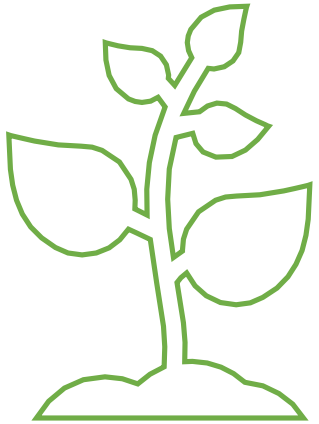
Sustainable bio-feedstock Availability in the EU: A Look into Different Scenarios towards 2050

Dr Calliope Panoutsou

Imperial College London

c.panoutsou@imperial.ac.uk

Imperial College London Consultants



Concawe

Biomass availability study in a nutshell

- Timeline: October 2020- June 2021
- Overview of the sustainable biomass availability in the European Union and the UK by 2030 and 2050.
- Food and feed crops are not included in this study.
- Only domestic (EU27 & UK) feedstocks of agricultural, forest and waste origin included in Annex IX of RED II (Part A and B).
- A short overview, but not detailed estimates of the potential for imports and algae.
- Up-to-date assumptions, that are in line with the European Green Deal, for the sustainable increase of available biomass acknowledging the biophysical restrictions of land resources and feedstocks as well as the adverse effects of climate change.

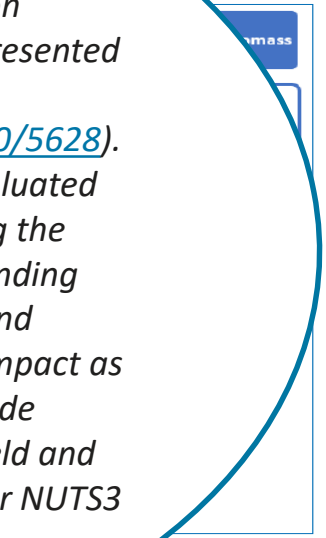
In all scenarios

Imperial College London
Consultants

- Strong political will to deliver the European Green Deal
- COVID-19: The economic recovery promotes the eco
  local producers while broaden the feedstock base
- Focus on biofeedstocks in RED II Annex IX (Part
  - Traditional biofuel crops (1st generatio
  - Biomass sustainability criteria of RED I
- Granularity at EU country level by 2030 and 2
- Low ILUC risk concept
- No negative effect on biodiversity:
  - conservation of land with significant biodiv
  - land management without negative effects on
- Imports potential
- Allocation of biomass raw materials to biobased products (bioplastics, biopharmaceuticals, construction materials, etc.)

The farming of biomass crops is currently being further assessed regarding their impacts on biodiversity according the methodology presented by Lindner & Knüpfer, 2020 (https://www.mdpi.com/2071-1050/11/20/5628). Firstly, the cultivation of miscanthus is evaluated and classified in hemeroby levels, meaning the amount of human influence on the surrounding ecosystem. From this biodiversity values and impacts can be derived. The biodiversity impact as a function of biomass provision will be made available, so a sweet spot of maximum yield and the least biodiversity impact per country or NUTS3 region can be established.

he study



Concawe

Concawe Scenarios

Imperial College London Consultants

1. **LOW. Low mobilization:**
   - Farming and forest practices at 2020 levels

2. **MEDIUM. Improved mobilisation in selected countries:**
   - Improved mobilisation in countries with high biomass availability

   (total estimated biomass potential ≥20 million tonnes per year) in combination to:
   - Strong infrastructure, good institutional framework, established policies/ targets for bioenergy, strong innovation profiles (Germany, France, Sweden, Finland, Italy, United Kingdom, Austria, Spain)
   - Or low costs (Poland, Romania, Czech Republic, Hungary, Bulgaria)

3. **HIGH. Enhanced availability and improved mobilisation:**
   - Improved research & innovation addressed for all countries (Pushed to a higher technical sustainable potential)

Improved Research & Innovation:

Raw materials

- Increase yields with the use of varieties that are better adapted to local ecosystems, the introduction of crop rotations, the use of cover crops to prevent soil erosion in sensitive areas and at the same time increase crop production, etc.

Practices

- Improved agricultural management practices (e.g. selection of varieties, crop rotation and intercropping, fertilization, water management, adoption of precision agriculture practices).
- Improved harvesting practices and machinery
- Cultivation of crops in unused, abandoned and severely degraded land due to low quality.
- Advances in separation, collection and energetic usage of UCO/Fats Oils & Greases and the organic waste fractions.

Key assumptions

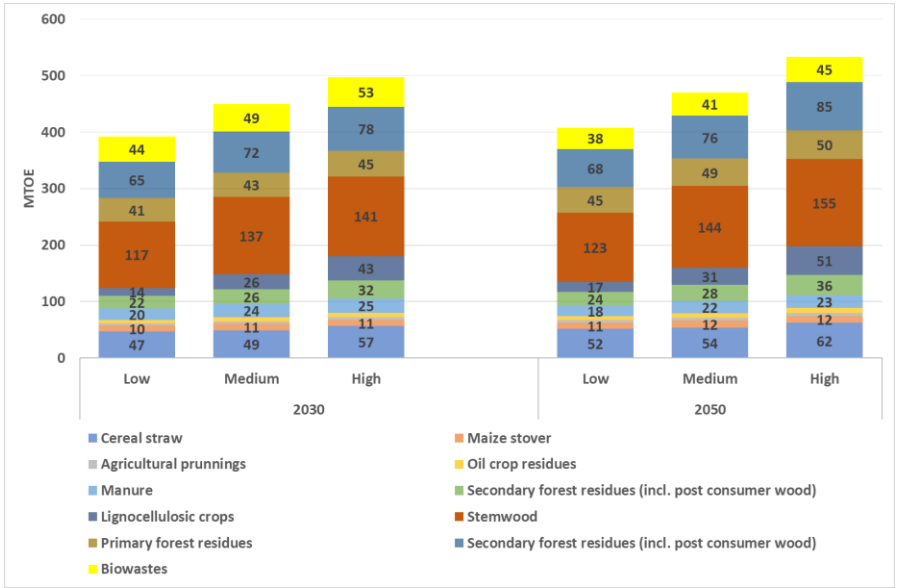
Imperial College London Consultants

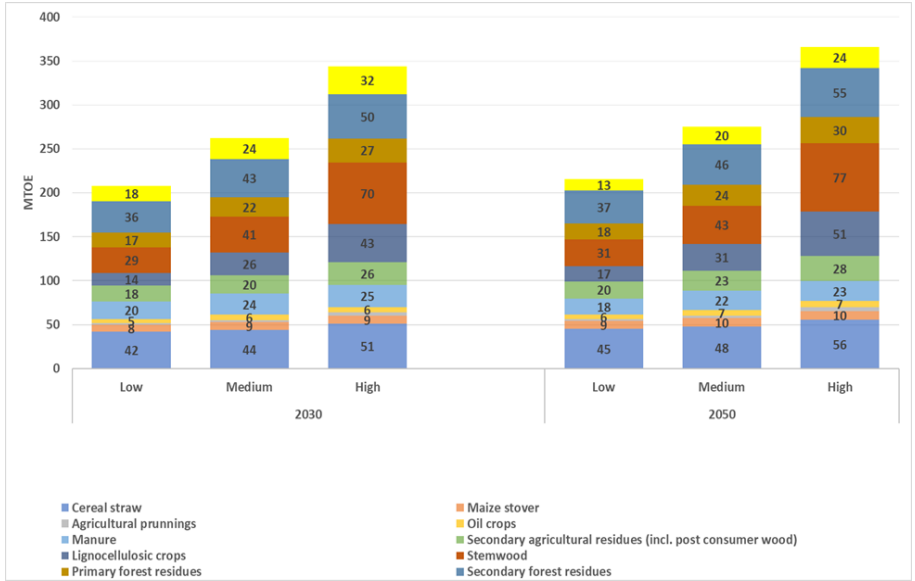
	Scenario 1 (Low)	Scenario 2 (Medium)	Scenario 3 (High)
Agriculture			
Removal rate of field residues	40%	45%	50%
Use of prunings	5%	20%	50%
Moderate yield increases in perennial lignocellulosic crops in unused, degraded and abandoned land	1%	1%	2%
Share of unused, degraded and abandoned land for dedicated crops, excluding biodiversity rich land and land with high carbon stocks	25%	50%	75%
(Current share of unused, degraded and abandoned land for dedicated crops: No official statistics- only experiments and demonstration scale)			
Forestry			
Stem wood used for energy purposes (Current stemwood for energy: 45%)	25%	30%	50%
Primary forestry residues availability for energy production	40%	50%	60%
Secondary forestry residues and post consumer wood availability for energy	55%	60%	65%
Wastes			
Biowaste used for energy production	60% in 2030 (65% in 2050) of biowaste is recycled and 40% in 2030 (35% in 2050) is separately collected and available for bioenergy	50% in 2030 (55% in 2050) of biowaste is recycled and 50% in 2030 (45% in 2050) is separately collected and available for Anaerobic Digestion	40% in 2030 (45% in 2050) of biowaste is recycled and 60% in 2030 (55% in 2050) is separately collected and available for Anaerobic Digestion

Estimated total sustainable biomass (Mtoe)

Subtracting allocation to biobased products

All markets → Bioenergy



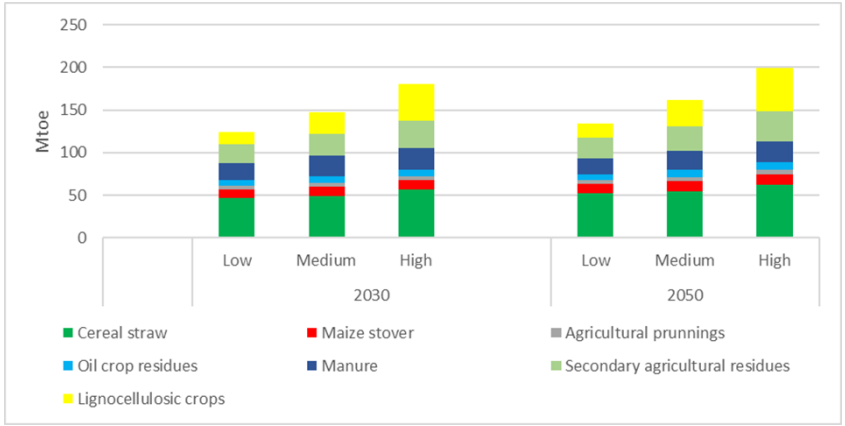


- ✓ Concawe's scenarios forecast a total EU potential biomass for all sectors of 392-533 Mtoe/y by 2030/2050.
- ✓ Allocation to bioenergy sector of 208-366 Mtoe/y by 2030/2050

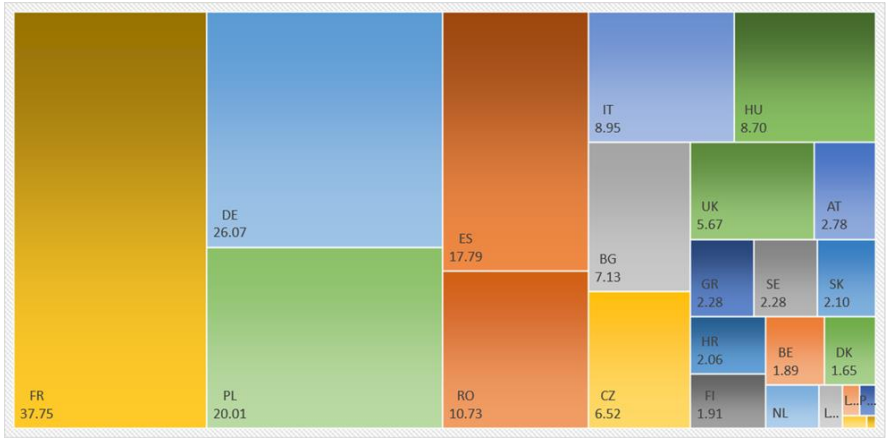
Agriculture

Estimated biomass potential from agriculture for all markets

Estimated biomass potential from agriculture



Regional distribution



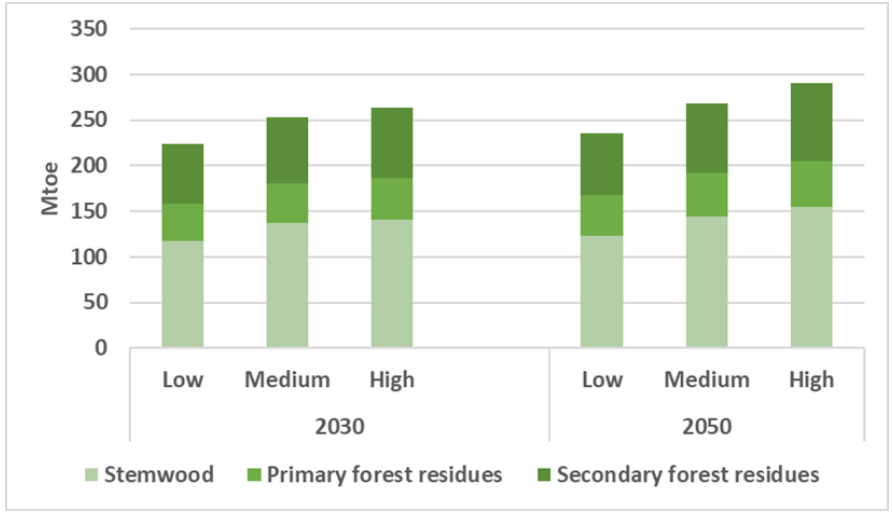
Note: Regional distribution for Scenario 1 (million dry tons).
Similar for Scenario 2 and 3

	Key parameters	Low	Medium	High
Agriculture	Share of marginal land for lignocellulosic crops	25%	50%	75%

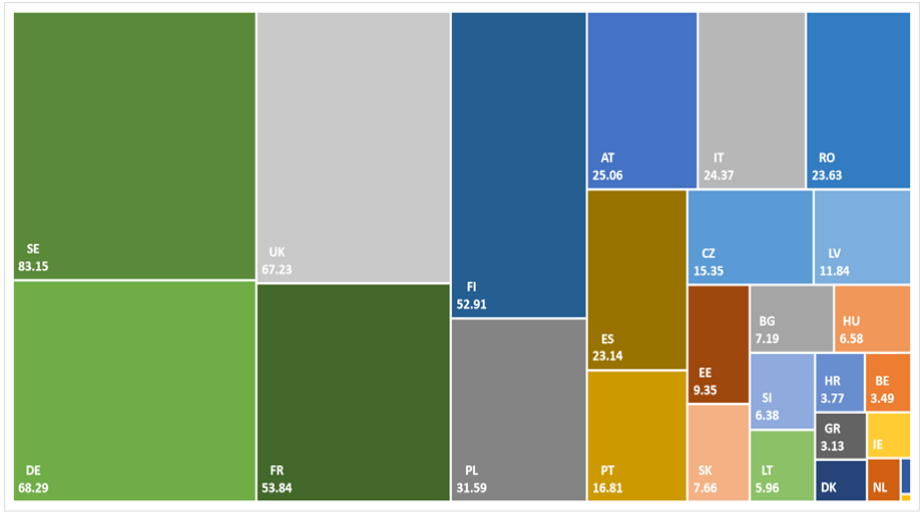
Forestry

Estimated biomass potential from forestry for all markets

Estimated biomass potential from forestry



Regional distribution



Note: Regional distribution for Scenario 1 (million dry tons).
Similar for Scenario 2 and 3

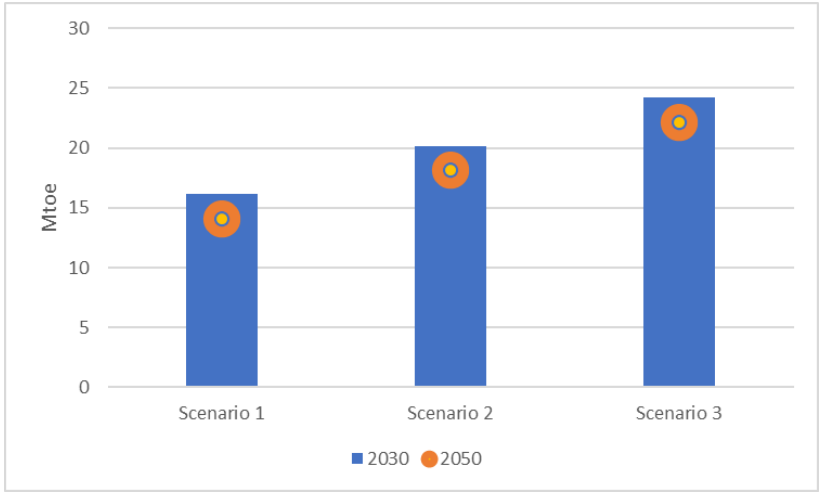
	Key parameters	Low	BAU	High
Forestry	Stemwood for energy	25%	30%	50%

Concawe

Biowastes

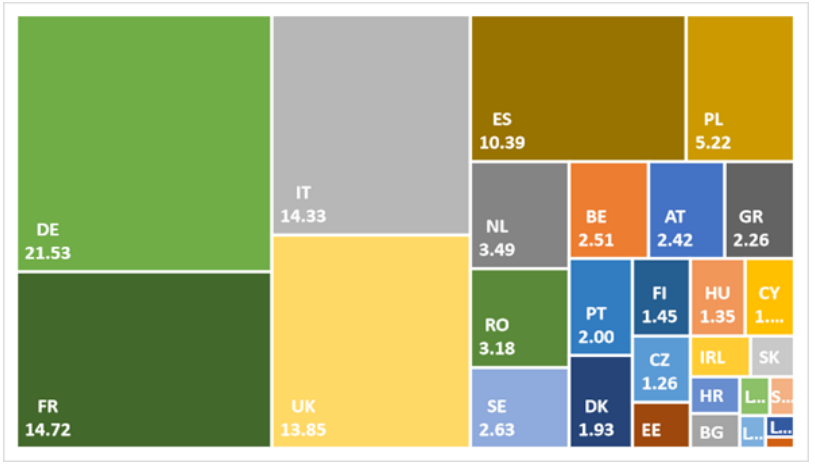
Estimated biomass potential for biowastes for all markets

Estimated biomass potential from biowastes



Note: Chart for bioenergy.
To be updated

Regional distribution



Note: Regional distribution for Scenario 1 (million dry tons).
Similar for Scenario 2 and 3

	Key parameters	Low	BAU	High
Wastes	Biowastes for energy	35%	45%	50%

Important considerations

What is the sustainable biomass availability (2030/2050) with no impact on biodiversity?

The potential is there- It is important to highlight that the biomass potential availability estimated in this study are based on very conservative assumptions.

Furthermore, **additional potential to the one estimated by this study can be expected** the potentials from algal biofuels plus other sustainable biomass feedstocks not included in RED II Annex IX that have not been taken into consideration at all in the above calculations.

Therefore, it can be concluded that the **biomass potentials in 2030 and 2050 would most probably be higher than those estimated by this study**.

However, to realise this potential, **additional R&D would be required as well as the implementation of improved management strategies**. Even if the potential is there, the supply chain would need to be developed to mobilise all these resources.

This means that an enormous effort must be done in all Member States, as the maturity and reliability of several key biomass conversion technologies is still an issue and their progress towards market deployment is an important concern.

Conclusions

What is the sustainable biomass availability (2030/2050) with no impact on biodiversity?

- Many different publications providing different ranges with not always transparent assumptions
- Concawe has commissioned a study with Imperial College. Main results:
  - ✓ Total EU potential sustainable biomass availability (agriculture, forestry and biowastes) for all sectors of 392-533 Mtoe/y (low-high scenario) by 2030/2050.
  - ✓ Allocation to the total bioenergy sector of 208-366 Mtoe/y (low-high scenario) by 2030/2050.
  - ✓ The European Commission (A Clean Planet for all, Impact Assessment) is allocating ~120-170 Mtoe/y (2030/2050) of the bioenergy to power + industry + residential sectors.
  - ✓ This means that, even with EU COM power allocation, there is a potential of 88- 196 Mtoe/y of biomass for transport sector in 2050.
- Concawe will use this estimate to support the assessment on the potential deployment of low carbon fuels in the transport sector towards 2050.