ADVANCEFUEL

Status of Conversion Technologies and How to Get There

Stakeholder Webinar, 2/6/2020
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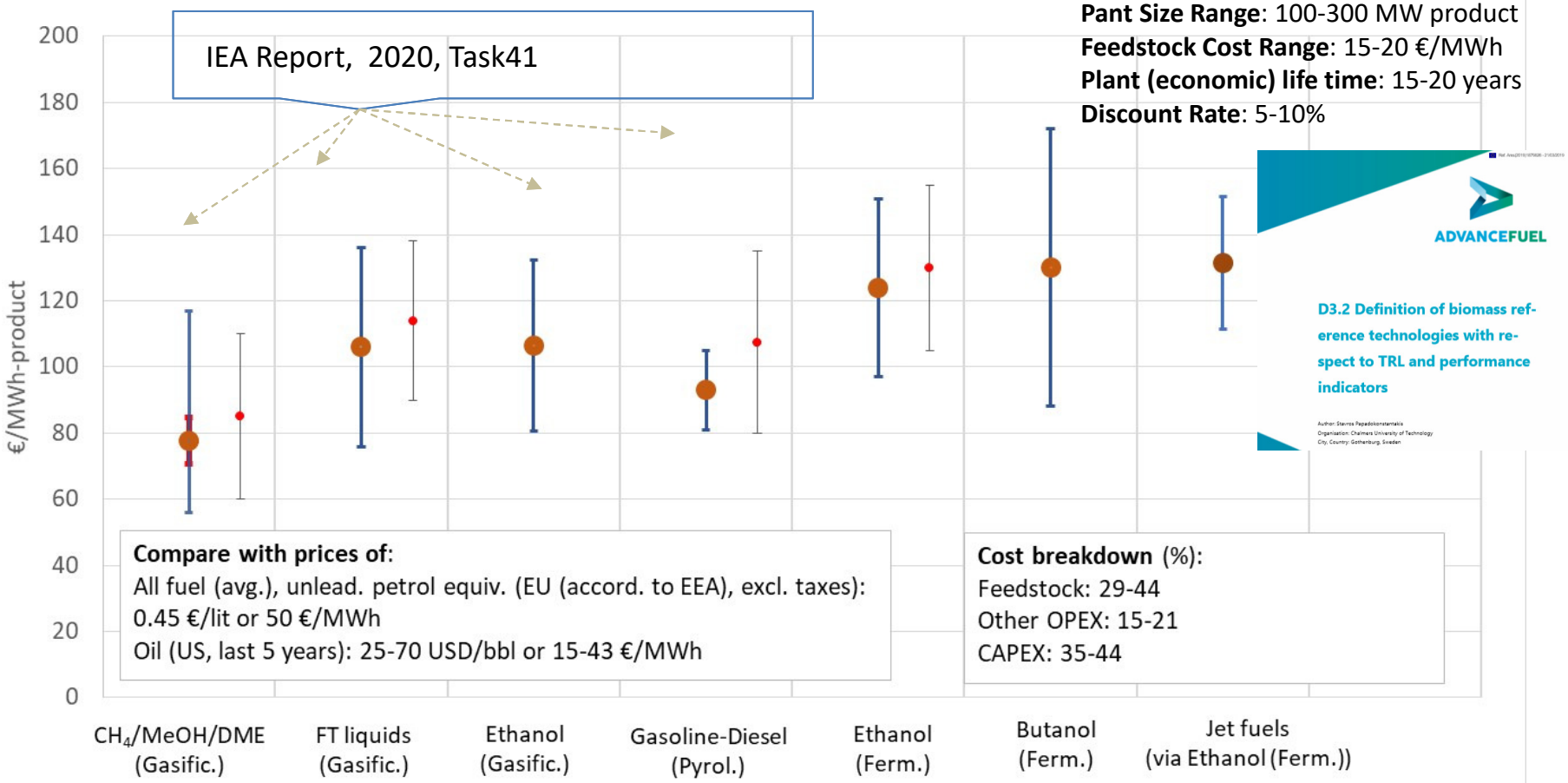
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N.° 764799.

Current Status: Production Cost



TRL varies from 6-9, ethanol via fermentation and methane/methanol/DME via gasification being at the upper end, while jet fuels via ethanol and ethanol via gasification being at the lower end.

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Current Status: Main Conclusions

- There is a **significant gap** between the production cost of advanced biofuels and the price of conventional fossil fuels of at least **20 to 40 €/MWh-product**.

- At an initial phase, this can be achieved via subsidies, but in the long run **the cost to use fossil fuels must be (become) higher than the cost to use biofuels** (e.g., via additional CO_2 taxes for fossil fuels)**.**

- **Feedstock cost** is a large share of production cost, which can have important implications on policy measures (i.e., use of biomass in several sectors may drive up biomass prices), so that biofuels may need to be **sourced to sectors** where **substitution** away from carbon based fuels **is difficult** or costly.

- To limit the fuel production cost, it should be secured that **commercially available process technologies** (for the different process steps including product upgrading) will require units of a **sufficiently large size**.

- **High capital cost for the required large-scale production** implies high financial risk.

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Scope for CAPEX Reduction: Multi-component learning by doing approach

Technology	Value	Range
Learning rate (LR)		
Gasification Step	0.05	0.02
Liquefaction Step	0.05	0.02
Gasifier (in Gasification Step)	0.15	0.05
Cumulative installed capacity (CIC)		
Gasification Step	200 MW	
Global nominal liquefaction capacity	570,205 MW	
Cumulative annual growth rate (CAGR)		
Gasification Step	0.06	0.02
Liquefaction Step	0.05	0.02

Example: Liquid biogas production

- The process Biomass -> Syngas ->Biogas->Liquefied Biogas is divided into **two steps** (Gasification/Liquefaction)

- In **each step**, **process components** are **individually analysed**,where appropriate (e.g., air separation for direct gasification)

- **Scenarios for annual growth rates** are constructed (A: based on current, conservative trends, B: based on satisfying future targets)

$$C(Q_t) = \sum C(Q_{0i}) \cdot [\frac{Q_t}{Q_0}]^{-b(i)} = C_{01}[\frac{Q_{t1}}{Q_{01}}]^{-b(1)} + C_{02}[\frac{Q_{t2}}{Q_{02}}]^{-b(2)} + \cdots . + C_{0n}[\frac{Q_{tn}}{Q_{0n}}]^{-b(n)}$$

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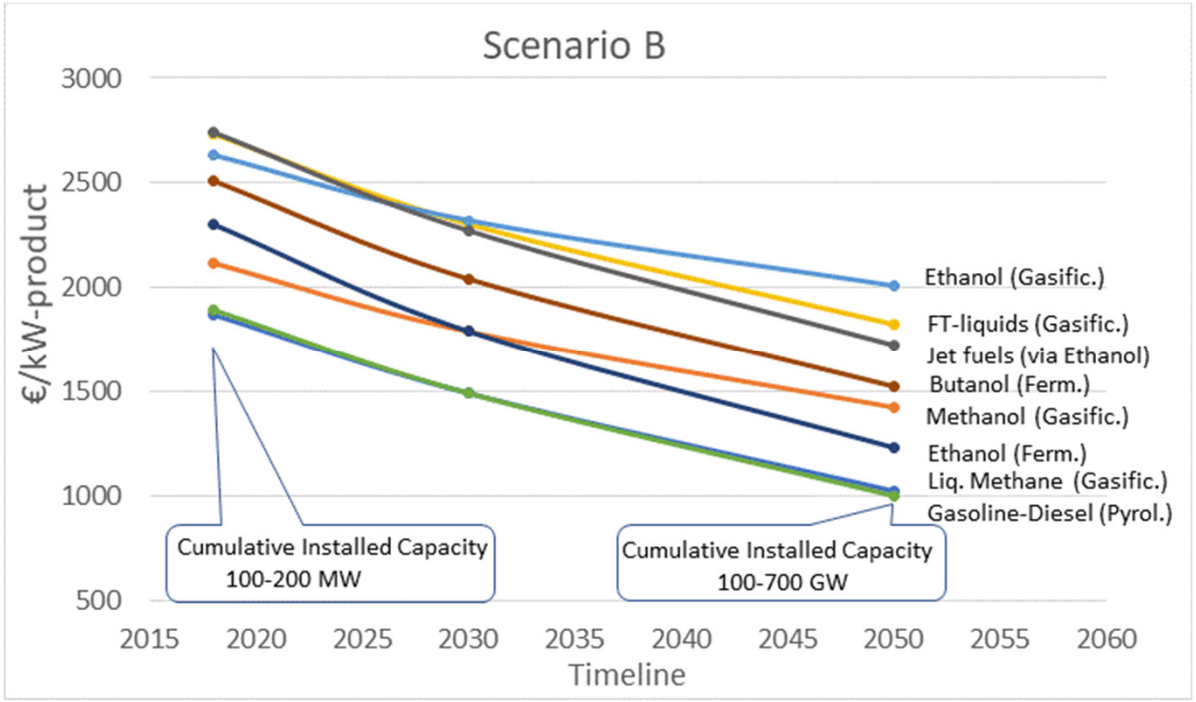
Scope for CAPEX reduction



CAPEX reduction up to 40% can only be expected for substantial increase of installed capcity (i.e., 1000-4000 plants) until 2050 (consistent with targets for 20-25 % advanced liquid biofuels in sustainbale transportation).

For lower capacity growth rates (e.g., scenario A) or short-term (2030), expected cost reductions range from 10-20%.

To ensure **high full-load** hours, requires experience (learning by doing)

The main part of **reductions in investment costs** can be expected in **"assembling" of plants**

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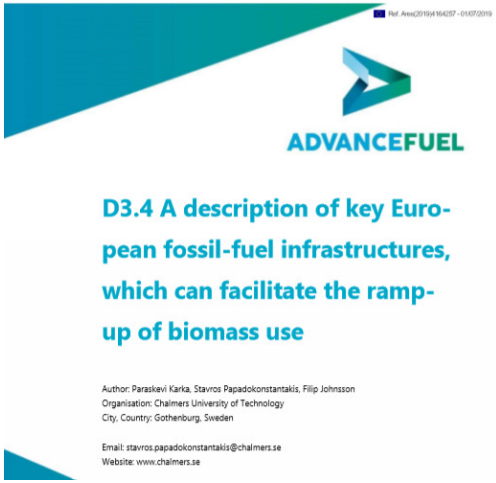
Integration to Existing Infrastructures

Examples of CAPEX reduction (compared to stand-alone advanced biofuel plants)

- **15-40%** by co-processing biogenic feedstock (e.g., bio-oil, FT-waxes) in crude oil refineries
- **Up to 50%** by co-location of 1st and 2nd generation bioethanol plants
- **Up to 50%** by transforming boilers (e.g., for district heating, pulp mills) into gasification systems (increases also 2.6 times the existing boilers' performance)



Black dots: existing coal power plant sites that are assumed suitable for construction of bio-oil units and/or biomass co-firing as stepping-stone for development of biomass market and infrastructures
Purple dots: oil refineries identified as suitable for biobased feedstock (i.e., co-processing of bio-oil)
Coloured areas: feedstock used to cover the demand (200 km transport limitation)

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Integration to Existing Infrastructures
Other steppingstone options

- **Other technological options**, such as co-firing or combined heat and power in district heating networks, which combine bio- and fossil-based infrastructures **can contribute indirectly** to the ramp-up of **biomass use**.
- Even if these options are **not a priority of the ADVANCEFUEL project**, as they do not focus on the production of liquid biofuels themselves, they can indirectly contribute to enable environment for the development of **biomass market and infrastructures**.
- When the **existing solid fuel supply infrastructures** (road and water way transportation) and the onsite thermal plants, coal power plants and combined heat and power plants are **phased out**, the sites can be partially or fully **replaced by pyrolysis units** for the production of **intermediates** which can be transported to refineries.
- To use existing infrastructure also includes **taking advantage of existing knowledge and know-how on thermal processes** as well as utilizing existing sites which keeps transaction costs low.

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Thank you for your attention

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