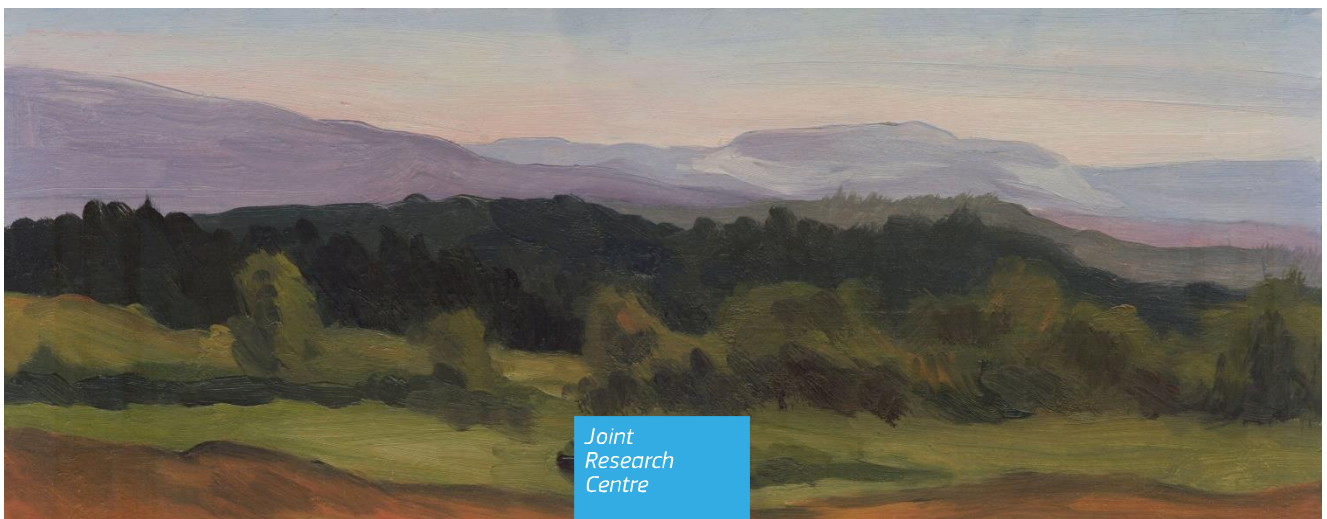# JRC SCIENTIFIC INFORMATION SYSTEMS AND DATABASES REPORT

# Implementation of the EU Bioeconomy Monitoring System dashboards

*Status and technical description as of December 2020*

Kilsedar, C.E., Wertz, S., Robert, N., Mubareka, S.

2021

How to cite this report: Kilsedar, C.E., Wertz, S., Robert, N., Mubareka, S, *Implementation of the EU Bioeconomy Monitoring System dashboards: Status and technical description as of December 2020*, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-28946-3, doi:10.2760/577115, JRC123675.

# Contents

## Acknowledgements

## Abstract

The EU Bioeconomy Monitoring System is pursuant to the Action 3.3.2 of the EU Bioeconomy Strategy (COM/2018/673). It addresses the need for a comprehensive monitoring system by establishing a mechanism to measure the progress of the EU bioeconomy towards the five strategic objectives it tackles. It defines and implements a comprehensive monitoring framework for the EU bioeconomy, which covers environmental, social and economic dimensions of sustainability and relates to the overarching Sustainable Development Goals (SDGs) context.

This document describes the front-end and back-end system design as well as the content of the EU Bioeconomy Monitoring System as of December 2020. The EU Bioeconomy Monitoring System was officially launched in November 2020 on the occasion of the Global Bioeconomy Summit. The system is embedded in the Knowledge Centre for Bioeconomy at this location: https://knowledge4policy.ec.europa.eu/bioeconomy/monitoring_en.

# 1 Introduction

This document describes the user interface of the EU Bioeconomy Monitoring System as it is nested within the Knowledge Centre for Bioeconomy (KCB): https://knowledge4policy.ec.europa.eu/bioeconomy/monitoring_en. A list of indicators that are published in the EU Bioeconomy Monitoring System in 2020, as well as the full list of indicators to be included in the monitoring system in the coming years, are also described in this document. The conceptual framework and methodology are further described elsewhere (Giuntoli et al., 2020; Robert et al., 2020). Furthermore, a description of the methods behind each indicator is published in the data owner websites.

In the first section of this report, we describe the monitoring system objectives and scope. We then walk the reader through the user interface, describing the features developed up to the time of writing, following with a description of the front-end and back-end technology. Finally, the relevance of creating technical sheets for each indicator is presented. The indicators that are included in the EU Bioeconomy Monitoring System and their technical descriptions are detailed in the annex.

Action 3.3.2 in the 2018 Bioeconomy Strategy related to the development of an EU Bioeconomy Monitoring System as described in COM/2018/673, states the need to increase observation, measurement, monitoring and reporting capabilities and build an EU-wide, internationally coherent monitoring system to track economic, environmental and social progress towards a sustainable bioeconomy, which addresses the need for a comprehensive mechanism by which to measure the progress of the EU Bioeconomy towards it's five strategic objectives. A comprehensive monitoring framework for the EU Bioeconomy should, according to the description in this action, address environmental, social and economic dimensions of sustainability and relate to the overarching Sustainable Development Goals (SDGs) context. The development and the implementation of the monitoring framework are based on a set of indicators that were selected in a participatory process to provide information on the condition, performance and trajectory of the bioeconomy as a whole—including ecosystems and their services, primary production sectors (forestry, agriculture, aquaculture and fisheries) and bio-based industries—at different levels (systemic and sectorial). See for example, KCB (2019) and KCB (2020).

At the time of its release on the occasion of the Global Bioeconomy Summit on November 18, 2020, the EU Bioeconomy Monitoring System provided information on trends and changes over time at the EU-27 (not including the UK), EU-28 (including the UK) and Member State levels for a subset of selected indicators. These do not necessarily provide an explanation for the trends or changes, nor do they imply causal links, however they are the first step in a monitoring system. The full list of indicators planned to be implemented in the EU Bioeconomy Monitoring System at this level are shown in Annex 3.

In 2021, the JRC will focus on further developing the monitoring system so that it goes one step further, and highlights the causal links, or at least correlations, between fluctuations in the basic indicators and the EU Bioeconomy. We aim to produce methods that provide an overview of trade-offs and synergies within the bioeconomy using tools such as life cycle analysis and composite indicators. These impacts are assessed both within and outside the EU borders to acknowledge and monitor the impacts of EU demands in exporting countries. This action pledges to cover different geographical and territorial levels and the monitoring system is closely linked to analogous Member States' activities.

The consistency, stability and availability of the monitoring system will be guaranteed by the KCB and will be reviewed periodically.

## 1.1 Objectives of the EU Bioeconomy Monitoring System

- To provide robust indicators whose numbers can be trusted as a reference for bioeconomy-related policy formulation, assessment and evaluation;

- To ensure a flexible monitoring system that is conducive to modifications as new data and information become available;

- To coordinate with other monitoring frameworks, in the Member States and international organisations (e.g., FAO, OECD);

- To identify relevant indicators to gauge the progress and sustainability of the EU Bioeconomy both within and outside of the EU;

- To minimise reporting burdens on all data providers;

- To improve data collection exercises in order to close identified gaps;

- To review the framework periodically to ensure it is fit for purpose;

- To disseminate the information in a user-friendly way, through dashboards and other dynamic visualisations in the KCB;

- To provide underlying data and assumptions behind the indicators, ensuring reproducibility to the best extent possible.

## 1.2 Expected impacts/outcomes of the EU Bioeconomy Monitoring System

- The design of this monitoring framework to monitor the sustainability of bioeconomy in a holistic way could serve as an example for other regions;

- The monitoring system offers a single entry point for harmonised indicators that are relevant to the EU Bioeconomy;

- The action, while monitoring the support of the bioeconomy to the five objectives of the Strategy, will indirectly support the preparation and the evaluation of the mentioned related EU policies/legislations/instruments that also contribute to addressing similar or shared objectives;

- Monitoring the progress of the EU Bioeconomy in a consistent way across EU will enable better coordination and cooperation at different policy levels, including regional and local scales, thus, the impact of the monitoring framework may be an improved and consistent basis for better policy decisions at different policy levels;

- Dissemination of the information provided by the monitoring framework will better inform policy and public debates.

## 2  General description

The EU Bioeconomy Monitoring System is a series of dashboards showing trends in indicators that were selected based on their relevance to the overall EU bioeconomy monitoring conceptual framework, as described in Giuntoli et al. (2020) and Robert et al. (2020), in collaboration with external partners, including experts from the Member States and international organisations through the Community of Practice on Bioeconomy (managed by the KCB) through workshops and online discussions (KCB, 2019; KCB, 2020).

For the first release of the beta monitoring system in November 2020, the indicators that are translated to dashboards are there to highlight temporal trends and comparisons between the Member States and regional averages. They measure the state or condition of sectors and systems that rely on biological resources, their functions and principles and the pressures that might exist on them (so-called 'output' indicators). They consist of a set of indicators that were selected for the launch to show trends in specific themes that are noteworthy. This layer of indicators includes basic indicators (measurements and indicators from other sources), processed indicators (e.g., special treatment of bio-based sectors within NACE processed by the JRC) and system level indicators (e.g., LCA, footprint processed by the JRC).

After the first release of the beta version, the JRC will continue to build upon the monitoring system by investing in ways to tie together the indicators in the underlying layer in order to provide key messages. In 2021–2022, the focus will be on the following:

1) Finalising the SDGs and Green Deal tools, whereby the users can select indicators through the priorities set for these two initiatives;

2) Design and computation of selected composite indicators and system level indicators;

3) Shift to the input indicators (governance) so that the JRC can begin the work of assessing causality between the EU actions to promote bioeconomy, and the output indicators already reported within the Monitoring System.

### 2.1  Editorial committee

The responsible person for the content in the EU Bioeconomy Monitoring System is Sarah Mubareka, JRC.D1. The KCB oversees the overall quality of the content. Any new content of the EU Bioeconomy Monitoring System must be pushed through, and therefore approved by the editorial team of the KCB.

### 2.2  URL

The EC hosts a permanent URL for the KCB. The EU Bioeconomy Monitoring System is embedded in that at https://knowledge4policy.ec.europa.eu/bioeconomy/monitoring_en. The breadcrumb is European Commission > Knowledge for policy > Bioeconomy > EU Bioeconomy Monitoring System.

### 2.3  Security

The JRC Local Informatics Security Officer (LISO) has performed a series of security controls to ensure that the level of security of this website complies with the EC security policies. Risks and impact assessment for this information system has been elaborated and is currently under further scrutiny given the addition of a database that is foreseen to manage the data behind the EU Bioeconomy Monitoring System within the KCB. This is further described in section Front-end and back-end technology.

### 2.4  Content

Several actors have approved the content before it was put online. The main actors are the JRC webmaster and DG COMM. The Controllers have already given a first opinion of the EU Bioeconomy Monitoring System components within the KCB. The changes they have recommended have been applied except for the accessibility issues, which will be implemented as needed.

### 2.5  Target user audience

The primary users of the monitoring system are policymakers at EU level. This category of users might benefit from information that is aggregated and interpreted using the scientific knowledge and familiarity of EU policy in the JRC. We also target policymakers at national and regional levels. Other users are EU Agencies and

researchers and bio-based industry. The monitoring system should also cater to EU citizens by providing useful information on consumer footprint and the life cycle assessment of selected products in order to help citizens ponder the choices they make. The monitoring system should provide useful information for each of these categories of users.

## 2.6   Main menu items

The main menu items that were included in the launch in November 2020 are the following: "Headline Indicators", "EU Bioeconomy Objectives", "Bioeconomy and SDGs" and "Bioeconomy and Green Deal".

The main menu of the EU Bioeconomy Monitoring System is always present as the KCB frames it (Figure 1).
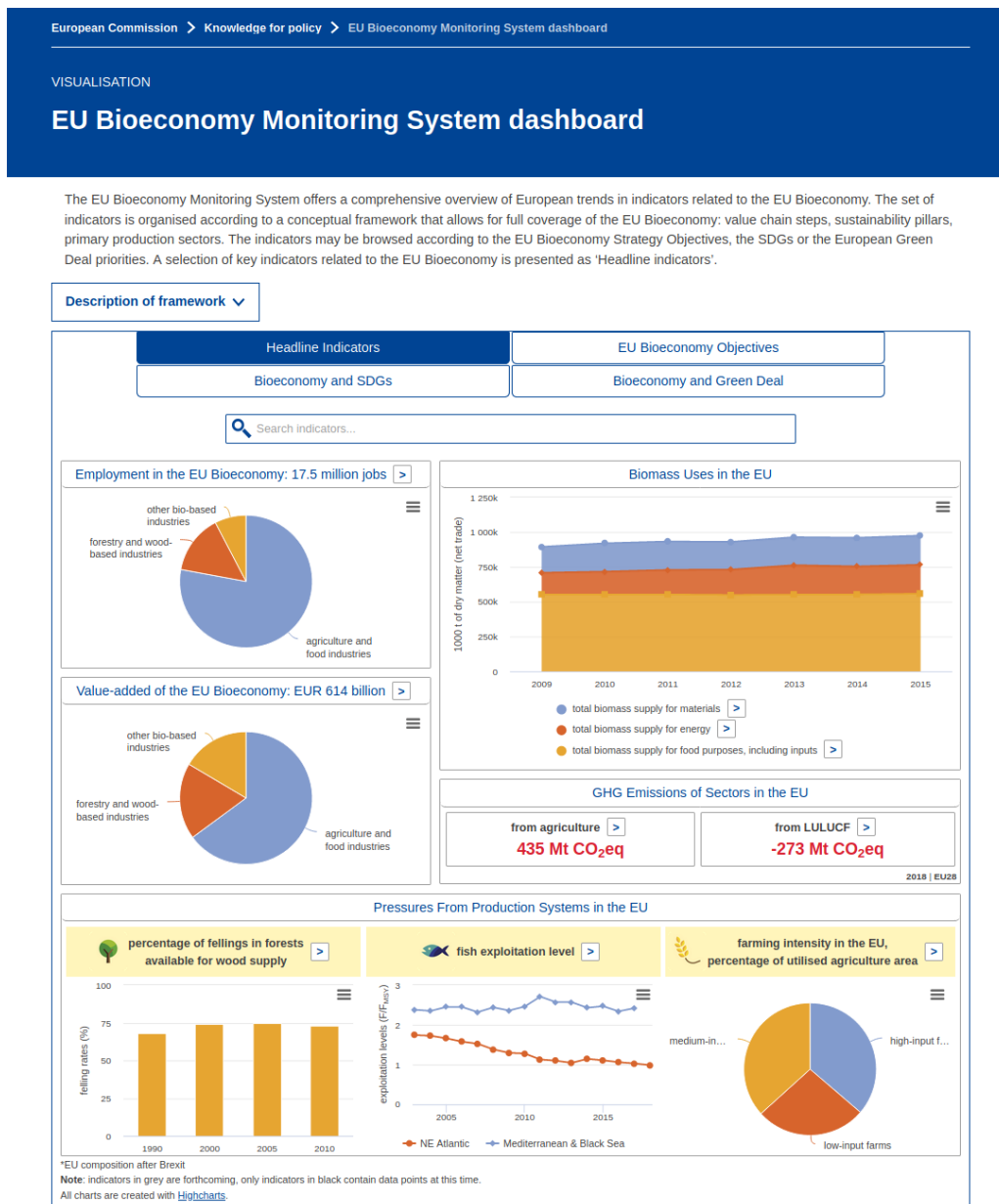


**Figure 1.** Framing of EU Bioeconomy Monitoring System is Knowledge Centre for Bioeconomy.

## 2.7   Description of pages

1. **<u>Headline Indicators</u>**. This menu option leads to the main page of the monitoring system. The users are immediately presented with a dashboard showing selected indicators that cover different facets of the EU Bioeconomy. This first page is meant as an entry point to the more detailed datasets in the monitoring system. It is designed to encourage users with different interests in the targeted audience group (see the section on Target user audience) to go deeper into the indicators of the monitoring

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system. This page shows a variety of numbers, sometimes combined so that the users can visualise related indicators next to one another. For example, the indicator for biomass uses for food is under Objective 1 of the EU Bioeconomy Monitoring System, while the indicators for biomass uses for energy and materials are under Objective 3. In the main dashboard, we see these indicators in the same area chart so that the users can compare trends in biomass uses among the three of them. The choice of the few indicators shown on this first page was based on the following criteria: covering all 5 objectives and including aggregated or value-added indicators computed by the JRC or other DGs and Agencies of the European Commission. Each element within the dashboard is clickable, leading the users to a more detailed dashboard about that indicator. See Figure 3 for example and Annex 1: Headline indicators for the details on the headline indicators.

1.1. Employment and value-added. These indicators summarise the overall employment in and value-added of the EU Bioeconomy. When clicked, the user is taken to a page where more details, divided by sector and each Member State, are shown (Objective 5)

1.2. Biomass uses. There is a stacked area chart showing the trend in biomass uses from 2009 to 2015 at the centre of the dashboard. When the user clicks on any one of the three components of the chart (total biomass supply for food purposes, including inputs; total biomass supply for energy; total biomass supply for materials), they are brought to the detailed indicators page for each of these components (Objectives 1 & 3).

1.3. GHG emissions. The indicators in this section show emissions from the agriculture and LULUCF sector. When the user clicks on any of these indicators, they are taken to their respective detailed page (Objective 4).

1.4. Pressures from production systems. This series of indicators is a selection to show the pressures from forestry on forests, fisheries on fresh and marine water systems and agriculture on agroecosystems. Although many indicators compose the pressures series of indicators, we have selected one per primary production system. For forestry, long term ratio of annual fellings to net annual increment; for fisheries, fishing mortality of commercially exploited fish and shellfish exceeding fishing mortality at maximum sustainable yield; for agriculture, intensification of farming (Objective 2).

2. **EU Bioeconomy Objectives.** The bioeconomy strategy objectives are shown in five hexagons representing each of the objectives (Figure 4). The hexagons contain the icons produced for this purpose by the JRC Communications Unit. When the user hovers over a hexagon, the icon is transformed into the EU bioeconomy objective text.

    2.1. User clicks on an objective. Then, they are taken to a subpage where all the indicators related to the selected objective are listed.

    2.2. A filter composed of two steps is presented on the page. The first step is the selection of a (a) normative criterion, (b) key component, (c) value chain step or (d) primary production sector.

    2.3. When the user makes a selection, the second step of the filter is activated. The second step provides the user with a list of items that are related to the first selection and the selected objective. Once the user completes the second step of the filtering, the list of indicators is updated.

    2.4. When the user selects an indicator, a dashboard appears in three panes. Pane 1 is a clickable choropleth map showing the relative differences between the Member States based on a quantile classification method that best highlights differences between the countries. Pane 2 is a column chart showing the same information as in the map but in a column chart in order to facilitate comparability among Member States. Pane 3 is a line chart showing the trend for the indicator over time. By default, the chart shows the EU aggregate. Below the line chart, there is a list of clickable Member States so the user may overlay the Member States of interest. The choropleth map and the line chart are linked, so that if a Member State is selected on the map, it is also shown in the line chart. Only in the case of intensive indicators, the Member States are compared with EU-27 and EU-28 in pane 2, whereas they are always compared with EU-27 and EU-28 in pane 3 if data are available. Some indicators also contain shares, in which case these are also represented in all the panes. All three panes are equipped with a mouse-over feature, whereby the exact numbers are shown for the point of interest (i.e., where the mouse is located). For the first two panes, there is a timeline slider. The user may visualise the map or column chart for any point in time along the timeline. The default is the latest year of available data (Figure 5).

3. **Bioeconomy and SDGs.** This menu item takes the user to a page showing the SDGs in a 4x4 (+1) matrix. When the user clicks on one of the SDGs, they are presented with a list of indicators that are related to this SDG. This option has not yet been developed at the time of writing and no figure can therefore be shown at this time.

4. **Bioeconomy and Green Deal.** This menu item takes the user to a page showing the Green Deal priorities. Similar to the SDGs page, when the user clicks on one of the priorities, they are presented with a list of related bioeconomy indicators. This option has not yet been developed at the time of writing and no figure can therefore be shown at this time.
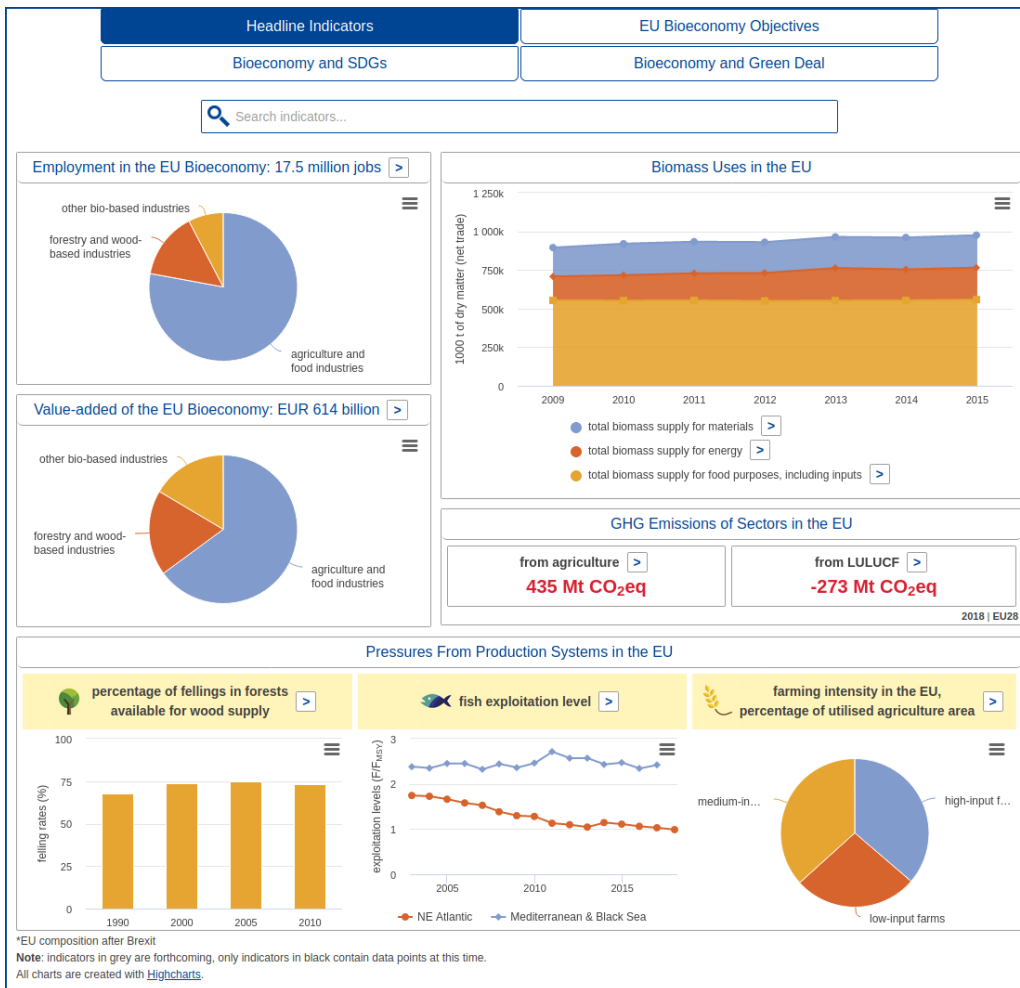
**Figure 2.** First mock-up of the landing page of the EU Bioeconomy Monitoring System.
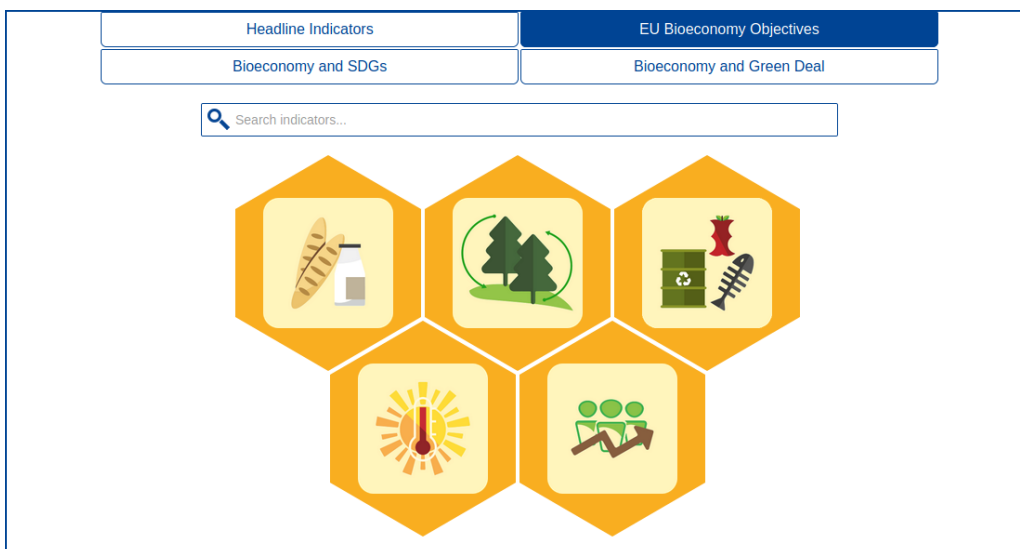


**Figure 3.** Layout for selection of indicators by strategy objective.
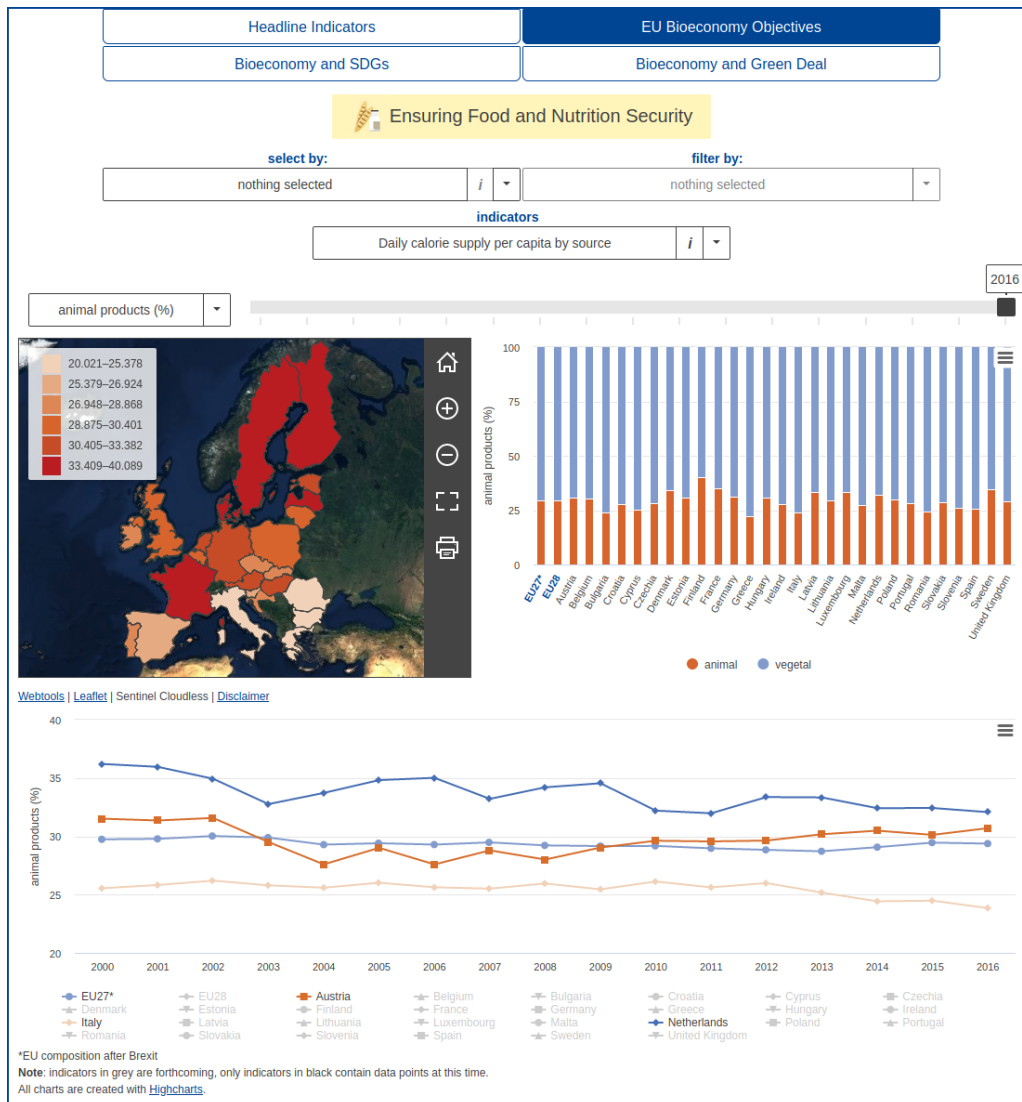
**Figure 4.** Example of the three panes in the dashboard behind the EU Bioeconomy Objectives button.

# 3 Front-end and back-end technology

This platform follows the client-server paradigm. The client is hosted on an Apache2 server during development. It is then transferred to the Drupal 8 content management system (CMS) for enabling global and public access. The client is a web application that has been developed on a Linux operating system using an Atom text editor. The front-end is written in HTML, CSS and JavaScript, making use of multiple libraries, which are Highcharts for creating data visualizations (such as area, column and line charts), Webtools which uses Leaflet for creating choropleth maps, jQuery for accelerating the coding process, jQuery UI for adding a search bar with autocomplete and Bootstrap for building responsive dashboards. However, in the light of the recent news, as many components as possible will be created using the Europa Component Library (ECL) at the beginning of 2021. The data used in the chart and map visualizations were generated by the front-end developer using Python programming language in JSON format using the datasets that were delivered in CSV format and spreadsheets and datasets retrieved from the Eurostat server. Currently, static JSON files are used for the visualizations. In the future, an API will generate the JSON files on the fly, upon request, which will eventually represent the server-side of the platform. The application that provides the API is developed using the Django web framework and Django REST framework and the data are stored in a MySQL database. The client has been developed in collaboration with the developer of the API (back-end developer) and future requirements were taken into consideration to minimize the transition costs.

# 4 Description of indicators

The aim of the EU Bioeconomy Monitoring System is to provide policymakers and other stakeholders with reliable and harmonised data and knowledge about the bioeconomy throughout the years. The indicators were chosen and computed based on the interaction with national and international experts through several workshops and exchanges.

Despite the high number of different data sources and the wide range of technical expertise required, the JRC must provide sound and up-to-date indicators. To ensure the update and reproducibility of each indicator yearly, technical sheets are created detailing the meaning of the indicators, their computation and the input data used (Annex 5).

Increasing the transparency on the interpretation, data and methodologies of the basic, processed and system level indicators will also make the construction and use of composite indicators easier in the future. Disseminating methodological information together with numerical results is the precursor to ensure that the indicator is understood and reproducible or re-traceable. This handbook will also set the base for improvements in the future.

Each technical sheet is structured in three sections. The first section positions an indicator among all other indicators by detailing the associated EU strategy objective, normative criterion, key component, indicator number and full name. The unit of the indicator is also specified.

The second section gives the reader a clear sense of what is measured by the indicator and background information. First, the organization responsible for the creation of the indicator and the contact details of the relevant expert are given. Then, a link to the data of the indicator is provided, together with metadata when available. The indicator type and directionality are specified, with their corresponding definitions available in the glossary (Annex 4). Finally, an interpretation of the indicator is given.

The third section is meant to enable the reader to reproduce the indicator. However, some indicators cannot be reproduced without the input of an expert. In this case, the technical sheet walks the reader through the steps in as much detail is possible. This section provides the information on the input data, indicating the data source, data type, location of the data available for download and other information on the data. More general information is also available such as the geographic coverage, which corresponds to the geographical extent of the data available; the frequency of the update of the data; and the timeliness of access to new data. The length of the time series, which indicates the number of years for which there are available data; and comparability over time, which corresponds to the length of comparable time series without methodological breaks in the data points are also available.

# 5 Dissemination & way forward

In this document, we discuss the technical implementation of the EU Bioeconomy Monitoring System and not the theoretical developments, although the two are clearly related. Whereas the scientific team is responsible for the further development of the concepts behind the monitoring system, the technical team is responsible for the implementation of the front- and back-end of the monitoring system. The following sections discuss the technical aspects only.

# 6 Implementation plan

In the first years of the technical implementation of the EU Bioeconomy Monitoring System, the JRC will rely on an Administrative Agreement with RTD to ensure the development of the system evolves according to the expectations of the Core DG group responsible for the implementation of the EU Bioeconomy Strategy. The JRC estimates that the final stable monitoring system as described as our aspirations and outlined in Giuntoli et al. (2020) and Robert et al. (2020) will be fully in place by the end of 2022.

## 6.1 Implementation team

The implementation team includes a back-end developer who is also the KCB developer. This figure is responsible for the database and API to link the database to the monitoring system. A second technical figure is the front-end developer, who interacts with the scientific team to understand the expectations in data visualisation and who implements these data visualisations according to the criteria set out by DG COMM for website development. She also communicates with the back-end developer so that the data of the indicators are stored in the database and the API serves the data suitable for visualization. A third figure is a trainee who is responsible for the documentation of the indicators. She will write technical sheets to ensure that all indicators are reproducible. This is especially important for the indicators developed at the JRC. The fourth member is the team leader who oversees the process. Needless to say that there are numerous scientific collaborators who are producing data and knowledge used in the specific indicators.

## 6.2 Post-implementation plan

Once the EU Bioeconomy Monitoring System is fully implemented (expected at the end of 2022), the monitoring system may be considered as an operational tool. Under normal circumstances the JRC does not maintain operational tools and perform redundant tasks, however in this particular case, because of the nesting of the monitoring system within the KCB and the KCB being under the responsibility of the JRC, the monitoring system will also likely remain under the responsibility of the JRC. This is desirable because we know that the bioeconomy is evolving very quickly and new research needs will arise. Thus, new features and requirements will certainly appear in the coming decade.

## 6.3 Daily management of the system

The JRC has a scientific production mandate with high data management requirements and can therefore guarantee a constant presence of staff with competences in the web development domain. Furthermore, as a tool embedded in the KCB, so long as the Knowledge for Policy Centres exist, there will be competent staff to maintain them.

# 7 Way forward

## 7.1 Next tools

In 2021–2022 the dashboards will incorporate the rest of the basic and processed indicators and as system level and composite indicators will be created by the scientific team, the page dedicated to headline indicators may be extended or replaced by the visualizations of these new indicators or a new page or pages dedicated to them may be created. Furthermore, the relation between basic and processed indicators and the EU Green Deal and the SDGs will be demonstrated by developing tools that are designed for this purpose.

In this period, the scientific team will also work on identifying the connections between the output indicators and the EU actions for promoting bioeconomy by researching input indicators, thus visualizations that will demonstrate such connections in the best possible way will be developed. Furthermore, the scientific team will make an effort to trace the environmental footprint of trade and consumption and visualizations best suited for revealing the footprint of such activities will be created. While this plan for 2021–2022 will be carried out entirely, some adjustments may be made for special requests.

## 7.2 Link to State of Bioeconomy Report

The JRC plans to initiate a series of Science for Policy Reports at the end of 2022 in a cross-unit collaboration, in which the EU Bioeconomy Monitoring System will play a key role in providing the data behind the policy report. The report is planned to go beyond the data in the monitoring system itself, offering added intellectual value through the interpretations of the trends, as well as ad hoc studies to go deeper into the drivers behind the indicators, with an expert-based analysis on specific themes that could also be defined by an ad hoc steering committee that should be extended.

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## List of figures

## Annexes

### Annex 1. Headline indicators

The so-called headline indicators that are prepared for the launch of the EU Bioeconomy Monitoring System are actually indicators that are present within the list of the indicators published under the objectives, but which we wish to highlight for various reasons. These reasons are further explained in the table below. The criteria for inclusion of the headline indicators are coverage of all five strategy objectives and the value-added of the JRC knowledge (where possible). For details on the meaning of each indicator, the reader is referred to Annex 3, where all indicators to be included in the EU Bioeconomy Monitoring System are described in detail.

| Indicator id | Indicator name | Reason for inclusion as headline for launch |
|---|---|---|
| 1.1.a.4 | Total biomass supply for food purposes, including inputs | To emphasize the value-added of the JRC knowledge, to complete 'biomass use trends' stacked area chart, to cover objective 1<br><br>JRC indicator from Biomass mandate<br><br>Produced by JRC.D2 and JRC.D4 |
| 2.2.a.2 | Long term ratio of annual fellings (m3/ha/year) to net annual increment (m3/ha/year) | To emphasize the value-added of the JRC knowledge, to cover objective 2<br><br>JRC indicator from Biomass mandate<br><br>Produced by JRC.D1 |
| 2.2.b.2 | Fishing mortality of commercially exploited fish and shellfish exceeding fishing mortality at maximum sustainable yield | To emphasize the value-added of the JRC knowledge, to cover objective 2<br><br>F/FMSY, data behind the STECF-Adhoc-20-01<br><br>Produced by JRC.D2<br><br>https://publications.jrc.ec.europa.eu/repository/bitstream/JRC120481/kj-ax-20-002-en-n.pdf |
| 2.2.d.5 | Intensification of farming (share of high, medium and low input farms in UAA) | To cover objective 2<br><br>Percent UAA under the three management categories<br><br>Produced for CAP and retrieved from Eurostat |
| 3.4.a.2 | Total biomass consumed for energy | To emphasize the value-added of the JRC knowledge, to complete 'biomass use trends' stacked area chart, to cover objective 3<br><br>JRC indicator from Biomass mandate<br><br>Produced by JRC.D1, JRC.D2 and JRC.D4 |
| 3.4.a.3 | Total biomass consumed for materials | To emphasize the value-added of the JRC knowledge, to complete 'biomass use trends' stacked area chart, to cover objective 3<br><br>JRC indicator from Biomass mandate<br><br>Produced by JRC.D1, JRC.D2 and JRC.D4 |
| 4.1.a.3 | Net GHG emissions (emissions and removals) from agriculture | To cover objective 4<br><br>Climate change mitigation indicator<br><br>Data retrieved from Eurostat |
| 4.1.a.6 | Net GHG emissions (emissions and removals) from LULUCF | To cover objective 4<br><br>Climate change mitigation indicator<br><br>Data retrieved from Eurostat |

| 5.1.b.2 | Value-added per sector | To emphasize the value-added of the JRC knowledge, to cover objective 5<br><br>Novel approach to calculate the value-added of bio-based industries in NACE classification<br><br>Produced by JRC.D4 |
|---------|------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| 5.2.a.1 | Persons employed per bioeconomy sectors | To emphasize the value-added of the JRC knowledge, to cover objective 5<br><br>Novel approach to infer employment in bio-based sectors in NACE classification<br><br>Produced by JRC.D4 |

**Annex 2. Indicators published on launch date November 16, 2020**

| Indicator id | Indicator name |
|---|---|
| 1.1.a.1 | Agricultural factor income per annual work unit (AWU) |
| 1.1.a.4 | Total biomass supply for food purposes, including inputs |
| 1.1.b.1 | Prevalence of moderate or severe food insecurity in the total population, yearly estimates |
| 1.1.c.1 | Daily calorie supply per capita by source |
| 2.1.b.4 | Share of organic farming in utilised agricultural area |
| 2.2.a.1 | Long term ratio of annual fellings (m3/ha/year) to net annual increment (m3/ha/year) |
| 2.2.b.2 | Fishing mortality of commercially exploited fish and shellfish exceeding fishing mortality at maximum sustainable yield |
| 2.2.d.5 | Intensification of farming (share of high, medium and low input farms in UAA) |
| 2.3.a.2 | Roundwood removals |
| 3.1.a.1 | Domestic Material Consumption (Biomass) |
| 3.1.b.1 | Energy productivity |
| 3.1.b.2 | Share of renewable energy in gross final energy consumption |
| 3.1.c.2 | Circular material rate |
| 3.4.a.2 | Total biomass consumed for energy |
| 3.4.a.3 | Total biomass consumed for materials |
| 4.1.a.3 | Net GHG emissions (emissions and removals) from agriculture |
| 4.1.a.6 | Net GHG emissions (emissions and removals) from LULUCF |
| 5.1.b.2 | Value-added per sector |
| 5.2.a.1 | Persons employed per bioeconomy sectors |

## Annex 3. All indicators

The full list of indicators and some of their attributes are given below. The colour in the first column indicates whether data are available for the indicator (green); data may be available for the indicator (yellow) or there are no known data for the indicator (red).

| | Indicator name | EU strategy objective | Normative criteria | Key component | Unit |
|---|---|---|---|---|---|
| 1.1.a.1 | Agricultural factor income per annual work unit (AWU) | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Availability | index (2010=100) |
| 1.1.a.2 | New food products (by sector) | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Availability | kg |
| 1.1.a.3 | New food value chains (by sector) | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Availability | |
| 1.1.a.4 | Total biomass supply for food purposes, including inputs | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Availability | 1000 tonnes dry matter |
| 1.1.a.5 | Biomass directly consumed by humans by source (animal, fish, plant-based, algae) | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Availability | 1000 tonnes dry matter |
| 1.1.b.1 | Prevalence of moderate or severe food insecurity in the total population, yearly estimates | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Access | percent |
| 1.1.b.2 | Average dietary energy supply adequacy | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Access | percent |
| 1.1.c.1 | Daily calorie supply per capita by source | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Utilisation | kCal/capita |
| 1.1.c.2 | Indicator concerning food quality, or food safety | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Utilisation | |
| 1.1.c.3 | Animal welfare | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Utilisation | |

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| 1.1.d.1 | Government support to research and development (by sector) | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Stability | eur / GDP |
| 1.1.d.2 | Food purchasing power | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Access | Index |
| 1.1.d.3 | Import dependency ratio of food (import/domestic production) | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Stability | |
| 1.1.d.4 | Value of food imports over total merchandise exports | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Stability | |
| 1.1.d.5 | EU's self-sufficiency rate on protein for feed | Ensuring Food and Nutrition Security | Food security and nutrition are supported | Stability | |
| 1.2.a.1 | Economic impact of trade in exporting countries of food (to EU) | Ensuring Food and Nutrition Security | Local economies, societies and environmental conditions of countries exporting food to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies | Economic impact of trade in exporting countries of food (to EU) | |
| 1.2.b.1 | Environmental footprints in exporting countries of food (to EU) | Ensuring Food and Nutrition Security | Local economies, societies and environmental conditions of countries exporting food to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies | Environmental footprints in exporting countries of food (to EU) | ha |
| 1.2.c.1 | Social impact of trade in exporting countries of food (to EU) | Ensuring Food and Nutrition Security | Local economies, societies and environmental conditions of countries exporting food to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies | Social impact of trade in exporting countries of food (to EU) | |
| 2.1.a.1 | Biochemical oxygen demand in rivers | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Environmental quality | mg O2 per litre |

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| 2.1.a.2 | Phosphate in rivers | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Environmental quality | mg PO4/l |
| 2.1.a.3 | Phosphorus in lakes | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Environmental quality | mg P/l |
| 2.1.a.4 | Nitrate in groundwater | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Environmental quality | mg NO3/l |
| 2.1.a.5 | Nitrate in rivers | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Environmental quality | mg NO3-N/l |
| 2.1.a.6 | Nutrients in transitional, coastal and marine waters | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Environmental quality | µmol/l |
| 2.1.a.7 | Bathing water quality | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Environmental quality | km |
| 2.1.a.8 | Exposure of forest area to ozone in EEA member countries | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Environmental quality | categorical |
| 2.1.a.9 | Exceedance of air quality standards in urban areas | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Environmental quality | ug.m-3 O3 |
| 2.1.b.1 | Percentage area of urban green space (or percentage of natural area within the city boundaries) | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Structural and functional ecosystem attributes | |
| 2.1.b.2 | Landscape fragmentation Index | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Structural and functional ecosystem attributes | index |
| 2.1.b.3 | Share of High Nature Value farmland in agricultural area | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Structural and functional ecosystem attributes | percent of UAA |
| 2.1.b.4 | Share of organic farming in utilised agricultural area | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Structural and functional ecosystem attributes | percent of UAA |
| 2.1.b.5 | Livestock density index | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Structural and functional ecosystem attributes | unit per ha |

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| 2.1.b.6 | Forest fragmentation and connectivity index | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Structural and functional ecosystem attributes | percent |
| 2.1.b.7 | Deadwood | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Structural and functional ecosystem attributes | m3 per ha |
| 2.1.b.8 | Share of forest area | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Structural and functional ecosystem attributes | percent tot land area |
| 2.1.b.9 | Forest and other wooded land growing stock | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Structural and functional ecosystem attributes | 1000m3 |
| 2.1.b.10 | Ecological status of European waters | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Structural and functional ecosystem attributes | categorical |
| 2.1.b.11 | Fish stock biomass in NE Atlantic & Mediterranean | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Structural and functional ecosystem attributes | Fish stock biomass – index 2003 = 100 |
| 2.1.d.1 | Bird and butterfly indices EU aggregate (common farmland bird Index, common forest bird index, grassland butterfly index) | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Species diversity and abundance | index rel to 1990 or 2000 |
| 2.1.d.2 | Age and size distribution of commercially-exploited fish species | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Species diversity and abundance | % or number or cm |
| 2.1.e.1 | Surface of marine and terrestrial sites designated under NATURA 2000 | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Conservation status of habitats and species | percent land area |
| 2.1.e.2 | Conservation Status of European Habitats | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Conservation status of habitats and species | categorical |
| 2.1.e.3 | Conservation status of grassland | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Conservation status of habitats and species | percent of assessments of habitats |

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| 2.1.e.4 | Threatened tree species in forests | Managing Natural Resources Sustainably | Ecosystem capacity to produce services is maintained or enhanced | Conservation status of habitats and species | |
| 2.2.a.1 | Long term ratio of annual fellings (m3/ha/year) to net annual increment (m3/ha/year) | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from Forest Management | percent |
| 2.2.a.2 | Fraction of primary residues remaining in forest | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from Forest Management | percent |
| 2.2.a.3 | Change in ecosystems extent: Forest and woodland | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from Forest Management | ha |
| 2.2.a.4 | Land use / land cover type taken over by forest | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from Forest Management | ha |
| 2.2.a.5 | Number of annual introductions of invasive alien species in forests | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from Forest Management | number/y |
| 2.2.a.6 | Certified forests | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from Forest Management | |
| 2.2.b.1 | Nutrient discharge from fisheries aquaculture | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from marine fisheries & aquaculture management | |
| 2.2.b.2 | Fishing mortality of commercially exploited fish and shellfish exceeding fishing mortality at maximum sustainable yield | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from marine fisheries & aquaculture management | F/FMSY |
| 2.2.b.3 | Number of annual introductions of invasive alien species in marine waters | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from marine fisheries & aquaculture management | number/a |
| 2.2.c.1 | Number of annual introductions of invasive alien species in freshwater | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from freshwater fisheries & aquaculture management | number/a |

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| 2.2.c.2 | Size of aquaculture production units | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from freshwater fisheries & aquaculture management | |
| 2.2.c.3 | Number of integrated multi-trophic aquaculture production units | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from freshwater fisheries & aquaculture management | count |
| 2.2.d.1 | Ammonia emissions from agriculture | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from agroecosystems | kg/ha |
| 2.2.d.2 | Land use / land cover type taken over by agricultural land | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from agroecosystems | ha |
| 2.2.d.3 | Change in ecosystems extent: cropland & grassland | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from agroecosystems | ha |
| 2.2.d.4 | Number of annual introductions of invasive alien species in agroecosystems | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from agroecosystems | number/a |
| 2.2.d.5 | Intensification of farming (share of high, medium and low input farms in UAA) | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from agroecosystems | percent |
| 2.2.d.6 | Sales of pesticides | Managing Natural Resources Sustainably | Primary production sectors are managed sustainably | Pressures from agroecosystems | kg of active ingredient |
| 2.3.a.1 | Biomass production in EU from primary production sectors (agriculture, forests, fisheries, algae, waste) | Managing Natural Resources Sustainably | Ecosystem services contribution to human well-being is maintained or enhanced | Provisioning services | sector-specific units |
| 2.3.a.2 | Roundwood removals | Managing Natural Resources Sustainably | Ecosystem services contribution to human well-being is maintained or enhanced | Provisioning services | m3 o.b. |

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| 2.3.b.1 | Flood regulation (flood control, flow, demand, potential, unment demand, monetary values) | Managing Natural Resources Sustainably | Ecosystem services contribution to human well-being is maintained or enhanced | Regulating services | |
| 2.3.b.2 | Air quality | Managing Natural Resources Sustainably | Ecosystem services contribution to human well-being is maintained or enhanced | Regulating services | |
| 2.3.b.3 | Net ecosystem productivity | Managing Natural Resources Sustainably | Ecosystem services contribution to human well-being is maintained or enhanced | Regulating services | coefficient 0 to 1 |
| 2.3.c.1 | Aesthetics considerations of nature | Managing Natural Resources Sustainably | Ecosystem services contribution to human well-being is maintained or enhanced | Cultural services | |
| 2.3.c.2 | Recreational services (recreation, flow, demand, potential) | Managing Natural Resources Sustainably | Ecosystem services contribution to human well-being is maintained or enhanced | Cultural services | mln eur/y |
| 3.1.a.1 | Domestic Material Consumption (Biomass) | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | Resource efficiency (Material footprint) | 1000 tonnes |
| 3.1.a.2 | Material Footprint (Biomass) | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | Resource efficiency (Material footprint) | tonne / capita |
| 3.1.a.3 | Land footprint IN EU of EU consumption (for non-food&feed) | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | Resource efficiency (Material footprint) | |
| 3.1.b.1 | Energy productivity | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | Energy efficiency | eur / kgoe |

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| 3.1.b.2 | Share of renewable energy in gross final energy consumption | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | Energy efficiency | % |
| 3.1.b.3 | Share of renewable energy in gross final energy consumption of bio based industries or bioenergy industries | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | Energy efficiency | |
| 3.1.c.1 | Cascading factor of wood resources | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | Biogenic waste prevention, re-use/recycling, and recovery | factor |
| 3.1.c.2 | Circular material rate | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | Biogenic waste prevention, re-use/recycling, and recovery | % |
| 3.1.c.3 | Final Energy Consumption from renewable municipal waste | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | Biogenic waste prevention, re-use/recycling, and recovery | TJ |
| 3.1.c.4 | Recycling rate of bio-waste | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | Biogenic waste prevention, re-use/recycling, and recovery | kg / capita |
| 3.1.c.5 | Energy from biomass waste or residues | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | Biogenic waste prevention, re-use/recycling, and recovery | percent recovery of all waste |
| 3.1.c.6 | Products from biomass waste or residues | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | Biogenic waste prevention, re-use/recycling, and recovery | |

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| 3.2.a.1 | Food loss index | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Food loss and waste is minimised and, when unavoidable, its biomass is reused or recycled | Food loss and waste minimization | percent |
| 3.2.a.2 | JRC Food waste indicator | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Food loss and waste is minimised and, when unavoidable, its biomass is reused or recycled | Food loss and waste minimization | |
| 3.3.a.3 | Environmental impacts based on product-based LCA and basket of representative products of the bioeconomy | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Bioeconomy should promote sustainable production and consumption of biomass and bio-based products (within EU) | Bio-based products environmental impacts | |
| 3.4.a.1 | Import dependencies for energy (wood,biofuels, bioenergy) | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | Consumption and demand for biomass and bio-based products | % |
| 3.4.a.2 | Total biomass consumed for energy | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | Consumption and demand for biomass and bio-based products | 1000 tonnes dry matter |
| 3.4.a.3 | Total biomass consumed for materials | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | Consumption and demand for biomass and bio-based products | 1000 tonnes dry matter |
| 3.4.a.4 | Share of woody biomass used for energy | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | Consumption and demand for biomass and bio-based products | % |
| 3.4.b.1 | Liquid biofuels production (bioethanol, pure biogasoline, biodiesel, bio jet kerosene and other liquid biofuels) | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | Production of bio-based products | 1000 tonnes |

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| 3.4.b.2 | Biogasses (indigenous) production | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | Production of bio-based products | TJ |
| 3.4.b.3 | Production of bio-based materials (plastics, textiles, chemicals) | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | Production of bio-based products | tonnes |
| 3.4.b.4 | Advanced biofuels production | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | Production of bio-based products | ktoe |
| 3.4.c.1 | Share of renewables for transport, electricity and heating & cooling | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | Reduced dependence on non-renewable resources | % |
| 3.4.c.2 | Total consumption of energy, including fossil-based | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | Reduced dependence on non-renewable resources | ktoe |
| 3.4.c.3 | Share of wood-based constructions | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | Reduced dependence on non-renewable resources | % |
| 3.4.c.4 | Share of consumption of bio-based plastics, textiles and chemicals | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | Reduced dependence on non-renewable resources | % |
| 3.5.a.1 | Economic impact of trade in exporting countries of non-food (to EU) | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Local economies of countries exporting non-food commodities to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies | Economic impact of trade in exporting countries of non-food (to EU) | |

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| 3.5.b.1 | Environmental footprints in exporting countries of non-food (to EU) | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Local economies of countries exporting non-food commodities to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies | Environmental footprints in exporting countries of non-food (to EU) | |
| 3.5.c.1 | Social impact of trade in exporting countries of non-food (to EU) | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | Local economies of countries exporting non-food commodities to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies | Social impact of trade in exporting countries of non-food (to EU) | |
| 3.6.a.1 | Self-assessed satisfaction with recreational and green areas | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | The sustainability of urban centres is enhanced | Enhanced well-being and health of urban dwellers | % |
| 3.6.a.2 | Self-assessed satisfaction with living environment | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | The sustainability of urban centres is enhanced | Enhanced well-being and health of urban dwellers | % |
| 3.6.a.3 | Self-assessed overall life satisfaction | Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | The sustainability of urban centres is enhanced | Enhanced well-being and health of urban dwellers | % |
| 4.1.a.1 | Net GHG emissions (emissions and removals) from bioenergy (absolute and relative vs. total sector emissions) | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change mitigation | tCO2e and % |
| 4.1.a.2 | Net GHG emissions (emissions and removals) from BBI (absolute and relative vs. total industrial emissions) | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change mitigation | tCO2e and % |
| 4.1.a.3 | Net GHG emissions (emissions and removals) from agriculture | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change mitigation | tCO2e |

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| 4.1.a.4 | Net GHG emissions (emissions and removals) from bio-waste (absolute and relative vs. total waste emissions) | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change mitigation | tCO2e and % |
| 4.1.a.5 | GHG emissions from fishing and aquaculture | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change mitigation | 1000 tCO2e |
| 4.1.a.6 | Net GHG emissions (emissions and removals) from LULUCF | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change mitigation | 1000 tCO2e |
| 4.1.a.7 | Financial support to bio-based sectors (climate action) | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change mitigation | Euro/pc |
| 4.1.b.1 | Climate change indices (country level precipitation and temp) | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | TBC rain and temp units |
| 4.1.b.2 | Crop yield (3 main crops) | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | ton/ha |
| 4.1.b.3 | Water exploitation index (WEI) | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | % |
| 4.1.b.4 | Soil moisture (seasonal average) | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | % |
| 4.1.b.5 | Soil erosion / desertification | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | Tg C/y |
| 4.1.b.6 | Soil organic carbon content | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | percent |
| 4.1.b.7 | Adaptation in agriculture, share of farmers with CAP risk management tools (insurance) | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | % |
| 4.1.b.8 | Adaptation in agriculture, share of agricultural land under | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | % |

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| | commitments to improve adaptation (ha) | | | |
| 4.1.b.9 | Adaptation in agriculture, unsustainable water use: share of irrigated land under commitments to improve water balance | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | % |
| 4.1.b.10 | Adaptation in forest, # fire instances | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | # |
| 4.1.b.11 | Adaptation in forest, Burnt area | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | ha |
| 4.1.b.12 | Adaptation in forest, Damages due to storm events (forests) | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | |
| 4.1.b.13 | Adaptation in fisheries, potential catch | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | tons |
| 4.1.b.14 | MS Preparedeness – Year of adoption of the National Adaptation strategy/Plan (NAS/NAP) | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | # |
| 4.2.b.15 | Adaptation, International Transboundaries effects – loss in GDP | Mitigating and adapting to climate change | Climate change mitigation and adaptation are pursued | Climate change adaptation | % |
| 4.2.a.1 | City preparedness – # cities signatories of COM – Adaptation | Mitigating and adapting to climate change | The sustainability of urban centres is enhanced | Enhanced resilience/adaptation to climate change for urban areas | # |
| 4.2.a.2 | Investments in urban adaptation through nature-based infrastructures or EBA | Mitigating and adapting to climate change | The sustainability of urban centres is enhanced | Enhanced resilience/adaptation to climate change for urban areas | Euro/pc |
| 5.1.a.1 | Contribution of the Bioeconomy to GDP | Strengthening European competitiveness and creating jobs | Economic development is fostered | Contribution of bioeconomy to economic development | % |
| 5.1.a.2 | Value Added per sector / Bioeconomy value added | Strengthening European competitiveness and creating jobs | Economic development is fostered | Contribution of bioeconomy to economic development | % |

| 5.1.a.3 | GVA to turnover ratio | Strengthening European competitiveness and creating jobs | Economic development is fostered | Contribution of bioeconomy to economic development | ratio |
| 5.1.a.4 | Economic productivity (GVA/unit of biomass) | Strengthening European competitiveness and creating jobs | Economic development is fostered | Contribution of bioeconomy to economic development | GVA/unit biomass / sector |
| 5.1.a.5 | Gross value added per person employed in bioeconomy | Strengthening European competitiveness and creating jobs | Economic development is fostered | Contribution of bioeconomy to economic development | 1000 EUR per worker |
| 5.1.b.1 | Turnover in bioeconomy per sector | Strengthening European competitiveness and creating jobs | Economic development is fostered | Value of raw and processed biomass, value added in bioeconomy sectors | Million EUR |
| 5.1.b.2 | Value-added per sector | Strengthening European competitiveness and creating jobs | Economic development is fostered | Value of raw and processed biomass, value added in bioeconomy sectors | Million EUR |
| 5.1.c.1 | Export value | Strengthening European competitiveness and creating jobs | Economic development is fostered | Exports of EU food and non-food biomass, processed goods and/or related technologies | EUR |
| 5.1.c.2 | Trade balance (net export) | Strengthening European competitiveness and creating jobs | Economic development is fostered | Exports of EU food and non-food biomass, processed goods and/or related technologies | EUR |
| 5.1.d.1 | Terms-of-Trade of biomass (export/import) | Strengthening European competitiveness and creating jobs | Economic development is fostered | Comparative advantage | ratio |
| 5.1.d.2 | Revealed comparative advantage of biomass (Balassa index) | Strengthening European competitiveness and creating jobs | Economic development is fostered | Comparative advantage | index |
| 5.1.d.3 | Number of enterprises in bioeconomy | Strengthening European competitiveness and creating jobs | Economic development is fostered | Comparative advantage | number |
| 5.1.d.4 | Bioeconomy SME birth & death rates | Strengthening European competitiveness and creating jobs | Economic development is fostered | Comparative advantage | % |

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| 5.2.a.1 | Persons employed per bioeconomy sectors | Strengthening European competitiveness and creating jobs | Inclusive economic growth is strengthened | Employment in bioeconomy | person |
| 5.2.b.1 | Occupation health and safety in bioeconomy sectors | Strengthening European competitiveness and creating jobs | Inclusive economic growth is strengthened | Working conditions related to bioeconomy | |
| 5.2.c.1 | Employment by age in bioeconomy sectors | Strengthening European competitiveness and creating jobs | Inclusive economic growth is strengthened | Equality & inclusiveness in bioeconomy sectors | person |
| 5.2.c.2 | Employment by educational level in bioeconomy sectors | Strengthening European competitiveness and creating jobs | Inclusive economic growth is strengthened | Equality & inclusiveness in bioeconomy sectors | person |
| 5.2.c.3 | Employment by gender in bioeconomy sectors | Strengthening European competitiveness and creating jobs | Inclusive economic growth is strengthened | Equality & inclusiveness in bioeconomy sectors | person |
| 5.2.c.4 | Income by gender by sector | Strengthening European competitiveness and creating jobs | Inclusive economic growth is strengthened | Equality & inclusiveness in bioeconomy sectors | EUR |
| 5.2.c.5 | Income distribution along bioeconomy value chains | Strengthening European competitiveness and creating jobs | Inclusive economic growth is strengthened | Equality & inclusiveness in bioeconomy sectors | EUR per step in the value chain |
| 5.3.a.1 | Distance to logistics hubs (territorial dimension) | Strengthening European competitiveness and creating jobs | Resilience of the rural, coastal and urban economy is enhanced | Physical infrastructure (accessibility, services) | km |
| 5.3.c.1 | Bioeconomy investments in rural and coastal areas | Strengthening European competitiveness and creating jobs | Resilience of the rural, coastal and urban economy is enhanced | Bioeconomy investments in rural & coastal areas | EUR |
| 5.3.c.2 | Number of bioeconomy businesses developed with policy support | Strengthening European competitiveness and creating jobs | Resilience of the rural, coastal and urban economy is enhanced | Bioeconomy investments in rural & coastal areas | number |
| 5.3.d.1 | Transformation of biomass at farm (or coop) level | Strengthening European competitiveness and creating jobs | Resilience of the rural, coastal and urban economy is enhanced | Rural income diversification | Tonnes?? |
| 5.3.d.2 | Income diversification in rural areas, by farmer age for production and transformation at farm or coop level. | Strengthening European competitiveness and creating jobs | Resilience of the rural, coastal and urban economy is enhanced | Rural income diversification | ? |

| | | | | |
|---|---|---|---|---|
| 5.3.d.3 | Income diversification of rural and coastal biomass producers (other than agriculture) | Strengthening European competitiveness and creating jobs | Resilience of the rural, coastal and urban economy is enhanced | Rural income diversification | ? |
| 5.3.e.1 | Income of primary producers (fish & seafood landing income, agriculture households, forest owners) | Strengthening European competitiveness and creating jobs | Resilience of the rural, coastal and urban economy is enhanced | Income of primary producers | EUR |
| 5.4.a.1 | Adoption of new bioeconomy technology by primary producers for both production and transformation levels | Strengthening European competitiveness and creating jobs | Existing knowledge is adequately valued and proven sound technologies are fostered | Existing knowledge on bioeconomy technologies | ? |
| 5.4.a.2 | Rolling-out of pilot projects | Strengthening European competitiveness and creating jobs | Existing knowledge is adequately valued and proven sound technologies are fostered | Existing knowledge on bioeconomy technologies | number |
| 5.4.a.3 | Investment in TRL8-9 bio-based products | Strengthening European competitiveness and creating jobs | Existing knowledge is adequately valued and proven sound technologies are fostered | Existing knowledge on bioeconomy technologies | EUR |
| 5.5.a.1 | % persons employed with 3º education in bioeconomy sectors | Strengthening European competitiveness and creating jobs | Knowledge generation and innovation are promoted | Knowledge generation/ (high level) education | % |
| 5.5.a.2 | Changes in University curricula (number) | Strengthening European competitiveness and creating jobs | Knowledge generation and innovation are promoted | Knowledge generation/ (high level) education | number |
| 5.5.a.3 | Investment in higher education related to bioeconomy | Strengthening European competitiveness and creating jobs | Knowledge generation and innovation are promoted | Knowledge generation/ (high level) education | EUR |
| 5.5.b.1 | Number of patents by bioeconomy sectors | Strengthening European competitiveness and creating jobs | Knowledge generation and innovation are promoted | Research and innovation | number |
| 5.5.b.2 | Investment in research and innovation (1000 eur) | Strengthening European competitiveness and creating jobs | Knowledge generation and innovation are promoted | Research and innovation | 1000 EUR |
| 5.5.b.3 | Open innovation | Strengthening European competitiveness and creating jobs | Knowledge generation and innovation are promoted | Research and innovation | ? |

| | | | | | |
|---|---|---|---|---|---|
| 5.5.b.4 | New non-food products produced from primary sources | Strengthening European competitiveness and creating jobs | Knowledge generation and innovation are promoted | Research and innovation | number? |
| 5.5.b.5 | Number of research outputs in the field of bioeconomy | Strengthening European competitiveness and creating jobs | Knowledge generation and innovation are promoted | Research and innovation | number |
| 5.6.a.1 | Market or consumers acceptance | Strengthening European competitiveness and creating jobs | Demand and supply-side market mechanisms and policy coherence between supply and demand of food and non-food goods are enhanced | Market mechanisms (e.g., prices, consumer awareness) | ? |
| 5.6.a.2 | Number of labelled or certified bio-based products | Strengthening European competitiveness and creating jobs | Demand and supply-side market mechanisms and policy coherence between supply and demand of food and non-food goods are enhanced | Market mechanisms (e.g., prices, consumer awareness) | number |
| 5.6.c.1 | Share biomass uses by primary sector | Strengthening European competitiveness and creating jobs | Demand and supply-side market mechanisms and policy coherence between supply and demand of food and non-food goods are enhanced | Resource competition among sectors of the bioeconomy and Biomass demand for new value chains | percent |
| 5.6.c.2 | Producer prices per primary production sector | Strengthening European competitiveness and creating jobs | Demand and supply-side market mechanisms and policy coherence between supply and demand of food and non-food goods are enhanced | Resource competition among sectors of the bioeconomy and Biomass demand for new value chains | EUR/tonne? |

**Annex 4. Glossary**

| | |
|---|---|
| Indicator | In general terms, an indicator is a quantitative or a qualitative measure derived from a series of observed facts that can reveal relative positions (e.g., of a country) in a given area. When evaluated at regular intervals, an indicator can point out the direction of change across different units and through time. In the context of policy analysis, indicators are useful in identifying trends and drawing attention to particular issues. They can also be helpful in setting policy priorities and in benchmarking or monitoring performance (Nardo et al., 2008). |
| Headline indicator | Headline indicators are indicators that were chosen to be emphasized in the launch of the EU Bioeconomy Monitoring System in November 2020 for various reasons. This choice was notably based on the coverage of all five strategy objectives and the value-added of the JRC knowledge. |
| Output indicator | Output indicators measure the state or condition of sectors and systems. |
| Input indicator | Input indicators correspond to drivers, such as governance. |
| Basic indicator | Basic indicators are a collection of indicators that are not necessarily harmonised among themselves. Each indicator in this group has its own specific purpose. The basic indicators are often borrowed from reporting systems that are used to gauge EU policy, used in the framework of European and international reporting, or may be produced ad hoc to monitor a specific facet of the EU Bioeconomy (Giuntoli et al., 2020). |
| Processed indicator | Processed indicators are more sophisticated than basic indicators in that a certain level of harmonisation, computation and interpretation is made to generate these indicators. These are more useful indicators with respect to basic indicators because although they may be sector-specific, value-chain specific, objective-specific etc., their meaning is interpreted within the context of the EU Bioeconomy (Giuntoli et al., 2020). |
| System level indicator | System level indicators are those that require a higher level of value and judgment with respect to basic and processed indicators in their compilation given a higher level of complexity of the questions the indicators are addressing (Giuntoli et al., 2020). |
| Composite indicator | A composite indicator is formed when individual indicators are compiled into a single index on the basis of an underlying model. The composite indicator should ideally measure multi-dimensional concepts which cannot be captured by a single indicator (Nardo et al., 2008). |
| Intensive (indicator type) | An intensive variable is one which does not depend on system size (such as temperature, pressure, or density). For example, if a country would clone itself into double its size, the percent of the studied factor would remain the same. In this way, the studied factor can be compared to small and big countries alike. |
| Extensive (indicator type) | An extensive variable is one which depends on system size (such as mass or volume). |
| Positive directionality | An indicator with a positive directionality indicates that an increasing trend is indicative of a desired state or response (e.g., an indicator of the number of employed people has positive directionality). |
| Negative directionality | An indicator with a negative directionality indicates that a decreasing trend is indicative of a desired state or response (e.g., an indicator of the number of alien species has negative directionality). |

## Annex 5. Technical sheets for indicators

### Annex 5.1. Agricultural factor income per annual work unit (AWU) (1.1.a.1)

| Agricultural factor income per annual work unit (AWU) | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 1.<br><br>Ensuring Food and Nutrition Security | 1.<br><br>Food security and nutrition are supported | a.<br><br>Availability | 1 |
| Unit of the indicator | Index 2010 = 100 | | | |

Information on the indicator

<table>
<tr>
<td rowspan="3">Source</td>
<td>Organization creator of the indicator</td>
<td>Eurostat – DG AGRI</td>
</tr>
<tr>
<td>Contact person</td>
<td></td>
</tr>
<tr>
<td>Location of the indicator:<br><br>General & Specific link</td>
<td>Agricultural factor income per annual work unit (AWU) (SDG_02_20)[1]</td>
</tr>
<tr>
<td colspan="2">Type (intensive or extensive)</td>
<td>intensive</td>
</tr>
<tr>
<td colspan="2">Directionality (positive or negative)</td>
<td>positive</td>
</tr>
<tr>
<td colspan="2">Input/Output</td>
<td>output indicator</td>
</tr>
<tr>
<td colspan="2">Interpretation</td>
<td>The indicator is a partial labour productivity measure of the agricultural sector.<br><br>&bull;   Agricultural factor income[1]<br><br>It measures the income generated by farming, which is used to remunerate borrowed or rented factors of production (capital, wages and land rents) as well as own production factors (own labour, capital and land). Factor income corresponds to the deflated (real) net value added at factor cost of agriculture. The implicit price index of GDP is used as deflator.<br><br>&bull;   Annual work units (AWUs)[1]<br><br>It is defined as full-time equivalent employment (corresponding to the number of full-time equivalent jobs), i.e., as total hours worked divided by the average annual number of hours worked in full-time jobs within the economic territory.</td>
</tr>
<tr>
<td colspan="2">More information</td>
<td>&bull;   Availability[2]<br><br>This key component includes indicators concerning supply of food resources, food production and storage.<br><br>The Agricultural factor income per annual work unit (AWU)[1] is used to monitor progress towards SDG 2 on ending hunger and malnutrition.</td>
</tr>
</table>

---

[1] Eurostat Metadata. Agricultural factor income per annual work unit (AWU) (source: Eurostat, DG AGRI) (sdg_02_20). https://ec.europa.eu/Eurostat/cache/metadata/en/sdg_02_20_esmsip2.htm

[2] Giuntoli, J., Robert, N., Ronzon, T., Sanchez Lopez, J., Follador, M., Girardi, I., Barredo Cano, J., Borzacchiello, M., Sala, S.,M'Barek, R.,La Notte, A., Becker, W. and Mubareka, S., Building a monitoring system for the EU bioeconomy, EUR 30064 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-15385-6, doi:10.2760/717782, JRC119056

| | | SDG 2 – among other things – aims to ensure access to safe, nutritious and sufficient food. Improving agricultural productivity and the incomes of food producers are key factors in achieving this goal. |
| --- | --- | --- |
| | | EU subsidies and direct payments have become an important share of the agriculture factor income. |
| | | One of the five general objectives of the Common Agricultural Policy (CAP) is to ensure a fair standard of living for farmers. |
| | | The CAP is financed by two funds: the European Agricultural Guarantee Fund (EAGF), which finances direct payments to farmers as well as market measures, and the European Agricultural Fund for Rural Development (EAFRD) under which rural development programmes are financed. |
| | | https://unstats.un.org/sdgs/report/2019/Goal-02/ |

Information on the input data

| Source of the data | Organization issuing the data | Data source: EAA, Economic accounts for agriculture<br><br>Data provider: Eurostat |
| --- | --- | --- |
| | Type of data | Various formats / Downloadable CSV file |
| | Location of the data | Eurostat – Data Browser (SDG_02_20)<br><br>https://ec.europa.eu/Eurostat/databrowser/view/sdg_02_20/default/table?lang=en > Download |
| Information on the data | | Eurostat provides the agricultural factor income per AWU as an index based on data reported by the countries.<br><br>DG AGRI calculates and publishes absolute values on agriculture factor income per AWU.<br><br>EAA uses agricultural statistics plus administrative information.<br><br>The EAA are satellite accounts of the European System of Accounts, providing complementary information and concepts adapted to the particular nature of the agricultural industry. Although their structure very closely matches that of the national accounts, their compilation requires the formulation of appropriate rules and methods. |
| Geo coverage | | All Members States – Data per country |
| Frequency of the updated data | | Annually |
| Timeliness of access to data | | T-1 |
| Length of time series | | >10 years |
| Comparability over time | | >5 data points w/0 break |

**Annex 5.2. Total biomass supply for food purposes, including inputs (1.1.a.4)**

| Total biomass supply for food purposes, including inputs | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 1.<br><br>Ensuring Food and Nutrition Security | 1.<br><br>Food security and nutrition are supported | a.<br><br>Availability | 4 |
| Unit of the indicator | 1000 T of Dry Matter (net trade) | | | |

Information on the indicator

| Source | Organization creator of the indicator | EC – Joint Research Centre |
|---|---|---|
| | Contact person | Robert M'barek (Robert.M'BAREK@ec.europa.eu) |
| | Location of the indicator:<br><br>General & Specific link | The EU Biomass Flows tool[3]<br><br>https://op.europa.eu/en/publication-detail/-/publication/74413f58-32be-11eb-b27b-01aa75ed71a1/language-en |
| Type (intensive or extensive) | | extensive |
| Directionality (positive or negative) | | positive |
| Input/Output | | output indicator |
| Interpretation | | The indicator shows the total primary biomass used annually for food purposes. This includes plant-based food, animal-based food (estimated as feed equivalents) and fish biomass consumed directly or used as animal feed. It also includes imports of food items.<br><br>• Biomass<br><br>Biomass is defined as "the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste" (source: Renewable Energy Directive).<br><br>The bioeconomy as it is described in the Bioeconomy Strategy (COM(2012) 60 final) is based on biomass since it "encompasses the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy". |
| More information | | • Availability[4]<br><br>This key component includes indicators concerning supply of food resources, food production and storage.<br><br>In the EU Biomass Flows tool, feed and food uses[3] can be split into: (i) aquatic-based food, (ii) plant-based food, and (iii) animal feed and bedding (the feed equivalent of animal-based food). More information[3] on biomass supply (p.6) and use for food purposes (p.14) in the technical report that complements the tool. |

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[3] Gurría, P. et al., Biomass flows in the European Union: The EU Biomass Flows tool, version 2020, EUR 30454 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-25378-5, doi:10.2760/14342, JRC122379.
[4] Giuntoli, J. et al., Building a monitoring system for the EU bioeconomy, EUR 30064 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-15385-6, doi:10.2760/717782, JRC119056

Information on the input data

| | | |
|---|---|---|
| Source of the data | Organization issuing the data | EC – The BIOMASS project – Joint Research Centre, based on data from Eurostat, FAOSTAT and national statistical offices |
| | Type of data | Downloadable CSV file |
| | Location of the data | As data query: Data portal of agro-economics Modelling – DataM > EU Biomass Flows > Query > Select the following filters either in the Excel downloaded from DataM or directly online: |

| | |
|---|---|
| Geopolitical entity | one or more member states and/or the EU27+UK |
| Year | a single year between 2008 and 2017 |
| Sector | 'All sectors' |
| Level_Sankey | 'L0 – Total biomass' |
| Lifecycle step | 'Uses' and 'Exports' |
| Source | 'Food & feed' (ID T4) and 'Supply' (ID T3) |
| Target | 'Food & feed' (ID T4) and 'Exports' (ID T8) |
| Flow | 'Total biomass' (ID TOTAL) |
| Unit | '1000 T of dry matter (Net trade)' |

From the results of this query, you will need to deduct food exports from the food available for consumption. This is calculated as follows: [Value of Source:Supply to Target:Food & feed] – [Value of Source:Food & feed to Target:Exports].
Please note that there might be other results, such as exports of biomass not specifically designated for consumption as food (plant products).

You can also go directly on the Sankey diagrams in the Biomass flows tool. See the user guide[5] for help in using this tool. The data download will show all flows of biomass. Please consider only the value of biomass available for food purposes [Source:Supply to Target:Food & feed] and deduct the value of food exports [Source:Food & feed to Target:Exports].

| | |
|---|---|
| Information on the data | Data are compiled and elaborated by different Units within the JRC. The data comes from different sources.<br><br>The data point "Latest available data" corresponds to the latest data available from each sector, which could be different years. |
| Geo coverage | All Members States – Data per country: EU27+UK |
| Frequency of the updated data | Annual for this indicator.<br><br>Other indicators in the EU Biomass flows tool (e.g., biomaterials or bioenergy) will be updated with a different frequency. |
| Timeliness of access to data | T–3 |

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[5] The EU Biomass Flows tool – User guide
https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS/data/EU%20Biomass%20Flows%20user%20guide.pdf

| Length of time series | >10 years |
|---|---|
| Comparability over time | >5 data points w/0 break |

**Annex 5.3. Prevalence of moderate or severe food insecurity in the total population (1.1.b.1)**

| Prevalence of moderate or severe food insecurity in the total population, yearly estimates | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 1.<br><br>Ensuring Food and Nutrition Security | 1.<br><br>Food security and nutrition are supported | b.<br><br>Access | 1 |
| Unit of the indicator | Percent (%) | | | |

Information on the indicator

| Source | Organization creator of the indicator | FAO – Statistics Division –<br>Food Security and Nutrition Statistics Team |
|---|---|---|
| | Contact person | |
| | Location of the indicator:<br>General & Specific link | FAO SDGs – Indicator 2.1.2[6] Prevalence of moderate or severe food insecurity in the population based on the Food Insecurity Experience Scale<br><br>http://www.fao.org/sustainable-development-goals/indicators/212/en/ |
| Type (intensive or extensive) | | intensive |
| Directionality (positive or negative) | | negative |
| Input/Output | | output indicator |
| Interpretation | | The indicator is an estimate of the percentage of a country's population that faces food insecurity in one year. It is an indicator of lack of food access.<br>• Food insecurity[7]<br>A person is food insecure when they lack regular access to enough safe and nutritious food for normal growth and development and an active and healthy life. This may be due to unavailability of food and/or lack of resources to obtain food. Food insecurity can be experienced at different levels of severity. |
| More information | | • Access[8]<br>This key component includes concepts of physical and economic access to food.<br>People experiencing moderate food insecurity[7] have reduced the quality and/or quantity of their food and are uncertain about their ability to obtain food due to lack of money or other resources. This state can increase the risk of some forms of malnutrition, such as stunting in children, micronutrient deficiencies or obesity in adults.<br>People experiencing severe food insecurity[7] have run out of food and, at the most extreme, have gone days without eating. This group of people are those we call the "hungry". |

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[6] FAO SDGs – Indicator 2.1.2 Prevalence of moderate or severe food insecurity in the population based on the Food Insecurity Experience Scale. Metadata. https://unstats.un.org/sdgs/metadata/files/Metadata-02-01-02.pdf
[7] FAO. 2020. Hunger and food insecurity. http://www.fao.org/hunger/en/
[8] Giuntoli, J., Robert, N., Ronzon, T., Sanchez Lopez, J., Follador, M., Girardi, I., Barredo Cano, J., Borzacchiello, M., Sala, S.,M'Barek, R.,La Notte, A., Becker, W. and Mubareka, S., Building a monitoring system for the EU bioeconomy, EUR 30064 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-15385-6, doi:10.2760/717782, JRC119056

Information on the input data

| Source of the data | Organization issuing the data | FAO |
|---|---|---|
| | Type of data | Microsoft Excel |
| | Location of the data | Data download available via http://www.fao.org/sustainable-development-goals/indicators/212/en/ |
| Information on the data | | FAO estimates food insecurity using the Food Insecurity Experience Scale through a survey module (FIES-SM) based on experiences of individuals or households associated with constrained access to food.<br><br>It is linked to the Voices of the Hungry project (VoH)[9] which has for key objective to estimate comparable prevalence rates of food insecurity in national populations for more than 140 countries every year.<br><br>The probability to be food insecure is estimated using the one-parameter logistic Item Response Theory model[10] (the Rasch model) and thresholds for classification are made cross-country comparable by calibrating the metrics obtained in each country against the FIES global reference scale, maintained by FAO. The threshold to classify "moderate or severe" food insecurity corresponds to the severity associated with the item "having to eat less" on the global FIES scale.<br><br>The indicator is calculated as an average over 3 years (eg. data for 2015 is the average of 2014-2016 data). |
| Geo coverage | | All Members States - Data per country |
| Frequency of the updated data | | Annually |
| Timeliness of access to data | | >T-3 |
| Length of time series | | 5-10 years |
| Comparability over time | | 3-5 data points w/0 break |

[9] Cafiero, Carlo & Nord, Mark & Viviani, Sara & Grossi, Mauro & Ballard, Terri & Kepple, Anne & Miller, Meghan & Nwosu, Chiamaka. (2016). Methods for estimating comparable prevalence rates of food insecurity experienced by adults throughout the world. 10.13140/RG.2.1.5112.9207.
[10] Hatzinger, Reinhold & Mair, Patrick. (2010). eRm - extended Rasch modelling An R Package for the Application of Item Response Theory Models.

**Annex 5.4. Daily calorie supply per capita by source (1.1.c.1)**

| Daily calorie supply per capita by source | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 1. Ensuring Food and Nutrition Security | 1. Food security and nutrition are supported | c. Utilisation | 1 |
| Unit of the indicator | Kilocalories / capita / day | | | |

Information on the indicator

| Source | Organization creator of the indicator | Eurostat |
|---|---|---|
| | Contact person | |
| | Location of the indicator: General & Specific link | Daily calorie supply per capita by source (T2020_RK100)[11] |
| Type (intensive or extensive) | | intensive |
| Directionality (positive or negative) | | descriptive |
| Input/Output | | output indicator |
| Interpretation | | The indicator presents the total supply of daily calorie for each person in one country in one year and the split into calories from animal and vegetal products. It should not be confused with the per capita consumption of those products (calorie consumption) as calorie supply includes also losses through food distribution and mismanagement. |
| More information | | • Utilisation[12] This key component includes concepts of both sufficient quality and quantity of food (nutrition safety and nutrition quality are included here) as well as the animal • Supply available The supply available during a given period is the total quantity of all foodstuffs produced in a country added to the total quantity imported and adjusted to any change in stocks that may have occurred since the beginning of the reference period. • Data on per capita food supplies These data are expressed in terms of quantity and by applying appropriate food composition factors for all primary and processed products. The data for this indicator can also be expressed in terms of its energy value. |

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[11] Eurostat Metadata. Daily calorie supply per capita by source (T2020_RK100).
https://ec.europa.eu/Eurostat/cache/metadata/EN/t2020_rk100_esmsip2.htm
[12] Giuntoli, J., Robert, N., Ronzon, T., Sanchez Lopez, J., Follador, M., Girardi, I., Barredo Cano, J., Borzacchiello, M., Sala, S.,M'Barek, R.,La Notte, A., Becker, W. and Mubareka, S., Building a monitoring system for the EU bioeconomy, EUR 30064 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-15385-6, doi:10.2760/717782, JRC119056

Information on the input data

| Source of the data | Organization issuing the data | Data source: FAO<br>Data provider: Food and Agriculture Organization of the United Nations, Statistics Division (FAOSTAT): Food supply (kcal/capita/day),<br>Information reported as well by Eurostat |
| --- | --- | --- |
| | Type of data | Microsoft Excel Worksheet |
| | Location of the data | Eurostat– Data Browser (T2020_RK100)<br><br>https://ec.europa.eu/Eurostat/databrowser/view/t2020_rk100/default/table?lang=en > Download |
| Information on the data | | Note that Eurostat is not the producer of these data, only re-publishes them. These data are not considered European statistics.<br>The supply data[1] are based on Food Balance Sheets (FAO) from covered countries. These food balance sheets show the availability for human consumption for each food item i.e., each primary commodity, which corresponds to the sources of supply and its utilisation.<br>Data sources are primarily FAO questionnaires, national publications available in the ESS Library and Country visits by statisticians involving discussions with national experts. |
| Geo coverage | | All Members States - Data per country |
| Frequency of the updated data | | Annually<br><br>This indicator is updated annually, usually in December. There is an agreement with FAOSTAT to provide Eurostat with up-to-date data. |
| Timeliness of access to data | | >T-3 |
| Length of time series | | >10 years<br><br>Presented time series starts in 2000. |
| Comparability over time | | >5 data points w/0 break |

**Annex 5.5. Share of organic farming in utilised agricultural area (2.1.b.4)**

| Share of organic farming in utilised agricultural area $\frac{UAA\ (ha) managed\ in\ organic\ farming}{Total\ UAA\ (ha)} * 100$ | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 2.<br><br>Managing Natural Resources Sustainably | 1.<br><br>Ecosystem capacity to produce services is maintained or enhanced | b.<br><br>Structural and functional ecosystem attributes | 4 |
| Unit of the indicator | % of UAA managed in organic farming relative to the total UAA | | | |

Information on the indicator

| Source | Organization creator of the indicator | Eurostat, E2: Environmental statistics and accounts; sustainable development |
|---|---|---|
| | Contact person | |
| | Location of the indicator:<br><br>General link &<br><br>Specific link | Area under organic farming (sdg_02_40)<br><br>https://ec.europa.eu/Eurostat/cache/metadata/en/sdg_02_40_esmsip2.htm |
| Type (intensive or extensive) | | intensive |
| Directionality (positive or negative) | | positive |
| Input/Output | | output indicator |
| Interpretation | | The indicator measures the share of organic crop area out of the total utilised agricultural area (UAA).<br><br>Organic crops are defined here as fully converted and under conversion to organic farming.<br><br>The series on the dashboard starts from 2012 only, corresponding to when all countries start to report. |
| More information | | Farming is recognised to be organic if it complies with Council Regulation (EC) No 834/2007, which has set up a comprehensive framework for the organic production of crops and livestock and for the labelling, processing and marketing of organic products, as well as for governing imports of organic products into the EU. The detailed rules for the implementation of this Regulation are laid down in Commission Regulation (EC) No 889/2008.<br><br>The related metadata can be found:<br><br>https://ec.europa.eu/Eurostat/cache/metadata/EN/org_esms.htm |

Information on the input data

| Source of the data | Organization issuing the data | Data source: European Statistical System (ESS). Data provider: Eurostat based on data reported by EU countries. |
|---|---|---|
| | Type of data | Various formats available on the Eurostat |
| | Location of the data | Indicator already computed and data already available. More data in the source dataset and download option: http://appsso.Eurostat.ec.europa.eu/nui/show.do?dataset=org_cropar&lang=en |
| Information on the data | | |
| Geo coverage | | All EU Members States |
| | | Data are presented for all EU Member States plus the United Kingdom, Norway, Switzerland and Turkey. |
| Frequency of the updated data | | Annually |
| Timeliness of access to data | | T-2 |
| Length of time series | | >10 years |
| Comparability over time | | >5 data points w/0 break |

**Annex 5.6. Long term ratio of annual fellings to net annual increment in forests available for wood supply (5-year averages) (2.2.a.1)**

| Long term ratio of annual fellings to net annual increment in forests available for wood supply (5-year averages)  $$\frac{Annual\ fellings\ (m^3\ /\ ha/yr)}{Net\ annual\ increment(m^3\ /\ ha/yr)} * 100$$ | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 2.  Managing Natural Resources Sustainably | 2.  Primary production sectors are managed sustainably | a.  Pressures from Forest Management | 1 |
| Unit of the indicator | Felling rate (%) | | | |

Information on the indicator

| Source | Organization creator of the indicator | Forest Europe Liaison unit / UNECE / Eurostat |
|---|---|---|
| | Contact person | Nicolas Robert (Nicolas.ROBERT@ec.europa.eu) |
| | Location of the indicator:  General & Specific link | State of Europe's Forests 2015 Report  Pages of interest 113 and 261 – indicator 3.1 |
| Type (intensive or extensive) | | intensive |
| Directionality (positive or negative) | | negative if above 100%, but threshold could be lower (e.g., 90% or even less). To consider natural disturbances. |
| Input/output | | output indicator |
| Interpretation | | The felling rate (%) gives an idea of the harvest intensity in Europe's Forests compared to their maximum supply capacity. Above 100%, the stock of wood is likely depleting because of too intense harvest. Values lower than 100% indicate harvest levels that can be sustained in the long term, as they entail an increasing growing stock, indicating that fellings can be increased in some conditions. |
| More information | | • Fellings (annual)[13]  Average standing volume of all trees, living or dead, measured overbark to minimum diameters as defined for "Growing stock" that are felled during the given reference period, including the volume of trees or parts of trees that are not removed from the forest, other wooded land or other felling site. Includes: silvicultural and pre-commercial thinnings and cleanings left in the forest; and natural losses that are recovered (harvested).  • Net (annual) increment[14]  Average annual volume of gross increment over the given reference period less that of natural losses on all trees, measured to minimum diameters as defined for "Growing stock". |

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[13] MCPFE 2003, from TBFRA 2000, modified, from Questionnaires on Quantitative Indicators, SoEF 2015
[14] TBFRA 2000, modified, FRA 2015, from Questionnaires on Quantitative Indicators, SoEF 2015

Information on the input data

| Source of the data | Organization issuing the data | Joint Forest Europe / UNECE / FAO / Forest Europe Liaison unit (changing every 5 years). Information reported as well by UNECE and Eurostat |
|---|---|---|
| | Type of data | Microsoft Excel Worksheet / downloadable CSV file |
| | Location of the data | • UNECE Statistical Database<br><br>Forestry > Productive Functions (Pan-European) > Increment and fellings (in forest available for wood supply) (Indicator 3.1.)<br><br>Select 'Fellings: Total'; Select all the countries > Select all the years > download the first Excel for 'Annual fellings' (numerator)<br><br>Select 'Net Annual Increment'; Select all the countries > Select all the years > download the second Excel for 'NAI' (denominator)<br><br>• SoEF Database<br><br>Quantitative > Criterion3 > Pan-European indicator 3.1 > download statistics > The annual fellings and the NAI are available for each country in the '3.1' tab in the Excel sheets.<br><br>• Eurostat<br><br>The indicator should soon be published in the table: for_vol (expecting the release of the new SoEF) |
| Information on the data | | The most part of the information was provided by the National Correspondents (NCs) through a Questionnaire on Pan-European Indicators for Sustainable Forest Management. Quantitative indicators collected through the UNECE/FAO Forestry and Timber Section, Geneva (November 2013). Full details are provided in the country questionnaires. |
| Geo coverage | | All Members States - Data per country |
| Frequency of the updated data | | Every 5 years |
| Timeliness of access to data | | T-5 or more (data for the year 2015, corresponding to the period 2013-2017, will be available in 2020). |
| Length of time series | | >10 years |
| Comparability over time | | 3-5 data points w/o break |

**Further information: definitions**

-Gross (annual) increment[15]: Average annual volume of increment over the reference period of all trees measured to minimum diameters as defined for "Growing stock".

-Natural (annual) losses[15]: Average annual losses to the growing stock during the given reference period, measured to minimum diameters as defined for "Growing stock", due to mortality from causes other than cutting by man, e.g., natural mortality, diseases, insects attacks, fire, wind throw or other physical damage.

-Growing stock[16]: Volume over bark of all living trees with a minimum diameter of 10 cm at breast height (or above buttress if these are higher). Includes the stem from ground level up to a top diameter of 0 cm, excluding branches.

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[15] TBFRA 2000, modified, from Questionnaires on Quantitative Indicators, SoEF 2015
[16] FAO. (2012). Forest Resources Assessment, Working paper 180. FRA 2015 Terms and Definitions.

**Annex 5.7. Fishing mortality of commercially exploited fish and shellfish exceeding fishing mortality at maximum sustainable yield (2.2.b.2)**

| Fishing mortality of commercially exploited fish and shellfish exceeding fishing mortality at maximum sustainable yield $$\frac{F\ (10^x\ tonnes)}{F_{MSY}\ (10^x\ tonnes)}$$ | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 2. Managing Natural Resources Sustainably | 2. Primary production sectors are managed sustainably | b. Pressures from marine/coastal fisheries & aquaculture management | 2 |
| Unit of the indicator | Fish exploitation level ($ratio - no\ unit$) | | | |

Information on the indicator

| Source | Creator of the indicator | JRC-STECF |
|---|---|---|
| | Contact person | Cecilia Pinto (cecilia.pinto@ec.europa.eu) |
| | Location of the indicator: General & Specific link | Latest common fisheries policy (CFP) report 'STECF 20-01 adhoc – CFP monitoring.pdf' > Download > '3.2.7 Trend in F/F$_{MSY}$': p.32 |
| Type (intensive or extensive) | | intensive |
| Directionality (positive or negative) | | negative |
| Input/output | | output indicator |
| Interpretation | | The fish exploitation level indicates fishing pressure: the higher it is (F>1), the bigger there is a pressure existing on fish stocks. The trends shown are for European stocks although there are some stocks which are shared between European and non-European waters. The indicator shows the model-based trend over time of fish stock biomass relative to 2003 in two seas -the Northeast Atlantic and adjacent seas[17] and the Mediterranean and Black Sea[18]- and is presented as Index 2003 = 100. |
| More information | | 'Fish mortality' and 'fishing mortality' are important to distinguish as one is used to define the other. F= fishing mortality, or mortality by fishing on the stock; Z= fish mortality, measured by: $$Z = M + F$$ where : $$M = natural\ mortality\ of\ the\ fish\ species$$ Example of a detailed interpretation for 2017: -in the Mediterranean and Black Sea, the fish stocks were 2.4 times more than what they should be to enable the regeneration of fish stocks ($F \gg F_{MSY}$); |

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[17] FAO Major Fishing Area 27, Atlantic, Northeast. http://www.fao.org/fishery/area/Area27/en
[18] FAO Major Fishing Area 37, Mediterranean and Black Sea. http://www.fao.org/fishery/area/Area37/en

| | | -in the NE Atlantic, the equilibrium was reached. $(\frac{F}{F_{MSY}} = 1 \; or \; F = F_{MSY})$ |
|---|---|---|

Information on the input data

| Source of the data | Organization issuing the data | ICES (for the NE Atlantic and adjacent seas) / JRC STECF – Mediterranean Expert Working Group (for the Mediterranean and Black Sea) |
|---|---|---|
| | Type of data | -Data: Microsoft Excel / downloadable CSV file<br><br>-Codes: R files |
| | Location of the data | Latest common fisheries policy (CFP) supporting data and code > 'STECF 20-01 adhoc – all supporting data and codes.zip' > Download |
| Information on the data | | The indicator, for each sea, is computed using R:<br><br>-Process of NE Atlantic $\frac{F}{F_{MSY}}$ → 'report_nea.R', using 'Dataset_2020.csv';<br><br>-Mediterranean and Black Sea $\frac{F}{F_{MSY}}$ → 'report_med.R', using 'GFCM_SA_2020.csv' and 'STECF_CFP_2020.csv'.<br><br>Single species quantitative stock assessments were used to compute the indicator.<br><br>The stock assessment data for the Mediterranean and Black Sea area are obtained both from the STECF and GFCM working groups' reports. Nevertheless, on the online database "STECF Stock Assessment database in the Mediterranean and Black Sea" only the stock assessments ran by STECF working groups are available.<br><br>JRC-STECF runs analyses and accounts for a number of issues present in the Mediterranean stock assessments: 1. Differences in time series length, starting points and update dates of the stock assessments 2. Data from ICES (NE Atlantic) and GFCM & STECF working groups (Mediterranean and Black Sea) undergo a stock by stock quality check. |
| Geo coverage | | The NE Atlantic and adjacent seas (FAO area 27)[17] and the Mediterranean and Black Sea (FAO area 37)[18] |
| Frequency of the update of data | | Annually<br><br>The time series are annually updated, sometimes including new stocks due to newly available quantitative assessments, sometimes excluding stocks that are not assessed anymore which can result in small differences between annual versions of the indicator. |
| Timeliness of access to data | | T-2 (if the data are being released in 2018, they will be available in 2020). |
| Length of time series | | >10y |
| Comparability over time | | >5 data points w/o break |

**Annex 5.8. Intensification of farming (share of high, medium and low input farms in UAA) (2.2.d.5)**

| Intensification of farming (share of high, medium and low input farms in UAA) $$\frac{UAA\ (ha)\ managed\ by}{\substack{low\ or\ medium\ or\ high\ input\ farms \\ Total\ UAA\ (ha)}} * 100$$ | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 2. Managing Natural Resources Sustainably | 2. Primary production sectors are managed sustainably | d. Pressures from agroecosystems | 5 |
| Unit of the indicator | % of UAA managed by farms with different degrees of input intensity relative to the total UAA | | | |

Information on the indicator

| Source | Organization creator of the indicator | DG AGRI – FADN (Farm Accountancy Data Network) |
|---|---|---|
| | Contact person | |
| | Location of the indicator: General link & Specific link | https://ec.europa.eu/Eurostat/cache/metadata/en/aei_ps_inp_esms.htm#unit_measure1605002520834 |
| Type (intensive or extensive) | | intensive |
| Directionality (positive or negative) | | descriptive |
| Input/output | | output indicator |
| Interpretation | | Farm input intensity is used as a "proxy" of agricultural intensification, which is understood here as an increase in agricultural input use per ha of land. The indicator gives an indication of the agricultural area managed by farms with different degree of input intensity: low, medium and high intensity per ha[19]. |
| More information | | Farms are classified in intensity categories according to an estimate of inputs' volume per hectare of UAA. The inputs considered are fertilizers, pesticides and other crop protections and purchased feed. It allows covering both crop and livestock productions. |

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[19] European Commission (Agriculture and Rural Development), 2018. Cap context indicators 2014-2020. 33. Farming intensity. https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/cap-indicators-doc-c33_2018_en.pdf

Information on the input data

| Source of the data | organization issuing the data | DG AGRI, FADN (Farm Accountancy Data Network) and Eurostat, the statistical office of the European Union (Contact organization unit: Unit E1, Agriculture and Fisheries) |
| | | Member States report data to the Farm Accountancy Data Network (FADN). Data are then collected, validated and verified solely by DG Agriculture and Rural Development, by means of coherence, homogeneity and continuity tests. |
| | | FADN data are combined with the database on price indices of the means of agricultural production (data from the Economic accounts for agriculture). |
| | type of data | Various formats available on the Eurostat |
| | Location of the data | https://appsso.Eurostat.ec.europa.eu/nui/show.do?dataset=aei_ps_inp&lang=en |
| Information on the data | | The inputs considered are purchased fertilisers and soil improvers, pesticides (plant protection products), other means for protection such as traps and baits, bird scarers, anti-hail shells, frost protection and purchased feed. |
| Geo coverage | | All Members States - Data per country |
| Frequency of the updated data | | Annually |
| | | This indicator is a calculation based on FADN data which is disseminated annually. |
| Timeliness of access to data | | There is no pre-defined release calendar. The last data update was in 2020. |
| | | >T-3 |
| Length of time series | | >10 years |
| Comparability over time | | >5 data points w/0 break |

**Annex 5.9. Roundwood removals (2.3.a.2)**

| Roundwood removals | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 2.<br><br>Managing Natural Resources Sustainably | 3.<br><br>Ecosystem services contribution to human well-being is maintained or enhanced | a.<br><br>Provisioning services | 2 |
| Unit of the indicator | m³ o.b. | | | |

Information on the indicator

<table>
<tr><td rowspan="3">Source</td><td>Organization creator of the indicator</td><td>JRC-BIOMASS (DBForest)</td></tr>
<tr><td>Contact person</td><td>Noemi E. Cazzaniga (Noemi.CAZZANIGA@ext.ec.europa.eu)</td></tr>
<tr><td>Location of the indicator:<br><br>General & Specific link</td><td>JRC.D1 forest database 'DBForest'<br><br>https://publications.jrc.ec.europa.eu/repository/bitstream/JRC109869/jrc109869_biomass_report_final2pdf2.pdf  > section 3.1.2.4</td></tr>
<tr><td colspan="2">Type (intensive or extensive)</td><td>extensive</td></tr>
<tr><td colspan="2">Directionality (positive or negative)</td><td>positive</td></tr>
<tr><td colspan="2">Input/output</td><td>output indicator</td></tr>
<tr><td colspan="2">Interpretation</td><td>This indicator – measured in cubic metres over bark (including the bark) – describes the roundwood from fellings that are actually removed from the forest. It measures the actual flow of the ecosystem service "wood production" from the forest to the economy. This indicator is positive, as larger flows allow for an increase in the wood-based economy. This indicator reacts to harvests due to salvage loggings. It does not measure the possible overuse of the forest (see e.g., indicator 2.2.a.2, the long term ratio of annual fellings to net annual increment).</td></tr>
<tr><td colspan="2">More information</td><td>•     Primary woody biomass<br><br>All roundwood felled or otherwise harvested and removed. It comprises all wood obtained from removals, i.e., the quantities removed from forests and from trees outside the forest, including wood recovered due to natural mortality and from felling and logging. It includes all wood removed with or without bark, including wood removed in its round form, or split, roughly squared or in other form, e.g., branches, roots, stumps and burls (where these are harvested) and wood that is roughly shaped or pointed. (source: JFSQ- Eurostat, FAO, ITTO, UNECE. Joint Forest Sector Questionnaire Definitions 2016. https://www.unece.org/fileadmin/DAM/timber/mis/jfsq/2016/jq2016def-e.pdf.)</td></tr>
</table>

Information on the input data

| Source of the data | Organization issuing the data | FAO / UNECE / ITTO (Joint Forest Sector Questionnaire, JFSQ) Information reported as well by Eurostat |
| | Type of data | Microsoft Excel Worksheet / downloadable CSV file |
| | Location of the data | DBForest |
| Information on the data | | The basic data collection is carried out by country correspondents in the Member States and EFTA countries. Data are generally collected from the users of roundwood (the wood industry companies or companies that trade in roundwood). See the full list of sources. |
| | | For this indicator, the total removals over bark were collected through the latest Joint Forest Sector Questionnaire (published August 2019) > 'JQ1 Production' > "Removals of roundwood (wood in the rough)". Removals under-bark downloaded on the FAOSTAT website: http://www.fao.org/faostat/en/#data/FO (Elements: production quantity; Items aggregated: Roundwood (Total)) |
| | | Conversion to over bark using conversion factors from UNECE/FAO (2010)[20], Forest products conversion factors for the UNECE region. Since coefficients are not available for all countries, the average "Volume ratio wood/bark plus wood" are applied: |
| | | <ul><li>Saw/veneer logs: 0.88</li><li>Pulp/fuelwood logs:<ul><li>Conifer: 0.88</li><li>Non-conifer: 0.87</li></ul></li></ul> |
| | | Some differences are possible with the data reported by Eurostat which include national estimates of over-bark volumes of roundwood removals. However, because statistics over-bark are available for few countries and few years, the approach based on under-bark reported statistics and the UNECE/FAO 2012 conversion coefficients was preferred. |
| Geo coverage | | All Members States – Data per country |
| Frequency of the updated data | | Annually |
| Timeliness of access to data | | T-2 |
| Length of time series | | >10 years |
| Comparability over time | | >5 data points w/0 break |

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[20] UNECE, FAO. Forest Product Conversion Factors for the UNECE Region. Geneva: 2010. www.unece.org/fileadmin/DAM/timber/publications/DP-49.pdf (accessed November 2, 2020).

**Annex 5.10. Domestic Material Consumption (Biomass) (3.1.a.1)**

| Domestic Material Consumption (Biomass) | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 3.<br><br>Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | 1.<br><br>Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | a.<br><br>Resource efficiency (Material footprint | 1 |
| Unit of the indicator | Thousand tonnes (1000 T) | | | |

Information on the indicator

| Source | Organization creator of the indicator | Eurostat |
|---|---|---|
| | Contact person | |
| | Location of the indicator:<br><br>General & Specific link | Eurostat – Material flow accounts (env_ac_mfa)<br><br>https://ec.europa.eu/Eurostat/cache/metadata/en/env_ac_mfa_sims.htm |
| Type (intensive or extensive) | | intensive |
| Directionality (positive or negative) | | negative |
| Input/output | | output indicator |
| Interpretation | | The Domestic Material Consumption (Biomass) indicates the total amount of material –biomass– in thousands tonnes actually consumed domestically by resident units.<br><br>• Domestic Material Consumption[21]<br><br>DMC measures the total amount of materials directly used by an economy and is defined as the annual quantity of raw materials extracted from the domestic territory, plus all physical imports minus all physical exports. The DMC indicator provides an assessment of the absolute level of the use of resources, and allows to distinguish consumption driven by domestic demand from consumption driven by the export market.<br><br>The indicator provides a basis for policies[22] to decouple the growth of the economy from the use of natural resources so as to achieve a reduction of environment degradation resulting from primary production, material processing, manufacturing and waste disposal. |
| More information | | • Domestic extraction (DE)[23] |

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[21] Eurostat. Glossary: Domestic material Consumption.
https://ec.europa.eu/Eurostat/statistics-explained/index.php/Glossary:Domestic_material_consumption_(DMC)

[22] UN, Sustainable development goals, knowledge platform. 2007. Indicators of Sustainable Development: Guidelines and Methodologies – Third edition Methodology sheets. p.351. https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=108&menu=35

[23] Eurostat. Glossary: Domestic extraction. https://ec.europa.eu/Eurostat/statistics-explained/index.php/Glossary:Domestic_extraction_(DE)

| | | DE is the input from the natural environment to be used in the economy. It is the annual amount of raw material (except for water and air) extracted from the natural environment. |
| | | The DMC is part of the "SDG 12 responsible consumption and production" https://unstats.un.org/sdgs/report/2019/goal-12/ |

Information on the input data

| Source of the data | Organization issuing the data | Eurostat |
| | Type of data | Various formats / Microsoft Excel Worksheet |
| | Location of the data | Material flow accounts [env_ac_mfa] |
| Information on the data | | Eurostat collects economy-wide material flow accounts data from national statistical institutes (NSI) via an annual questionnaire. |
| | | DMC is part of Eurostat's 'Economy-wide material flow accounts (EW-MFA)', which provide an aggregate overview of the material flows into and out of an economy. |
| | | EW-MFA are legally covered by Regulation (EU) 691/2011 on European Environmental Economic Accounts. |
| Geo coverage | | All Members States – Data per country |
| Frequency of the updated data | | Annually |
| Timeliness of access to data | | T-1 |
| Length of time series | | 5-10 years |
| Comparability over time | | >5 data points w/0 break |

**Annex 5.11. Energy productivity (3.1.b.1)**

| Energy productivity $$\frac{GDP\ (10^6\ \text{€})}{\text{Gross available energy}\ (10^3\ \text{Tonnes}\ of\ oil\ equivalent)}$$ | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 3. Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | 1. Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | b. Energy efficiency | 1 |
| Unit of the indicator | $\dfrac{\text{€}}{\text{kg of oil equivalent (KGOE)}}$ | | | |

Information on the indicator

| Source | Organization creator of the indicator | Eurostat |
|---|---|---|
| | Contact person | |
| | Location of the indicator: General & Specific link | Eurostat - Energy productivity (t2020_rd310)[24] |
| Type (intensive or extensive) | | intensive |
| Directionality (positive or negative) | | positive |
| Input/output | | output indicator |
| Interpretation | | The indicator measures the productivity of energy consumption and provides a picture of the degree of decoupling of energy use from growth in GDP. The indicator results from the division of the GDP by the gross available energy for a given calendar year. The data used in the monitoring system is filtered by unit equals to EUR_KGOE (Euro per kilogram of oil equivalent (KGOE)). • GDP (numerator) Eurostat uses the GDP either in the unit of million euro in chain-linked volumes to the reference year 2010 (at 2010 exchange rates) or in the unit million purchasing power standards (PPS). The unit euro in chain linked volumes allows observing the energy productivity trends over time in a single geographic area, whereas the unit PPS allows comparison between countries for the same year. -GDP in chained volume measures GDP without the effect of price to give a measure of 'real GDP' (it takes into account inflation and measures actual output produced) and therefore it makes more sense to use it for trends analysis. • Gross available energy (denominator) Is calculated as= Primary production + Recovered & recycled products + Imports – Exports + Stock changes. |

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[24] Eurostat Metadata. Energy productivity (t2020_rd310) https://ec.europa.eu/Eurostat/cache/metadata/en/t2020_rd310_esmsip2.htm

| More information | The energy productivity is part of the "SDG 7 Ensure access to affordable, reliable, sustainable and modern energy for all" https://unstats.un.org/sdgs/report/2019/goal-07/ |
|---|---|

Information on the input data

| Source of the data | Organization issuing the data | Data source: ESS<br>Data provider: Eurostat |
|---|---|---|
| | Type of data | Various formats / Microsoft Excel Worksheet / CSV |
| | Location of the data | • Eurostat<br><br>Energy productivity [t2020_rd310]<br><br>http://appsso.Eurostat.ec.europa.eu/nui/show.do?dataset=t2020_rd310&lang=en<br><br>• Eurostat – Data Browser [NRG_IND_EP]<br><br>https://ec.europa.eu/Eurostat/web/products-datasets/-/nrg_ind_ep > Access data browser > Download |
| Information on the data | | Countries report data to Eurostat which then provides them.<br><br>To compute the indicator:<br><br>• Gross Domestic Product (GDP) at market prices (nama_10_gdp): numerator<br><br>Unit of measure> 'Chain linked volumes (2010), million euro'<br><br>• Gross available energy (nrg_bal_c): denominator |
| Geo coverage | | All Members States – Data per country |
| Frequency of the updated data | | Annually |
| Timeliness of access to data | | T-2 |
| Length of time series | | 5-10 years |
| Comparability over time | | >5 data points w/0 break |

**Annex 5.12. Share of renewable energy in gross final energy consumption (3.1.b.2)**

| Share of renewable energy in gross final energy consumption | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 3.<br><br>Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | 1.<br><br>Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | b.<br><br>Energy efficiency | 2 |
| Unit of the indicator | Percent (%) | | | |

Information on the indicator

| Source | Organization creator of the indicator | Eurostat |
|---|---|---|
| | Contact person | |
| | Location of the indicator:<br><br>General & Specific link | Eurostat – Share of renewable energy in gross final energy consumption by sector (sdg_07_40)[25] |
| Type (intensive or extensive) | | intensive |
| Directionality (positive or negative) | | positive |
| Input/output | | output indicator |
| Interpretation | | The indicator measures the share of renewable energy consumption in gross final energy consumption according to the Renewable Energy Directive. The gross final energy consumption (denominator) is the energy used by end-consumers (final energy consumption) plus grid losses and self-consumption of power plants.<br><br>It also measures[26] how extensive is the use of renewable energy and, by implication, the degree to which renewable fuels have substituted fossil and/or nuclear fuels and therefore contributed to the decarbonisation of the EU economy. |
| More information | | Gross final consumption of energy[27] is the energy commodities delivered for energy purposes to industry, transport, households, services (including public services), agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production and including losses of electricity and heat in distribution and transmission.<br><br>The use of renewable energy sources[28] is seen as key element in energy policy, reducing the dependence on fuel imported from non-EU countries, reducing emissions from fossil fuel sources, and decoupling energy costs from oil prices. Directive 2009/28/EC (Renewable Energy |

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[25] Eurostat Metadata. Share of renewable energy in gross final energy consumption by sector (sdg_07_40) https://ec.europa.eu/Eurostat/cache/metadata/en/sdg_07_40_esmsip2.htm

[26] Eurostat – Data Browser. Share of renewable energy in gross final energy consumption by sector (SDG_07_40) https://ec.europa.eu/Eurostat/databrowser/view/sdg_07_40/default/table?lang=en

[27] Eurostat – Statistics explained. Archive: Energy from renewable sources. https://ec.europa.eu/Eurostat/statistics-explained/index.php/Energy_from_renewable_sources

| | | Directive) on promotion of the use of energy from renewable sources established accounting criteria for the 2020 targets on renewable energy sources. |
| | | The Share of renewable energy in gross final energy consumption is part of the "SDG 7 Ensure access to affordable, reliable, sustainable and modern energy for all" |
| | | https://unstats.un.org/sdgs/report/2019/goal-07/ |

Information on the input data

| Source of the data | Organization issuing the data | Data source: ESS<br>Data provider: Eurostat |
|---|---|---|
| | Type of data | Various formats / Microsoft Excel Worksheet / CSV |
| | Location of the data | • Eurostat<br>Share of renewable energy in gross final energy consumption (t2020_31)<br>http://appsso.Eurostat.ec.europa.eu/nui/show.do?dataset=t2020_31&lang=en<br>• Eurostat – Data Browser (SDG_07_40)<br>https://ec.europa.eu/Eurostat/databrowser/view/sdg_07_40/default/table?lang=en > select the energy balance of interest > 'Renewable energy sources' |
| Information on the data | | Data were collected in the framework of Regulation (EC) No 1099/2008 on energy statistics and complemented by specific supplementary data transmitted by national administrations to Eurostat.<br>The SHARES tool and the SHARES Tool Manual[28] support the calculation of the share of energy from renewable sources. More information on renewable energies can be found on the DG Energy website. |
| Geo coverage | | All Members States - Data per country |
| Frequency of the updated data | | Annually |
| Timeliness of access to data | | T-2 |
| Length of time series | | 5-10 years |
| Comparability over time | | >5 data points w/0 break |

[28] Eurostat. Energy from renewable sources. SHARES. https://ec.europa.eu/Eurostat/web/energy/data/shares

**Annex 5.13. Circular material rate (3.1.c.2)**

| Circular material rate<br><br>$\frac{circular\ material\ use\ (Tonnes)}{total\ material\ use\ (Tonnes)}$ *100<br><br>$= \frac{U}{M}$ *100 $= \frac{U}{DMC+U}$ *100<br><br>$= \frac{RCV_R - IMP_w + EXP_w}{DMC + RCV_R - IMP_w + EXP_w}$ *100 | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 3.<br><br>Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | 1.<br><br>Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved | c.<br><br>Biogenic waste prevention, re-use/recycling, and recovery | 2 |
| Unit of the indicator | % of total material use | | | |

Information on the indicator

| Source | Organization creator of the indicator | Eurostat |
|---|---|---|
| | Contact person | |
| | Location of the indicator:<br><br>General & Specific link | Eurostat – Circular material use rate (env_ac_cur)[29] |
| Type (intensive or extensive) | | intensive |
| Directionality (positive or negative) | | positive |
| Input/output | | output indicator |
| Interpretation | | The circular material use rate, also called Circularity rate measures the share of material recovered and fed back into the economy – thus saving extraction of primary raw materials – in overall material use. It is defined as the ratio of the circular use of materials (U) to the overall material use (M), in percentage.<br><br>A higher circularity rate value indicates that more secondary materials substitute for primary raw materials thus reducing the environmental impacts of extracting primary material. |
| More information | | • The overall material use (M)<br><br>M is measured by summing up the aggregate domestic material consumption (DMC) and the circular use of materials (U) ⇔ M=DMC+U<br><br>• Domestic material Consumption<br><br>DMC is an indicator derived from economy-wide material flow accounts (EW-MFA) collected under Regulation (EU) 691/2011. DMC represents the overall amount of primary raw materials used by an economy. It equals domestic extraction plus imports minus exports.<br><br>• The circular use of materials (U)<br><br>U is approximated by the amount of waste recycled in domestic recovery plants (RCV_R), minus imported waste destined for recovery |

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[29] Eurostat Metadata. Circular material use rate (env_ac_cur)
https://ec.europa.eu/Eurostat/cache/metadata/en/env_ac_cur_esms.htm
(cei_srm030) https://ec.europa.eu/Eurostat/cache/metadata/en/cei_srm030_esmsip2.htm
(sdg_12_41) https://ec.europa.eu/Eurostat/cache/metadata/EN/sdg_12_41_esmsip2.htm

| | | (IMPw), plus exported waste destined for recovery abroad (EXPw) ⇔ U=RCV_R– IMPw+ EXPw |
| | | Waste recycled in domestic recovery plants is approximated by the amount of hazardous and non-hazardous waste treated in recovery plants excluding amounts used for energy recovery and backfilling (recovery operations R2 to R11 as defined in the Waste Framework Directive [75/442/EEC](#)). This amount of treated waste is corrected by imports and exports of waste. |
| | | The circular material use rate is part of the "SDG 12 Ensure sustainable consumption and production patterns" |
| | | https://unstats.un.org/sdgs/report/2019/goal-12/ |

Information on the input data

| Source of the data | Organization issuing the data | Data source: ESS<br>Data provider: Eurostat |
|---|---|---|
| | Type of data | Various formats / Microsoft Excel Worksheet / CSV |
| | Location of the data | Eurostat– Data Browser (CEI_SRM030)<br><br>https://ec.europa.eu/Eurostat/databrowser/view/cei_srm030/default/table?lang=en > Download |
| Information on the data | | The circular material use rate is calculated using three European statistics:<br>(1) Treatment of waste by waste category, hazardousness and waste operations (env_wastrt) collected on the basis of the Waste Statistics Regulation (EC) No 2150/2002,<br>(2) economy-wide material flow accounts (env_ac_mfa), and<br>(3) international trade in goods statistics (comext).<br>The amounts of waste treated in domestic recovery operations (1) are corrected by net exports of waste destined for recycling sourced from Comext database (3).<br><br>A Eurostat paper of 2018 presents the reference methodology for the calculation method of the circular material use rate. |
| Geo coverage | | All Members States - Data per country |
| Frequency of the updated data | | Annually |
| Timeliness of access to data | | T-2 |
| Length of time series | | 5-10 years |
| Comparability over time | | >5 data points w/0 break |

**Annex 5.14. Total biomass consumed for energy (Net trade) (3.4.a.2)**

| Total biomass consumed for energy (Net trade) | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 3.<br><br>Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | 4.<br><br>Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | a.<br><br>Consumption and demand for biomass and bio-based products | 2 |
| Unit of the indicator | 1000 T of Dry Matter | | | |

Information on the indicator

| Source | Organization creator of the indicator | EC – Joint Research Centre |
|---|---|---|
| | Contact person | Robert M'barek (Robert.M'BAREK@ec.europa.eu) |
| | Location of the indicator:<br><br>General & Specific link | The EU Biomass Flows tool report<br><br>https://op.europa.eu/en/publication-detail/-/publication/74413f58-32be-11eb-b27b-01aa75ed71a1/language-en |
| Type (intensive or extensive) | | extensive |
| Directionality (positive or negative) | | positive |
| Input/output | | output indicator |
| Interpretation | | The indicator shows the total amount of agricultural and woody biomass consumed annually to produce energy.<br><br>It is desirable to have a positive indicator as long as the biomass consumed for energy is sustainable and does not limit the use for materials. |
| More information | | • Total agricultural biomass supply for energy (p.7)<br><br>Biomass for energy comes from: energy crops, crop residues<br><br>Imports are related to biofuels (bioethanol, biogasoline…) or the primary product that can be transformed or used for energy)<br><br>• Woody biomass supply (p.12)<br><br>This supply is made of the primary and secondary woody biomass supply.<br><br>Primary woody biomass: wood removed from forest, other wooded land and other lands with trees for energy use (mainly, but not only fuelwood).<br><br>Secondary woody biomass: all the woody biomass resulting from previous processing in at least one industry. It includes solid residues (i.e., chips and particles), other residues (i.e., black liquor, bark) and post-consumer wood used as a source of energy. |

Information on the input data

| Source of the data | Organization issuing the data | EC – The BIOMASS project– Joint Research Centre, based on data from Eurostat, FAO, ITTO, UNECE, national statistical offices and FAOSTAT. |
|---|---|---|
| | Type of data | Downloadable CSV file |
| | Location of the data | As data query: Data portal of agro-economics Modelling – DataM > EU Biomass Flows > Query > Select the following filters either in the Excel downloaded from DataM or directly online: |

| Geopolitical entity | one or more member states and/or the EU27+UK |
|---|---|
| Year | a single year between 2009 and 2015 |
| Sector | 'All sectors' |
| Level_Sankey | 'L0 – Total biomass' |
| Lifecycle step | 'Uses' |
| Source | Select all elements |
| Target | 'Bioenergy' (ID T6) |
| Flow | Select all elements |
| Unit | '1000 T of dry matter (Net trade)' |

You can also go directly on the Sankey diagrams in the Biomass flows tool. See the user guide[30] for help in using this tool. The data download will show all flows of biomass. Please consider only the value of biomass available for bioenergy [Source: Supply to Target: Bioenergy].

| Information on the data | The data is compiled and elaborated by different Units within the JRC. The data point "Latest available data" corresponds to the latest data available from each sector, which could be different years. |
|---|---|
| Geo coverage | All Members States – Data per country<br>EU27+UK |
| Frequency of the updated data | Biennially |
| Timeliness of access to data | >T-6 |
| Length of time series | 5-10 years |
| Comparability over time | >5 data points w/0 break |

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[30] The EU Biomass Flows tool – User guide
https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS/data/EU%20Biomass%20Flows%20user%20guide.pdf

**Annex 5.15. Total biomass consumed for materials (apparent consumption) (3.4.a.3)**

| Total biomass consumed for materials (apparent consumption) | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 3.<br><br>Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad | 4.<br><br>Consumption patterns of bioeconomy goods match sustainable supply levels of biomass | a.<br><br>Consumption and demand for biomass and bio-based products | 3 |
| Unit of the indicator | 1000 T of Dry Matter | | | |

Information on the indicator

| Source | Organization creator of the indicator | EC - Joint Research Centre |
|---|---|---|
| | Contact person | Robert M'barek (Robert.M'BAREK@ec.europa.eu) |
| | Location of the indicator:<br><br>General & Specific link | The EU Biomass Flows tool report<br><br>https://op.europa.eu/en/publication-detail/-/publication/74413f58-32be-11eb-b27b-01aa75ed71a1/language-en |
| Type (intensive or extensive) | | extensive |
| Directionality (positive or negative) | | positive |
| Input/output | | output indicator |
| Interpretation | | The indicator shows the total agricultural and woody biomass consumed annually in the production of materials. The higher the consumption for material, the more the bioeconomy is developing. NB: The efficiency of this consumption and the sustainability of the supply are assessed in other indicators of the framework. |
| More information | | • Total agricultural biomass supply for material (p.7)<br><br>Most of the total agricultural biomass supply are used for food / feed purpose and energy. Only a little part is for material use (e.g., cotton, lignocellulosic residues for chemicals, bioplastics)<br><br>• Woody biomass supply (p.12)<br><br>This supply is made of the primary and secondary woody biomass supply. Both primary and secondary apparent consumption are derived from domestic production and net trade (=imports - exports).<br><br>Primary woody biomass: wood removed from forest, other wooded land and other land with tree cover.<br><br>Secondary woody biomass= all the woody biomass resulting from a previous processing in at least one industry, it includes solid by-products (i.e., chips and particles), other by-products (i.e., black liquor, bark) and post-consumer wood.<br><br>• Production of materials (p.19)<br><br>Due to large data gaps in terms of biomaterial uses of agricultural biomass, biomaterial uses are under-estimated in EU Biomass Flows |

| | | reported in the JRC tool. Almost all of the biomaterials originate from wood. |
|---|---|---|

Information on the input data

| Source of the data | Organization issuing the data | EC - The BIOMASS project- Joint Research Centre based on data from Eurostat, FAO, ITTO, UNECE, national statistical offices and FAOSTAT. |
|---|---|---|
| | Type of data | Downloadable CSV file |
| | Location of the data | As data query: Data portal of agro-economics Modelling - DataM > EU Biomass Flows > Query > Select the following filters either in the Excel downloaded from DataM or directly online: |

| Geopolitical entity | one or more member states and/or the EU27+UK |
|---|---|
| Year | a single year between 2008 and 2017 |
| Sector | 'All sectors' |
| Level_Sankey | 'L0 – Total biomass' |
| Lifecycle step | 'Uses' and 'Exports' |
| Source | 'Biomaterials' (ID T5) and 'Supply' (ID T3) |
| Target | 'Biomaterials' (ID T5) and 'Exports' (ID T8) |
| Flow | 'Total biomass' (ID TOTAL) |
| Unit | '1000 T of dry matter (Net trade)' |

From the results of this query, you will need to deduct biomaterials exports from the domestically consumed biomaterials. This is calculated as follows: [Value of Source:Supply to Target:Biomaterials] - [Value of Source:Biomaterials to Target:Exports].
Please note that there might be other results, such as exports of biomass not specifically designated for consumption as food (plant products).

You can also go directly on the Sankey diagrams in the Biomass flows tool. See the user guide[31] for help in using this tool. The data download will show all flows of biomass. Please consider only the value of biomass available for biomaterials [Source:Supply to Target:Biomaterials] and deduct the value of biomaterials exports [Source:Biomaterials to Target:Exports].

| Information on the data | The data is compiled and elaborated by different Units within the JRC and comes from different sources. The data point "Latest available data" corresponds to the latest data available from each sector, which could be different years. |
|---|---|
| Geo coverage | All Members States - Data per country |
| | EU27+UK |
| Frequency of the updated data | Biennially |

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[31] The EU Biomass Flows tool – User guide
https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS/data/EU%20Biomass%20Flows%20user%20guide.pdf

| | |
|---|---|
| Timeliness of access to data | >T-6 |
| Length of time series | 5-10 years |
| Comparability over time | >5 data points w/0 break |

**Annex 5.16. Net GHG emissions (emissions and removals) from agriculture (4.1.a.3)**

| Net GHG emissions (emissions and removals) from agriculture | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 4. Mitigating and adapting to climate change | 1. Climate change mitigation and adaptation are pursued | a. Climate change mitigation | 3 |
| Unit of the indicator | 1000t $CO_2$ eq. | | | |

Information on the indicator

| Source | Organization creator of the indicator | European Environment Agency (EEA) |
|---|---|---|
| | Contact person | |
| | Location of the indicator: General & Specific link | Eurostat Metadata Greenhouse gas emissions by source sector (source: EEA) (env_air_gge)[32] |
| Type (intensive or extensive) | | extensive |
| Directionality (positive or negative) | | negative |
| Input/output | | output indicator |
| Interpretation | | Agriculture Green House Gas Net emissions, in thousand tonnes of $CO_2$ equivalents (mostly methane CH4 and nitrous oxide N2O), are mainly related to the management of agricultural soils (e.g., fertiliser and lime application), enteric fermentation by ruminant animals and manure management and, to a lesser extent, to rice cultivation and crop residue burning. When the indicator has a positive value, it indicates that emissions > removals of GHG. In all countries of the EU, from 2000 to 2018, net GHG emissions from agriculture where positive. |
| More information | | The activities included in the GHG net calculations for the agriculture sector are[33] all anthropogenic emissions from agriculture, except for fuel combustion emissions and sewage emissions, which are covered in Energy and Waste modules. A carbon dioxide equivalent[34] (CO2-eq) is a metric measure used to compare the emissions from various greenhouse gases on the basis of their global-warming potential (GWP), by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential. |

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[32] Eurostat Metadata. Greenhouse gas emissions by source sector (source: EEA) (env_air_gge) https://ec.europa.eu/Eurostat/cache/metadata/en/env_air_gge_esms.htm
[33] European Environment Agency. 2016. *Manual for the EEA greenhouse gas data viewer*. https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer > Greenhouse gases data viewer – Manual > download
[34] Eurostat. Glossary: Carbon dioxide equivalent. https://ec.europa.eu/Eurostat/statistics-explained/index.php/Glossary:Carbon_dioxide_equivalent

Information on the input data

| Source of the data | Organization issuing the data | European Environment Agency (EEA)<br>Information reported as well by Eurostat |
|---|---|---|
| | Type of data | Microsoft Excel Worksheet/downloadable CSV file |
| | Location of the data | EEA greenhouse gas – data viewer > Slicer: All GHG (CO2 equ) ><br><br>Categorical (emission source – IPCC sector): 3 'Agriculture' > 'Export to Excel'<br><br>The data can also be found on:<br><br>Eurostat "Greenhouse gas emissions by source sector (source : EEA) [env_air_gge]" > 'Download' |
| Information on the data | | The EU as a party to the UNFCCC reports annually its greenhouse gas inventory for the year t-2 and within the area covered by its Member States. The inventory contains data on carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF6) and nitrogen trifluoride (NF3). The EU inventory is fully consistent with national greenhouse gas inventories compiled by the EU Member States. |
| Geo coverage | | All Members States - Data per country |
| Frequency of the updated data | | Annually |
| Timeliness of access to data | | T-2<br><br>The EEA publishes data 18 months after the reference year (e.g., final 2014 emissions usually became available in May 2016). |
| Length of time series | | >10 years |
| Comparability over time | | >5 data points w/0 break |

**Annex 5.17. Net GHG emissions (emissions and removals) from LULUCF (4.1.a.6)**

| Net GHG emissions (emissions and removals) from LULUCF | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 4.<br><br>Mitigating and adapting to climate change | 1.<br><br>Climate change mitigation and adaptation are pursued | a.<br><br>Climate change mitigation | 6 |
| Unit of the indicator | Million tonnes $CO_2$ equivalents | | | |

Information on the indicator

| Source | Organization creator of the indicator | European Environment Agency (EEA) |
|---|---|---|
| | Contact person | |
| | Location of the indicator:<br><br>General link &<br><br>Specific link | Eurostat Metadata<br><br>Greenhouse gas emissions by source sector (source: EEA) (env_air_gge)[35] |
| Type (intensive or extensive) | | extensive |
| Directionality (positive or negative) | | negative |
| Input/output | | output indicator |
| Interpretation | | LULUCF Green House Gas Net emissions, in million tonnes of $CO_2$ equivalents (mainly $CO_2$), cover "managed lands" (forest land, cropland, grassland, wetlands, settlements, other lands) from the following pools:<br><br>Living biomass (above and below-ground values); Dead organic matter (deadwood and litter); Soil organic carbon (mineral and organic). Harvested wood products such as timber used in construction or furniture are reported as an additional pool.<br><br>When the indicator has a positive value, it indicates that emissions > removals of GHG.<br><br>Globally in the EU, from 2000 to 2018, net GHG emissions from LULUCF where negative. |
| More information | | The activities included in the GHG net calculations for the agriculture sector are[36] total emissions and removals from activities relating to land use, land-use change and forestry.<br><br>A carbon dioxide equivalent[37] (CO2-eq) is a metric measure used to compare the emissions from various greenhouse gases on the basis of their global-warming potential (GWP), by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential. |

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[35] Eurostat Metadata. Greenhouse gas emissions by source sector (source: EEA) (env_air_gge) https://ec.europa.eu/Eurostat/cache/metadata/en/env_air_gge_esms.htm
[36] European Environment Agency. 2016. Manual for the EEA greenhouse gas data viewer. https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer > Greenhouse gases data viewer – Manual > download
[37] Eurostat. Glossary: Carbon dioxide equivalent. https://ec.europa.eu/Eurostat/statistics-explained/index.php/Glossary:Carbon_dioxide_equivalent

Information on the input data

| Source of the data | Organization issuing the data | European Environment Agency (EEA)<br>Information reported as well by Eurostat |
|---|---|---|
| | Type of data | Microsoft Excel Worksheet/downloadable CSV file |
| | Location of the data | EEA greenhouse gas – data viewer > Slicer: All GHG (CO2 equ) ><br><br>Categorical (emission source – IPCC sector): 4 'Land Use, Land-Use Change and Forestry' > 'Export to Excel'<br><br>The data can also be found on:<br><br>Eurostat "Greenhouse gas emissions by source sector (source : EEA) [env_air_gge]" > 'Download' |
| Information on the data | | The EU as a party to the UNFCCC reports annually its greenhouse gas inventory for the year t-2 and within the area covered by its Member States. The inventory contains data on carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF6) and nitrogen trifluoride (NF3). The EU inventory is fully consistent with national greenhouse gas inventories compiled by the EU Member States. |
| Geo coverage | | All Members States - Data per country |
| Frequency of the updated data | | Annually |
| Timeliness of access to data | | T-2<br><br>The EEA publishes data 18 months after the reference year (e.g., final 2014 emissions usually became available in May 2016). |
| Length of time series | | >10 years |
| Comparability over time | | >5 data points w/0 break |

**Annex 5.18. Value-added per sector (5.1.b.2)**

| Value-added per sector | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 5.<br><br>Strengthening European competitiveness and creating jobs | 1.<br><br>Economic development is fostered | b.<br><br>Value of raw and processed biomass, value added in bioeconomy sectors | 2 |
| Unit of the indicator | Million EUR | | | |

Information on the indicator

| Source | Organization creator of the indicator | EC JRC Seville and nova-Institute http://nova-institute.eu/ |
|---|---|---|
| | Contact person | Tévécia Ronzon (tevecia.ronzon@ec.europa.eu) |
| | Location of the indicator:<br>General & Specific link | https://datam.jrc.ec.europa.eu/datam/mashup/BIOECONOMICS |
| Type (intensive or extensive) | | extensive |
| Directionality (positive or negative) | | positive |
| Input/output | | output indicator |
| Interpretation | | Value added[38] refers to the value added at factor costs. It is the gross income from operating activities after adjusting for operating subsidies and indirect taxes. Value adjustments (such as depreciation) are not subtracted. It is measured at nominal prices in this study, as in the Eurostat sbs_na_ind_r2 data source.<br><br>The value added is used as an indicator of economic performance – rather than turnover as the sum of turnover across sectors leads to double counting. |
| More information | | The bioeconomy sectors of interest here are:<br><br>(1) Agriculture and food industries<br><br>Agriculture (A01); Food (C10); Beverage (C11);<br><br>(2) Forestry and wood-based industries<br><br>Forestry (A02); Wood products (bC16); Paper (bC17); Wooden furniture (bC31);<br><br>(3) Other bio-based industries<br><br>Fishing and Aquaculture (A03); Tobacco (C12); Bio-based textiles (bTEXT); Liquid biofuels (bFUEL); Bio-based chemicals pharmaceuticals, plastics and rubber (excl. biofuels) (bCHEM); bio-based electricity (bD3511). |

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[38] Jobs and Wealth in the European Union Bioeconomy > Other information > Definitions > https://datam.jrc.ec.europa.eu/datam/mashup/BIOECONOMICS/index.html#

Information on the input data

| | | |
|---|---|---|
| Source of the data | Organization issuing the data | JRC |
| | Type of data | Zip folder with a CSV file |
| | Location of the data | EU Open Data Portal – Jobs and wealth in the EU bioeconomy / JRC-Bioeconomics > Resources > download JRC-Bioeconomics ZIP > 'Attribute' > 'Value added at factor cost' |
| | | The data can also be foumd on: |
| | | The JRC-Bioeconomics dataset > info > 'JRC Bioeconomics' > Choose from bulk or interactive download |
| | | In the .xls sheet: |
| | | • Filter the dataset by attribute (code) that equals to V12150 and NACE codes that equal to A01, A02, A03, bC13, bC14, bC15, bC16, bC31, bC17, bchem, bC21, bC22, Biod, Bioeth, bD3511, C10, C11 and C12. |
| | | • To obtain the data of its corresponding headline indicator, filter the dataset by attribute (code) that equals to V12150, country code that equals to European Union (27 countries, from 01/02/2020) and NACE codes that equal to A01, A02, A03, bC16, bC31, bC17, bTEXT, bCHEM, bFUEL, bD3511, C10, C11 and C12. |
| | | • To calculate the value-added of agriculture and food industries, sum the values where the NACE code is A01, C10 and C11. |
| | | • To calculate the value-added of forestry and wood-based industries, sum the values where the NACE code is A02, bC16, bC31 and bC17. |
| | | • To calculate the value-added of other bio-based industries, sum the values where the NACE code is A03, C12, bTEXT, bCHEM, bFUEL and bD3511. |
| | | Moreover, in the data of the headline indicator, year equals to 2017. |
| Information on the data | | Eurostat is issuing various data then used to compute the indicator through a collaborative work between JRC and nova-Institute. |
| | | Eurostat - National accounts (nama_10_a64); |
| | | Eurostat - Structural Business Statistics (sbs_na_ind_r2); |
| | | Eurostat - Production of electricity (nrg_bal_peh) |
| | | The national accounts from Eurostat were the data source for compiling value added data (Eurostat nama_10_a64) for agriculture, forestry, and fishing and aquaculture. Estimates on manufacturing sectors and the production of bioelectricity were derived from the Eurostat structural business statistics (sbs_na_ind_r2) as well as corresponding sectoral bio-based shares. The latter were determined from expert knowledge, Eurostat prom DS-066341 (manufacturing NACE sectors), and Eurostat nrg_bal_peh (NACE D3511). |
| Geo coverage | | All Members States - Data per country |
| Frequency of the updated data | | Annually |
| Timeliness of access to data | | T-3 |
| Length of time series | | 5-10 years |
| Comparability over time | | >5 data points w/0 break |

**Annex 5.19. Persons employed per bioeconomy sector (5.2.a.1)**

| Persons employed per bioeconomy sector | EU strategy objective | Normative criteria | Key component | Indicator number |
|---|---|---|---|---|
| | 5.<br><br>Strengthening European competitiveness and creating jobs | 2.<br><br>Inclusive economic growth is strengthened | a.<br><br>Employment in bioeconomy | 1 |
| Unit of the indicator | Number of Persons Employed | | | |

Information on the indicator

| Source | Organization creator of the indicator | EC JRC Seville and nova-Institute http://nova-institute.eu/ |
|---|---|---|
| | Contact person | Tévécia Ronzon (tevecia.ronzon@ec.europa.eu) |
| | Location of the indicator:<br><br>General & Specific link | Developments of Economic Growth and Employment in Bioeconomy Sectors across the EU[39] |
| Type (intensive or extensive) | | extensive |
| Directionality (positive or negative) | | positive |
| Input/output | | |
| Interpretation | | The number of persons employed[40] is defined as the total number of persons who work in the observation unit (inclusive of working proprietors, partners working regularly in the unit and unpaid family workers working regularly in the unit), as well as persons who work outside the unit who belong to it and are paid by it (e.g., sales representatives, delivery personnel, repair and maintenance teams). It includes persons absent for a short period (e.g., sick leave, paid leave or special leave), and also those on strike, but not those absent for an indefinite period. It also includes part-time workers who are regarded as such under the laws of the country concerned and who are on the payroll, as well as seasonal workers, apprentices and home workers on the pay-roll. |
| More information | | The bioeconomy sectors of interest here are:<br><br>(1) activity sectors that fully belong to the bioeconomy: agriculture, forestry, fishing and aquaculture, the manufacturing of food, beverages, tobacco, and paper.<br><br>(2) "bio-based shares" for sectors which only partially belong to the bioeconomy, i.e., sectors that produce products made of biomass as well as of fossil-, mineral-based or synthetic feedstock: the manufacture of textiles, wearing apparel, leather, wood products, furniture, chemicals, pharmaceuticals, plastics and rubber, and the production of electricity.<br><br>Liquid biofuels as bioethanol and biodiesel are also available. |

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[39] Ronzon, T. et al. Developments of Economic Growth and Employment in Bioeconomy Sectors across the EU. Sustainability. 2020, 12 (11), 4507. https://www.mdpi.com/2071-1050/12/11/4507
[40] Jobs and Wealth in the European Union Bioeconomy > Other information > Definitions > https://datam.jrc.ec.europa.eu/datam/mashup/BIOECONOMICS/index.html#

Information on the input data

| Source of the data | Organization issuing the data | Eurostat |
|---|---|---|
| | Type of data | Microsoft Excel Worksheet / downloadable CSV file |
| | Location of the data | The JRC-Bioeconomics dataset > info > 'JRC Bioeconomics' > Choose from bulk or interactive download<br><br>Data can also be found on:<br><br>EU Open Data Portal – Jobs and wealth in the EU bioeconomy / JRC-Bioeconomics > Resources > download JRC-Bioeconomics ZIP > 'Attribute' > 'Number of persons employed' |
| Information on the data | | Eurostat – National accounts employment data by industry (nama_10_a64_e);<br><br>Eurostat – Structural Business Statistics (sbs_na_ind_r2);<br><br>Eurostat – Production of electricity (nrg_bal_peh)<br><br>Eurostat is issuing various data then used to compute the indicator through a collaborative work between JRC and nova-Institute.<br><br>The national accounts from Eurostat were the data source for compiling employment data (Eurostat nama_10_a64_e) for agriculture, forestry, and fishing and aquaculture. Estimates on manufacturing sectors and the production of bioelectricity were derived from the Eurostat structural business statistics (sbs_na_ind_r2) as well as corresponding sectoral bio-based shares. The latter were determined from expert knowledge, Eurostat prom DS-066341 (manufacturing NACE sectors), and Eurostat nrg_bal_peh (NACE D3511). |
| Geo coverage | | All Members States – Data per country |
| Frequency of the updated data | | Annually |
| Timeliness of access to data | | T-3 |
| Length of time series | | 5-10 years |
| Comparability over time | | 3-5 data points w/0 break |

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