

2050

RESIDUES

BIOMASS

BIOENERGY EXPLAINED

4

BIOMASS FOR ENERGY: POTENTIAL IN 2050

The Paris Agreement has set a clear objective to keep global warming below +2 °C. Different technologies can contribute to cutting CO₂ levels: bioenergy, representing a staggering 62% of the renewable energy mix, is one of the main drivers of the transition towards a net-zero carbon economy – an economy with a balance between CO₂ emissions and removals.

The availability of sustainable biomass is a decisive factor to determine the contribution of bioenergy to the 2050 energy mix. A recent literature review on biomass potential conducted by A. Faaij (University of Groningen) shows that the amount of biomass used for bioenergy can triple within sustainable and environmental limits and at a reasonable cost. This factsheet explains the main findings of the study and provides an overview on viable sectoral evolution in the next decades.



HOW MUCH BIOMASS IS AVAILABLE IN THE EU?

Existing studies have calculated the domestically available potential for biomass for energy to be between 169 and 737 Mtoe (7 - 30 EJ) each year in Europe from 2050 onwards.

The literature review concludes that the middle range potential of 406 Mtoe (17 EJ), which is 25% of the total energy consumption in EU-28 in 2016¹, can be achieved by 2050 – considering different constraints (e.g. costs).

This means that, compared to the actual 140.3 Mtoe (5.8 EJ) used in 2016, the potential gives enough room to **almost triple the amount of bioenergy in the EU-28 energy mix.**



1
Mtoe

OIL TRANSPORTATION CAPACITY OF 4 VERY LARGE CRUDE CARRIERS (VLCC). ONE VLCC HAS A CAPACITY OF 2 MILLION BARRELS OF OIL

406
Mtoe

MIDDLE-RANGE POTENTIAL FOR BIOMASS IN THE YEAR 2050

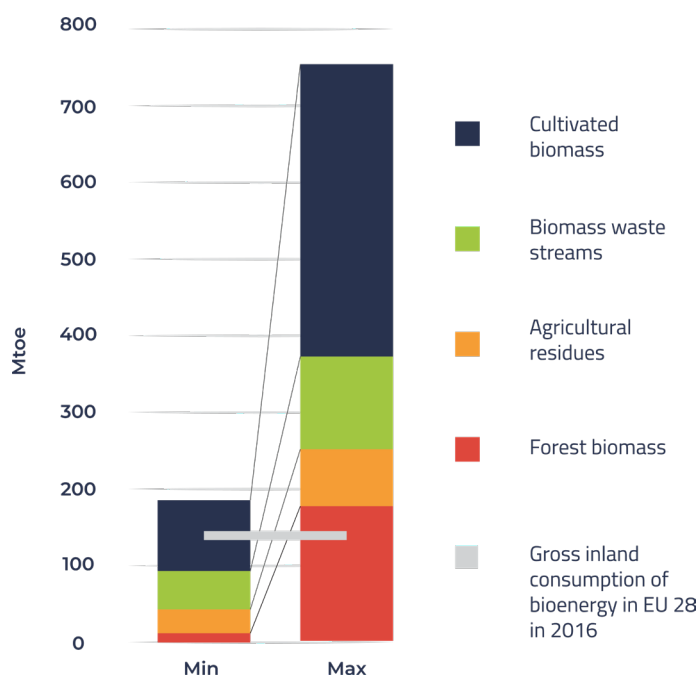
Agricultural biomass plays a central role in the study. To achieve the potential by 2050, the energy contribution of agricultural biomass will need to increase significantly and become at least as important as that of energy from forest biomass.

Moreover, the study focuses on biomass available in Europe, reflecting an important statistic: **95% bioenergy consumed in Europe is sourced within EU borders**, leaving only a mere 5% to imports which can nevertheless add flexibility for bioenergy demand. Thus, bioenergy not only enables an energy transition, but it's also local, increasing the security of supply and creating local jobs in the EU.



WHY IS THERE A LARGE RANGE IN THE BIOMASS POTENTIAL?

The highest estimate represents a technical potential within the limits of annual biomass growth, available technologies and other land uses. Environmental factors such as biodiversity, water and soil quality, nature conservation and economic factors (i.e. costs) often lead to more conservative (low or middle-range) estimations. Yet, more recent studies² emphasise that environmental conditions are not necessarily limiting the available biomass potential; synergies between biomass production and environment protection measures can be realised with smart and sustainable management practices in forestry and agriculture – something that should be better reflected in future biomass potential studies.





KEY FACTORS BEHIND THE CALCULATIONS

Existing studies estimate the available biomass potential considering the following factors:

Energy crops: Estimates, ranging from 79 to 377 Mtoe (3.3 - 15.8 EJ), depend on the land considered for production, on crop diversity and the selection of species as well as the intensity of agricultural management practices. Food security and the exclusion of areas of nature conservation have been well respected, including in studies that produced higher estimates.

Agricultural residues: The potential extends from 45 to 67 Mtoe (1.9 - 2.8 EJ) and depends on the type of residues used for energy (only straw and maize stover or also cuttings and pruning residues), on the impact of weather and on soil protection measures.

Forest biomass: The lowest potential in literature (5 Mtoe, 0.2 EJ) is extremely conservative as it assumes that all residues (e.g. tree tops and branches) will remain in the forest and almost no industrial residues will be available. With a more active sustainable forest management and a resource-efficient use of residues from wood working industries, the forest biomass potential can reach as much as 174 Mtoe (7.3 EJ).

Biodegradable waste: The availability of biodegradable waste strongly depends on how waste management practices are applied in the respective sectors; it ranges from 40 to 119 Mtoe (1.7 - 5 EJ).



IS THE BIOMASS AVAILABLE AT LOW COST?

Almost 86% of the biomass considered in the potential has a cost below 1.8 ct/kWh (5 €/GJ). This means that the bioenergy feedstock will cost far less than crude oil, priced at 3.8 ct/kWh (10.73 €/GJ). When comparing the cost of forestry and agricultural residues, there are no major price differences (see graphs below). The graphs show the availability of feedstock depending on the price. Part of the potential from agricultural residues will be actually cheaper than forestry residues.

Cost supply curves for agricultural residues (fig. 2) and forest residues (fig. 3) as presented in [de Wit et al., 2010], for 2010, 2020 and 2030 (roadside costs)

Fig. 2

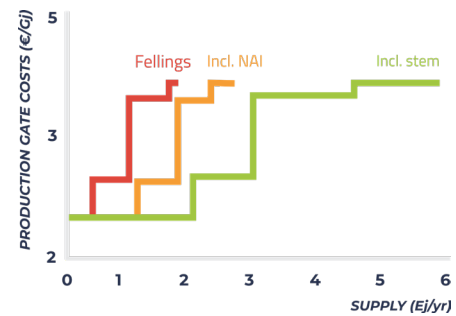
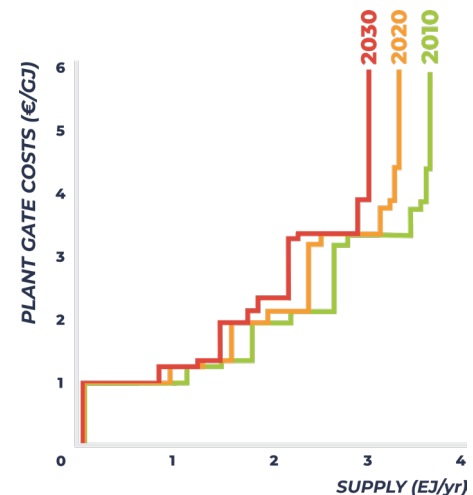


Fig. 3



HOW TO UNTAP THE POTENTIAL WITHIN ENVIRONMENTAL LIMITS?

There are several measures to increase the availability of biomass in a sustainable way, all of which maintain important synergies between biomass production and environmental measures:

- Biomass production and climate adaptation measures. For instance, sustainable forest management can significantly reduce the risk of forest fires;
- Biomass production and environmental measures. Perennial energy crops can greatly decrease the risk of soil erosion;
- Bioenergy and bio-based materials. Transforming by-products of forest-based industries in bioenergy increases resource efficiency;
- Bioenergy and food production. Increased productivity in agriculture leaves more land for both food and energy production growth.

LEARN MORE

The full study on biomass potential can be downloaded [here](#).

Other factsheets on forest biomass and agricultural biomass are available on Bioenergy Europe's website.

www.bioenergyeurope.org

SOURCES

1. Gross inland consumption in EU28 in 2015 was 1628 Mtoe (68.1 EJ). Source: Eurostat

2. Kluts et al: Sustainability constraints in determining European bioenergy potential: A review of existing studies and steps forward.


All information used in this factsheet is coming from: Prof. Dr. André P.C. Faaij (2018) Securing sustainable resource availability of biomass for energy applications in Europe; review of recent literature.

Bioenergy Europe, formerly known as the European Biomass Association (AEBIOM), is the voice of the bioenergy sector at EU-level. It aims at developing a sustainable bioenergy market based on fair business conditions.

Bioenergy Europe is a non-profit, Brussels-based international organisation founded in 1990, bringing together more than 40 associations and 90 companies.

www.bioenergyeurope.org

Place du Champ de Mars 2
1050 Brussels
T : +32 2 318 40 34
info@bioenergyeurope.org



Bienergy
EUROPE