



What is Bioenergy?

FEEDSTOCK



69.6%
Woody biomass

Forestry
& wood industry
residues



18.3%
Agricultural biomass

Crops
& residues



12.1%

Biowaste

Solid municipal
biowaste, sewage

TECHNOLOGY



50.9%



Power plants



Bioliquid plants



49.1%



Boilers



Heat plants



CHP plants



Stoves



Biogas plants

OUTPUT



74.7%
Heat



13.4%
Electricity



11.9%
Transport fuel

Next ...

Bioenergy &
SUSTAINABILITY

Bioenergy &
CARBON NEUTRALITY

Bioenergy &
FORESTRY

Bioenergy &
AGRICULTURE

Bioenergy &
POWER

Bioenergy &
BUILDINGS

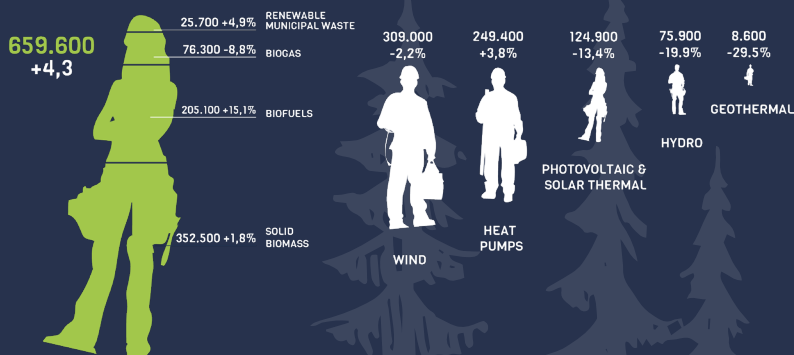
Bioenergy in our
INDUSTRIES

BIOENERGY & Sustainability

Bioenergy is sustainable in economic, social and environmental terms. It fosters rural development, it creates jobs and, being cost-effective, it contributes to a sustainable future, fair to our societies and environment.



EMPLOYMENT DISTRIBUTION IN RENEWABLE ENERGY (2016, EU-28)



BIOENERGY

SUSTAINABILITY CRITERIA

With the Renewable Energy Directive, environmental sustainability criteria now exist for all types of bioenergy, making it the only form of energy with a guarantee of sustainable sourcing, irrespective of the geographic origin of the biomass.

WHAT DO THEY GUARANTEE?

Sustainability



Biodiversity, soil quality, protection of nature, etc.

LULUCF



Maintaining the carbon stock in the forest.

GHG



Significant GHG emission savings compared to fossil fuels.

What's next?

Bioenergy is the only energy source with sustainability criteria. Now it is all about implementing them in the newly-adopted EU Energy and Climate Framework!

1. **We must ensure a smooth transposition and implementation of the sustainability criteria:** all stakeholders need to cooperate and set up systems to prove compliance towards the directive's requirements.
2. **All forthcoming legislation should maintain coherence with the 2030 Energy and Climate Framework to ensure legal certainty for economic operators.** To guarantee investments in the bioenergy sector in the coming years, legal certainty is needed for bioenergy producers and technology providers.



BIOENERGY is Carbon Neutral

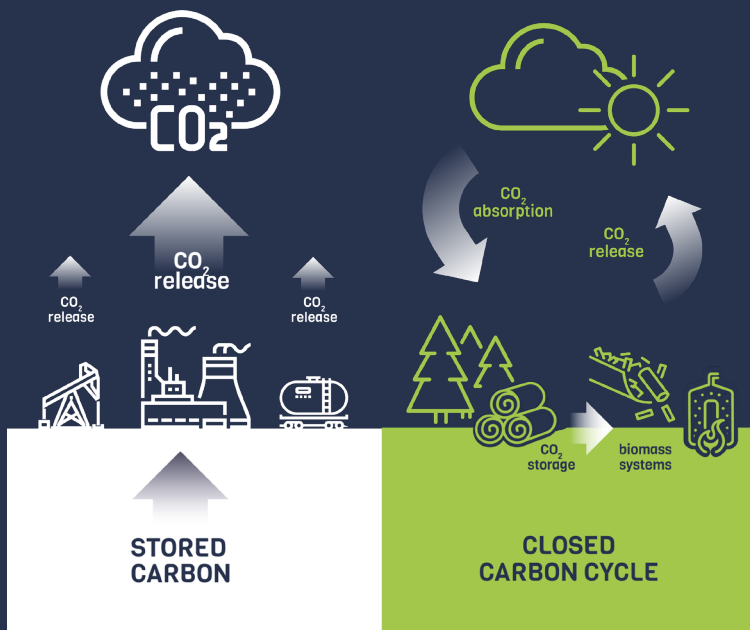
Bioenergy is carbon neutral: carbon that plants photosynthesize is then released with combustion. Fossil emissions are completely different: the carbon released in the atmosphere had built up and stored in the ground for thousands, millions of years!

THE BASICS

It is important to replant trees and support the natural regeneration of the forest after harvesting, which should be calibrated so that the forest can keep its carbon absorption capacity in the future.

Wetlands and undrained peatlands with high-carbon stock capacity should not be used for agriculture to avoid the release of large amounts of carbon.

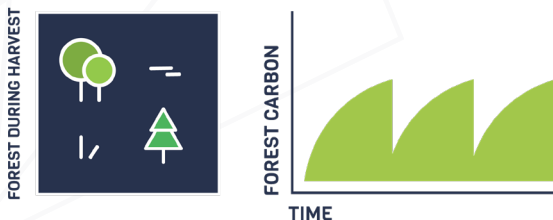
CARBON CYCLE: FOSSIL FUELS vs BIOMASS



CARBON ACCOUNTING

10t wood removal from...

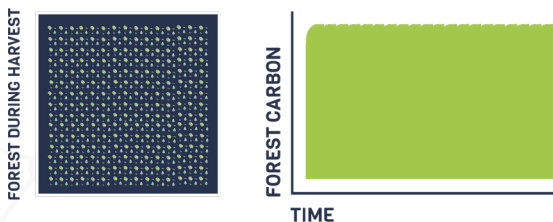
10 Stands



100 Stands



1000 Stands



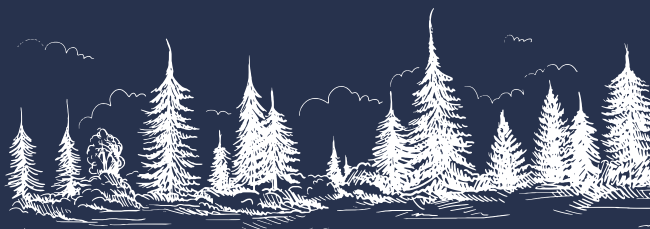
The carbon absorption capacity of our forests and their carbon stock are carefully monitored. Changes in carbon stocks cannot be observed within a few years and in single stands*. Carbon accounting should always look at a regional, zoomed-out picture and not on one stand or single tree, because this is what the atmosphere 'sees'. At large-scale, the carbon capacity should be maintained at any point in time. For agricultural biomass, carbon cycles are renewed on an annual basis.

* A **forest stand** is a contiguous community of trees sufficiently uniform in composition, structure, age and size class distribution, spatial arrangement, site quality, condition, or location to distinguish it from adjacent communities. A productive forest is a collection of stands.

EXTRA MEASURES

Emissions for the processing and transportation of biomass must also be taken into account. The sustainability criteria in the Renewable Energy Directive make sure that these emissions are kept to a minimum with high-GHG saving requirements. Also, good progress is being done in researching and developing technologies to capture and store CO₂, preventing it to reach the atmosphere.

BIOENERGY & Forestry



Today, bioenergy is mostly produced from by-products of forest management operations and of the wood industry, such as sawmills. This makes perfect environmental and economic sense!

IT'S ABOUT RESIDUES

In the last 15 years, our consumption of bioenergy greatly increased while the amount of wood removals for energy purposes has been steady! That tells us that bioenergy is not a driving force behind wood removals from forests, it rather valorizes residues from other forest-based industries. Smart!

PULPWOOD

Paper



LOW VALUE WOOD

What: tops, branches, bark
Uses: bioenergy, bio-based products

HIGH VALUE WOOD

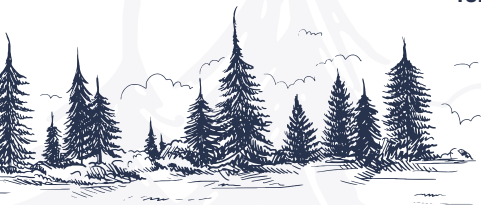
What: timber
Uses: Furniture, construction

95.9% of bioenergy consumed in the EU is local, yet bioenergy is not a cause for deforestation in Europe, nor putting the carbon stock of our forests at risk. On average, more than 30% of the annual forest increment remains in the forest, increasing the carbon stock. The area of European forests is expanding by a football field per minute: an extra carbon sink potential for the coming decades!

FORESTS & BIOENERGY ARE GROWING

FORESTS & CLIMATE CHANGE

No wonder forests are an important element of climate change mitigation and must also adapt to climate change. Global warming affects forests with wild fires, insect outbreaks and extreme weather events such as storms and drought periods. Sustainable, adaptive forest management can prevent this. Bioenergy is also economically attractive for forest owners, creating a market for forest residues that would be otherwise left on the forest floor and be a potential fire hazard.

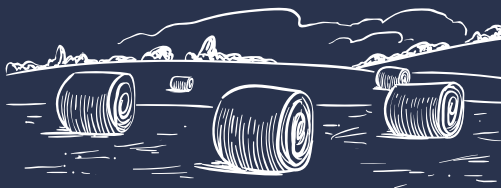


What's next?

WE MUST:

1. **Increase public funding** for climate adaption measures: In the future Common Agriculture Policy, rural development funds (the main funding instrument for sustainable forest management) must be increased to make forests and agricultural land adaptive to climate change.
2. **Create market incentives** for sustainable forest management: Bioenergy brings a market value for forest residues and will thus make sustainable forest management economically attractive.
3. **Support a bio-based economy.** Encouraging public incentives such as a carbon tax will foster the substitution of both fossil-based material and energy and ultimately contribute to a sustainable management of our forests.
4. **Ensure coherence** among different legislations with a renewed EU forest strategy: Forestry is a national competence, but many EU legislative acts touch upon forest-related issues which leads to a lack of coherence in forestry legislation. When developing new legislations, consistency with existing energy, climate and environmental laws should be carefully assessed. A renewed EU forest strategy will bring additional coherence.

BIOENERGY & Agriculture



Energy can be harnessed from agricultural residues and dedicated crops - known as 'energy crops'. With the right policy framework, agrobiomass will express its full potential: goodbye fossil fuels, welcome climate change mitigation!

TYPES OF AGROBIOMASS

THE POTENTIAL

According to the Commission's long-term vision, of all the raw materials that can be used for the production of bioenergy, domestic agrobiomass is the one that is set to grow the most by 2050. To achieve the 2050 climate and energy objectives the energy contribution of agricultural biomass will need to increase significantly and become as important as that of energy from forest biomass. With imported biomass at a mere 4-6%, depending on the scenarios, we should focus on promoting the cultivation of short rotation coppice and lignocellulosic grasses in particular, and stimulate the valorisation of residues.

LAND AVAILABILITY

Agricultural residues: on-field biomass residues such as cereal straw, corn-stover, rice straw, orchard prunings, plantation removal wood and others.

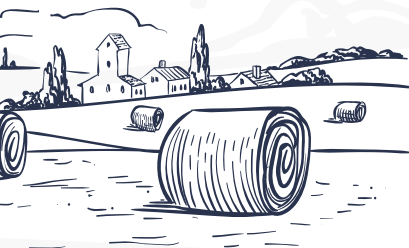
Agro-industrial byproducts: olive stones & olive cake, grape marc, sunflower husks, chaff, nut shells and others.

Miscanthus: a high-yielding, grassy and perennial energy crop. Unlike annual crops, it only requires input in the 1st year, plus it stores carbon in the soil and doesn't need fertilisers.

Short-rotation coppice (SRC): perennial woody energy crops. Fast-growing tree species can be cut down to a low stump in winter, producing plenty of new stems in the next growing season. The most common are willow and poplar.

It is estimated that 5.6M hectares of agricultural land will be abandoned by 2030: part of it could be used for energy purposes (to date, only about 100K hectares are). Willow and miscanthus adapt particularly well to poor soils and help restoring them, increasing their profitability. Investing in energy crops can also stimulate rural development and economic growth by diversifying farmers' income.

CLIMATE ADAPTATION IS KEY!



Perennial energy crops contribute to climate adaptation by:

- Fighting soil erosion and preventing mud slides caused by agricultural intensification;
- Improving soil quality and helping capturing carbon;

Furthermore they:

- Improve water quality and the loss of nutrients in the soil (nutrient leaching), acting as a natural filter;
- Greatly increase biodiversity.

What's next?

WITHIN THE CAP, WE MUST:

1. **Support** synergies between sustainable bioenergy and agriculture.
2. **Reward** the environmental benefits of growing energy crops in marginal land.
4. **Support** the energy valorisation of residues and ban burning on the fields to abate open fire emissions.
5. **Recognise** the important role of energy crops in climate adaptation.
6. **Acknowledge** the benefits of perennial energy crops in improving water quality and limiting nutrient leaching.
7. **Give** energy crops a chance to be supported under the CAP coupled income support.

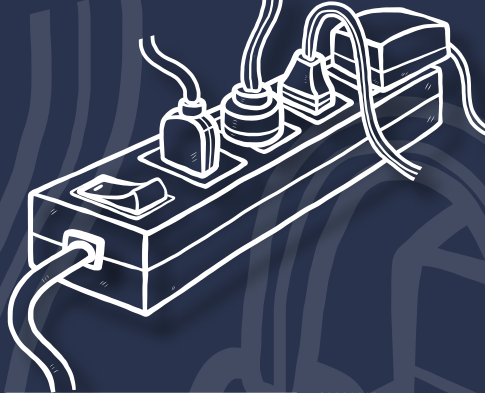
BIOENERGY & Power

Biopower, bioenergy in the form of electricity, represents around 5,5% of the total gross electricity generation in the EU. Our power system, increasingly based on variable renewable sources of energy such as wind and sun, will need a dispatchable and flexible supply of power. Biomass is easily storable and can be used when the wind is not blowing, and the sun is not shining.

DIFFERENT INSTALLATIONS

- **Power-only:** installations producing only electricity, with possible recovery of waste heat;
- **Combined Heat and Power (CHP):** simultaneous production of electricity and useful heat for industries and households.

FOSTERING ENERGY EFFICIENCY

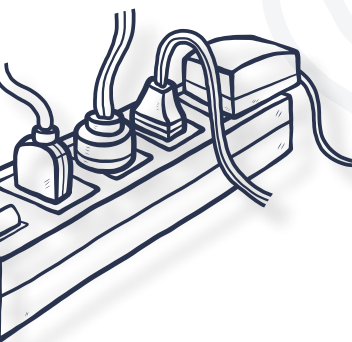


A FLEXIBLE SOLUTION TO POWER DEMAND

Our electricity supply must be continuous: bioenergy can provide the baseload. Also, in times of high electricity demand, flexible biomass fuels can cover peak loads!

Biomass is highly adapted for seasonal balancing. Running at full capacity when the heat demand is high, technologies such as biomass CHP can counterbalance the lower power production of solar energy in winter time.

While 58% of bioelectricity is produced in CHP, only 28% of electricity is produced in CHP in the overall electricity mix. Recently adopted legislation states that, from 2020, biomass power-only plants can be defined sustainable only if it's proven that CHP was not a cost-effective option and that best available technology efficiency thresholds are reached.



ONGOING INNOVATIONS

Innovation in the field of electrical efficiency never stops. New technologies combine the production of several outputs (e.g. CHP & bio-oil production), other offer high-efficient, small-scale solutions (micro-CHP). Research is also being done to increase plant flexibility (e.g. shortening the period of time needed to start up the plant at full capacity, or finding ways to increase the flexibility of fuels used - e.g. multifuel boilers) and the ability to combust more challenging fuels (e.g. waste wood, agricultural biomass).

What's next?

TO UNLOCK SYNERGIES WITH OTHER RENEWABLES, WE MUST:

- 1. Recognise** the complementary role of flexible renewables to stabilise the power system and to secure the supply of electricity.
- 2. Create** a level playing field with variable renewables: balancing and transmission costs as well as the value of dispatchability and security of supply must be integrated in the price of energy or be rewarded as services.
- 3. Support** R&D and demonstration projects focusing on plant and fuel flexibility to create a power system fit for the future.

BIOENERGY & Buildings

Bioenergy is by far the main source of renewable heat, with 87% of all renewable heat coming from biomass - heating 66M households! Decarbonizing our buildings calls for cost-effective, CO₂-neutral solutions such as... bioenergy!

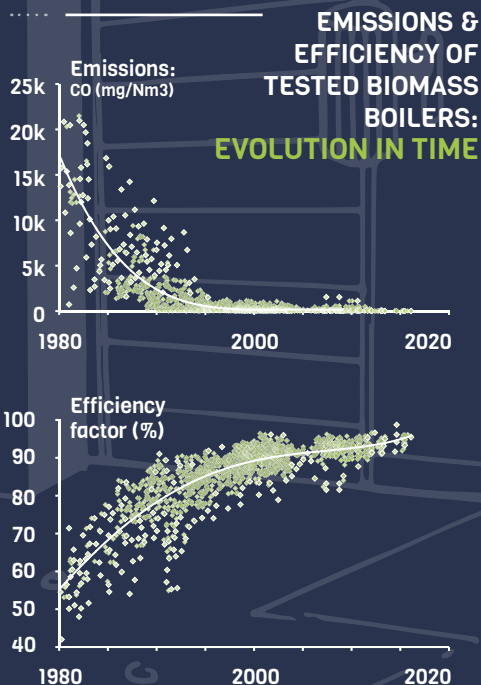
CLEAN, EFFICIENT & MODERN

Biomass stoves are no longer associated with archaic means of obtaining heat. Today's innovative technologies guarantee that high efficiency goes hand in hand with low emissions. Different technologies can produce clean heat from biomass:

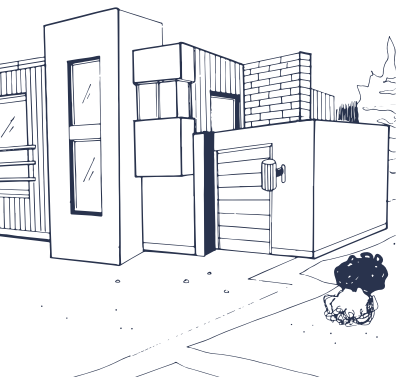
- **Individual biomass stoves**, used as local space heaters;
- **Individual biomass boilers**, to provide hot water and space heating for a whole house;
- **District heating** – the distribution of heat to different buildings from a central production site.

CHALLENGE: REPLACEMENT

The real challenge lies in replacing not only our oil or gas boilers, but also old and inefficient biomass installations with modern ones. This is possible with the right policy framework, and both climate change and air quality will improve as a result.



Source: Francisco Josephinum
BLT Wieselburg, compiled:
Bioenergy2020+ GmbH



HEATING WHOLE DISTRICTS

District heat reaches high levels of efficiency with minimal emissions. Where applicable, biomass district heating or combined heat and power (CHP) should be incentivized.

GOOD BUT NOT ENOUGH

A recent EU legislative act (RED II) has introduced a non-binding renewable obligation to increase the share of renewable sources in the heating & cooling sector (H&C) by 1.3 percentage point each year. However...

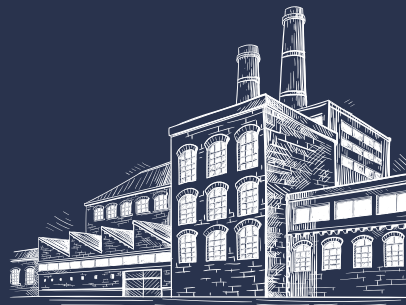
- **The obligation is non-binding for Member States.** We need to ensure each Member State acts and takes appropriate measures;
- **More is needed.** Even if all Member States fulfill their obligation, the EU would not reach a 40% renewable H&C in 2030. With an objective of a net-zero emissions economy by 2050, the H&C sector needs to be fully decarbonised by 2050 or before.

What's next?

TO REACH A NET-ZERO GHG ECONOMY BY 2050, WE NEED:

1. **A strategy** that gradually phases out subsidies to fossil fuels and permits/sale authorisations of non-RES projects.
2. **A price on carbon** in sectors outside the Emissions Trading Scheme (ETS) like H&C (<20 MW).
3. **A centralised approach**, enforced locally.
4. **Awareness campaigns** on existing renewable solutions.
5. **Financial incentives** to help end-users finance the higher upfront investment cost linked to renewable solutions.

BIOENERGY in our Industries



Bioenergy delivers the temperature, pressure and quantity of thermal energy needed by many industrial processes, decarbonising the energy demand of the industry sector by replacing fossil fuels. Technologies are available and employed at large scale!

PROVIDING FOR OUR INDUSTRY NEEDS

Bioenergy covers 8% of the total EU industry demand: the industrial use of bioheat is 1/4 of the final energy consumption of bioenergy. Bioheat produced at large scale (in dedicated plants and combined heat and power) is often cost-competitive with fossil fuel alternatives and it can rely on different inputs including waste and by-products and reduces the amount of air emissions.

PRESSURE, TEMPERATURE & ON DEMAND

IN 2016:

19,4%

of the final consumption of bioenergy went to industries
(22.521 Ktoe)

32%

of bioelectricity was self-produced by industries
(4.939 Ktoe)

Steam temperatures above 500°C and pressures of as much as 160 Bar can be achieved with solid biomass, depending on the technology and the fuel quality. Further, with thermal gasification, torrefaction and steam explosion technologies, high temperatures comparable to those provided by fossil fuels can be reached. Biomass is flexible and dispatchable and therefore adaptive towards the needs of our industries. In addition, multifuel technologies provide the industry with the necessary flexibility to maximise resource efficiency and increase the use of renewable fuels.

INDUSTRY SUBSECTORS BIOENERGY CONTRIBUTION TO FINAL ENERGY CONSUMPTION (%)

Biomass stream integrated in the process

Wood & wood products	58.67%
Paper	60%
Food & tobacco	3.88%



Other sectors bioenergy can help decarbonise

Fertilizers
Textile
Chemical
Food & beverage
Cement
Iron
Non-ferrous metals



ACROSS SECTORS

The use of bioenergy in the industrial context largely varies depending on the sector. Sectors employing biomass in their processes are naturally keen to use bioenergy to improve their sustainability and resource efficiency. For example, the pulp and paper and the wood and wood product industries already cover a large portion of their energy demand with bioenergy!

What's next?

1. **Bioenergy** already provides 8% of the total EU industry demand.
2. **Bioenergy** is one of the few solutions available to decarbonize several industrial processes where high temperatures and pressures are required.
3. The use of **residue streams** for bioenergy in industrial sectors involving biomass as raw material delivers resource efficiency! Multifuel solutions can be used across industrial sectors and allow a higher penetration of bioenergy, providing for operational flexibility and allowing to preserve existing infrastructures.



Bioenergy Europe is the voice of European bioenergy. It aims to develop a sustainable bioenergy market based on fair business conditions.

Founded in 1990, Bioenergy Europe is a non-profit, Brussels-based international organisation bringing together more than 40 associations and 90 companies, as well as academia and research institutes from across Europe.

www.bioenergyeurope.org

**info@bioenergyeurope.org
+ 32 23184100**