Strategies for the optimal bioenergy use in Austria with focus on domestic biomass availability

Christa Dißauer[1], Marilene Fuhrmann[1], Jakob Wächter[2], Reinhard Haas[2], Cecilie Foldal[3], Robert Jandl[3], Andreas Schindlbacher[3], Christoph Strasser[1]

[1]BEST – Bioenergy and Sustainable Technologies GmbH

[2]TU Wien, Institut für Energiesysteme und Elektrische Antriebe, Energy Economics Group (TU Wien – EEG)

[3]Bundesforschungs- und Ausbildungszentrum für Wald (BFW)

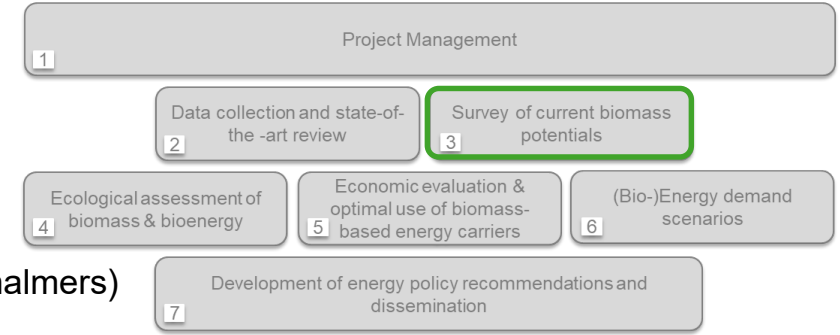
Central European Biomass Conference, Graz

BIOSTRAT project

Duration: 01/09/2023 – 31/08/2025

Partners: BEST GmbH
Austrian Research Centre for Forests (BFW)
Energy Economics Group, TU Wien
Subcontractor: Göran Berndes (IEA Task 45, TU Chalmers)

Funding: Austrian Climate Research Programme (ACRP)



Goals:

- identify and present optimized bioenergy pathways for 2050
  - scenarios based on simulations,
  - starting from the historical and **current & future biomass availability**
  - and cost/price developments
  - ecological assessment via LCA of the conversion technologies

Objective & Approach

- **Evaluate available biomass for energy production in Austria up to 2050**
- **Biomass availability:** Assessment of sustainably (sustainable harvesting principles) available biomass
  - focusing on forest wood and the role of forests as carbon sinks
  - most significant raw material assortments by volume (forest biomass, agricultural biomass and residues/waste)
- Import shares for wood were assumed constant, whereas agricultural residues were considered strictly domestic

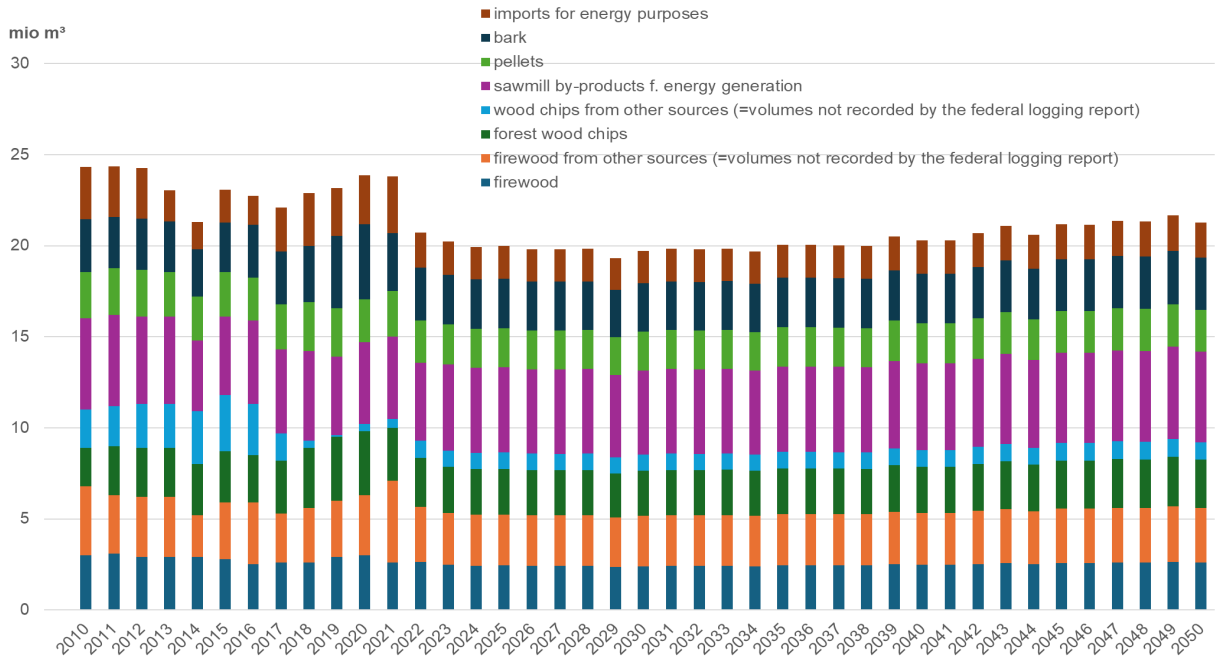
Challenges:

- **Major uncertainties regarding climate-induced impacts on forest growth**
- **Limitations include incomplete data, regional land-use constraints as well as trade-offs between biodiversity conservation and biomass harvesting**

Woody biomass availability up to 2050

- Availability based on the National Forest Inventory & the results of the Care4Paris project
  - The Care4Paris project aimed at showing the effect of climate change scenarios and adaptation measures in forestry.
  - Reference R4.5: Forest management and timber use in **business-as-usual**
- The import rates were kept constant based on the average of the historical data for the years 2010-2021, as the Austrian sawmill industry is heavily dependent on imports and has long-standing contracts and networks with its trading partners.

Woody biomass availability in Austria up to 2050



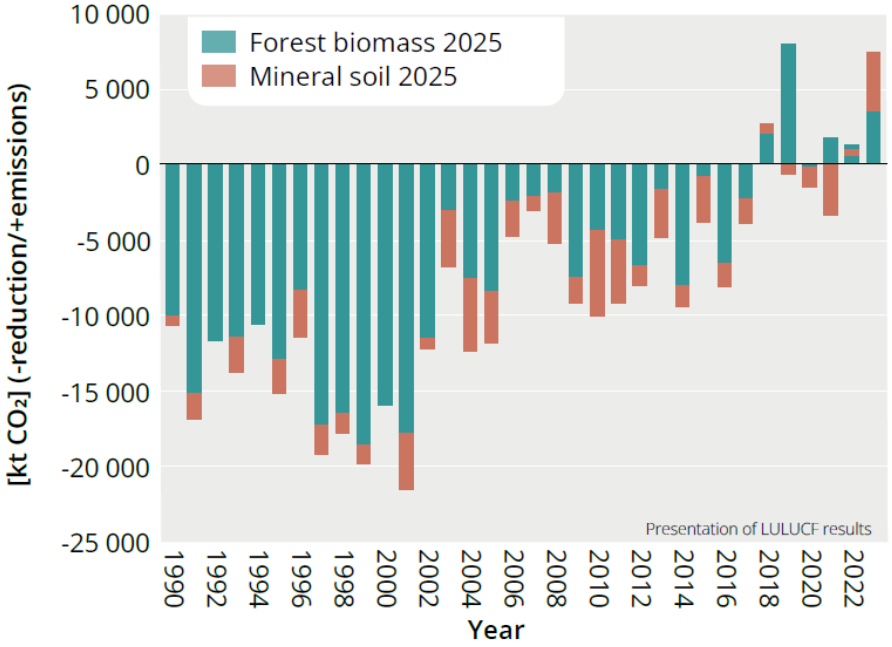
- It is a scenario, not a forecast (first scenario year: 2023)
- Slight decline in available quantities until 2050

Forest management and wood use – expactations

- Austrian forests are expected to sequester CO_2 from the atmosphere and thus fulfilling the country's commitment to reduce greenhouse gas emissions.
  - Rapid climate change is increasingly leading to calamities that counteract the CO_2 sink capacity of forests. **At the current rate of climate change, the future of our forests is uncertain and their function as a carbon sink is difficult to maintain.**
- Bioeconomy is to be supplied with wood assortments and biomass for energy production.
- The energetic use of sustainably produced forest biomass (residual forest wood, sawmill by-products, firewood, etc.) is an indispensable component of the Austrian energy transition in the medium term.

CO_2 balance of the Austrian forest as reported in the greenhouse gas inventory

- In recent years, for the first time, the sink capacity was not achieved, and forests temporarily became a CO_2 source
- Impacts on fluctuations:
  - changes in harvest intensity
  - occurrence of major disturbance events
  - global warming also plays a direct role (For example, in very warm and precipitation-rich years, more organic carbon is decomposed)



CO_2 sequestration in Austria‘s forests – Forest Management opportunities

- High biomass stocks in the forest harbour the risk of high carbon losses in major disturbances (fire, bark beetle, storm, etc.).
- In addition to actively adapting forests to climate change („climate-fit forests“), there are options for increasing biomass carbon stocks and thus CO_2 sequestration in Austria‘s forests, at least temporarily.
    - Growth-optimized management combined with a shift in the value chain towards fewer, more durable and higher quality wood products
- **An expansion of the carbon sink in Austrian forest can only succeed if greenhouse gas emissions are reduced in all sectors, so that global warming remains within a manageable corridor, and if forest management adapts to climate change as quickly as possible.**

Agricultural biomass, residues and biogenic waste

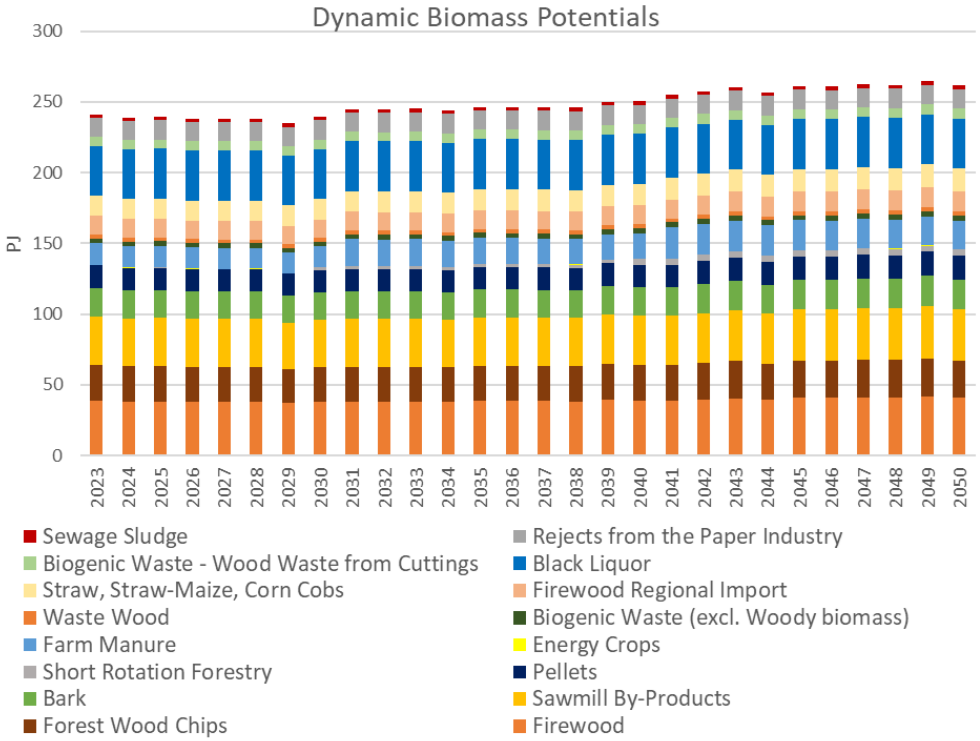
Assumptions for development of realistic biomass potential until 2050

	Assumptions for development until 2050
Biogenic waste	correlated to demographic development (Statistics Austria: +11 %)
Short rotation	2.25% conversion of "low-yielding permanent grassland incl. grassland fallow" by 2030, 5% by 2040
Waste wood	correlated to demographic development (Statistics Austria: +11 %)
Energy crops	Stagnation
Straw	10% cereal straw but 40% maize straw; due to reduced meat consumption: land that was used directly or indirectly for meat production is used for food production
Corn cobs	land that was used directly or indirectly for meat production is used for food production
Farm manure	decline due to less meat consumption (historic trend, ama) 30% use until 2030 (UBA scenario), 40% until 2040 and 50% until 2050
Sewage sludge	correlated to demographic development (Statistics Austria: +11 %)

- Regarding the agricultural biomass and biogenic residues, the great potential lies in farm manure and (maize) straw.
- Mobilizing this potential remains a challenge.
- Land is a resource that is in high demand (construction activities, transport/business premises, solar parks…)

Biomass availability in Austria up to 2050

Imports were kept constant over time



Summary & Conclusions

- **Forest biomass:** Annual harvest volumes from Austrian forests are projected to decrease slightly by 2050, although projections are uncertain due to possible extreme weather events and changes in forest area.
- **Agricultural and waste biomass:** Straw, manure, and biogenic waste could provide about **40 PJ of energy** by 2050, roughly 3 % of Austria's current energy demand. Mobilization is challenging due to competition with food production and photovoltaic land use.
- **Sustainable forest management**
  - Climate change threatens the function of forests as carbon sinks → Climate-adaptive forestry practices are essential to minimize carbon losses and maintain forest health
- **Mobilize untapped potentials**
  - Legal and logistical frameworks should be developed to better utilize agricultural residues and biogenic waste (e.g., end-of-waste policies, decentralized biomass hubs)

Conclusions BIOSTRAT project

- **Economic Viability**
  - Biomass use in individual heating systems and local/district heating networks is currently the most cost-effective application and is projected to remain so until 2050
  - CHP plants are largely competitive, especially in winter, and are critical for achieving 100 % renewable electricity in Austria
  - Using low-cost feedstocks & a higher CO_2 price improves the economic outlook for biomass technologies
  - Main barrier: high investment costs
- **Biomass Allocation and Supply Gaps**
  - Domestic biomass potential can largely meet projected demand until 2050, a national supply deficit of 3–4 % of bioenergy demand would need to be covered by imports or other renewable energy sources
- **Sustainable forest management**
  - Climate change threatens the function of forests as carbon sinks → Climate-adaptive forestry practices are essential to minimize carbon losses and maintain forest health
- **Mobilize untapped potentials**
  - Legal and logistical frameworks should be developed to better utilize agricultural residues and biogenic waste (e.g., end-of-waste policies, decentralized biomass hubs)

Contact

christa.dissauer@best-research.eu

Area 3 – Sustainable supply and value cycles

www.best-research.eu

RESOURCES

Biomass Availability
Biomass Potentials
Supply-Chain Concepts

SUSTAINABILITY

Sustainability Quick-Check
Global Warming Potential
Life-Cycle Assessment

MARKET

Techno-Economic Analyses
Econometric Modelling
Social Sciences & Humanities

KNOW-HOW

Trainings
Stakeholder Workshops
Networking