

CIRCULAIR

CIRCULAIR project overview

Valentin Batteiger, Bauhaus Luftfahrt

BioTheRos Workshop, 06.10.2026



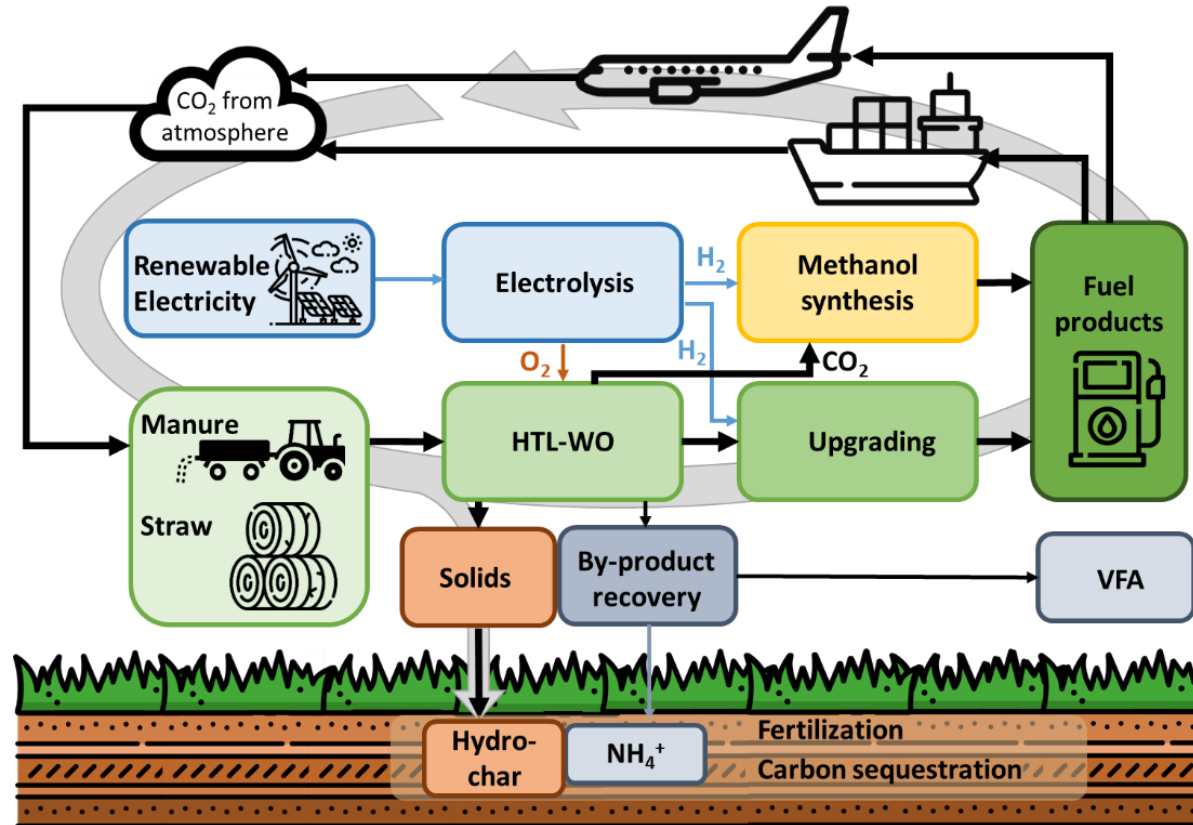
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the European Union



Horizon Europe CIRCULAIR (1/2023-04/2027)



- CIRCULAIR demonstrates the production of jet fuel, methanol and further products from manure and straw via hydrothermal liquefaction (HTL)



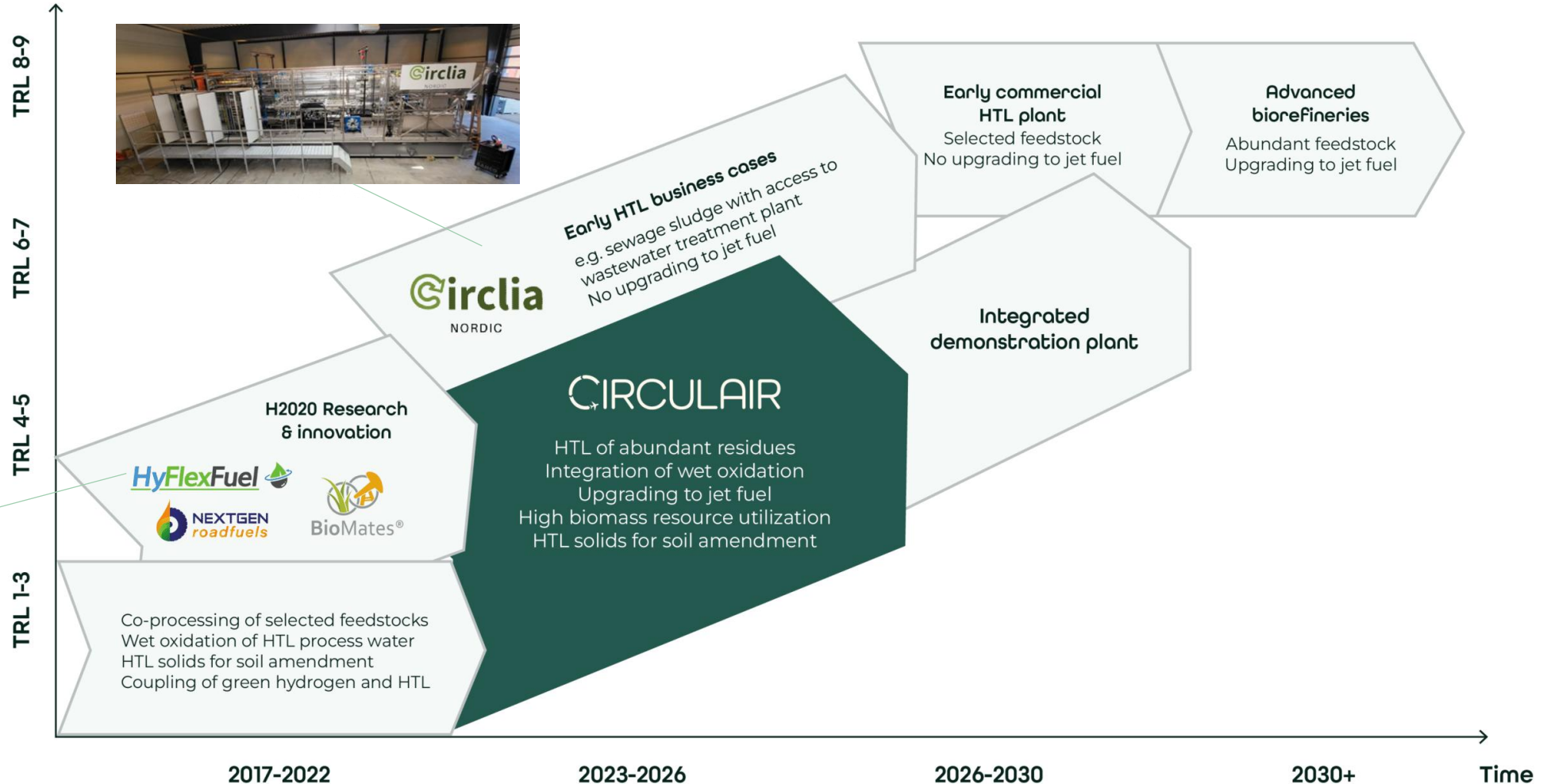
www.project-circulair.eu



HTL: Hydrothermal liquefaction; WO: Wet oxidation; VFA: Volatile Fatty Acids

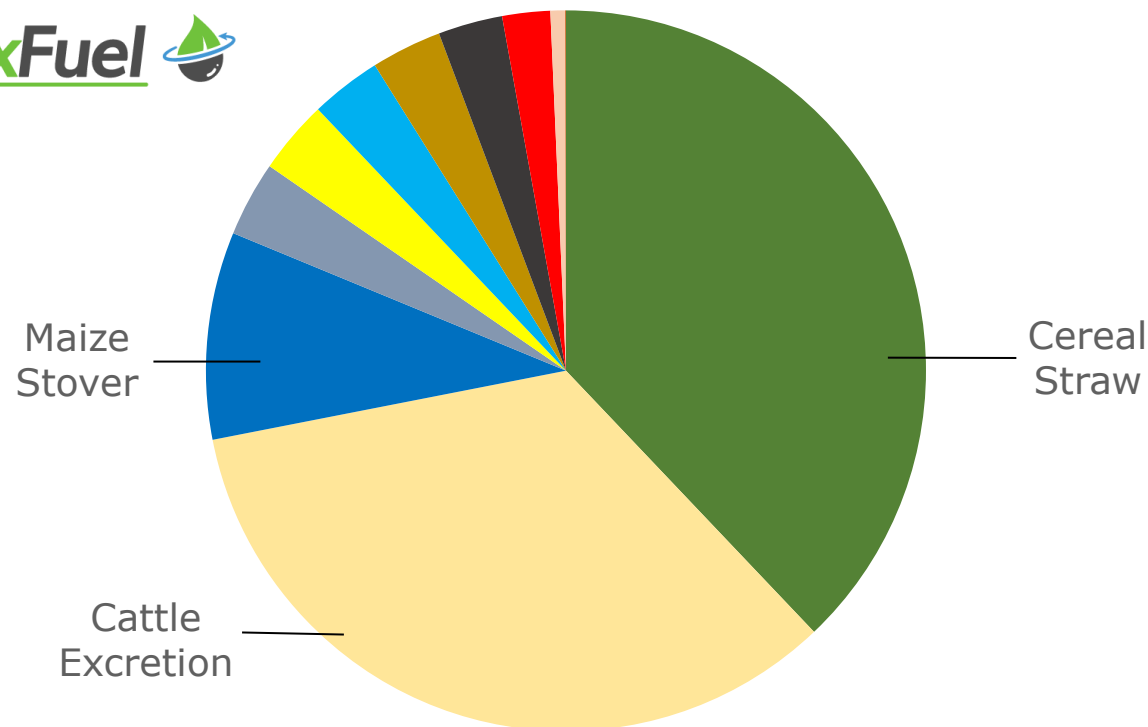
CIRCULAIR Roadmap: Prepare next wave of HTL scale-up

Technology Readiness Level (TRL)



Quantification of feedstock potentials in EU-27 and UK

- Cereal straw, cattle excretions and maize stover more than 80% of selected biogenic residues (forestry excluded here)



	Residue	t/dm	%
	Cereal Straw	111,218,767	37.90
	Cattle Excretions	99,833,871	34.02
	Maize Stover	27,303,796	9.31
	Pigs Excretions	9,894,913	3.37
	Biogenic Municipal Waste	9,701,468	3.31
	Sewage Sludge	9,331,943	3.18
	Oilseed Rape Straw	9,315,992	3.17
	Sunflower Straw	8,495,328	2.90
	Sugarbeet Leaves	6,294,350	2.15
	Rice Straw	1,948,126	0.66
	Poultry Excretions	86,004	0.03
	Total	293,424,558	100.00

Based on maximum technical biomass potential

Source: F. Bellot, DBFZ, HyFlexFuel Final Workshop 2021, https://www.hyflexfuel.eu/wp-content/uploads/11_2021-09-24_HFF_Final_Workshop_DBFZ_v1_Bellot_FINAL.pdf

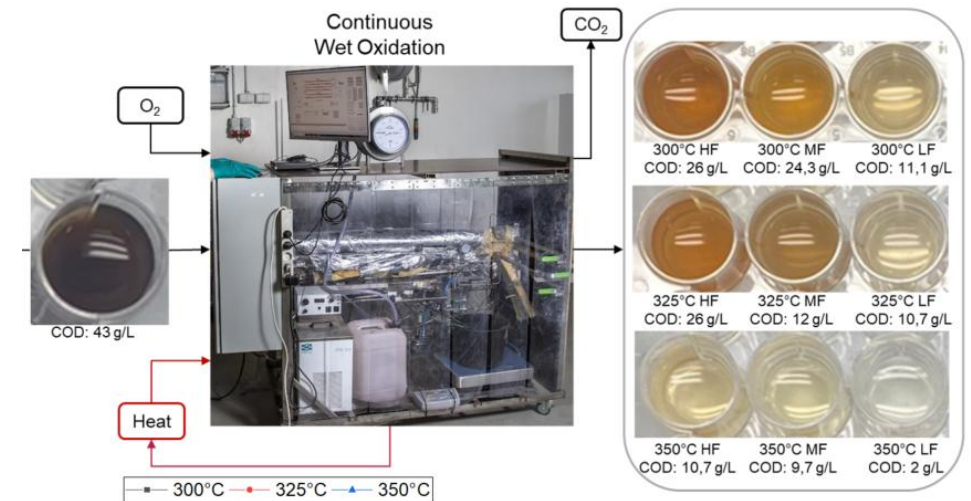
CIRCULAIR Main Objectives

OBJECTIVES

- 1 Develop and demonstrate a **cost-effective pathway** to biofuel production from **abundant feedstock**
- 2 Produce a high share of **on-specification jet fuel** from **HTL biocrudes**
- 3 Prepare near-complete **biomass utilisation** by coupling with **green hydrogen**
- 4 **Enable negative contributions** to the green house gas (GHG) balance of HTL fuel production

Cost-effective path to biofuels from abundant feedstock

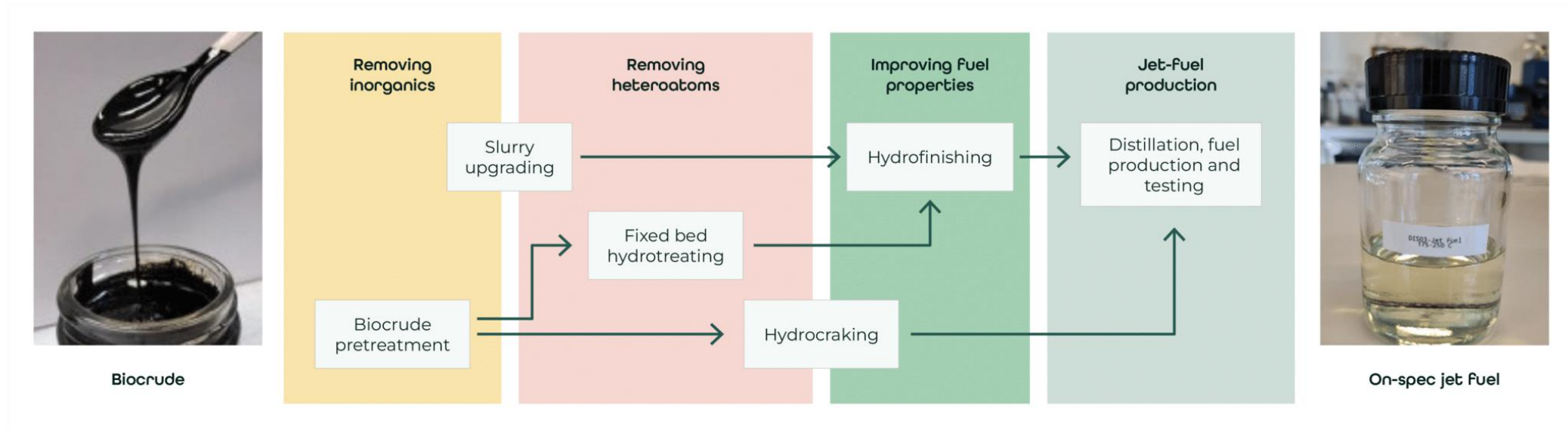
- HTL perceived as prime option for wet waste conversion to biofuels
 - CIRCULAIR: New pilot plant for HTL and wet oxidation (WO) of HTL aqueous phase
- CIRCULAIR addresses HTL's process water challenge
 - Wet oxidation (WO) to reduce COD of HTL aqueous phase
 - Exothermal WO can cover a high share of process heat demand



Sources: Biller; Wet Oxidation as an Enabling Technology for Hydrothermal Liquefaction, pyroliq conference 2023
C. E. Schuck, G. Zoppi, K. Anastasakis, P. Biller, "Continuous wet oxidation of hydrothermal liquefaction aqueous phase: oxidant supply and integration potential", Biomass and Bioenergy, Vol. 202, 2025
<https://doi.org/10.1016/j.biombioe.2025.108192>

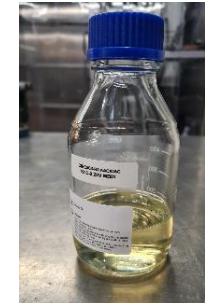
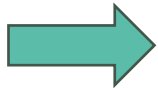
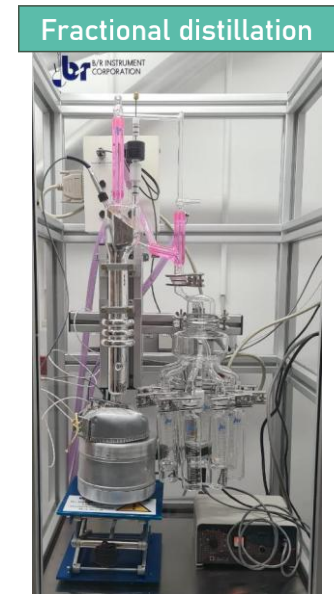
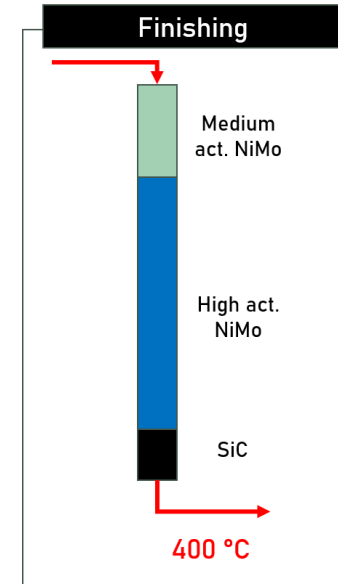
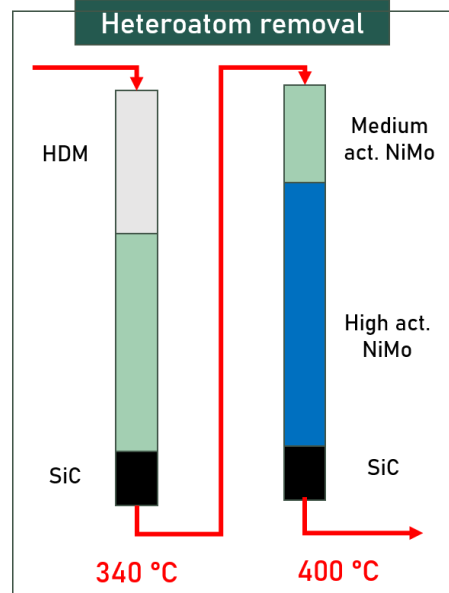
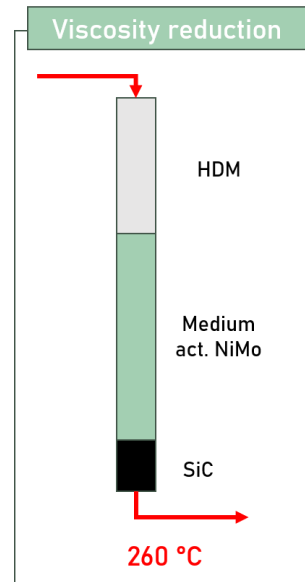
High share of on-specification jet fuel from HTL biocrude

- Tailored upgrading schemes to convert HTL biocrude to jet fuel
 - Achieve a high share of jet fuel by hydrocracking



Focus topic: Upgrading of HTL biocrude to jet fuel

- Multi-stage processing:



ASTM prescreening

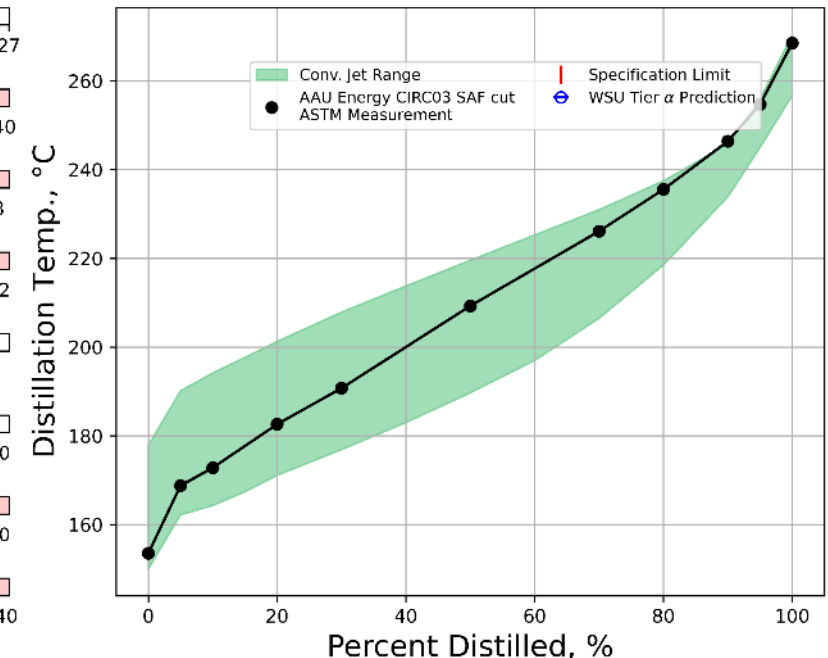
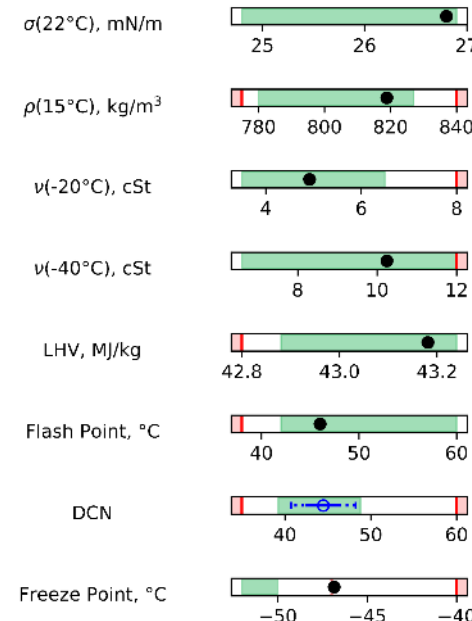
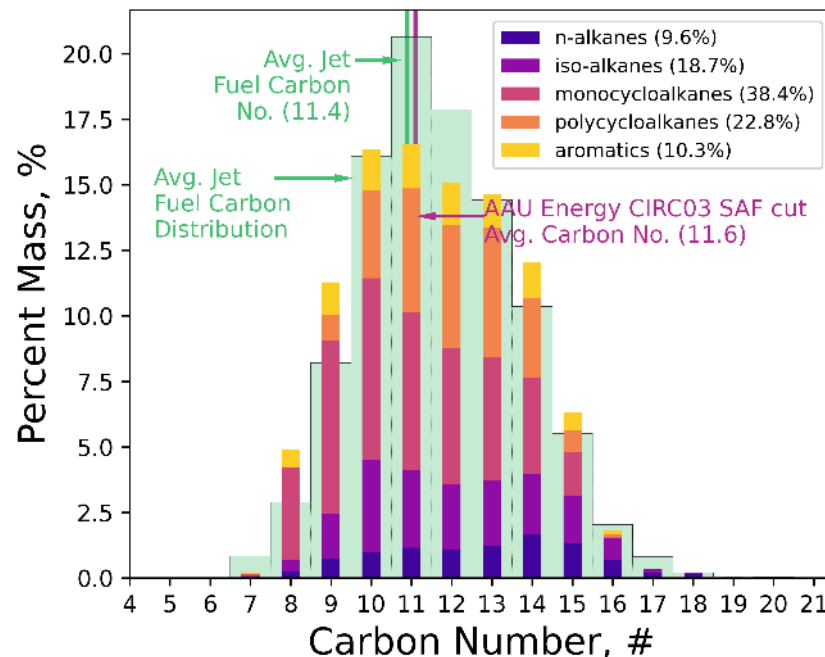


WASHINGTON STATE
UNIVERSITY

Credits: J. Heyne, Z. Yang, J. Zhang

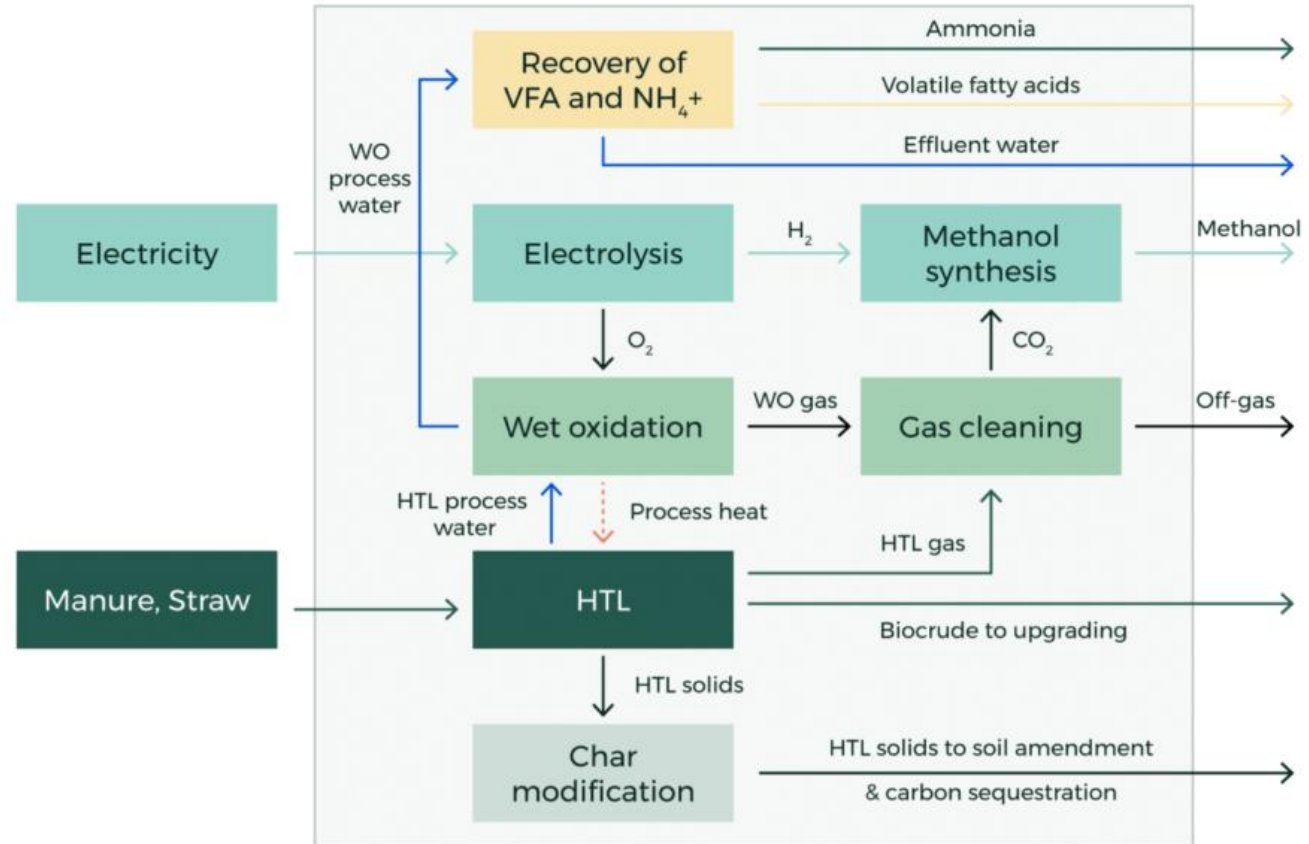


- Maximizing the jet-fuel cut: **134 – 270 °C**
- Obtained jet fraction: **43.1%**
- Prescreening: Properties within ASTM specifications (D7566)



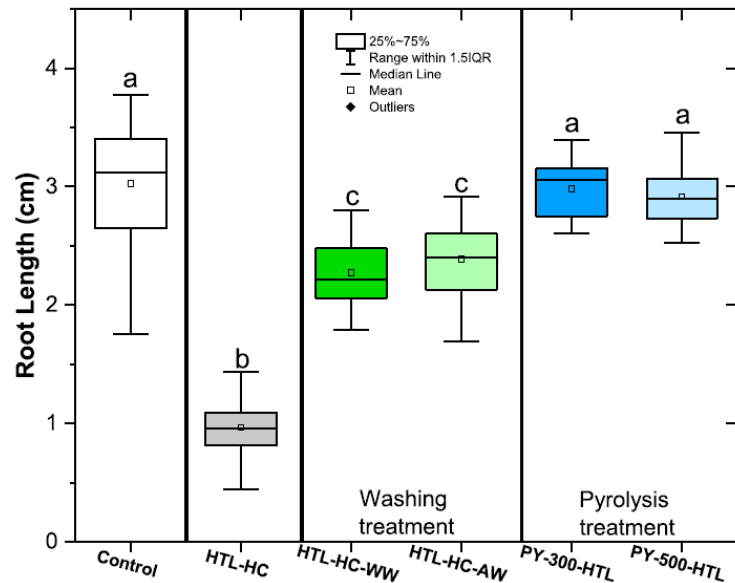
Near complete biomass utilization: Co-product recovery

- Wet oxidation (WO): Energetic use of HTL aqueous phase
- CO₂ recovery from HTL gas and WO gas
- PtX: Use green H₂ to convert CO₂ streams to methanol
- Recovery of VFA and NH₄ from WO process water
- Modification of HTL solids for soil amendment



Negative contributions to the GHG balance of HTL

- Suitability of HTL solids for soil amendment & carbon sequestration



Batista et al,
2025



Pot trials at UHOH, results to be published

- Change in manure handling practise
 - Avoided emissions can exceed forgone credits

Conclusion: Highlights and high-level results

- Pilot plant for integrated HTL-WO designed and commissioned
- Wet oxidation: COD reduction and heat release characterized
- Jet fuel samples produced and characterized ($N < 2$ ppm).
- Aqueous phases: Co-product recovery schemes developed
- Gas phases characterized, CO_2 purification schemes developed
- HTL solids: Treatment methods developed, soil amendment trials
- Process models for system analyses developed

For details see:

<https://project-circulair.eu/publications/>
<https://zenodo.org/communities/he-circulair/>

CIRCULAIR Dissemination

CIRCULAIR Online Workshop on Jet fuel production from HTL 19 October 2026

The CIRCULAIR project invites to an online workshop with topic: **Sustainable Aviation Fuel from Hydrothermal Liquefaction: Conversion Technologies, Fuel Qualification and Commercialization.**

This workshop will take place on **Monday, 19 October 2026 from 16:00 to 18:45 (CEST).**

Registration is now open.

[CIRCULAIR online workshop | Register](#)

Hydrothermal liquefaction (HTL) is a feedstock flexible biomass conversion technology that is in particular attractive for wet residue and waste streams. The first session of the workshop will focus on research and development of conversion technologies for the upgrading of HTL biocrudes to sustainable aviation fuels. The second session will be focused on fuel qualification for use as an aviation turbine fuel and commercialization perspectives.



CIRCULAIR video

CIRCULAIR develops innovative conversion technologies to produce sustainable fuels from abundant agricultural residues through hydrothermal liquefaction.

[LEARN MORE ABOUT THE PROJECT](#)

Workshop registration:

<https://project-circulair.eu/online-workshop/>

Project video:

<https://project-circulair.eu/>

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Thank you!

For questions,
please contact:

CIRCULAIR

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