Overview of the agrobiomass sector in Europe / the AgroBioHeat project
• Agrobiomass sector in Europe
  • Bioenergy overview, agrobiomass potential, utilization models and management practices
• The AgroBioHeat project
  • Objective, consortium, activities and first AgroBioHeat boiler test results
• Final remarks
Agrobiomass sector in Europe
Bioenergy in Europe – Overview

Repartition by energy source for the different final usages in the EU28 in 2018 and their relative importance in the total final energy consumption (%)
(Source: SHARES 2018, Eurostat)

Note: Calculated in accordance to the methodology established in Directive 2009/28/EC and Regulation (EC) No 1099/2008. For the energy source repartition in transport ‘Other renewables’ represents RES electricity used in transport which also counts towards the RES for electricity (not for the sector share in total final energy consumption). Multipliers included.

Distribution of renewable gross final energy consumption in the EU28 in 2018 (%)
(Sources: SHARES 2018, Eurostat)

Distribution of the different biomass feedstock for energy in 2018 (%)
(Sources: Eurostat and Bioenergy Europe’s estimates)

Image Sources: Bioenergy Europe Statistical Report 2020
• **Herbaceous agricultural residues:** 168 Mt dry, technical potential / 123.5 Mt dry sustainable potential

• **Agricultural prunings:** 12.5 Mt dry, technical potential

• **Agro-industrial residues:** not insignificant quantities available on the market, e.g. 1.2 Mt of exhausted olive cake just in Spain

• **Perennial energy crops:** currently 118,480 hectares in EU28 (around 0.07 % of Utilized Agricultural Area), primarily with miscanthus, poplar and willow

References for agrobiomass potential:
- Herbaceous agricultural residues: Scarlat et al., 2019
- Agricultural prunings: Dyjakon & Garcia-Galindo, 2019
- Agro-industrial residues: Manzanares et al., 2017
- Energy crops: Bioenergy Europe Statistical Report 2020
Agrobiomass use – Danish straw model

- Straw in Denmark: 2.25% of gross energy consumption and 10.2% of RES production (2018)
- 5.5 million tons per year between 2013-2019 on average; 3.4 million tons for agriculture and energy purposes; 2.1 million tons straw surplus
- Energy applications include farm heating, DH systems, CHP and large-scale power generation
- Examples of replication on local / regional scale can be found in other European countries

Images: left - Strudstrup Power Station, Denmark (Source: Torben Skøtt, Biopress) / right-top - St. Merlose Heating Plant, Denmark (Source: Linka) / right-middle – ACCIONA’s Sangüesa straw-fired power plant, Spain (Source: Abengoa) / right-bottom: arrival of the straw boiler at Grand Poitiers, France (source: Grand Poitiers twitter)
• Olive stones and exhausted olive cake: Mediterranean countries
• Sunflower husks: mostly Eastern Europe
• Nut shells and fruit stones: smaller, local production in Europe
• Many others: cotton ginning residues, flax shives, distillery residues, corn cobs, etc.
• Self-consumption by producing industries (e.g. olive pomace mills, vegetable oil industries) for process heat
• Leftover quantities are made available to the market for wide range of applications depending on properties: domestic heating, greenhouses, industrial heat, CHP / power production
• Market shares in residential heating markets of some countries may be comparable to wood pellets
• High quality assortments for small-scale heating applications can be certified under the BIOmasud® label
• Usually initiated by pioneers with a vision for local agrobiomass utilization

• Agrobiomass mobilization typically ranges from a few hundred to a few thousand tons per year per initiative

• Different models: agrobiomass pellets / briquettes for market, self-consumption for heat, greenhouses, small district heating systems, small power plants

• May serve as inspirations for similar initiatives...

• ...but still not widespread models

“La Girada” (Vilafranca del Penedès, Spain): 500 kW boiler fueled with vineyard prunings for municipal district heating. Image source: Vineyards4heat project

Vioenergiaki Patridas (Veria, Greece): 1 MWe gasifier using wood chips from peach tree plantation removals. Image source: M. Karampinis

AgroTherm GmbH (Malchin, Germany): 800 kW boiler using fen biomass from paludiculture for district heating. More info: BOnaMoor project

FIUSIS (Calimera, Italy): world’s first 1 MWe biomass power plant fueled exclusively by olive tree prunings. Image source: Fiusis Srl Facebook page
Field burning of stubble

*During our self-isolation, Ukrainian fields are burning!*

Although on-field burning of stubble, straw is officially forbidden, it remains a culturally entrenched stereotype that has terrible consequences. It harms humans, animals, the ecosystem as a whole.

Screenshots of NASA fire map. Information from the last 7 days.

There are more fires per unit area in Ukraine than in Poland, Slovakia, Belarus, Hungary and other European countries.

Image Sources: NASA FIRMS System / UABIO Newsletter (April 2020) / bottom right – The Energy and Resources Institute (India)
Field burning of prunings

Image Sources: top – AGROinLOG project Greek demo video / bottom left – M. Karampinis / bottom right - Facebook
AgroBioHeat project and activities
Overall aim: support European rural decarbonisation through market uptake of agrobiomass heating solutions

- Funding: Horizon 2020, Grant Agreement 818369
- Granting Authority: European Climate, Infrastructure and Environment Executive Agency (CINEA)
- Duration: 1\textsuperscript{st} January 2019 – 31\textsuperscript{st} December 2021
- Total budget / EU funding: 2,998,043.75 € / 2,998,043.75 €
- Project Coordinator: Centre for Research and Technology Hellas (Greece)
- Website: [http://www.agrobioheat.eu](http://www.agrobioheat.eu)
AgroBioHeat – Consortium

Technical partners

CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS
circe RESEARCH CENTRE FOR ENERGY RESOURCES AND CONSUMPTION
BIOS BIOENERGIESYSTEME GmbH

European Association

Bioenergy EUROPE

National multipliers

GREEN ENERGY Romanian Innovative Biomass CLUSTER
LABIO Bioenergy Association of Ukraine
Aile initiatives énergie environnement
aveBiom
INASO-PASEGES
ZELA Zelená Energetská Zadruga

Straw & network expertise
Operator of biomass heating plants
Social sciences expertise

Canada Biomass Cluster/AgroBioHeat Joint Virtual Webinar, 5 May 2021
Vilafranca del Penedès (ES) – 27th February 2020

- Workshop on using vineyard prunings for heat / energy production
- Site-visit to “La Girada” district heating of local municipality, fueled exclusively with vineyard prunings / 500 kW Heizomat boiler
- Site-visit to Familia Torres / 2.6 MW biomass boiler coupled with adsorption chiller for cooling / fueled by forest wood chips and vineyard prunings
- Further information: https://agrobioheat.eu/vilafranca-del-penedes-visit/
- YouTube video: https://www.youtube.com/watch?v=EfjApzdnqFQ
www.agrobiomass-observatory.eu

- 680 agrobiomass heating cases (thermal output < 50 MW)
- 51 other cases of agrobiomass use (power, CHP, large-scale heat, etc.)
- 67 equipment manufacturers (boilers, flue gas cleaning systems, others)
- 113 ESCOs & Installers
- 114 agrobiomass fuel suppliers

Continuously updated!
Guides and factsheets

English: https://agrobioheat.eu/agrobiomass-guides/
Français: https://agrobioheat.eu/fr/guides-agrobiomass/

English: https://agrobioheat.eu/agrobiomass-factsheets/
Français: https://agrobioheat.eu/fr/fiche-dinformation-agrobiomass/
Matchmaking events and sector promotion

https://bringing-value-to-agrobiomass.b2match.io/

- 259 participants
- > 280 bilateral meetings
- 2nd edition planned for Autumn 2021
AgroBioHeat boiler tests – first results

<table>
<thead>
<tr>
<th></th>
<th>CO [mg/Nm³]</th>
<th>OGC [mg/Nm³]</th>
<th>NOₓ as NO₂ [mg/Nm³]</th>
<th>TSP ds boiler [mg/Nm³]</th>
<th>TSP ds ESP [mg/Nm³]</th>
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<tbody>
<tr>
<td>Ecodesign emission limit*</td>
<td>500</td>
<td>20</td>
<td>200</td>
<td>40</td>
<td>40</td>
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<tr>
<td>Boiler 1 / Sunflower husk pellets</td>
<td>4.5</td>
<td>&lt; 1.0</td>
<td>369.4</td>
<td>16.6</td>
<td>n.a.</td>
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<tr>
<td>Boiler 1 / Poplar</td>
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<td>&lt; 1.0</td>
<td>299.9</td>
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<td>n.a.</td>
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<tr>
<td>Boiler 1 / Agropellets</td>
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<td>&lt; 1.0</td>
<td>480.8</td>
<td>12.8</td>
<td>n.a.</td>
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<tr>
<td>Boiler 2 / Miscanthus</td>
<td>169.4</td>
<td>&lt; 1.0</td>
<td>238.7</td>
<td>91.7</td>
<td>28.0</td>
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<tr>
<td>Boiler 2 / Olive stones</td>
<td>267.8</td>
<td>&lt; 5.5</td>
<td>177.6</td>
<td>68.7</td>
<td>21.0</td>
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</tbody>
</table>

* According to the Ecodesign Regulation for woody biomass fuels

Boiler 1: 45 kW nominal capacity (with wood chips), based on innovative extreme air staging concept

Boiler 2: 49 kW nominal capacity (with wood chips) / 40 kW (with miscanthus, agropellets and energy corn) based on moving grate technology and conventional air staging, coupled with ESP

All data relate to seasonal emissions = 0.15*emission FL + 0.85*emission PL (FL: Full Load; PL: Partial Load) and dry flue gas @10 vol% O₂

- Boiler efficiencies ranging from 87% to 94% (on fuel NCV basis)
- Dioxin measurements for miscanthus well below the limits of German regulations (1. BImSchV)

For further details, see EUBCE 2021 presentation / paper: T. Brunner, P. Nowak, C. Mandl, I. Obernberger, Assessment of Agrobiomass Combustion in State-of-The-Art Residential Boilers, Session reference: 2AO.5.1
Final remarks
• Agrobiomass represents a major untapped renewable energy potential
• Success cases of agrobiomass-to-energy are numerous, but mostly local / regional
• The issue of agrobiomass utilization is not just for the energy sector; it is inseparable from the state-of-play in the agricultural sector
• Agrobiomass fuel costs can be cheaper than most other options (fossil or biogenic)...
• ... but fuel properties require specific technologies for effective utilization
• Efficiency and emissions during agrobiomass combustion can be comparable with woody biomass combustion (again, with appropriate technologies)
• Tailored policy instruments can promote agrobiomass-to-energy market uptake
• The AgroBioHeat project aims to support the take-off of the sector... mostly in Europe, but Canadian stakeholders can also benefit from several outputs of the project!
Promoting the penetration of agrobiomass heating in European rural areas

Thank you for your attention!

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Visit us at: www.agrobioheat.eu  AgroBioheat  #AgroBioHeat  AgroBioHeat

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