SYNGERGIES BETWEEN BIO-FUEL AND E-FUEL PRODUCTION

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Renewable Energy Directive II (RED II)

- Criteria on sustainability and greenhouse gas savings
- Target for renewable transport fuels
  - 14% in 2030, of which 3.5% advanced biofuels
This translates to 100 plants of 200 million liters capacity*
  - Or 300-400 plants at 200Mwth capacity
We need to bring technology to the market today!
  - Accelerate the development, build demo’s

*Fuels Europe Statistical report 2018 and
GAIN Report Number:NL1902 - EU Biofuels Annual 2019
Electrofuels for the transport sector: A review of production costs

Selma Brynolf, Maria Taljegard, Maria Grahn, Julia Hansson

https://doi.org/10.1016/j.rser.2017.05.288
BIOPROCESSES

CO₂ → H₂ → E-fuels

Circular biomass → Bio process

Heat → Power → Chemicals

Fuels

CO₂

H₂ - Hydrogen

E-fuels

Fuels

Circualr biomass

Heat

Power

Chemicals

H₂
TNO developed a unique gasification technology

- Highly flexible - cater for different feedstock types;
  - agricultural-, selected municipal- and / or plastic waste streams;
- Product gas can be used to:
  - Generate electricity;
  - Generate heat;
  - Produce chemicals;
  - Produce green gas and / or bio-fuels;
- Can be scaled, high efficiency, weather independent;

- Source of CO$_2$
- Can be integrated with e-fuels
GASIFICATION OPTION

$\text{CO}_2 + \text{H}_2 \rightarrow \text{Biochemicals}$

$\text{Biofuels}$

$\text{Renewable gas}$

$\text{Heat & power}$

E-fuels
INTEGRATION OPTIONS

CO₂ → Fischer-Tropsch → LPG, Gasoline, Jet-fuel, Diesel, Waxes, Olefins

CH₄ → Syngas (CO + H₂) → Methanol → DME, Acetic acid, Formaldehyde, MTBE

Syngas (CO + H₂) → EtOH, i-C₄, H₂ → Aromatics, Mixed Alcohols, Ammonia
USP: In-situ removal of Steam by adsorption, increased conversion efficiency

Driver:
› Increase DME production and efficiency in one pass

Current project:
› SEDMES: Sorption-enhanced DME synthesis (in situ removal of steam by adsorption)
› Interreg E2C: pilot demonstrator at TRL6 of coupled 50 MW electrolyser sorption enhanced DME synthesis to 3 kg/hr DME
CONCLUSIONS

- It is a huge challenge to bring substantial amounts of renewable fuels to the market
- There is an urgency to start building demo’s and plants as soon as possible
- Different high TRL technologies exist

- One option is to use gasification for green gas production
  - High TRL
  - Has future BECCS / BECCU options
  - Source of “pure” CO2 that can be integrated with green hydrogen

- Cost price of e-fuels are very dependent on cost of electricity
- Biofuels are very dependent on cost of biomass