

# Measuring the size of EU Bioeconomy by Input-Output Approach

## Abstract

The ultimate objective of the BioMonitor project is to analyse how the Bioeconomy affects our lives. Indicators derived from the national accounting system can contribute to this analysis. We show the development of the value added of the bioeconomy for 28 European Union Member States (MS) and 16 industries using Input-Output statistics covering the period from 2005 to 2015. The measurement method proposes a model that includes the up- and down-stream linkages of sectors of the bioeconomy. The results show that for the majority of the EU member States the value added of the up- and down-stream sector ranges between 40%-50% of the total bioeconomy value added and has on average increased since the financial crisis.

## Key points

- Bioeconomy value added shares for 2015 range between 2.13% for Luxembourg and 17.2% for Lithuania with more than half of the MS having a higher than 10% bioeconomy share.
- The up- and downstream sectors make-up an important part of the bioeconomy.
- The up- and downstream sectors started to rise after the financial crisis.

## Introduction

The European Commission has declared that developing the bio-economy is an important tool in achieving a carbon neutral and healthy environment in the EU by 2050. With the announcement of the European Green Deal and the new circular economy action plan, it has become clear that the Bioeconomy is at the core of the EU Green Policies for many years to come. The literature (Kardung et al., 2021; Acemoglu et al. 2016; Purnhagen and Wesseler, 2020) supports the notion that for evaluating the achievement of policy goals, deals and announcements we need measurable indicators. We seek a unifying cross-country measurement method that can be applied to Input-Output tables. The proposed measurement method provides 3 novel approaches:

1. The extension of the bioeconomy definition by including the upstream effect which we define as part of the value added of the output flow from industries to the agriculture, fishery, forestry and food sector.
2. We include the relevant industries of the economy following the EU sectorial definition of the bioeconomy and

the scope of the BioMonitor project (Kardung et al., 2021) that enables us to have a robust measurement of the value-added shares of the bioeconomy.

3. With certain adjustments on industry definitions, we can implement the approach on any Input-Output tables. This is a methodologically consistent and universal measurement method which allows for comparing different countries.

Heijman (2016) defines the agriculture, fishery, and forestry [S1] sector as being 100% bioeconomy and adds the additional downstream effect which is the value added (VA) generated by the output flow from the agriculture, fishery, and forestry [S1] sector to the other sectors of the economy (Downstream VA). In addition to the S1 sector we also define the food sector as belonging 100% to the bioeconomy following the definition of the European Commission. We add the up-stream sector, the share of VA of those sectors providing inputs to the [S1] sector (Upstream VA). Hence we developed the following definition:

$$\text{Bioeconomy (BE) Value Added (VA)} = 100\% \text{ BE industries VA} + \text{Downstream VA} + \text{Upstream VA}$$

We apply this method to all EU member states.

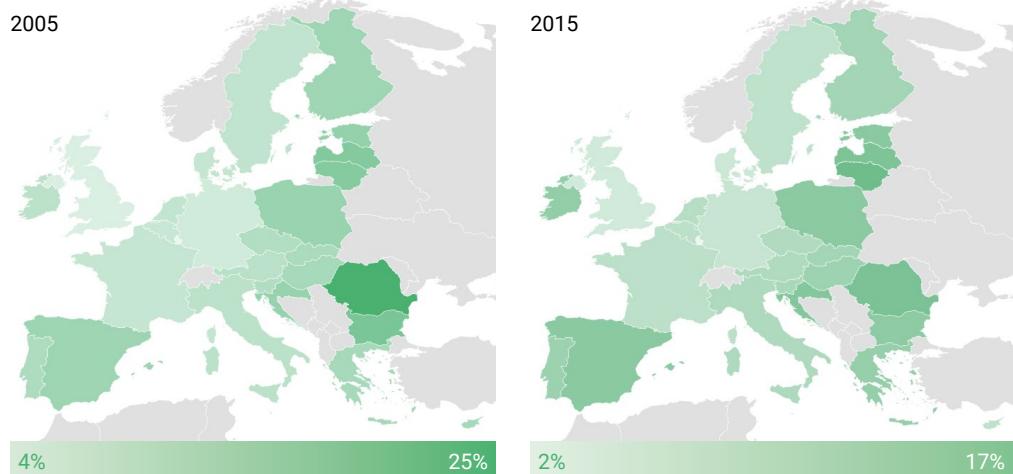
The data set is taken from the OECD statistics of Input-Output tables. It is available for a period of ten years from 2005 to 2015. For real value conversions, we used Eurostat's Harmonized Index of Consumer prices. For the exchange rate conversion to euros, we used the OECD exchange rate values.

### Results

The value added of each country has

increased during the period under study except for a brief time around 2008, when the financial crisis started. Figure 3-1 shows two maps of the EU Bioeconomy shares, the left for 2005 and the right for 2015. The green shading represents the degree of share, where the darker is the shading the greater is the bioeconomy value added. It can be observed that the green shading of eastern Europe is getting lighter meanwhile in western Europe the shading remains unchanged as we move from 2005 to 2015.

**Figure 3-1 EU Member States Bioeconomy Shares in Value Added, 2015**

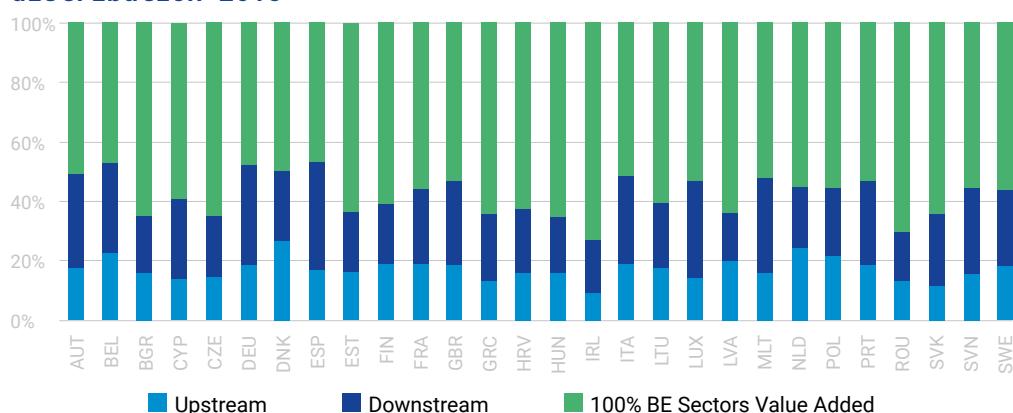


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Figure 3-2 shows the distribution of the bio-economy over upstream, downstream and full (100%) bioeconomic sectors for the EU-member states in the year 2015. For the countries Belgium, Germany and Spain, the total of downstream and upstream value added constitute more than 50% of the total bioeconomy value.

For Austria, Cyprus, Denmark, France, UK, Italy, Luxemburg, Malta, Netherlands, Poland, Portugal, Slovenia and Sweden the share is 40%-50%, and for Bulgaria, Cyprus, Czech Republic, Estonia, Finland, Greece, Croatia, Hungary, Ireland, Lithuania, Romania, and Slovakia the share is less than 40%.

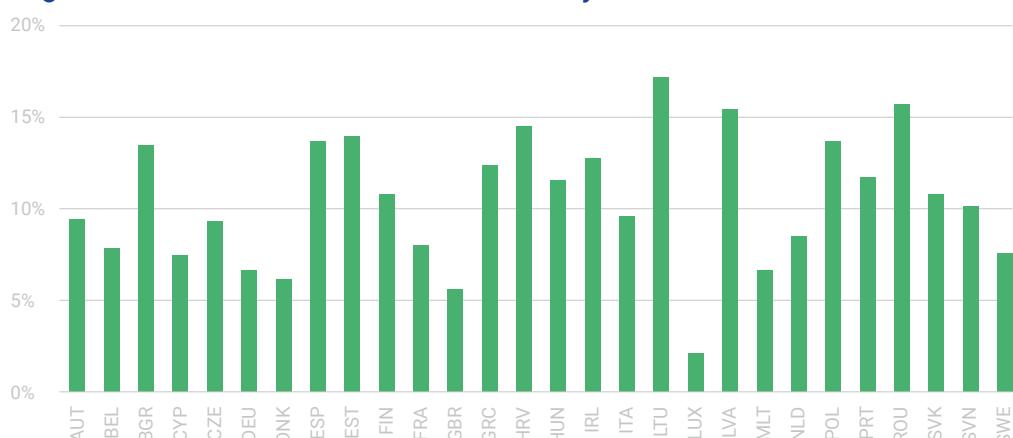
**Figure 3-2 EU Bioeconomy value added components percentage distribution 2015**



More than half of the member states have a higher than 10% bioeconomy value added share in 2015. The bioeconomy

value added shares for 2015 range from close to 2% (Luxembourg) to more than 17% (Lithuania), see Figure 3-3.

**Figure 3-3 EU Member States Bioeconomy Shares in Value Added 2015**



For all the results we derived, you can visit a user interface of our design on data portal of agro-economics Modelling (DataM) of European Commission:  
[https://datam.jrc.ec.europa.eu/datam/mashup/BM\\_BIECONOMIC SHARES/index.html](https://datam.jrc.ec.europa.eu/datam/mashup/BM_BIECONOMIC SHARES/index.html).

clear: which (part of) industries outside agriculture, forestry and fishing can we count as being a part of the bioeconomy. The results of this study can be used to derive other indicators by relating them to, for example, employment, population, emissions. This is a vast field for future analysis. Finally, the EU's Green Deal, which is a broad agenda for EU's future development requires a criterion to measure its degree of success. The Bioeconomy measure that we provide is one useful tool to that end. For more details please visit Cingiz et al., 2021.

### Conclusions and Policy Recommendations

Whereas using value added as an indicator is an agreed upon method in the literature, the definition of bioeconomy is still open to discussion. The challenge is

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