

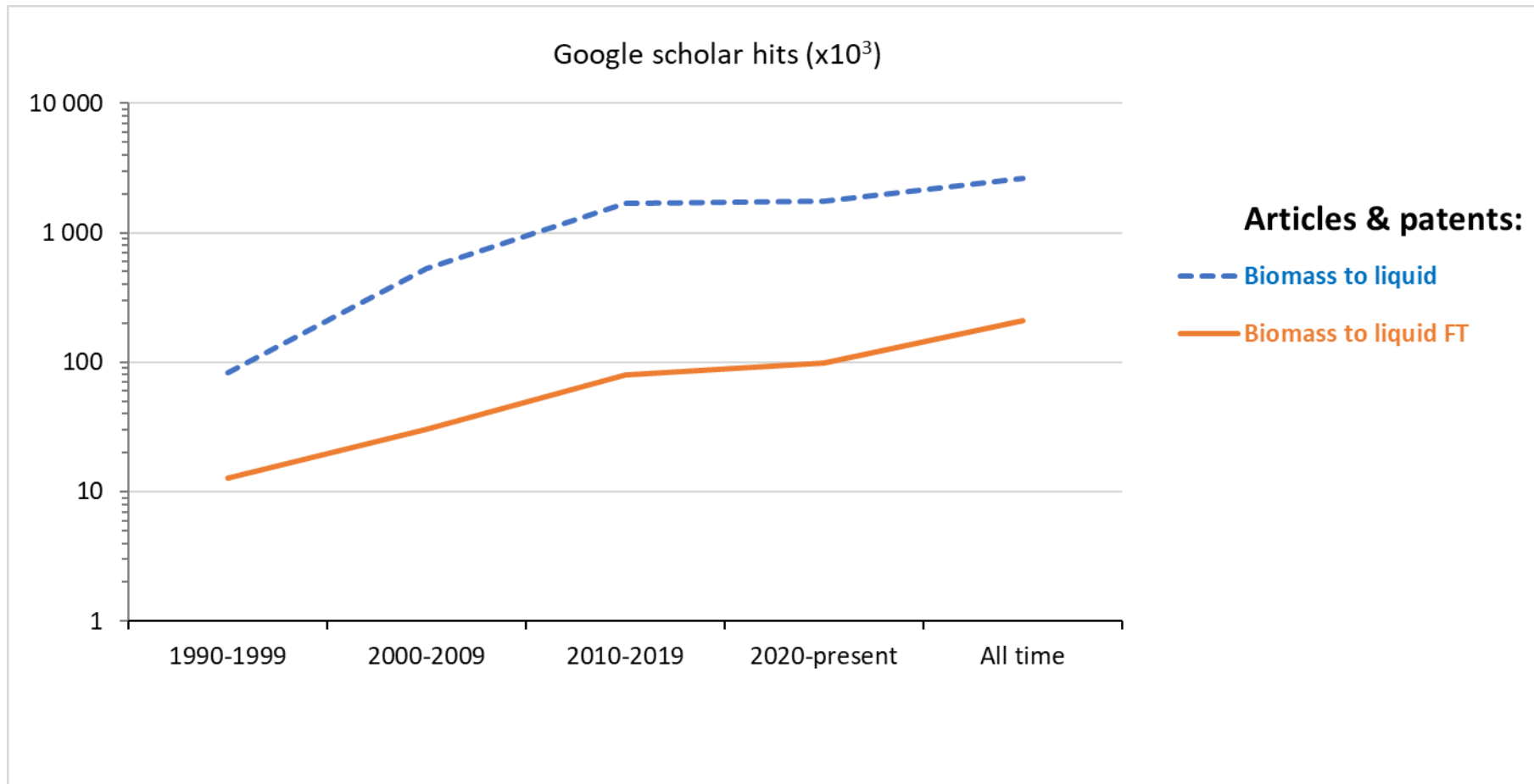
# Biomass to liquids via Fischer-Tropsch:

## **A brief review of recent developments**

**Sennai Mesfun**

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# Literature

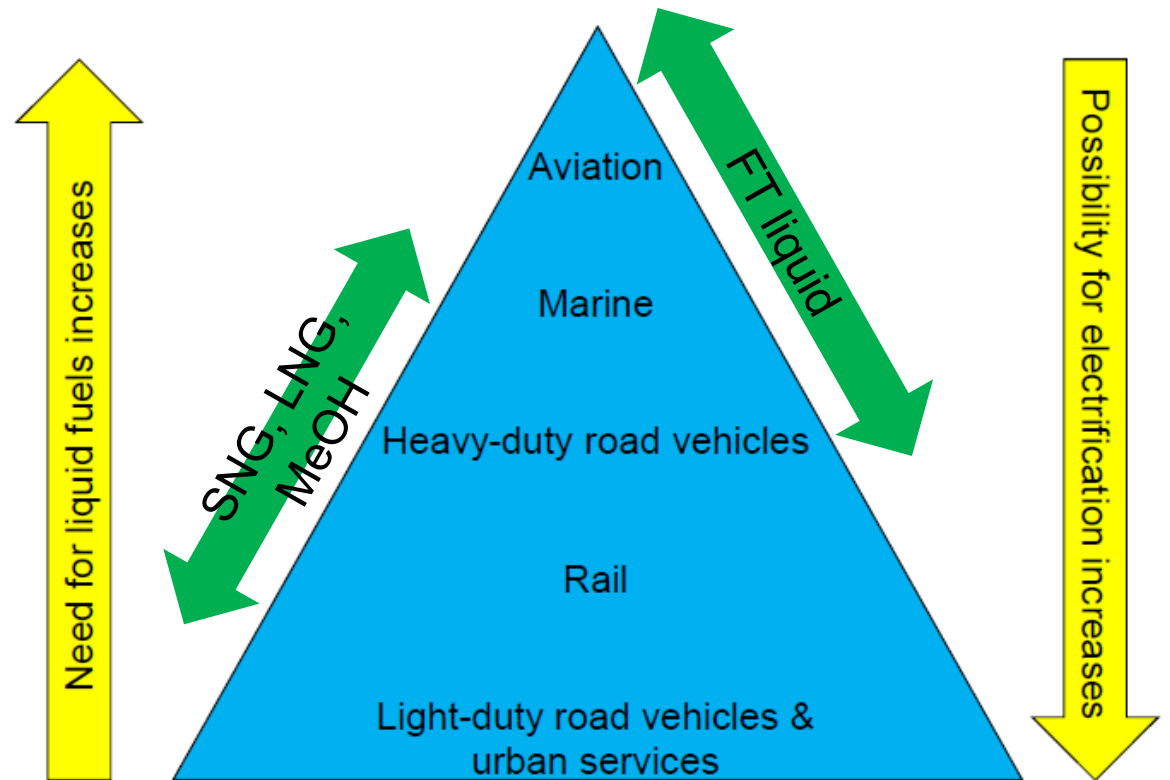


# Review criteria:

- Feedstocks according to RED II Annex 9A & B directives
- BtL FT plants planned, under construction or operational (EU, global)
- **Experimental work performed on actual biosyngas (EU, global)**
- Feasibility studies for first-of-its-kind BtL installations (EU)
  - Technoeconomic studies leading to a measurable economic indicator

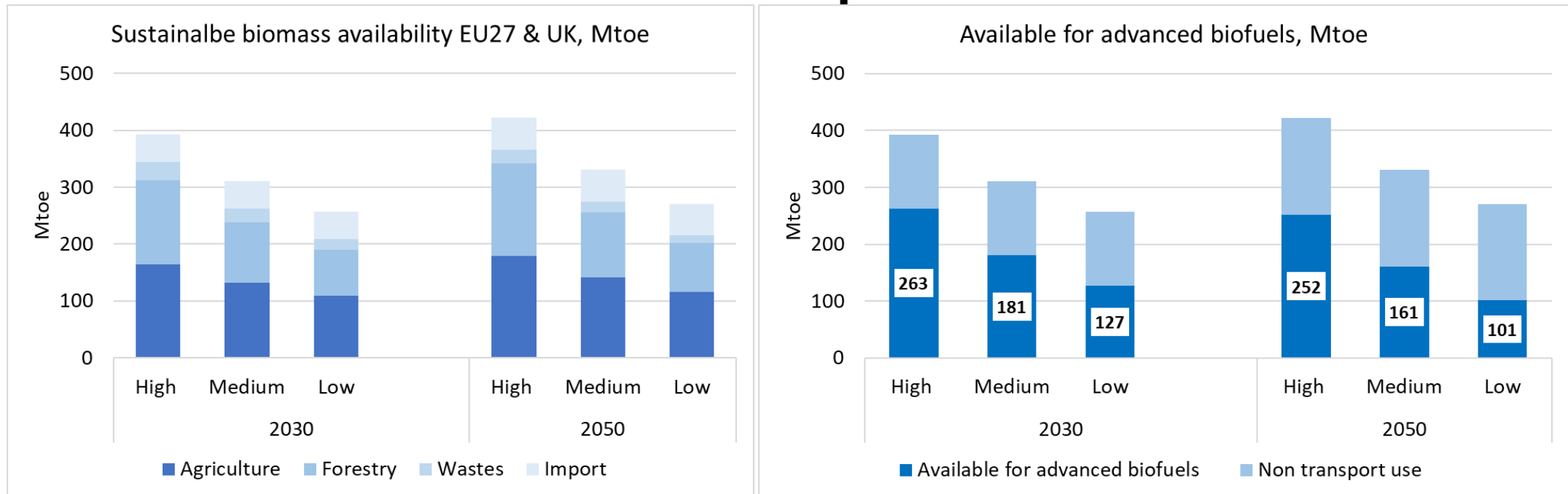
# Need for advanced biofuels

- Focus on sectors difficult to decarbonize in the short-term, such as long-distance transport, aviation and shipping
- Synthetic and liquefied natural gas (SNG, LNG) and methanol (Marine, long-distance tracks, rail)
- FT fuels (Aviation, ASTM approval)



Source: Nils-Olof Nylund, IMECHE Future Fuels, 2016

# EU27 & UK biofuels potential:



Advance biofuels potential [Mtoe]:

2030 [46 – 97]

2050 [71 – 176]

# BtL FT commercial developments: EU and global

# BtL developments - commercial (C), demo (D) and pilot (P) - EU

- Altolto, Immingham, UK (C)
- Fulcrum NorthPoint, Stanlow, UK (C)
- BioTfuel, Dunkirk, France (D)
- TU Vienna, Gussing, Austria (P)
- EU Horizon 2020 projects
  - GLAMOUR
  - COMSYN
  - ICO2CHEM

# Altalto

Altalto, Immingham, UK (C)

- **Partners:** British Airways/Shell/Velocys
- **Feed & capacity:** MSW 500 kTPY; 60 million liters (SAF, diesel & naphtha)
- **Technology:** TRI, POX; FTS Velocys; Upgrading Haldor Topsoe





# Fulcrum NorthPoint

Stanlow, UK (C)

- **Partners:** Essar Oil/Fulcrum Bioenergy/Stanlow terminals
- **Feed & capacity:** MSW; ~100 million liters SAF
- **Technology:** TRI, JM/BP FT technology
- Budget £600 million

<https://fulcrum-bioenergy.com/>

# BioTfuel

BioTfuel, Venette/Dunkirk, France (D)

- **Partners:** Axens, CEA, IFP Energies Nouvelles, Avril, ThyssenKrupp Industrial Solutions, TotalEnergies
- **Feed & capacity:** Straw, forest waste, dedicated energy crops; 60 t/y (diesel, SAF)
- **Technology:** Torrefaction, EFG
- Budget €190 million



# BtL developments - commercial (C), demo (D) and pilot (P) - Global

- Bayou Fuels, Mississippi, USA **(C)**
- Red Rock Biofuels, Oregon, USA **(C)**
- Fulcrum bioenergy, Sierra biofuels plant, Nevada, USA **(C)**
- AgBioEn, Victoria, Australia **(C)**

# Bayou fuels

- Natchez, Mississippi, USA
- Woody biomass
- 133 million liters/year (~72% SAF, naphtha)
- Pre-FEED and federal permitting completed
- Target financial close: Q1 2022

<https://www.bayoufuels.com/>

# Red rock biofuels

- Lakeview facility, Oregon, USA
- Woody biomass (166 kTPY, dry)
- 61 million liters/year renewable fuels (SAF & diesel)

<https://www.redrockbio.com/>

# Sierra Biofuels Plant (Fulcrum)

- Municipal solid waste MSW (175 kTPY, dry)
- 42 million liters/year renewable fuels
- Construction completed

<https://fulcrum-bioenergy.com/>

# AgBioEn (Australia's groundbreaking bioenergy facility)

- Katunga, Victoria, Australia
- Agricultural waste
- 150 million liters/year renewable fuels (diesel, SAF plus el., liquid CO<sub>2</sub>)
- Pyrolysis, FT
- Budget \$2 billion Australian dollars
- First production in 2021, full capacity 2023

<https://www.agbioen.com/>

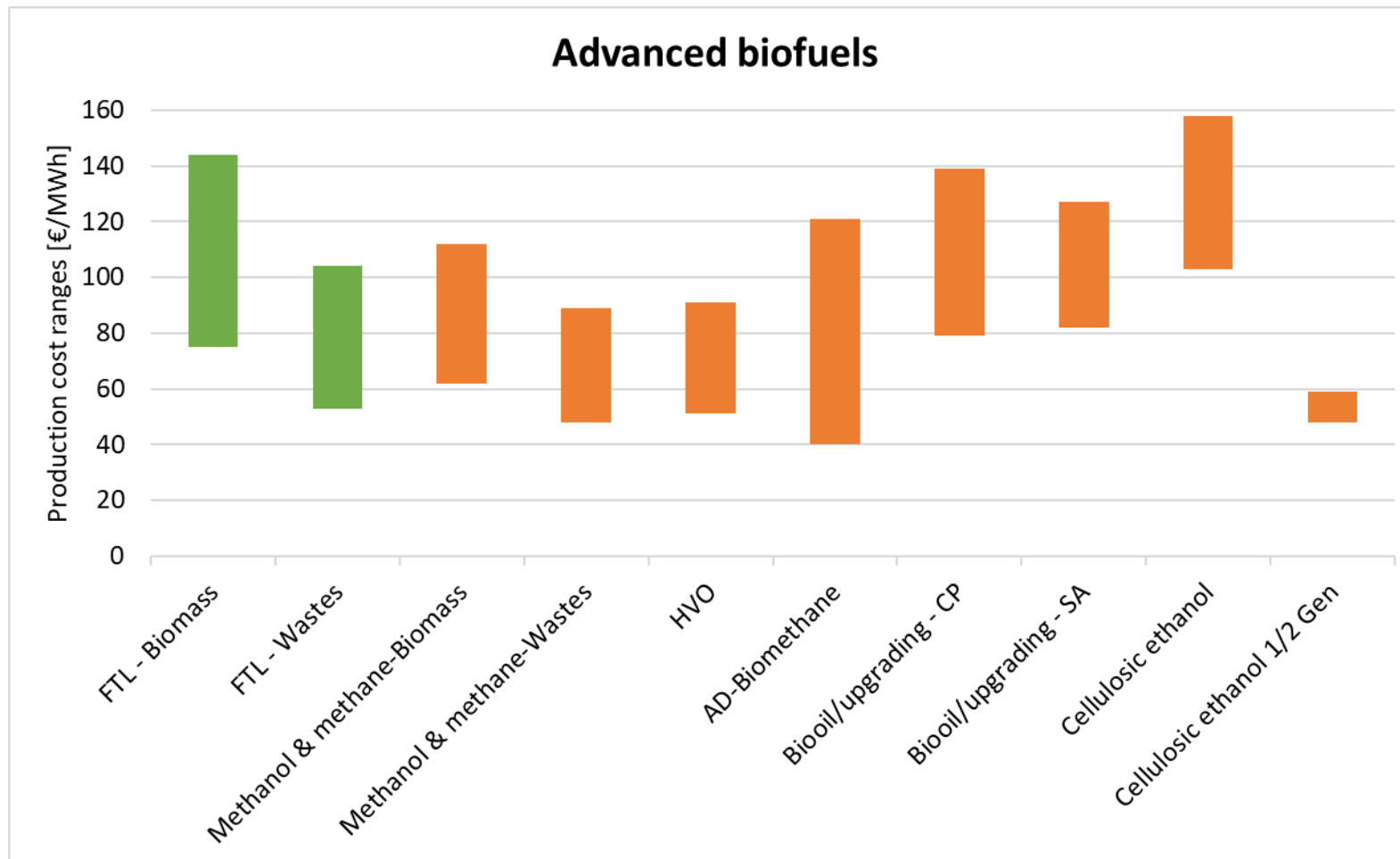
# BtL FT economic performance EU



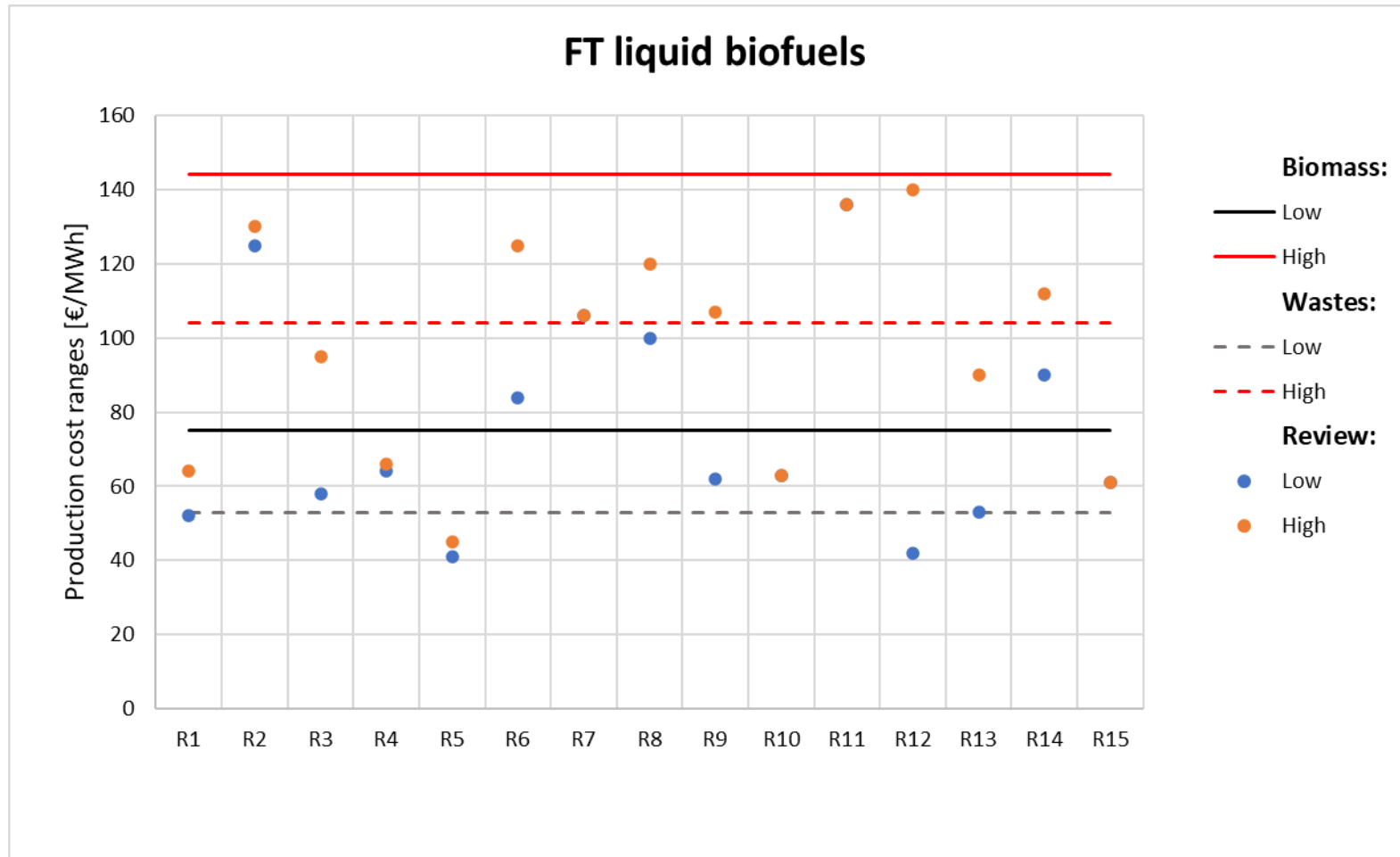
# Economic aspects

- Capital cost (>50% of production cost)
- Feedstock cost
- O & M (15%-30%)
- Configuration (Integrated vs. stand alone)

# Biofuel production cost ranges



# Production cost



# Concluding remarks

- Advanced biofuels key to decarbonize primarily aviation and maritime
- BtL FT developments intensifying, several commercial installations underway
- Economic performance showed a wide range of production cost (40 - 145 €/MWh)
- Integrated process configurations can help reduce production cost

Thank you for your attention!

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