



**IEA Bioenergy**  
Technology Collaboration Programme



## International trends in gasification - IEA Bioenergy Task 33

Jitka Hrbek, BOKU

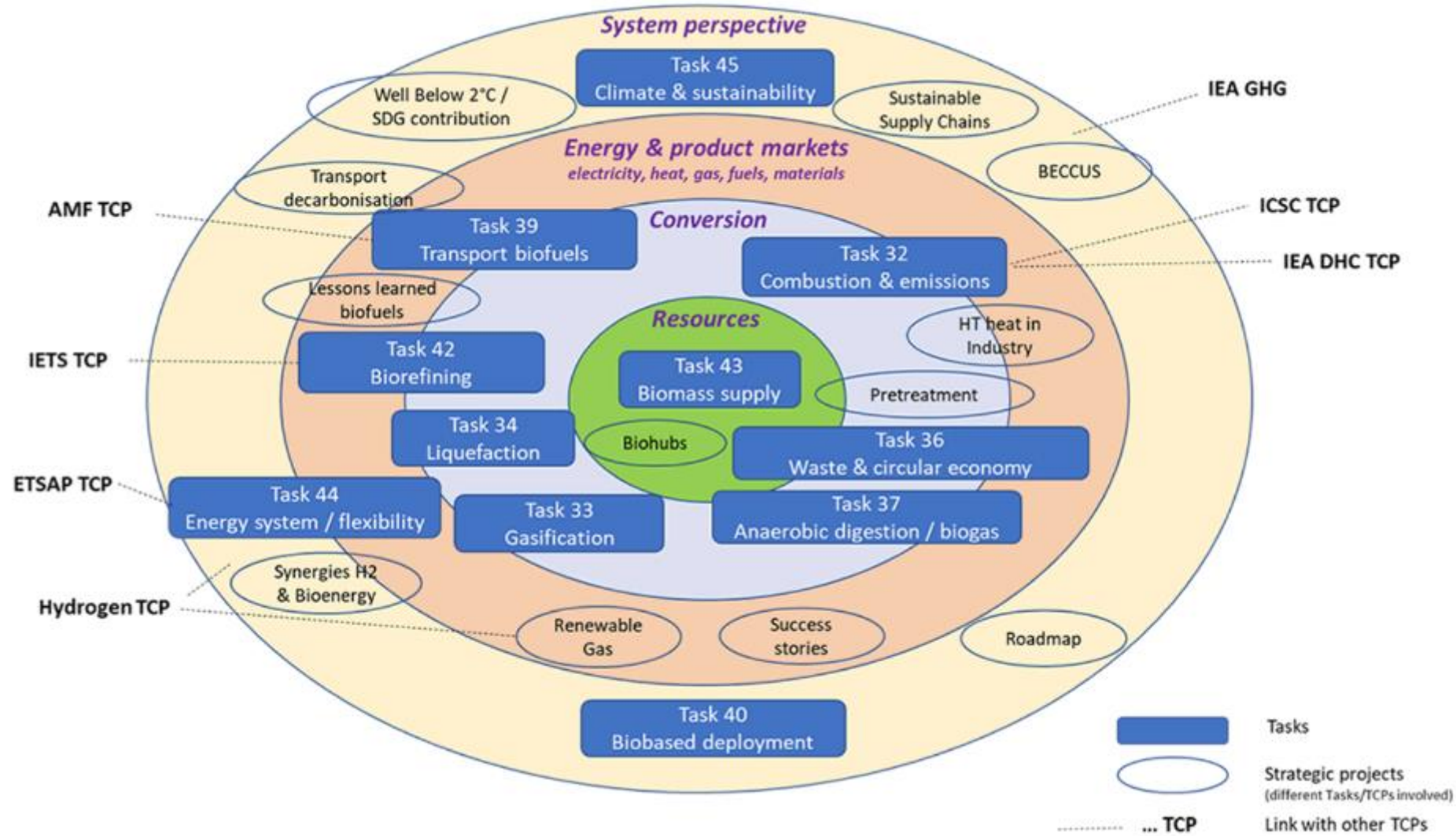
12. March 2025, Vienna

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# Outline

- What is IEA Bioenergy / Task 33
- Selected gasification facilities - overview
- Observations
- Conclusions / Recommendations

# IEA Bioenergy at a glance



# IEA Bioenergy Task 33

## Gasification of Biogenic and Waste Feedstocks for a Sustainable Future

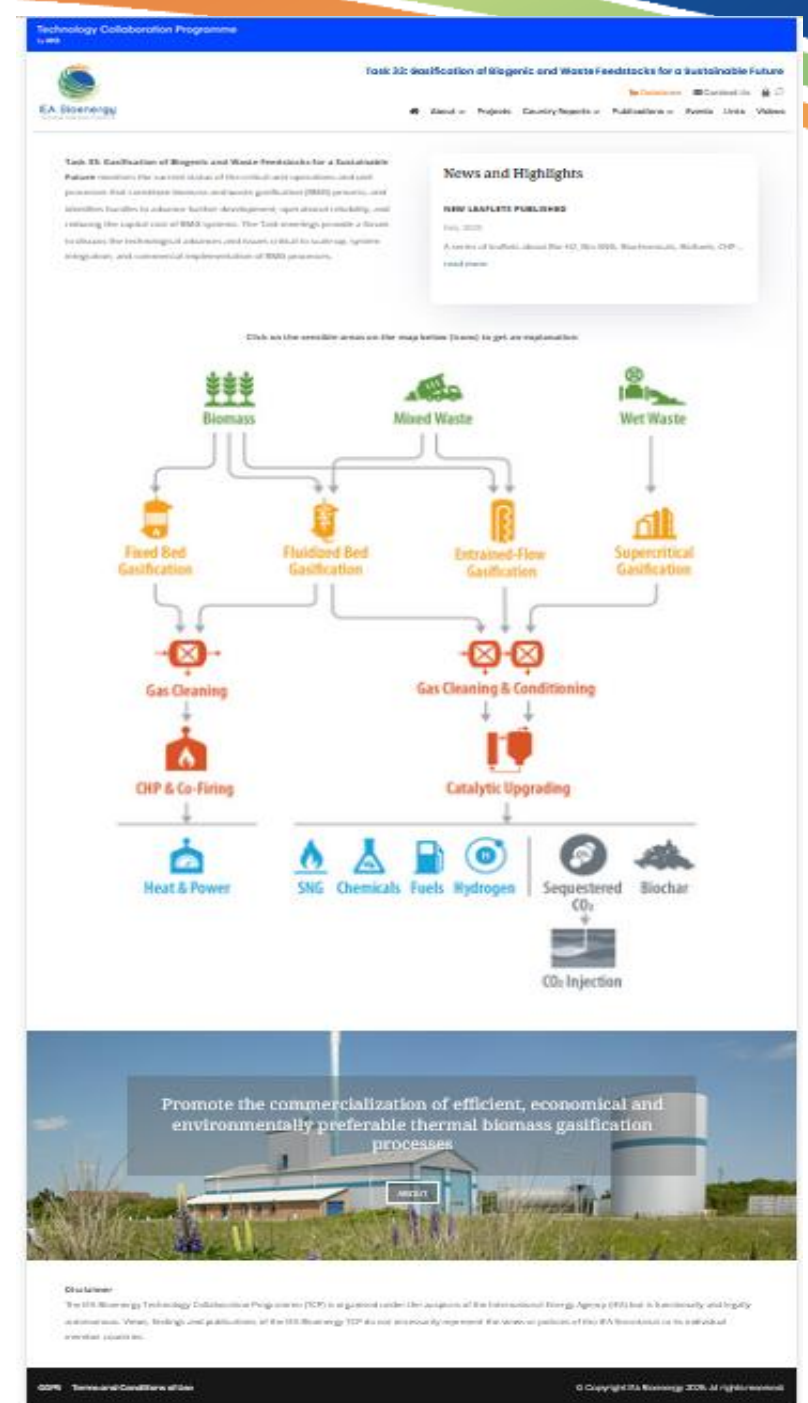
<https://task33.ieabioenergy.com/>

### Aim:

- Information exchange on thermochemical gasification (workshops, webinars)
- Monitoring of current status of gasification facilities (database)
- Identification of hurdles to advance further developments (Task projects)

Member countries: AT, BE, CA, CN, DE, FR, GB, IT, NL, SE, US

Lead / Co-lead: Jitka Hrbek, BOKU / Joakim Lundgren, LTU



Technology Collaboration Programme  
Task 33: Gasification of Biogenic and Waste Feedstocks for a Sustainable Future

News and Highlights  
NEW LEAFLETS PUBLISHED  
Feb. 2022  
A series of leaflets about the 10, 20, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%...  
read more

Click on the visible areas on the map below (zoom) to get an explanation.

Biomass Mixed Waste Wet Waste

Fixed Bed Gasification Fluidized Bed Gasification Entrained-Flow Gasification Supercritical Gasification

Gas Cleaning Gas Cleaning & Conditioning

CHP & Co-Firing Catalytic Upgrading

Heat & Power SNG Chemicals Fuels Hydrogen Sequestered CO<sub>2</sub> Biochar

CO<sub>2</sub> Injection

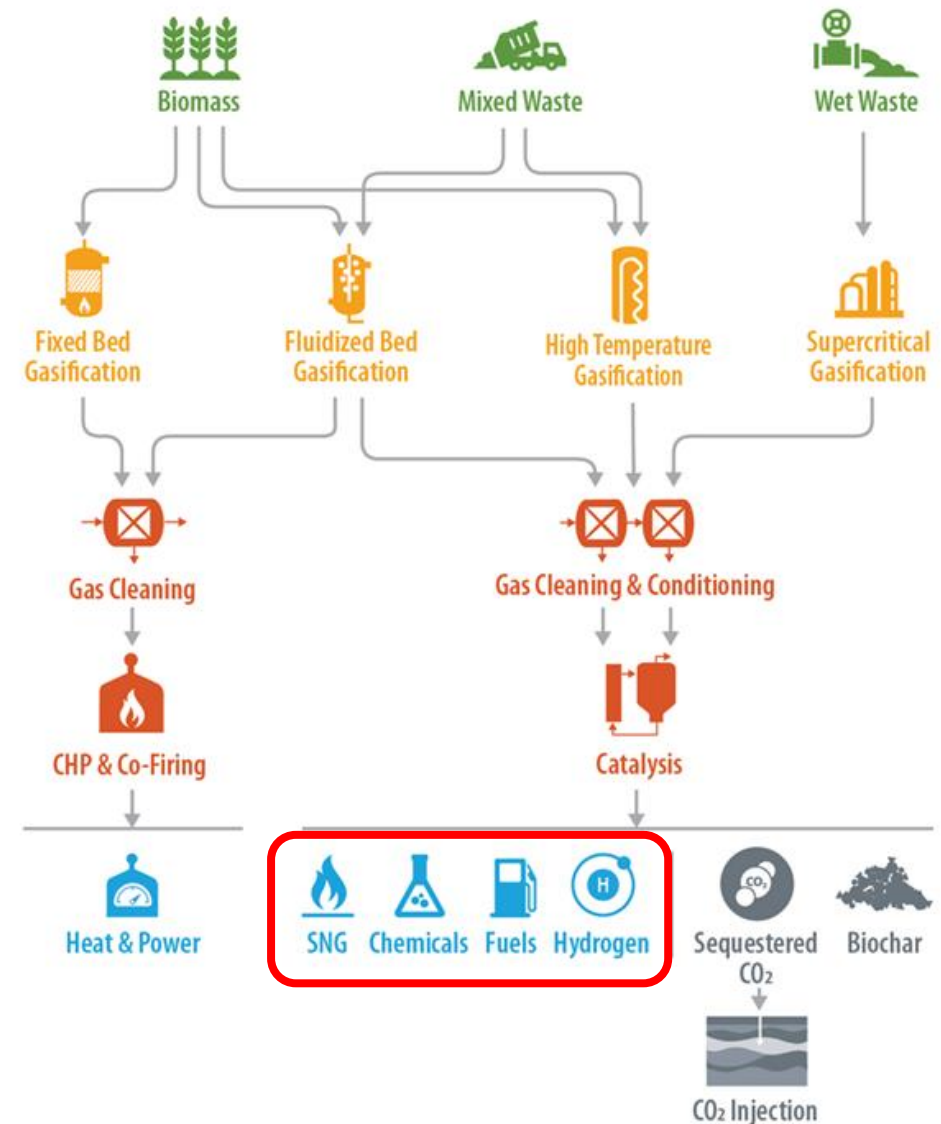
Promote the commercialization of efficient, economical and environmentally preferable thermal biomass gasification processes

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# Status of gasification

- In the past decades the gasification in small scale was booming. Nowadays, over 1700 operational gasification plants (CHP) can be found in Europe.
- As the CHP is already established technology, RD&D focuses on production of SNG, biofuels, biochemicals through gasification.



# Overview on selected gasification facilities in Europe, USA, Canada and China



# ABSL - Swindon UK



- Fluidized oxy-steam gasifier, connected to a plasma torch for syngas production (RadGas technology)
- Input RDF and waste wood
- Output SNG (1 500t/y), H<sub>2</sub> (500t/y)
- Status → First syngas produced in Jan-2024

# KEW Technology, Wednesbury, UK



Demonstration of end-to-end waste-to-X pathways

Pressurized - 7 bar, bubbling bed gasifier, air/steam/oxygen blown

Input: 15 000t/y waste

Output: DME, hydrogen, el. power

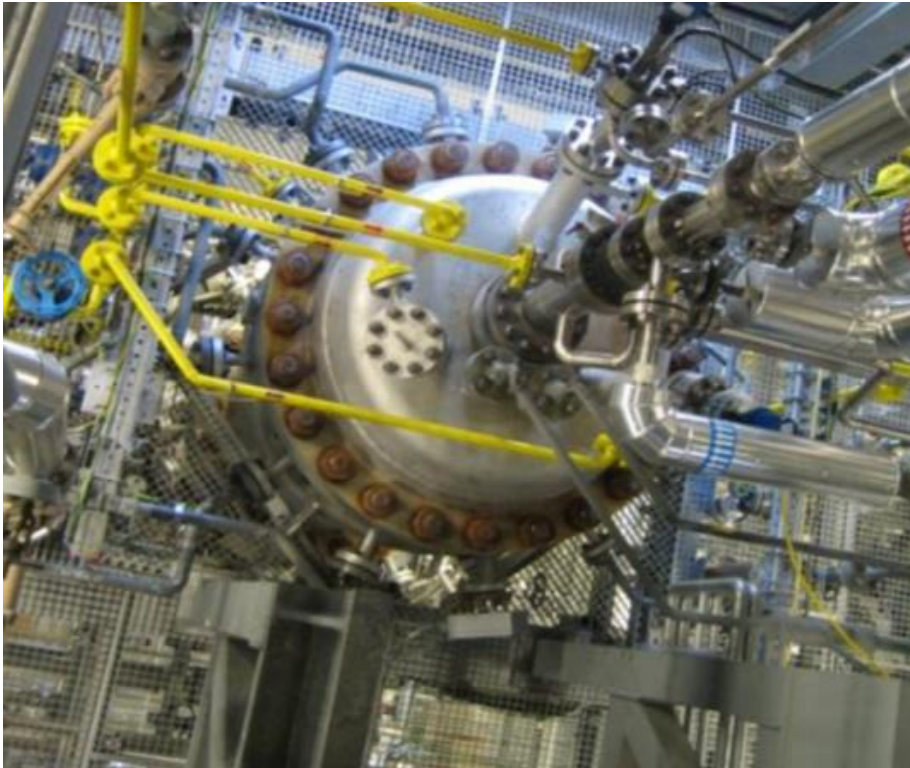
Investment: £ 50 Mio

Start-up: 2021



# Bioliq® High-pressure entrained flow gasifier

Top view of the Bioliq® syngas platform



- High pressure entrained flow gasifier
- Pressure 40 / 80 bar (abs)
- Capacity 5 MW<sub>th</sub>
- Gasoline type fuels from biogenic pyrolysis oil slurries
  - De-centralized pyrolysis of waste residues, centralized gasification
- Operational since 2014, **shut down End 2024**

# GoBiGas Indirect gasifier for SNG production



## Gobigas - on hold/mothballed

- FICB bed gasifier, provided by Repotec/Valmet
- $32 \text{ MW}_{\text{th}} \sim 50 \text{ ktpa}$  dry feedstock
- Green Gas  $20 \text{ MW}_{\text{SNG}}$
- Proj. start and operation: 2005-2018
- Successful demonstration, however next phase - commercial facility cancelled

# Engie - Salamandre project

**Salamandre project: ENGIE's first commercial project of SNG from gasification to be installed in Le Havre**

Project led by:

**storengy** (100% ENGIE subsidiary)

Partners:



Localization :



Le Havre



**Salamandre:**

Produce, on an industrial scale, a low-carbon synthetic gas that can be injected into the network or used as fuel (synthetic LNG), from solid fuels



**170 GWh of SNG / up to 11 ktpa of synthetic LNG** - For heavy / maritime transport and intensive industries  
**+ ~40 GWh of renewable heat** - For industries and urban networks



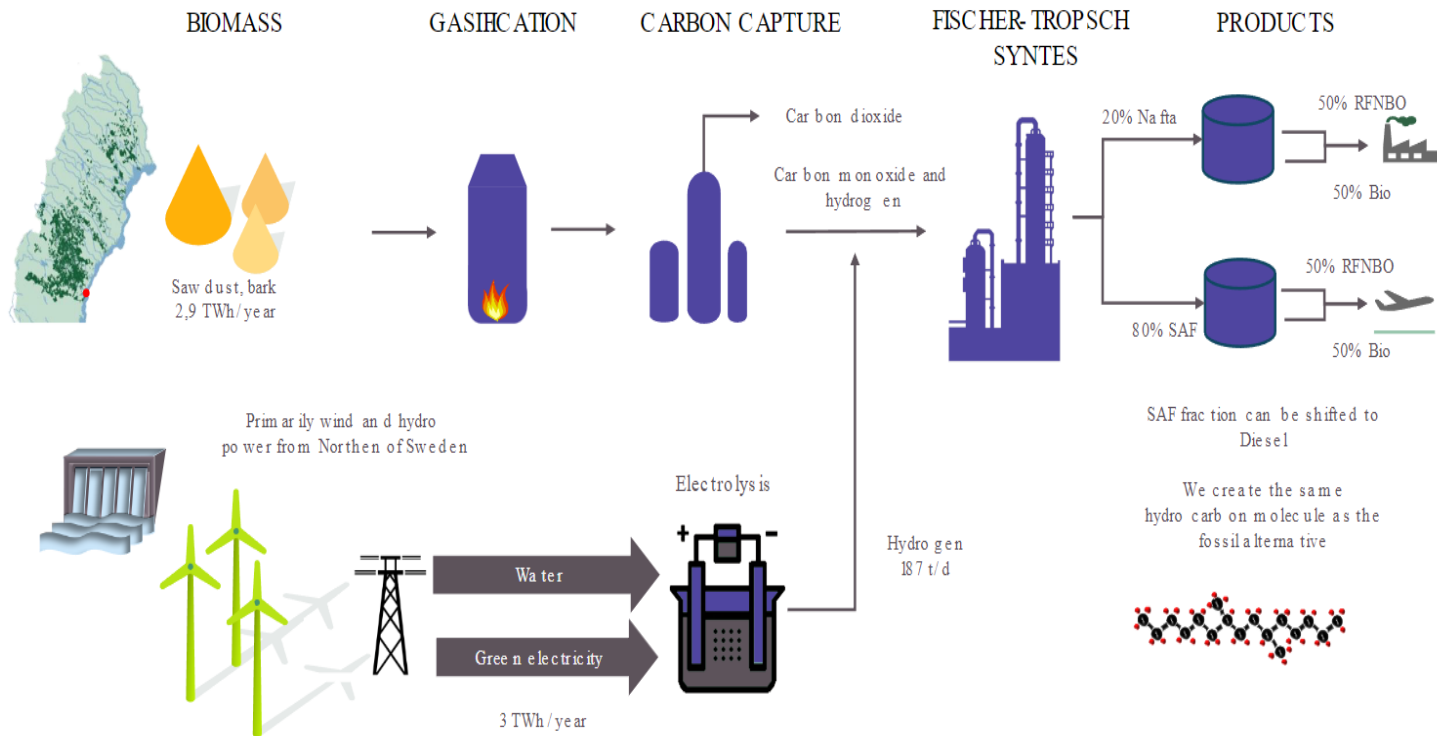
**70 000 t/year of non-recyclable waste recovered** - Supplied regionally, otherwise exported, incinerated or landfilled



From TRL 8 to 9  
Replicability of the solution

Status unclear

# Biorefinery Ostrand - Sweden (SCA and St1)



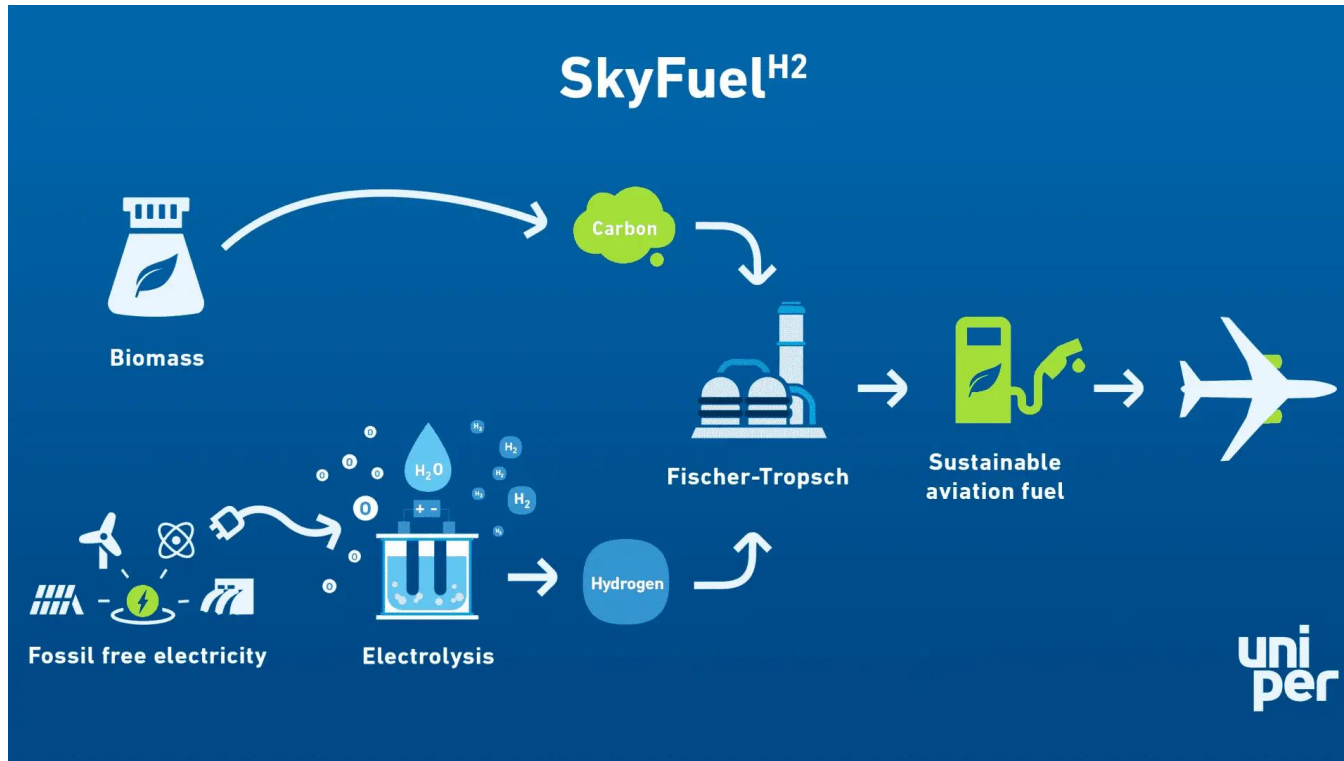
## SAF pathway combined with PtX

- Entrained flow gasification combined with torrefaction.
- 2.9 TWh/y ~ 400 MWth input
- PtX = 400 MW<sub>electrolyser</sub>
- Product = SAF + Nafta
- Integration with a pulp mill

Hydrogen from electrolysis allows to double amount of SAF



# SkyFuel<sup>H2</sup> - Sweden (Uniper)



SAF pathway combined with PtX

- Entrained flow gasification combined with torrefaction.
- ~ 100 MWth input of biomass
- PtX = 200 MW<sub>electrolyser</sub>
- Product = SAF + Nafta

Cancelled due to missing regulations to support SAF,  
no longer commercially viable

# RWE - FUREC project



## Von der Müllverbrennung...

Der meiste Restmüll aus der grauen Mülltonne wird immer noch verbrannt.

Wie toll wäre es, wenn wir Restmüll wiederverwenden könnten?

## zur stofflichen Verwertung.

Das FUREC-Projekt kann **Wasserstoff** aus Restmüll aus der grauen Mülltonne für Chemelot herstellen. Müll wird so zum Rohstoff für die chemische Industrie.

Der zirkuläre Wasserstoff ersetzt jährlich 280 Millionen Kubikmeter Erdgas. Das ist der Verbrauch von fast der Hälfte der Limburger Haushalte. Und es spart auch 400 Kilotonnen CO<sub>2</sub> ein.

Dank FUREC kann die Industrie mehr nachhaltige Produkte herstellen. Auf dem Weg zu einer zirkulären Wirtschaft.

FUREC umfasst zwei zu errichtende Anlagen in den Niederlanden, die Restmüll in „zirkulären“ und grünen Wasserstoff umwandeln (Quelle: RWE)

## RWE - FUREC project

- Torrefaction of waste
- EF gasification
- MSW input 700 ktpa
- H<sub>2</sub> produced 54 ktpa
- CO<sub>2</sub> avoided 380 ktpa
- Status: Under development
- Costs: ~600M€

# Fulcrum Bioenergy / Sierra Biofuels, US



- TRI Indirectly heated gasifier (heat pipes)
- BP Cans technology for FTS
- 350 ktpa MSW → 175 ktpa feed
- Status: Plant has been commissioned.
- Costs ~ 1 bnUSD

Status unclear



# Enerkem - Varennes, CA



- Enerkem BFB gasifier coupled to an electrolyzer (90 MW)
- first-ever waste-to-biofuel facility
- Input: 200 kt/y waste feedstock
- Product biofuels (MeOH) - 38 mio L/y
- Commissioning: 2025
- Costs ~ 700 M€

Combination of gasification and PtX.



## Special case - China

Company	Scale and technique route	Location	Status
China National Chemical Engineering Group Corporation Ltd.	1 million ton of methanol per year (0.2 million ton in the first-stage project); Biomass steam gasification	Yancheng, Jiangsu, China	Under construction
Debo bioenergy Ltd.	0.15 million ton of methanol per year. Biomass steam+oxygen gasification	Ruijin, Jiangxi, China	Under construction
Sany Group	0.37 million ton of methanol per year. Biomass gasification integrated with electrolysis of water	Changlin, Jilin, China	Signed a contract

- **32 green methanol** projects are planning or under construction in China, most of which applies biomass gasification.
- It is estimated, by 2025, China shares more than **60%** of global green methanol production, and by 2028, more **than 8.7 million** tons of green methanol will be produced by China.

# Observations

- EU plans for Green Gas production are not covered by the operational/under construction/planned projects
- In Europe, hydrogen and SNG production is actual, SAF as well
- Combination of gasification and PtX to double/triple the product is a good way
- USA is investing massively in SAF
- China is going to be a significant player in gasification
- Most technologies try to go to syngas asap

# Conclusions

- To have a successful project, solid scientific track record and remaining support is necessary
- Proper piloting and maintaining that basis is crucial in any technology development.
- Business case needs to be valid today but also 10-15 years into the future
- To be in charge of your own feedstock pre-treatment is a big advantage
- Flexibility to switch feedstock and/or application, both a strength as well as weakness
- Combination of gasification with hydrogen from Power-2-X offers to double/triple the product

# Recommendations

- Frame for gasification for advanced gases and fuels is necessary
- European Centre of Excellence on Gasification to develop and maintain competence to support developments and avoid mistakes, killing projects would be a great benefit
- The perfect synergy between biofuels and e-fuels needs stronger focus on all levels, from R&D to deployment.



**Thank you for your attention**

[Jitka.Hrbek@boku.ac.at](mailto:Jitka.Hrbek@boku.ac.at)

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