070	59253	41272	21999	10767	63280	50493
C27	58104	55462	35800	22185	10124	43804	50820
C28	58463	52225	42107	21478	13187	48060	50832
D	111804	59500	56596	51962	19614	55247	61060
E36	68032	47144	43991	37665	14430	33870	48871
E38	52581	38321	36128	38087	10369	35167	61898
F	35265	28601	19815	12206	7554	39045	28270
J	66897	53405	38746	31926	17242	51065	61556
M69_M70	19347	40820	14187	10373	10372	43301	37280
M71	41381	32627	10219	6779	11018	47601	41816
M72	83874	55391	56287	25858	12467	50612	61960
O	52566	44671	51442	32964	16570	41003	47135

As explained earlier in this chapter, the basic assumption of the estimation approach is that the labour compensation rates and intensities in an industry are sufficiently precise 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 renewbale sources and non-renewable sources are differnt 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).

5.4. Results on EGSS employment

In combining all the calculation steps described above in sections 5.1 to 5.3 EGSS direct employment by environmental activities and industries is compiled. With estimates made for most of the Member States it possible to produce estimates of EGSS time series for EU28 (European Union with 28 Member States)[77]. In the first table EGSS employment is broken down by environmental activities, in the second table it is broken down by industries. All these data are also cross-classified by environmental activities and industries.

[77] 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 35: Test calculation: total EGSS employment by environmental activities, EU28 (1000 FTE)

CEPA/CreMA	2007	2008	2009	2010	2011
Protection of ambient air and climate	111	109	113	98	102
Wastewater management	648	663	687	644	629
Waste management	957	999	1010	1062	1083
Protection and remediation of soil, groundwater and surface water	370	394	425	457	466
Noise and vibration abatement	25	24	25	22	21
Protection of biodiversity and landscapes	133	132	136	132	133
Other environmental protection	180	188	177	186	188
Management of water	146	154	147	142	144
Energy from renewable sources	324	446	523	596	647
Heat/energy savings and management	673	699	691	730	767

Table 36: Test calculation: total EGSS employment by industries, EU28 (1000 FTE)

NACE	2007	2008	2009	2010	2011
Total NACE	3568	3807	3934	4068	4181
of which:					
A	320	346	377	411	422
C26	49	69	70	66	66
C27	68	81	83	89	81
C28	93	118	122	133	117
D	90	103	114	124	132
E36	152	152	154	158	159
E37	266	260	267	260	262
E38	570	595	607	647	670
E39	63	66	67	72	74
F	1034	1124	1190	1200	1264
M71	145	155	161	160	177
O	379	366	359	365	366

The approach described in the previous sections has been tested for all Member States of the EU (except for Croatia) and results are shown in the following table.

Table 37a: Test calculations: total EGSS employment by 27 EU Member States (1000 FTE)

	2007	2008	2009	2010	2011
Belgium	53	56	60	72	70
Bulgaria	44	54	62	58	55
Czech Republic	91	100	119	133	110
Denmark	45	49	47	47	47
Germany	651	696	778	804	801
Estonia	8	10	9	8	11
Ireland	28	30	28	27	26
Greece	82	90	94	101	95
Spain	283	320	273	270	255
France	497	514	527	555	562
Italy	427	428	464	467	526
Cyprus	5	5	5	7	6
Latvia	24	25	22	22	21
Lithuania	29	27	35	34	33
Luxembourg	5	5	5	5	5
Hungary	60	65	65	69	69
Malta	3	3	3	3	3
Netherlands	124	124	119	125	121
Austria	99	102	100	105	116
Poland	257	282	299	309	328
Portugal	81	80	82	87	107
Romania	150	162	172	207	216
Slovenia	16	17	21	26	20
Slovakia	36	40	37	35	39
Finland	36	39	40	43	43
Sweden	61	66	66	68	78
United Kingdom	361	402	387	368	401

With the detailed compilations described in the previous sections it is possible to identify also that part EGSS employment which is due to market activities, which is the reporting requirement of Regulation (EU) No 691/2011.

Table 37b: Test calculations: EGSS employment in EU28 by type of activity (1000 FTE)

	2007	2008	2009	2010	2011
Market	2970	3218	3320	3450	3560
Non-market	507	493	519	520	522
Ancillary	91	96	96	98	98

5.5. Future improvements

Data on wage to output ratios 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 from specific surveys on EGSS that ask for 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 (see also section 3.2.1 for more details on using surveys). 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 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 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 the production cost structure can be useful additional information to allow for a better representation of EGSS specific conditions with respect to wages and employment. An example for the use of such additional data for the EGSS employment estimates is provided in annex D and has been implemented in the test calculations for energy from renewable sources.

6. TEST CALCULATIONS FOR EGSS GROSS VALUE ADDED

6.1. The model for estimating EGSS gross value added

The model for EGSS gross valued 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 linked with national accounts information on the ratios between gross valued added and output. Gross valued added covers compensation of employees, net operating surplus and mixed income and the consumption of fixed capital:

$$EGSS\_B1G_{cepa/crema,\ nace} = EGSS\_P1_{cepa/crema,\ nace} * (NA\_D1_{nace}+NA\_B2NB3N_{nace}+NA\_K1)/NA\_P1_{nace}$$

$EGSS\_B1G_{cepa/crema,\ nace}$: Gross valued added cross-classified by industries and environmental activities (EGSS)

$EGSS\_P1_{cepa/crema,\ nace}$: Output cross-classified by industries and environmental activities (EGSS)

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

NA_B2NB3N_{nace}: Net operating surplus and net mixed income by industries (NA)

NA_K1_{nace}: Consumption of fixed capital by industries (NA)

NA_P1_{nace}: Output by industries (NA)

The basic assumption is that the average gross value added shares in output for an industry are sufficiently precise indicators for the EGSS activities within the same 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 5.2 for details). Consumption of fixed capital derived from national accounts is added to obtain a proxy for the GVA in organic farming.

6.2. 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. With estimates made for most of the Member States it is possible to produce estimates for EU28 (European Union with 28 Member States)[78].

[78] 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 38: Test calculation: total EGSS GVA by environmental activities, EU28 (million EUR)

CEPA/CreMA	**2007**	**2008**	**2009**	**2010**	**2011**
Protection of ambient air and climate	6612	6407	6122	6220	6402
Wastewater management	41182	42353	40716	40970	41558
Waste management	64334	67095	64631	71857	73690
Protection and remediation of soil, groundwater and surface water	14061	15046	15378	16618	17845
Noise and vibration abatement	1453	1457	1502	1592	1335
Protection of biodiversity and landscapes	7764	7964	8260	8156	8408
Other environmental protection	9967	10418	9500	10248	10707
Management of water	9644	10066	9583	9323	9711
Energy from renewable sources	28816	39190	42055	49329	52994
Heat/energy savings and management	36085	37515	35644	39030	42521

Table 39: Test calculation: total EGSS GVA by industries, EU28 (million EUR)

NACE	**2007**	**2008**	**2009**	**2010**	**2011**
Total NACE	219917	237512	233393	253343	265172
of which:					
A	11402	12343	12682	13962	15249
C26	4004	5195	4732	5361	5276
C27	4156	5178	4527	5796	5414
C28	6401	7705	6942	8952	8586
D	15166	18655	21137	22907	24463
E36	9858	10015	9552	9759	10203
E37	21292	21715	20860	21688	22195
E38	42244	44185	42780	47792	48925
E39	4701	4923	4738	5310	5436
F	48230	52516	51938	53720	58749
M71	8868	9559	9363	9632	10730
O	20913	21045	21233	22171	22747

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

Table 40a: Test calculations: total EGSS gross value added by 27 EU Member States, 2011

	2007		2009		2011	
	million EUR	% of GDP	million EUR	% of GDP	million EUR	% of GDP
Belgium	4115	1.2	4718	1.3	6690	1.8
Bulgaria	321	1.0	518	1.4	564	1.4
Czech Republic	2320	1.7	3273	2.2	3701	2.3
Denmark	3948	1.7	4219	1.8	4764	1.9
Germany	48090	1.9	55335	2.3	64898	2.4
Estonia	232	1.4	229	1.6	330	2.0
Ireland	1806	0.9	1572	0.9	1559	0.9
Greece	5062	2.2	5651	2.4	4360	2.1
Spain	20113	1.9	22523	2.1	21858	2.0
France	33679	1.7	35499	1.8	39874	1.9
Italy	24392	1.5	28053	1.8	32378	2.0
Cyprus	189	1.1	219	1.2	287	1.5
Latvia	405	1.8	473	2.5	482	2.4
Lithuania	510	1.8	600	2.2	693	2.2
Luxembourg	318	0.9	372	1.0	406	1.0
Hungary	1219	1.2	1351	1.4	1588	1.6
Malta	84	1.5	98	1.6	116	1.7
Netherlands	10538	1.7	10588	1.7	11262	1.8
Austria	8371	3.0	8316	2.9	9847	3.2
Poland	4827	1.5	5740	1.8	7199	1.9
Portugal	2818	1.6	3156	1.8	3672	2.1
Romania	1859	1.5	2430	2.0	4017	3.0
Slovenia	525	1.5	697	1.9	680	1.8
Slovakia	1070	1.9	1200	1.9	1331	1.9
Finland	2815	1.5	2989	1.7	3525	1.8
Sweden	5936	1.7	5680	1.8	7812	1.9
United Kingdom	33605	1.6	27034	1.6	30379	1.6

With the detailed compilations explained in the previous sections it is possible to identify also that part EGSS GVA which is due to market activities, which is the reporting requirement of Regulation (EU) No 691/2011.

Table 40b: Test calculations: EGSS GVA in EU28 by type of activity (million EUR)

	2007	2008	2009	2010	2011
Market	180975	199247	193163	211012	222759
Non-market	32467	32176	33894	35185	35386
Ancillary	6475	6089	6335	7146	7027

ANNEX A: PROBLEMS RELATED TO THE CATEGORISATION OF ENVIRONMENTAL PRODUCTS

The categories of environmental products are defined partly with reference to the technology concept from research, development and innovation statistics and partly with reference to categories of goods and services (Eurostat, 2013b). In practice, EGSS statistics are usually compiled with reference to lists of goods and services and the EGSS technologies category is used to track the production and installation of certain investment products that are combined into items of investment (e.g. machinery, components, construction works, architectural and installation services which are combined to form a wind mill park). Some environmental technologies may be included in the categories of connected products or adapted goods, and there may be products that are at the same time connected and adapted goods (e.g. a biodegradable trash-bag). For such cases it is important to have a list of products that exclusively relates them to one of the different product categories.

Some further delimitation problems for cleaner goods and cleaner technologies are presented in greater detail in the box below:

Is a "cleaner good" or "cleaner technology" (adapted goods and integrated technologies) cleaner?

- The definition of "cleaner" poses measurement challenges because many goods and technologies produced or applied today are less polluting or less resource depleting than in the past (e.g. practically all motor vehicle engines fabricated today produce less air emissions and use less fuel than those engines of the same power produced 10 years ago). A good or a technology that is leading in terms of cleanness today may not be cleaner than the average of the goods and technologies of the same type in five years.

- Also the production of integrated technology and adapted goods and of the inputs used to operate them may result in environmental pollution or resource depletion. For example, for a low air emission vehicle to be recorded under CEPA 1 (protection of ambient air and climate) the car must be less polluting when used or scrapped than equivalent normal cars which furnish a similar utility. This criterion, however, does not take into account the pollution caused by the manufacturer of the car nor does it consider, in the case of an electric car, the emissions resulting from the production of the electricity used to operate the car (Eurostat, 2012a) (p. 7).

- Conventional production technologies or conventional goods may be no more polluting than integrated technologies and adapted goods if effective end-of-pipe technologies are installed to treat emissions or to scrap, reutilize or recycle the goods at the end of their life cycles without release of dangerous substances into the environment.

Is organic farming an integrated technology or the production of adapted goods?

- Organic farming is said to be an integrated technology in the 2009 EGSS handbook. However, when calculating the production value of the EGSS, there is unlikely to be any production of this technology. Therefore, organically produced agricultural products are, according to the EGSS handbook (p.55), considered as adapted goods, although the output from organic farming is not itself an environmental good that will enable someone to improve the environment.

Definitions used in the environmental protection expenditure accounts (EPEA) often differ from those in EGSS although the same terminology is used. In particular the scope and measurement of adapted goods and technologies are different in the two

environmental accounts domains. Such consistency problems between EPEA and EGSS are presented in greater detail in the box below:

The scope and measurement of adapted goods and integrated technologies in EGSS differs from that in the EPEA:

- Whereas in EGSS technologies are seen as product categories distinct from connected and adapted goods, in the environmental protection expenditure accounts (EPEA) end-of-pipe and integrated technologies are particular categories of investment expenditure (which are composed of various products).

- Whereas EPEA does not cover resource management expenditure, an adapted good in EGSS may also be less resource depleting and more resource-efficient when produced or used (2009 EGSS handbook, p. 35). EPEA and the 2009 EGSS handbook define adapted goods for environmental protection in a more restricted way as products that are more environmentally friendly when used or scrapped. This practical guide proposes that adapted goods for environmental protection also include goods which are more environmentally friendly when produced in order to align the definitions for EP and RM.

- In the EPEA only the environmental "extra" part of an adapted good is included, whereas for EGSS the entire value of an adapted good is to be included (Eurostat, 2009) (p. 36). It is difficult to see how adapted goods (e.g. low emission vehicles, energy saving refrigerators, wind electricity facilities, organic food) have environmental protection or resource management as their primary objective since the producer's main purpose according to the technical nature and intention may be similar to the purpose of similar conventional goods (e.g. to offer transport facility, to conserve food, to contribute to electricity supply, to contribute to food supply). The entire value of an adapted good may add considerable amounts of output, employment etc. to the EGSS statistics.

- Whereas in EGSS the output of integrated technologies is assessed at the total cost, the EPEA measures expenditure on integrated technologies based on the modification costs or extra-cost (the environmental share). As a possible way forward to survey integrated technologies at their full costs (as needed for EGSS output measurement) it has been suggested to change the (SBS) questionnaires by adding a question asking for the total investment in integrated technologies (not only the environmental share of the investment) (Eurostat, 2013a).

There are also practical problems to identify EGSS products across existing statistics. The identification of connected goods (only for sole environmental purposes) may be rather difficult if production and trade data are not available at a very detailed commodity breakdown; at higher levels of aggregations the product groups normally have multi-purpose characteristics. In such cases shares of environmental purpose may be applied, which make the concept of connected (sole-purpose) goods a theoretical one with limited operational usefulness.

Furthermore, since for most of the countries adapted goods are difficult to be identified, only a short indicative product list containing, for example, the most important adapted goods (e.g. organic farming) should be part of the EGSS statistics ensuring in this way comparability of data across countries (Eurostat, 2012d).

This practical guide recommends that the product categories need not to be identified separately for EGSS data compilation and reporting, if existing data available for the compilation of EGSS statistics do not allow their separate identification (see also annex C, EGSS handbook revision item 3a).

ANNEX B: PROBLEMS RELATED TO THE CATEGORISATION OF ENVIRONMENTAL PRODUCERS

There are *delimitation problems in the categorization of environmental producers.* In practice the definition of the specialist producers may be applied with some flexibility:

- Some government units that provide environmental services cannot really be classified as specialist producers because their principal activity is not environmental protection or resource management. For the sake of simplicity, however, all characteristic activities carried out by government may be classified as being produced by specialist producers when the data source provides figures for the total activity (e.g. COFOG).
- Another example is the case of wastewater management services provided by water supply units classified in NACE division E36. In theory, these producers would be classified as non-specialist producers since their principal activity is not environmental protection or resource management. Also for these units, for the sake of simplicity, all characteristic activities (e.g. their sewerage services produced in a secondary activity) may be classified as being produced by specialist producers.
- Specialist producers can be identified at individual unit level or at the level of specific NACE categories producing characteristic EGSS output as their principal activity (e.g. NACE 37 – sewerage). In the first case specialist producers could occur in any NACE category. However, to identify all of these producers a comprehensive survey would be needed which would allow knowing for each producer its value added (or at least output) which is due to EGGS production as well as his total value added or output. Once this information is available, there is, however, no advantage of separating specialist and non-specialist producers. In the second case the principal output of the specific NACE industry (for the above example of NACE 37 its sewerage output) could count towards EGSS plus its secondary EGSS output (e.g. some waste management output if produced as a secondary activity by NACE 37).
- The scope of specialist producers in EGSS is broader than in EPEA where it is limited to producers that primarily produce environmental protection specific services. In EGSS, specialist producer also produce goods for environmental protection and goods and services for resource management as their primary activity.

However, for the future Regulation amending Regulation (EU) No 691/2011 on European environmental economic accounts there is no need to report data separately for the various categories of producers of environmental goods and services.

This practical guide does not consider specialist and non-specialist producers as useful categories for EGSS compilation. The practical guide approach is to look rather at 'specialist' NACE categories (whose output can be considered as (almost) 100% such as the output of NACE E37 and NACE E38) and to determine for the other NACE categories environmental shares of their output.[79]

[79] To limit the concept of 'specialist' to NACE categories is recommended if no use is made of detailed enterprise databases. However, when such micro databases can be used for EGSS statistics the distinction between specialist and non-specialist producers may remain useful, since specialist producers may be found in many different NACE categories.

ANNEX C: ISSUES FOR REVISION FOR THE NEXT HANDBOOK ON EGSS

The handbook The Environmental Goods and Services Sector - A data collection handbook published in 2009 was designed to provide a description and analysis of the concepts related to the environmental goods and services sector, supplemented by a definition and a classification of the sector, practical hands-on and methodological guidance. Since the publication of this handbook important developments in the framework of environmental monetary accounting and in the development of specific methods have taken place that give reason to revise the handbook in order to maintain and enhance its usefulness as methodological guidance for EGSS data compilers (Eurostat, 2014).

This annex presents potential issues for revising and simplifying the EGSS handbook that need to be discussed and solved until a final draft of the handbook can be published. Country experts have been asked to comment on these issues identified by Eurostat. Therefore the list of issues below is not to be regarded as final. Depending on the outcome of these discussion some changes in the practical guide, too, may become necessary.

Chapter 1: Introduction

1. The description of the *policy context* is to be updated (Europe 2020, Employment Package, ILO green jobs, European Strategy for Environmental Accounting, amendment of Regulation 691/2011).

Chapter 2: The environmental goods and service sector

2. The scope and delimitations of EGSS activities will not change fundamentally from those defined in the 2009 handbook. Some clarification, simplification and modification are proposed for practical reasons.
    a. In order to define whether a good or a service is part of EGSS, the main environmental purpose (by technical nature and/or the producer intention) remains the main criterium. However, for practical reasons the revision should acknowledge that also the *user's perspective* may determine the scope of EGSS and that this is only to simplify the use of demand side data (in particular on environmental expenditure) in the compilation of EGSS statistics[80]:
        i. The exclusion of goods and services without environmental purpose and whose main purpose is to satisfy technical, human and economic from the scope of EGSS (2009 EGSS handbook, p. 32) needs to be reviewed in this

[80] Depending on the sources used for the compilation of EGSS statistics it may be rather difficult to strictly adhere to the technical nature and producer intention criteria, for example when EP and RM expenditure data (e.g. gross fixed capital formation for the production of EP services and for RM activities) are used to compile EGSS statistics. To translate the environmental expenditure concepts into the concepts of EGSS a bridge table would be necessary that details out differences in coverage and valuation. *[Note: The coverage and valuation differences between the Environmental Protection Expenditure Accounts and the EGSS statistics are detailed out in the SEAA 2012 (Table 4.3.6, p. 106).]* If not all information is available for this bridge table - to the extent that data on EGSS are compiled from demand-side information – the compiled EGSS data may include some goods and services that are not environmental products but which are used for EP and RM activities. [*Note: One of the differences detailed out is that environmental expenditure data include besides environmental goods and services also expenditure on other goods and services for environmental protection purposes.*] This is a deviation from the 2009 EGSS handbook and it is proposed by this practical guide only in order to simplify the use of EP and RM expenditure statistics in the compilation of EGSS statistics.

context. If such products are used for environmental purposes according to data on environmental expenditure they may be considered as in the scope of EGSS[81].

ii. In practice, the available sources may not allow to distinguish between installation of environmental equipment by producers that specialise in this work and by other producers. The 2009 EGSS handbook (p. 39) stipulates the latter to be excluded from the scope of EGSS. This exclusion should be reviewed for the next handbook: in order to measure e.g. employment comprehensively all activities installing environmental equipment should be in the scope of EGSS.

iii. Likewise, the sources may not allow distinguishing between components of an environmental product to be used exclusively in an environmental product and other components of an environmental product. The 2009 EGSS handbook (p. 39) excludes from the scope of EGSS the provision of the latter by an upstream producer to the main producer of the environmental product. This exclusion should be reviewed for the next handbook: in order to measure e.g. employment comprehensively all components of an environmental product delivered by an upstream producer to the main producer may be considered[82].

b. The SEEA 2012 acknowledges that due to close links to the environment the recording of *activities undertaken to minimise natural hazards and the effect of climate change* may lie within the domain of environmental monetary accounts. Areas already included in EGSS according to the 2009 handbook are the protection against soil erosion, which reduces the risk of landslides, and the prevention and control of forest fires. In practical terms, it may be difficult to separate out activities undertaken to minimize natural hazards from data covering EP and RM activities: for example, activities related to water but aimed at preventing flooding. The issue should be further reviewed for the next EGSS handbook: where activities to minimize natural hazards also prevent environmental damages or the depletion of natural resources and the relevant data do not allow separating out these activities the scope of EGSS may include activities that minimize natural hazards.

3. The definition of the various *categories of the environmental products* (environmental specific service, connected products, adapted goods, end-of pipe and integrated technologies) in the 2009 EGSS handbook will not be changed fundamentally. However, the role of these definitions for data compilation and reporting should be clarified and the definition of adapted products reviewed:

a. The categorisation of environmental products poses delimitation and identification challenges to compilers of statistics (for more details see annex A of the practical guide). In summary, these issues make the product categories less useful for EGSS statistics. The revised handbook should point out that the amended Regulation 691/2011 will not require these product categories to be identified separately for EGSS data compilation and reporting. In the framework of the voluntary data transmission, however, Eurostat will continue asking Member States to transmit data on market activities cross-classified by the product categories (in addition to cross classifications by environmental activity and economic activity), if the sources allow for this separate reporting.

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81 This may be limited only to cases where it facilitates the use of demand side data.

82 This may be limited to cases where demand side data are used and it is not possible to distinguish between components that are environmental products and that are non-environmental products. Wherever possible non-environmental products should be excluded from estimates based on demand side data.

b. It should be reviewed whether the revised handbook should extend the definition of adapted goods (or "cleaner goods") to more environmental-friendly or less polluting goods when produced[83] (not only when used or scrapped) and to also include cleaner and resource efficient services, if examples can be found for this[84].

4. The 2009 EGSS handbook identifies *institutional sectors* to which EGSS producers can be classified: general government and corporations (p. 39). The revised handbook should acknowledge that EGSS producers may be found in all institutional sectors as defined by ESA 2010, in particular also in the sector of non-profit institutions serving households and in the household sector (sole proprietorships within the household sector such as organic farmers and producers for own final consumption).

5. The *categorisation of environmental producers* as proposed by SEEA 2012 (in particular specialised and non-specialised producers) poses delimitation challenges to EGSS compilers. In practice, the definition of the specialist producers is an extra burden, less useful and should be applied with some flexibility (for more details see annex B of the practical guide). Therefore, the revised EGSS handbook should not consider specialist and non-specialist producers as useful categories for EGSS data compilation. The practical approach is to look rather at 'specialist' NACE categories (whose output can be considered as (almost) 100% such as the output of NACE E37 and NACE E38) and to determine for the other NACE categories environmental shares of their output.[85]

6. According to the 2009 EGSS handbook activities of the EGSS can be *market or non-market or ancillary* and hence EGSS output can be market, non-market and ancillary output. These issues need some additional clarification for the revised handbook, in particular:

   a. *EGSS output produced for own final use* was not explicitly covered by the 2009 EGSS handbook. Given the SEEA's focus on environmental goods and services wherever they occur in the economy it is reasonable that EGSS output should include also output produced for own final use. Output produced for own final use consists of goods and services that – according to ESA 2010 - are retained either for capital formation or for own final consumption by the same institutional unit[86]:

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83 Note that the EPEA and the 2009 EGSS handbook define adapted goods for environmental protection in a more restricted way as products that are more environmentally friendly when used or scrapped (see also Annex A for problems related to the categorisation of environmental products). In practice, however, the 2009 EGSS handbook proposes to record organic farming goods under adapted goods in the environmental protection domain, although they are clearly not cleaner when used but when produced. An alternative categorisation would be to treat organic farm products as characteristic goods , i.e. goods produced by characteristics activities (organic farming).

84 For practical reasons adapted products may only be included if there is a clear and reliable certification systems for these products (e.g. for organic farm products) and output can be measured by information on the shares of these certified parts of production. This could avoid that the scope of EGSS is massively broadened.

85 To limit the concept of 'specialist' to NACE categories is recommended if no use is made of detailed enterprise databases. However, when such micro databases can be used for EGSS statistics the distinction between specialist and non-specialist producers may remain useful, since specialist producers may be found in many different NACE categories.

86 In ESA 2010 output produced for own final use (P.12 is also called own-account production and it is a category distinct from non-market output (P.13).

i. The issue of *EGSS output produced and retained for capital formation* should be addressed in the revised EGSS handbook and explicitly included the scope of EGSS.[87]

ii. Only households can produce products for own final consumption. In ESA 2010 the list of goods produced for own final consumption is restricted to agricultural products retained by farmers, dwelling services produced by owner-occupiers and household services produced by employing paid staff. This practical guide recommends including all auto-production of energy from renewable sources in EGSS output. Therefore it should be considered to revise the EGSS handbook to explicitly *include energy from renewable sources auto-produced for final consumption*[88] *in the EGSS total output measure*. Where relevant, auto-production should be excluded from market output and be recorded under non-market output.

b. *Auto-production of energy from renewable sources for intermediate consumption*: The 2009 EGSS handbook (p. 42) recommends recording auto-production of renewable energy as an ancillary activity. This, however, contradicts the NACE Rev. 2 guidelines, which recommend that separate units should be recognised as kind-of activity units if separate data are available. The SNA 2008 says in paragraph 6.120 that it is unusual to record goods and services used as intermediate consumption in the same establishment but that there are occasion where it may be desirable. If such recording would be made, the goods and services in question add to, both, intermediate consumption and output so that value added is unaffected. ESA 2010 does not address this subject. The EGSS handbook should be revised to include auto-production of energy from renewable sources for intermediate consumption in the EGSS total output measure. Where relevant, auto-production should be excluded from market output and be recorded under non-market output. The EGSS handbook should be revised accordingly.

7. The SEEA 2012 research agenda also recommends that a review of the scope of resource management be undertaken:

a. The 2009 EGSS handbook (p. 61) specifies that only activities for forests not available for wood supply and for uncultivated forests should fall under CReMA 11A, whereas cultivated forests for wood supply should be excluded. The Eurostat Task Force (TF) on the resource management expenditure account (ReMEA) (2013) indicated that forest management should *focus on timber in both naturally regenerated forests and planted forests*. The issue should be reviewed for the revised handbook: it should explicitly allow for not including the management of forest areas (CReMA 11A) in the EGSS estimates if the actual definitions and available sources do not allow to separate CReMA 11A activities from the other forestry activities covered by NACE A02. However, if NACE A02.1 and NACE A02.4 activities can be separated out they should together provide an estimate of CReMA 11A (as proposed by the TF).

b. The 2009 EGSS handbook (p. 61) stipulates to exclude the distribution, collection and potabilisation of water (main activities under NACE E36) from

[87] Separate data on EGSS products retained for capital formation will mostly not be separately available. Therefore it should be recommended to record the production of EGSS products retained for capital formation under market output.

[88] Auto-production of energy is production for a consumer's own use. Examples are electricity production from an onsite generator to provide a portion of the consumer's electricity needs in order to displace imports from the grid on a day to day basis and the production of solar thermal energy for own consumption. In the national accounts, household production of energy not sold to the grid is not (explicitly) recorded.

CReMA 10 (management of water). The TF on ReMEA pointed out that the ideal option would be to establish estimation methods for the separation of water management, but it recognised that this area may be a low priority domain for many countries. The EGSS handbook should encourage countries, in particular those in which water resources are scarce, to direct *further research* to this issue. For reason of simplification and comparability across countries it should be reviewed whether the revised handbook is to recommend *including the whole water supply activities under CReMA 10 until common methods for separating out water management are available; the metadata* supplied with the statistics should then clearly indicate that a broad definition of water management is applied.

c. Following the recommendation of the TF on ReMEA the revised handbook should be reviewed *to exclude from the scope of CReMA 13A the production of biomass (wood etc.) that is converted into other forms of energy which are then sold*. The accounting of biomass used for that part that is not converted into marketed energy products (e.g. wood or wood pellets used by households for own consumption) should, however, be included and if necessary as an area for future research.

d. Wholesale in waste and scrap (NACE 46.77) in EGSS is seen as an important link in the production chain of waste management since it brings together supply and demand for waste and scrap. The handbook should review this issue: *If the data available to the national statistical institutes (e.g. NA, SBS) are detailed enough to identify the principal output of NACE 46.77 it should be considered as part of the materials recovery activities.* The output of NACE 46.77 should be allocated to the respective RM activities (CReMA 11B, CReMA 13C or CReMA 14) based on information on the type of material. If such information is not available this practical guide proposes that NACE 46.77 output should be allocated to the main activity which may often be CReMA 14[89].

e. The strict exclusion of *technologies, goods and services produced to extract, mobilise and exploit non-renewable resources* by the 2009 EGSS handbook (p. 32) should also be reviewed. If more efficient machinery and processes to reduce extraction losses are designed, why should that investment[90] be excluded from the scope of resource management?

8. Also certain environmental classification issues related to EP and its delimitation from RM need to be reviewed:

a. *Production of energy through incineration of waste* is in NACE E38.2 (waste treatment and disposal). In the SEEA 2012 (p. 259) the production of energy from the combustion (incineration) of any kind of waste is included in RM (production of energy from renewable sources - CReMA 13A) except where the incineration is carried out for the main purpose of waste treatment and disposal. The 2009 EGSS handbook (p. 52 and 65) specifies that the incineration of the non-biodegradable part of the waste should not be recorded as RM since it is not considered as renewable energy and, in general, the incineration of waste is seen a part of waste management (CEPA 3). *The handbook should be reviewed to include all waste incineration in CEPA 3, when data sources do not allow separating incineration of waste into incineration of renewable and non-renewable materials.* If incineration of bio-degradable waste can be separated

89 Since companies under NACE 46.77 may be engaged in the collection, transportation and sorting of waste recording under CEPA 3 may also be considered.

90 If these investments are produced by domestic EGSS companies.

out it should be allocated to CReMA 13A. Also the processing of waste cooking oil into biofuels should be allocated to CReMA 13A.

b. The recovery of sorted materials which is recorded under the economic activity NACE E38.32 can be waste management (CEPA 3) or the minimisation of the intake of forest resources (CReMA 11B), the minimisation of the intake of fossil resources as raw material for use other than energy production (CReMA 13C) or the management of minerals (CReMA 14). Allocating activities to recover materials to resource management classes requires separating the activities by materials[91]. However, making this split can be resource consuming and when there are quality concerns regarding the results (e.g. due to lack of data to make the split) it may be best to allocate materials recovery to one CReMA class using a predominance rule. The handbook should be reviewed *to record the recovery of sorted materials under CEPA 3 if the available information does not allow separating it out of other activities of NACE E38*. If, however, the recovery of sorted materials can be separated out, it may also be allocable to the respective RM activities (CReMA 11B, CReMA 13C or CReMA 14) based on information on the type of material. If such information is not available the handbook should propose that recovery of sorted materials separated out of NACE 38 should be allocated to the main activity which may often be CReMA 14.

c. NACE E39 (remediation activities and other waste management activities) contains activities that fall under waste management (CEPA 3) or the protection and remediation of soil, groundwater and surface water (CEPA 4). The handbook should be reviewed *to allow for recording all NACE E39 activities under CEPA 3 if the available information does not allow separating out activities to protect and remediate soil, groundwater and surface water*[92].

d. If data do not allow distinguishing *environmental consulting services and R&D activities for EP from those for RM*, they may be allocated to CEPA 8 or CReMA 15 depending on the assumed dominance; the metadata delivered with the statistics should clearly indicate the allocation rule.

Chapter 3: Practical approaches and methods for the identification and classification of the EGSS and Chapter 4: A framework for EGSS data collection

9. It should be considered to *merge the content of chapters 3 and 4* into one chapter since the practical approaches and methods for the identification and classification and the framework for data collection depend on the same resource constraints and data sources. The new chapter that replaces these two chapters could be called *Integrative Approach towards compiling Environmental Goods and Service Sector Statistics*. The current content of the two chapters could be amended by approaches described in the practical guide. For more detailed proposals concerning methods available to use existing sources in the compilation of EGSS statistics the new chapter could make reference to chapters 4, 5 and 6 of the practical guide.

10. It should be considered to *delete some of the annexes to chapters 3 and 4* of the 2009 handbook because they can be now considered as less relevant or obsolete:

    a. Annex 3 (correspondence tables between NACE Rev 1.1. and NACE Rev. 2) and annex 8 (examples of the classification of sustainable activities) are less relevant.

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[91] The use of detailed data on industry and construction (e.g. SBS data) could be useful in order to complement or split the national accounts data that are very aggregated.

[92] Where there is evidence that the largest part of NACE 39 is remediation of soil, groundwater and surface water CEPA 4 should be the adequate environmental activity category.

b. Annex 10 concerning demand-side approaches and annex 11 on estimating variables using surveys could be deleted because these topics would be covered by the main part of the new chapter.

c. The issue of double counting addressed in annex 12 should be addressed in the main part of chapter 2 (see above):

   i. *Upstream EGSS output*: In national accounts output includes all products which a producer unit provides to another producer unit. Therefore an intermediate input good or service produced by producer A and consumed by producer B is counted twice in the total output measure: explicitly in A's output and implicitly in B's output value through B's costs of production. If there are more than two producers in the production chain the value is counted again a third, fourth and so on time. This kind of multiple counting of output is netted out when gross value added (output minus intermediate consumption) and gross domestic product are calculated. In contrast to the treatment in national accounts, the 2009 EGSS handbook (p. 125, 132, 152) requires to deduct the consumption of EGSS products by EGSS producers (EGSS products purchased from other EGSS producers and consumed in the production of environmental products) for the quantification of EGSS output since otherwise 'double counting' would occur. This 'double counting' deduction should be deleted from the next revised version of the handbook, i.e. EGSS products purchased from other producer units and consumed in the production of environmental products should be included in the EGSS output measure.

   ii. *Upstream EGSS employment:* To designate employment due to the production of EGSS output the 2009 EGSS handbook (p. 132) used the terminology "direct environmental employment", whereas "indirect employment", which would be linked to "upstream and downstream activities that produce intermediary environmental technologies, goods and services", was excluded from the scope of EGSS employment. Exclusion of this kind of "indirect employment", however, underestimates the number of jobs in the EGSS; an increased specialisation of the production chains would have a decreasing impact on EGSS direct employment. For the next revised handbook it should be considered to include in EGSS employment also employment due to the upstream production of EGSS output (EGSS output used as intermediate input to the production of other environmental goods and services).

d. National examples for identifying the population (annex 4) and for calculating the EGSS variables (annex 13) should be merged in one annex with sub-annexes for the different countries covered by these examples.

e. Other annexes may need to be revised for consistency reason (revisions in other parts of the handbook) and updated.

Chapter 5: The standard tables

11. This chapter needs *updating* to reflect the most recent version of the data transmission tables and the requirements of the amended Regulation 691/2011.

Chapter 6: Presentation and interpretation of the data

12. This chapter needs *updating* reflecting the most recent data transmitted to Eurostat and the EU28 estimates for EGSS.

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 determined by a top down approach combining figures on total electricity generation with shares of electricity from renewable sources. This annex details out the approach used in the test calculations for Germany to estimate f.

For the test calculations estimates of the price ratio between electricity from renewable and non-renewable sources (f) were derived 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)[93]. 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 have been 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 have not been 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:

Test calculation: f-ratios, Germany

2007	2008	2009	2010	2011
150.8%	156.8%	167.7%	188.6%	208.0%

[93] Information on electricity generation costs can as well be found in national sources (e.g. Department of Energy & Climate Change, 2013).

In the test 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.

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.

Test calculation: 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.

Test calculation: Ratios 'wage : output' for electricity production, Germany

	2007	*2008*	2009	2010	2011
National accounts D	0.136	0.128	0.130	0.121	0.125
Electricity from renewable sources	0.144	0.137	0.141	0.136	0.143
Electricity from non-renewable s.	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.

Test calculation: Mark-up factors for employment for electricity from renewable source, Germany

2007	2008	2009	2010	2011
1.060	1.070	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 E: OVERVIEW OVER NACE AGGREGATION LEVELS USED

The NA data used in the test calculations are mostly available at the A*64 industry breakdown. This aggregation level has to be mapped to the 39 industries distinguished for the EGSS voluntary data transmission, whereas the A*21 breakdown will meet the future legal requirements.

	A*21		EGSS Questionnaire 2013		A*64	
NACE sections	**(groups) of divisions**	**label**	**(groups) of divisions**	**label**	**(groups) of divisions**	**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

	A*21		EGSS Questionnaire 2013		A*64	
			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
			31-33	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	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	36	Water collection, treatment and supply
			37	Sewerage	37-39	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services
			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
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

	A*21		EGSS Questionnaire 2013		A*64	
						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; management consultancy activities	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 activities	73	Advertising and market research
					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

	A*21		EGSS Questionnaire 2013		A*64	
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
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 extra-territorial organisations and bodies	99	Activities of extraterritorial organizations and bodies

ANNEX F: DATA SOURCES USED IN THE TEST CALCULATIONS

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
Supply table - current prices (NACE Rev. 2)	naio_cp15_r2
Use table - current prices (NACE Rev. 2)	naio_cp16_r2
Gross capital formation by industry (up to NACE A*64)	nama_10_a64_p5
Gross capital formation by 64 branches - at current prices	nama_pi64_c
Cross-classification of gross fixed capital formation by industry and by non-financial fixed asset - current prices	nama_pi22_21_c
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
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
Full-time and part-time employment by sex and economic activity (from 2008 onwards, NACE Rev. 2) - 1 000	lfsa_epgan2
Full-time and part-time employment by sex and economic activity (1983-2008, NACE Rev. 1.1) (1 000)	lfsa_epgana
Euro/ECU exchange rates – annual data	ert_bil_eur_a
Environmental protection expenditure in Europe - detailed data (NACE Rev. 2)	env_ac_exp1r2
Certified organic crop area	food_in_porg1
Land use - 1 000 ha - annual data	apro_cpp_luse
Annual detailed enterprise statistics on electricity, gas and water supply (NACE Rev. 1.1., E)	sbs_na_2a_el
Annual detailed enterprise statistics for industry (NACE Rev. 2, B-E)	sbs_na_ind_r2
Supply, transformation, consumption - gas - annual data	nrg_103a
Supply, transformation, consumption - electricity - annual data	nrg_105a
Supply, transformation, consumption – renewable energies - annual data	nrg_107a
Infrastructure – biofuel production capacities - annual data	nrg_114a
Gas - domestic consumers - bi-annual prices - new methodology from 2007 onwards	nrg_pc_202
Electricity prices components for domestic consumers, from 2007 onwards - annual data	nrg_pc_204_c
Electricity prices components for industrial consumers, from 2007 onwards - annual data	nrg_pc_205_c
Infrastructure - electricity - annual data	nrg_113a
Statistics on the production of manufactured goods	prom
Traditional international trade database access)	ComEx
International trade of EU, the euro area and the Member States by SITC product group	ext_lt_intertrd
Balance of payments by country	bop_q_c

b) Other sources

Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz. (2012). *Die wirtschaftliche Lage der landwirtschaftlichen Betriebe - Buchführungsergebnisse der Testbetriebe, Wirtschaftsjahr 2011/12*.

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit:

- (various editions). *Erneuerbare Energien in Zahlen - Nationale und internationale Entwicklung.*
- (2013). *Investitionen für ein klimafreundliches Deutschland - Eine Studie im Auftrag des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit.*
- (various editions). *Erneuerbare Energien in Zahlen - Internet-Update ausgewählter Daten.*

Bundesnetzagentur; Bundeskartellamt. (2012). *Monitoringbericht 2012*. Retrieved 06 19, 2012

Bundesverband der deutschen Bioethanolwirtschaft e.V. (2013). *Umrechnungsformeln für Biokraftstoffe*.

Deutsche Energieagentur (dena). (2010). *dena-Sanierungsstudie. Teil 1: Wirtschaftlichkeit energetischer Modernisierung im Mietwohnungsbestand*.

FAO, OECD (2013 and earlier issues): Agricultural Outlook

International Energy Agency; Nuclear Energy Agency. (2010). *Projected Costs of Generating Electricity*.

KFW Bankengruppe. (2014 and earlier issues). Monitoring der KfW-Programme „Energieeffizient Sanieren“ und „Energieeffizient Bauen“

Prognos AG. (2010). *Investitionen durch den Ausbau erneuerbarer Energien in Deutschland*.

Thünen-Institut. (2013). *Analyse der wirtschaftlichen Lage ökologisch wirtschaftender Betriebe*.

Verordnung über die Honorare für Architekten- und Ingenieurleistungen (HOIA): *Honorartafel zu § 16 Abs. 1 HOAI (Objektplanung Gebäude)*

Agence de l'Environnement et de la Maîtrise de l'Energie. (2013). *Batiment, Edition 2013.*

Baud, S. (2012). *Umweltorientierte Produktion und Dienstleistung (EGSS) 2011 - Umsatz und Beschäftigte in der Umweltwirtschaft.*

Blazejczak, J., & Edler, D. (2012). *Methods for estimation of gross employment effects of environmental protection.* Berlin: German Institute for Economic Research (DIW Berlin).

Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz. (2012a). *Die wirtschaftliche Lage der landwirtschaftlichen Betriebe - Buchführungsergebnisse der Testbetriebe, Wirtschaftsjahr 2011/12.*

Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz. (2012b). Kleinere Ernte, höhere Erlöse - Biolandwirte blicken auf ein erfolgreiches Jahr 2010 zurück, Press release no. 46 of 13.02.12.

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. (2011). *Erneuerbare Energien 2010.*

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. (2012). *Erneuerbare Energien in Zahlen - Internet-Update ausgewählter Daten.*

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. (2013a). *Erneuerbare Energien in Zahlen - Nationale und internationale Entwicklung.*

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. (2013b). *Investitionen für ein klimafreundliches Deutschland - Eine Studie im Auftrag des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit.*

Bundesnetzagentur; Bundeskartellamt. (2012). *Monitoringbericht 2012.*

Bundesverband der deutschen Bioethanolwirtschaft e.V. (2013). *Umrechnungsformeln für Biokraftstoffe*.

Bureau of Labor Statistics (BLS). (2013a). *Employment in Green Goods and Servcies – 2011*.

Bureau of Labor Statistics (BLS). (2013b). *Extended Technical Note.*

Constantino, S., Fritzsche, J., Obst, C., Schenau, S., Steinbach, N., & Steurer, A. (2013). *State of debate note on the Environmental Goods and Services Sector (EGSS).* London.

DESTATIS. (2014). *Produzierendes Gewerbe - Beschäftigung und Umsatz der Betriebe des Verarbeitenden Gewerbes sowie des Bergbaus und der Gewinnung von Steinen und Erden, Fachserie, 4 Reihe 4.1.1.*

Deutsche Energieagentur (dena). (2010). *dena-Sanierungsstudie. Teil 1: Wirtschaftlichkeit energetischer Modernisierung im Mietwohnungsbestand.*

Eckermann, F. (2012). *Beschäftigung im Umweltschutz.*

Economics and Statistics Administration. (2010a). *Measuring the Green Economy.*

Economics and Statistics Administration. (2010b). *Measuring the Green Economy - Appendix 2: Methodology for Estimating Shipments/Receipts and Employment for Green Products and Services.*

ECORYS. (2009). *Study on the Competitiveness of the EU eco-industry.*

ECORYS. (2012). *The number of Jobs dependent on the Environment and Resource Efficiency improvements.*

ECOTEC. (1999). *Analysis of the EU Eco-Industries, their Employment and Export Potential.*

Edler, D., & Blazejczak, J. (2012). *Beschäftigungswirkungen des Umweltschutzes in Deutschland im Jahr 2008.*

Edler, D., Blazejczak, J., Wackerbauer, J., Rave, T., Legler, H., & Schasse, U. (2009). *Beschäftigungswirkungen des Umweltschutzes in Deutschland im Jahr 2006.*

Ernst & Young Environment and Sustainability Services. (2006). *Eco-industries, its size, employment, perspectives, and barriers to growth in an enlarged EU.*

European Commission. (2012). *Towards a job-rich recovery.*

European Commission. (2013). *Market observatory & Statistics*.

European Commission, FAO, IMF, OECD, UN, World Bank. (2012). *System of Envrionmental-Economic Accounting: Central Framework, White cover publication, pre-edited text subject to official editing.*

European Commission, IMF, OECD, UN, World Bank. (2008). *System of National Accounts 2008.*

Eurostat. (1996). *European system of accounts (ESA 1995).* Luxembourg: Office for Official Publications of the European Communities.

Eurostat. (2000). *Manual on the Economic Accounts for Agriculture and Forestry (Rev. 1.1.).*

Eurostat. (2002). *SERIEE - European System for the collection of economic information on the environment — 1994 Version.*

Eurostat. (2005a). *Environmental expenditure statistics: Industry data collection handbook.*

Eurostat. (2005b). *Environmental Protection Expenditure and Revenue Joint Questionnaire/SERIEE Environmental Protection Expenditure Account, Conversion Guidelines.*

Eurostat. (2007). *Environmental expenditure statistics 2007 edition: General Government and Specialised Producers data collection handbook.*

Eurostat. (2008). *NACE Rev. 2 - Statistical classification of economic activities in the European Community.*

Eurostat. (2009). *The environmental goods and services sector - A data collection handbook.*

Eurostat. (2011). *Manual on sources and methods for the compilation of COFOG Statistics.*

Eurostat. (2012a). *Minutes of the 1-2 March 2012 meeting of the subgroup on environmental activity and expenditure classifications, , Subgroup of the Task Forces on environmental transfers and on RUMEA.* Retrieved 10 29, 2013, from CIRCABC:

Eurostat. (2012b). *Overview of existing classifications with relevance for the subgroup, Subgroup of the Task Forces on environmental transfers and on RUMEA.*

Eurostat. (2012c). *Proposal for new modules for inclusion in Regulation 691/2011: Environmental goods and services sector, Joint meeting of the Working Groups on environmental accounts and environmental expenditure statistics.*

Eurostat. (2012d). *Regulation on European Environmental Economic Accounts: New modules, Directors' Meeting on Environmental Statistics and Accounts, 20 November 2012.*

Eurostat. (2013a). *Environmental expenditure variables in the SBS Regulation – Results of the work of the electronic discussion group (EDG) on the SBS environmental variables and next steps.* Luxembourg: Eurostat.

Eurostat. (2013b). *Further integrating the monetary environmental accounts.*

Eurostat. (2013c). *The resource management expenditure account (ReMEA), Working Group Environmental Expenditure Statistics, Meeting of 20 - 21 March 2013 Doc. ENV/EXP/WG/4 (2013).*

Eurostat. (2013d). *Draft minutes of the meeting of the task force on the resource management expenditure account (ReMEA) of 16-17 October 2013, Version of 7 November 2013.* Luxembourg.

Eurostat. (2013e). *European System of Accounts (ESA 2010).*

Eurostat. (2013f). *International trade data, Reference Metadata in Euro SDMX Metadata Structure (ESMS).*

Eurostat. (2013g). *Electricity Prices - Price Systems 2012.*

Eurostat. (2014). *Revision of the 2009 EGSS Handbook, Doc. ENV/EXP/WG/3.3(2014).*

FAO, OECD. (2011). *Agricultural Outlook 2012-2021.*

Fondation d'entreprise Alcen pour la Connaissance des Énergies. (2013). *Tarification de l'électricité.*

Gehrke, B., & Schasse, U. (2013). *Umweltschutzgüter - wie abgrenzen? Methodik und Liste der Umweltschutzgüter 2013.*

GHK Consulting. (2007). *Links between the environment, economy and jobs.*

Greffet, P., Mauroux, A., Ralle, P., & Randriambololona, C. (2012). *Définir et quantifier l'économie verte.*

Institut für Arbeitsmarkt- und Berufsforschung. (2013). *Aktuelle Daten und Indikatoren zur Arbeitsmarktentwicklung in Ost- und Westdeutschland, Durchschnittliche Arbeitszeit und ihre Komponenten (Stand: 03.04.2013).*

International Energy Agency; Nuclear Energy Agency. (2010). *Projected Costs of Generating Electricity.*

International Labour Organisation (ILO). (2013). *Methodologies for assessing green jobs. Policy brief, February 2013.*

KFW Bankengruppe. (2011). *Impact on public budgets of KFW promotional programmes in the field of "energy-efffcient building and rehabilitation".*

KFW Bankengruppe. (2013). *Impact on public budgets of the KFW promotional programmes in the field of "energy-efffcient construction", "energy-effcient refurbishment" and "energy-effcient infrastructure" in 2011.*

Kleine, S. (2012). *Die umweltökonomischen Statistiken bis 2010.*

Naturschutzbund Deutschland (NABU) e.V. (2011). *Anforderungen an einen Sanierungsfahrplan - Auf dem Weg zu einem klimafreundlichen Gebäudebestand bis 2050.*

OECD, Eurostat. (1999). *The Environmental Goods & Servcies Industry - Manual for Data Collection and Anlaysis.*

OECD, IEA, Eurostat. (2004). *Energy Statistics Manual.*

Offermann, F., Sanders, J., & Nieberg, H. (n.d.). *Method for selecting comparable organic and conventional farms.*

Official Journal of the European Union. (2013). *REG. (EU) No 549/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 May 2013 on the European system of national and regional accounts in the European Union.*

Prognos AG. (2010). *Investitionen durch den Ausbau erneuerbarer Energien in Deutschland.*

Rørmose Jensen, P., & Månsson, H. (2012). *The Environmental Goods and Service Sector in Denmark. A Pilot Study. Report on Eurostat grant no. 50904.2011.005-2011.291*. Copenhagen: Statistics Denmark.

Statistik Austria. (2012). *Standard-Dokumentation Metainformationen (Definitionen, Erläuterungen, Methoden, Qualität) zur Umweltorientierten Produktion und Dienstleistung (EGSS).*

Statistisches Bundesamt (DESTATIS). (2010). *Erhebung der laufenden Aufwendungen für den Umweltschutz.*

Steenblik, R., & Geloso Grosso, M. (2011). *Trade in Services Related to Climate Change - an explanatory analysis, OECD Trade and Environment Working Papers 2011/03.*

Thünen-Institut. (2013). *Analyse der wirtschaftlichen Lage ökologisch wirtschaftender Betriebe*.

Umweltbundesamt. (2008). *Beschäftigung im Umweltschutz.*

van Rossum, M. (2012). *Economic indicators for the Dutch Environmental Goods and Services Sector - Time series data for 1995-2009.*

Voram, J., & van Rossum, M. (2013). *Economic Radar of the Sustainable Energy Sector in the Netherlands, 2008–2011.*

Workforce Information Council, Green Jobs Study Group. (2009). Measurement and analysis of employment in the green economy.