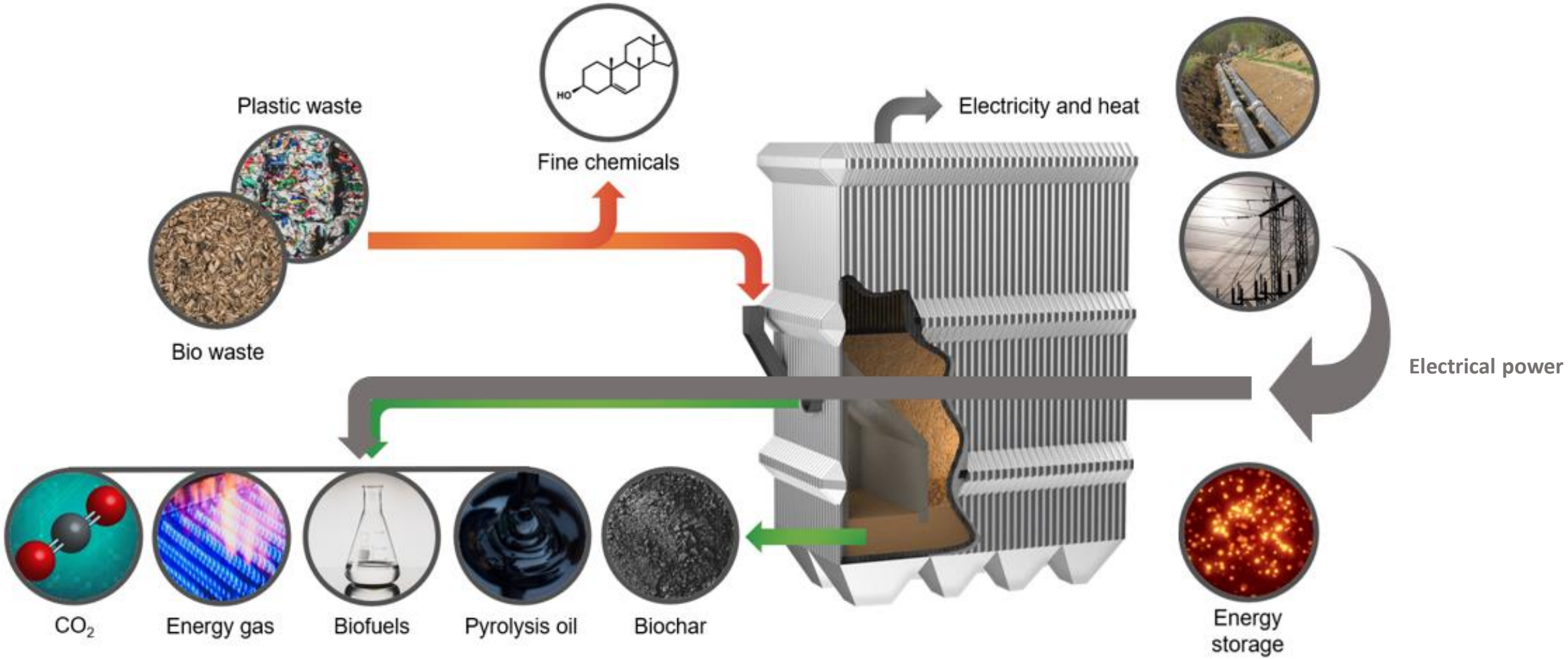
BIOSHARE

From cogeneration to polygeneration

Co-generation of SAF in combustion plants

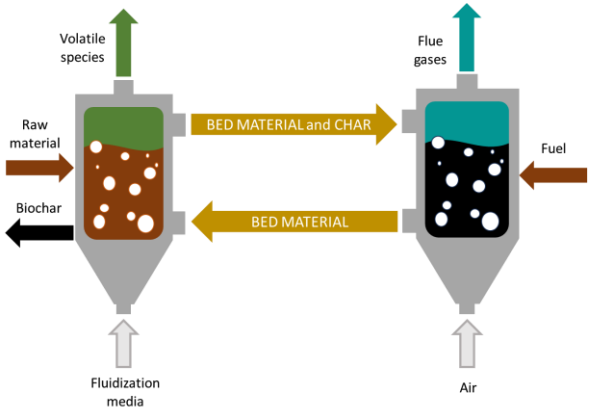
From cogeneration to polygeneration

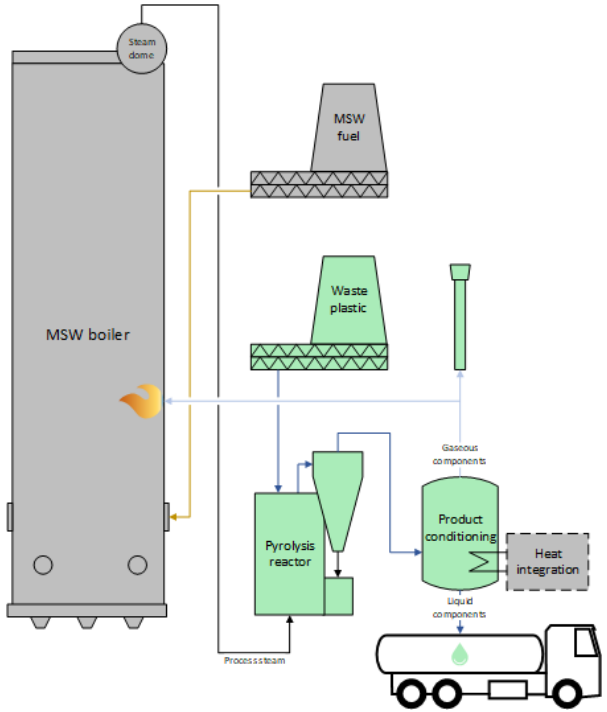


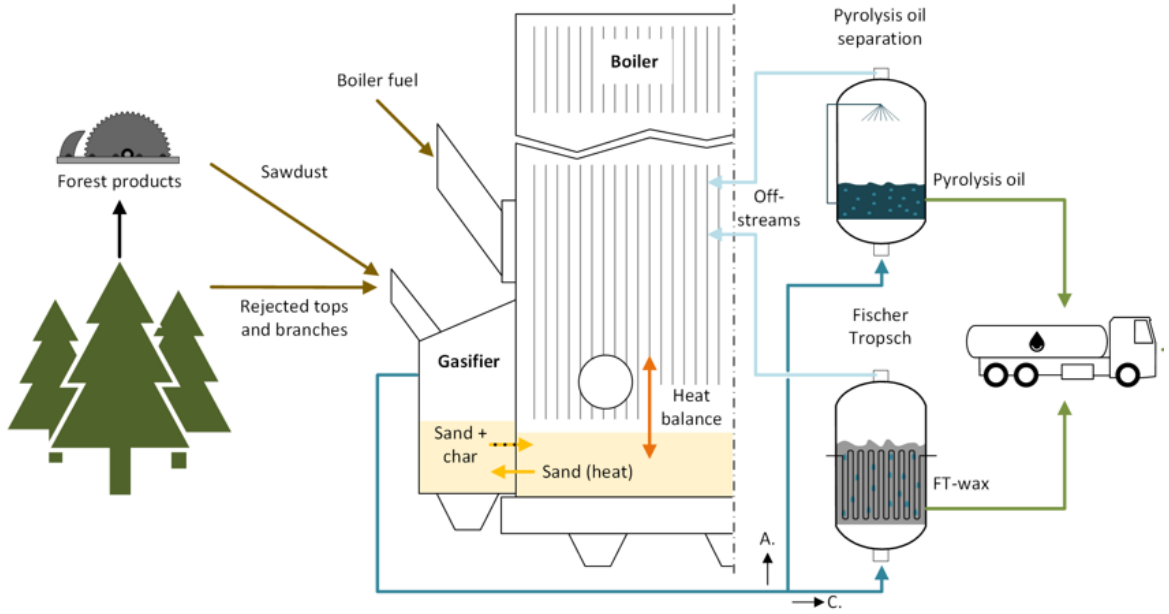
BIOSHARE

Technology - Thermochemical co-production

BioShare's technology enables additional products in addition to heat and power to be produced in the CHP sector.
Our fluidized bed solutions can be applied utilizing separate bed material or share bed material with a boiler



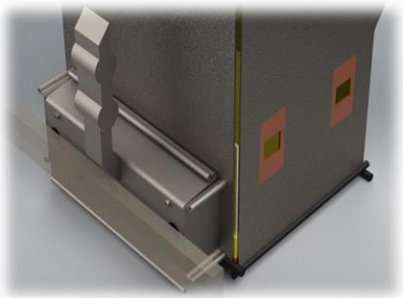




Reactor concepts for thermochemical co-production

External reactors

- Retrofit solution enabling essentially maintained boiler capacity
- Layout can be challenging
- Excellent integration benefits

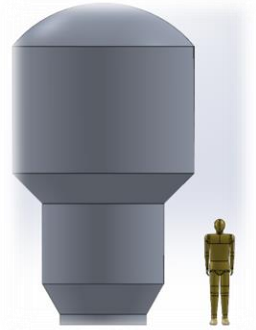


Internal reactors

- Solution for new boilers
- Retrofit alternative when lower boiler capacity is tolerated
- Excellent integration benefits

Stand-alone solutions

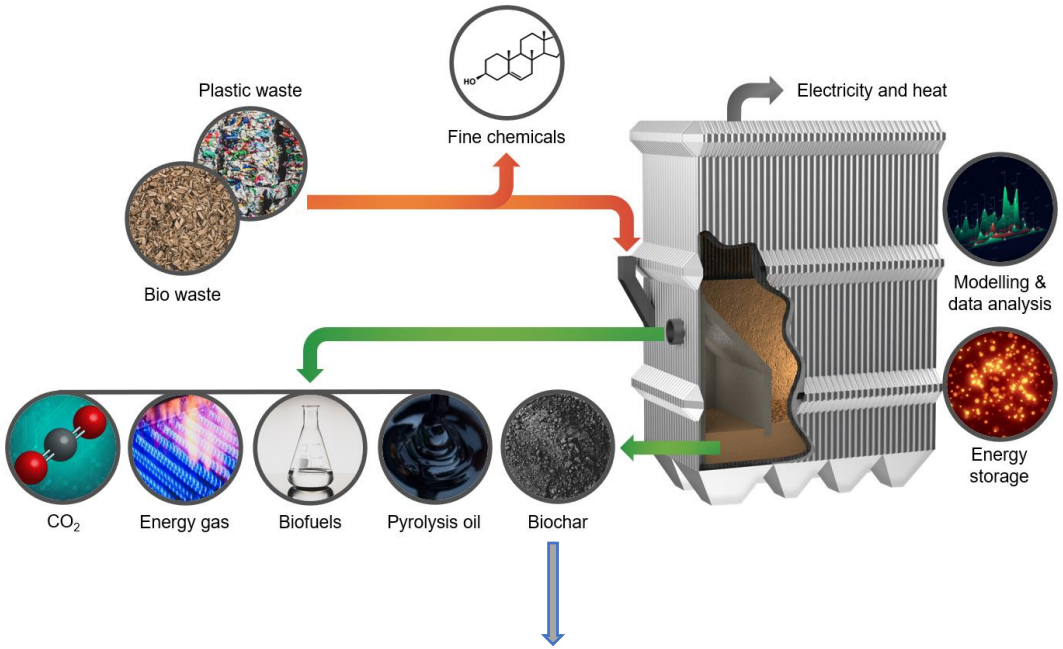
- Tailor made bed material
- Single-, dual or triple bed design
- Heated by combustion or electricity



BIOSHARE

Soon SAF ..but first a few words about Biochar

Biochar represent a viable and near-time solution for carbon capture and soil improvement as well as an option to provide the steel and metal industry with renewable raw material.

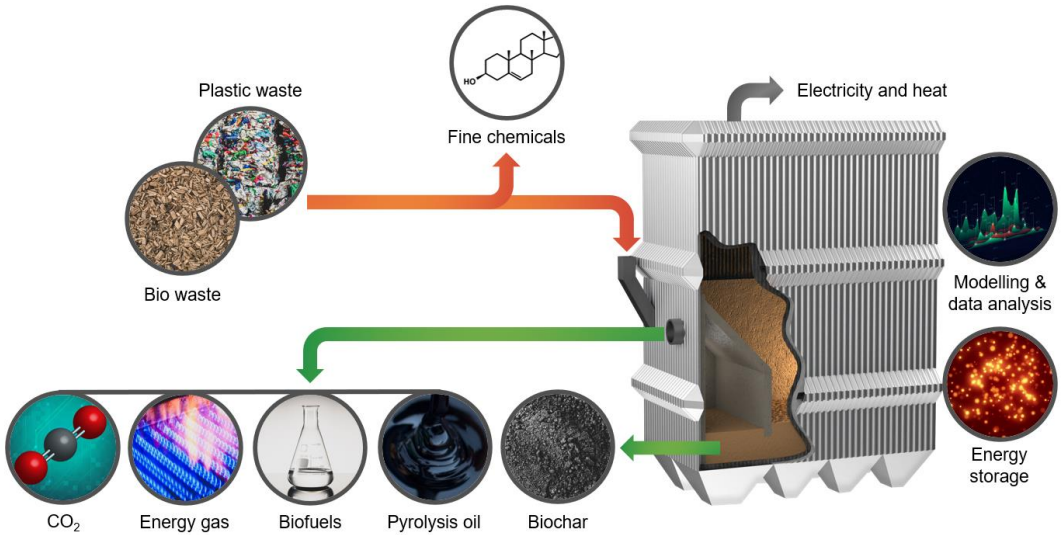


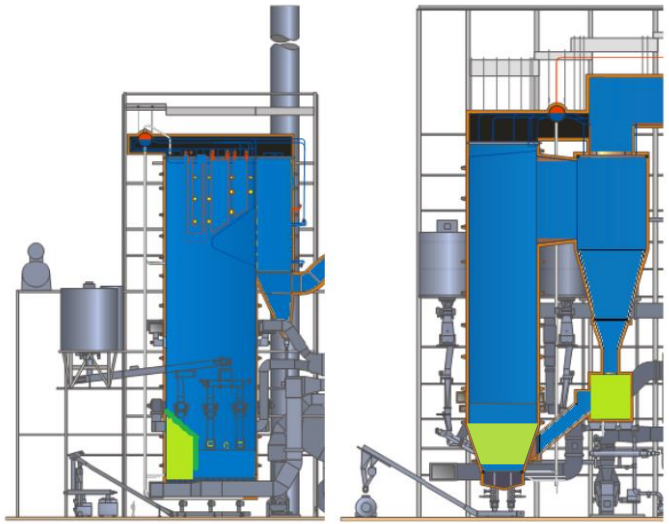
- Biochar with very high content of fixed carbon, and low amounts of volatile compounds
- Efficient implementation in circulating and bubbling fluidized bed boilers as well as in grate boilers

BIOSHARE

Biofuel production

A variety of different biofuels (bio-electro fuels) can be produced based on a co-production approach. Both types of fluidized bed boilers can be equipped with co-production functionality.





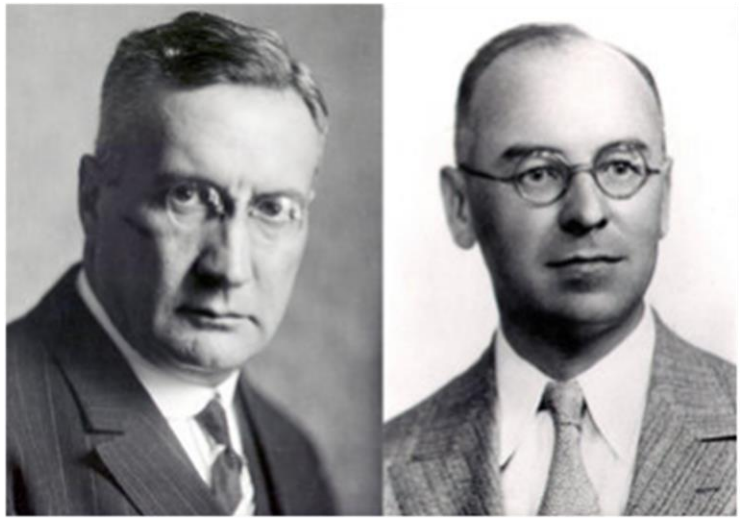
Upgrade to gasoline (+ diesel & LPG) in FCC (Can be stand-alone to minimize risk)

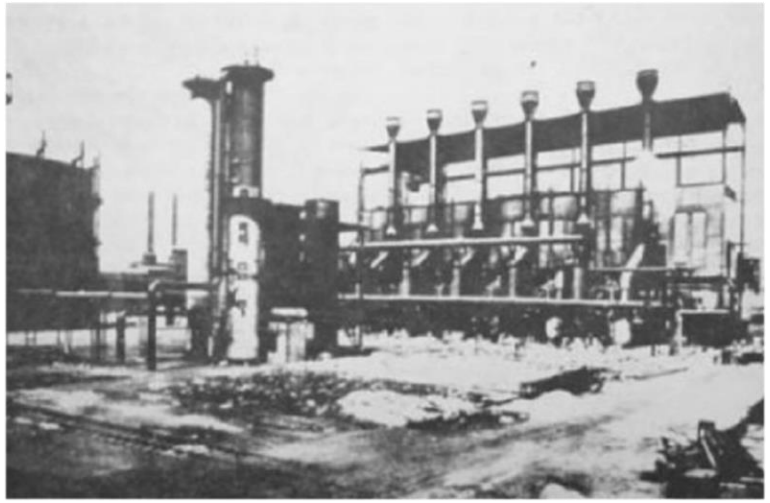
Catalytic/biological conversion of syngas to liquid fuels or additives **FT-SAF**

Use gas as-is for industrial heating or upgrade synthesis gas catalytically/biologically

BIOSHARE

Fischer-Tropsch fuel





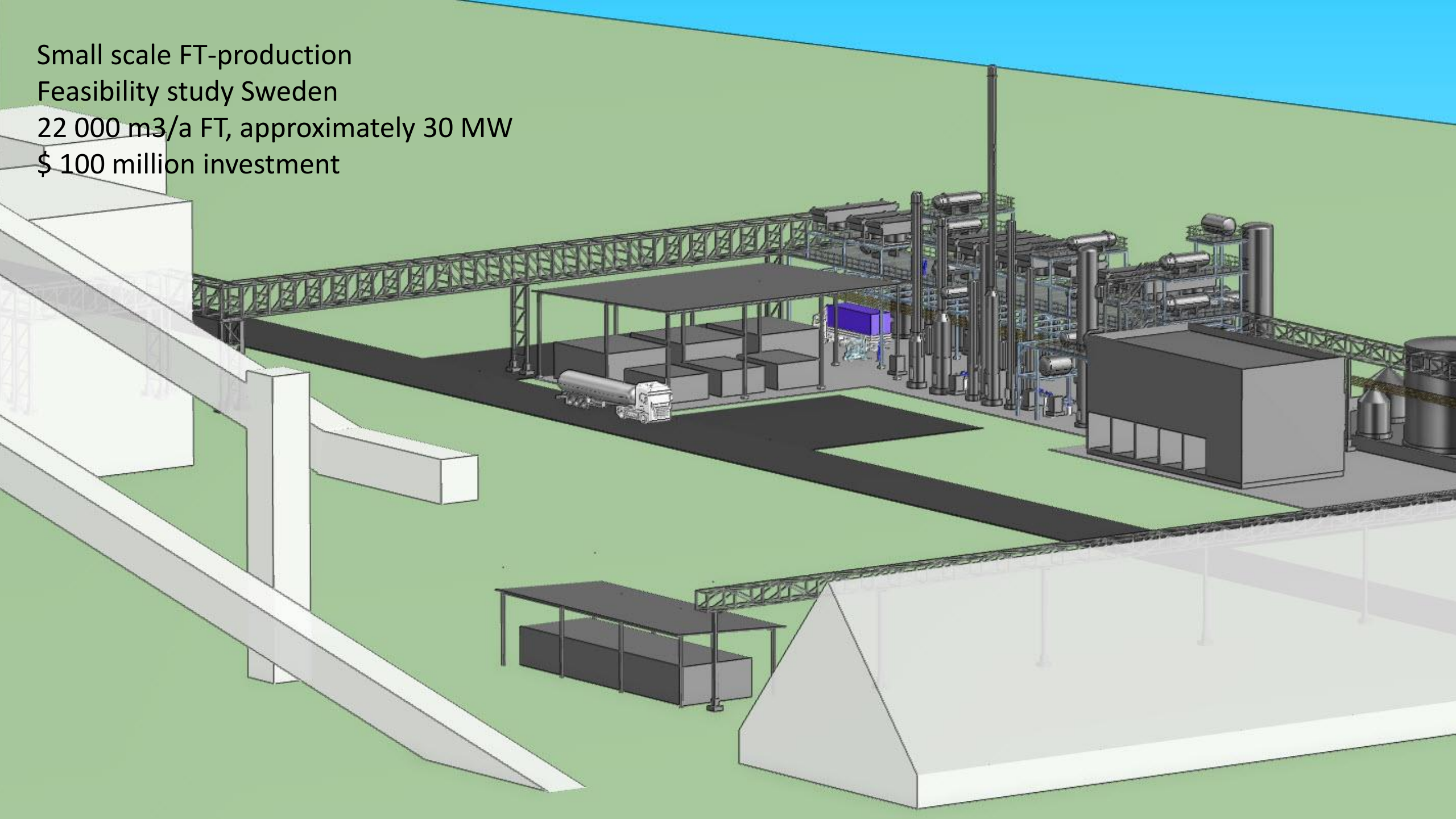
$$(2n+1)\,H_2 + n\,CO \rightarrow C_n H_{(2n+2)} + n\,H_2O$$

- Patented 1925 by Franz Fischer and Hans Tropsch at Kaiser Wilhelm Institute for Coal Research
- 600 000 t/a production in Germany 1940 from coal
- First synthetic fuel pathway to be certified for incorporation into aviation turbine fuel (2009)

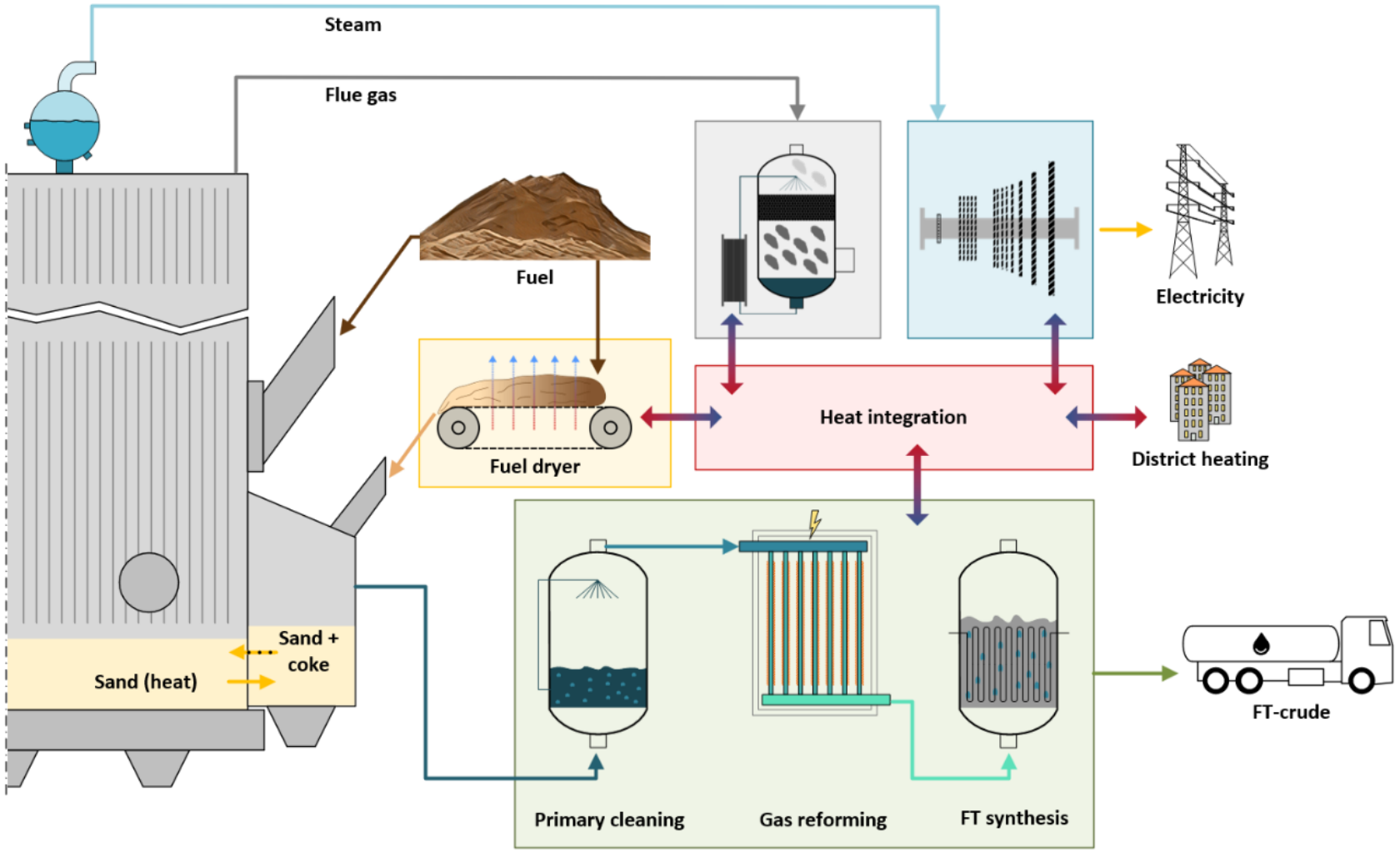
BIOSHARE

Large scale FT-production
Pearl GTL, Qatar
22 000 m3/day FT, approximately 10 000 MW
$ 18 billion investment

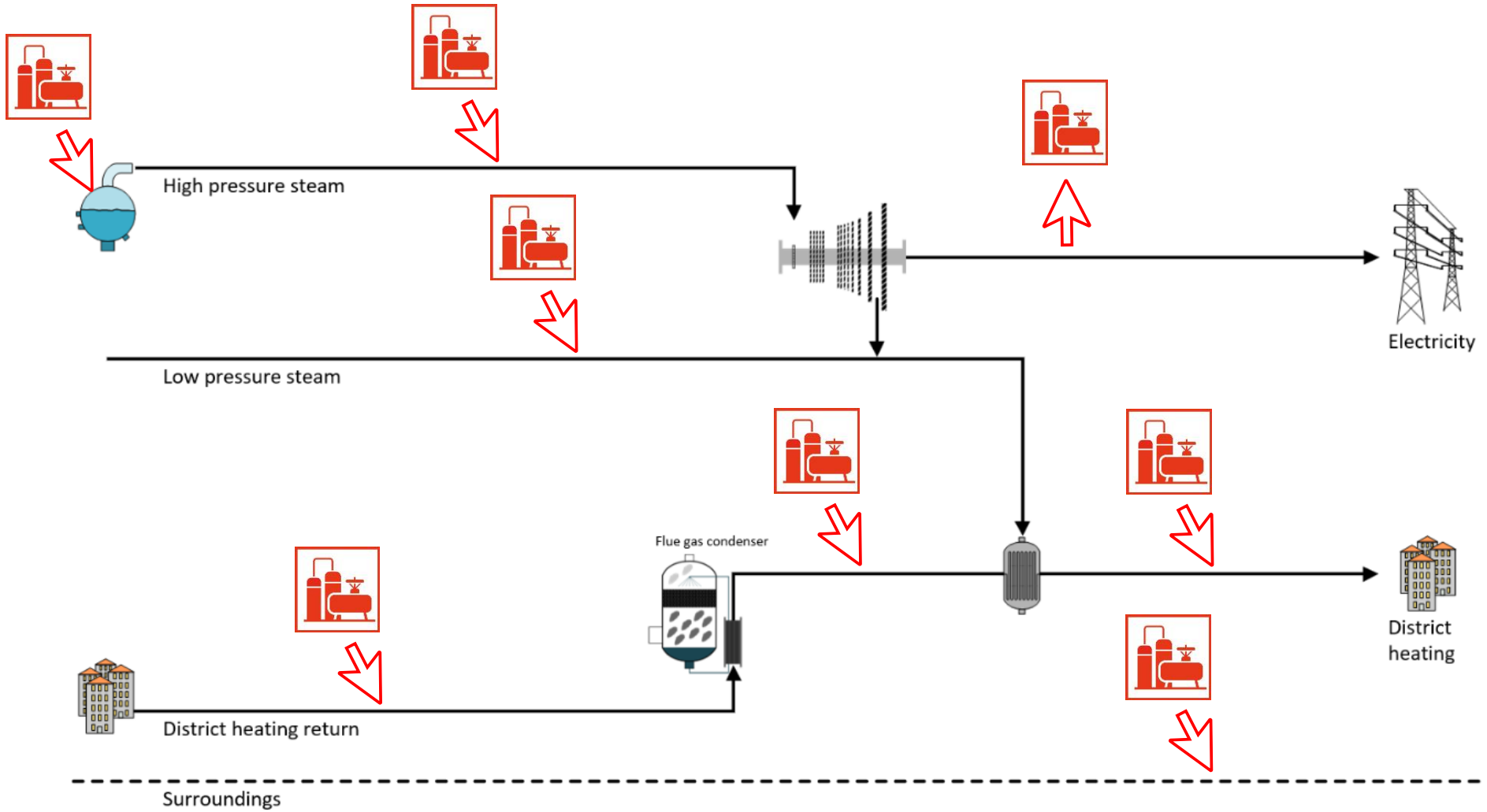
Small scale FT-production
Feasibility study Sweden
22 000 m3/a FT, approximately 30 MW
$ 100 million investment



FT based SAF - Process configuration

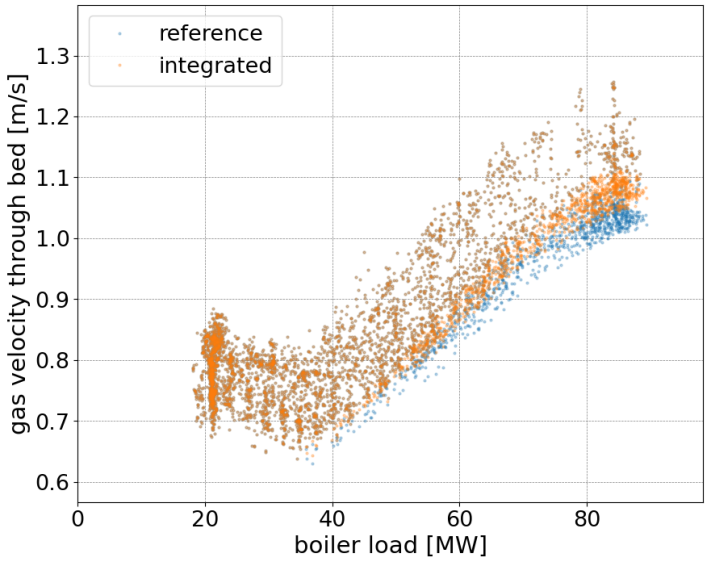


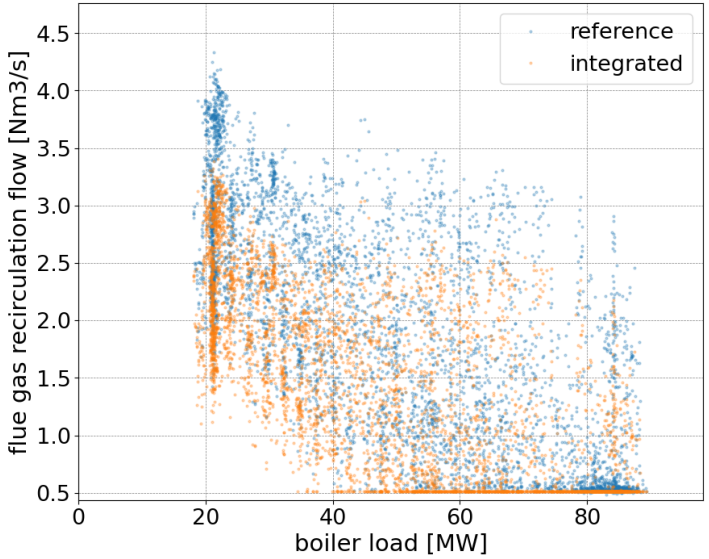
Heat integration principle



Boiler integrated syngas generation

- Syngas can be generated simultaneously with heat and power production
- Typically, the boiler capacity range is affected to a small extent
- Operation parameters for certain sub-systems will however be adjusted.





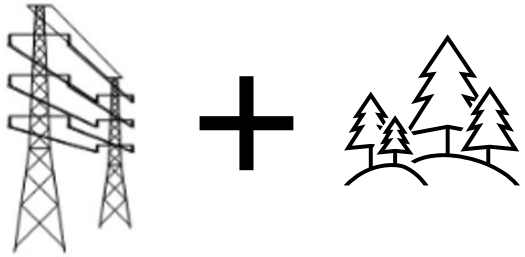
30 MW syngas reactor integrated with 90 MW boiler

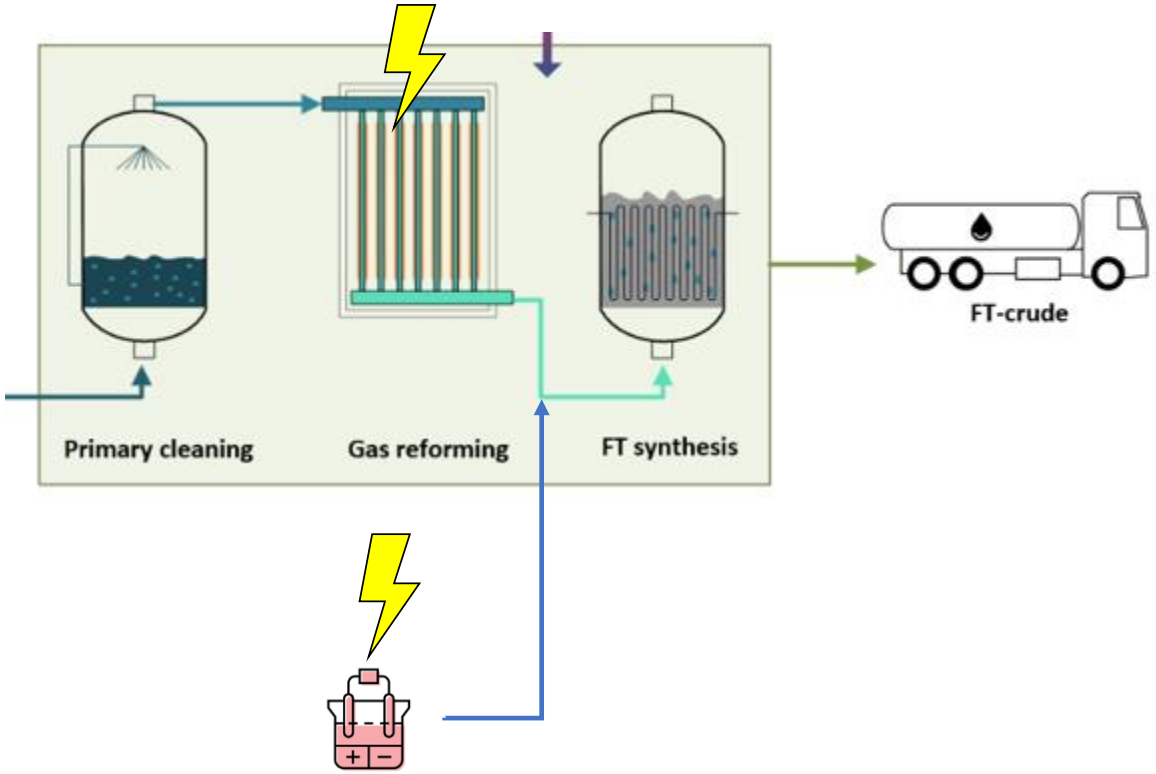
BIOSHARE

Options for power-to-liquid

Utilization of electrical energy can greatly increase capacity from a co-generation plant. Significant utilization can e.g. be realised by:

- Electrically enhanced gasification
- Electrical methane reforming
- Additional hydrogen supply from electrolysis





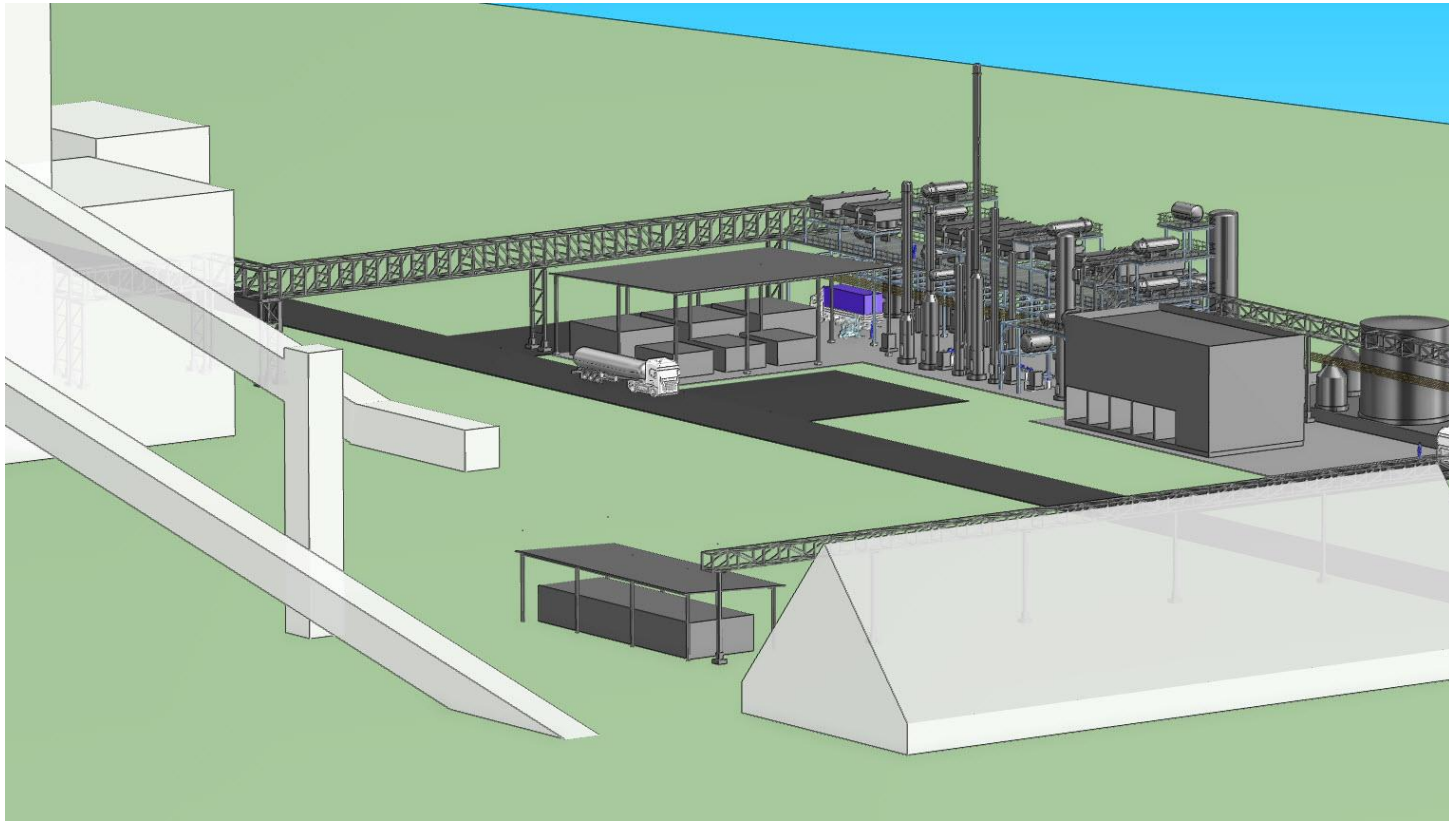
BIOSHARE

Performance

Example of KPI:s from a feasibility study:

- Capacity 30 MW FT crude
- Capex 100 MEUR
- Opex 72 EUR/MWh
- Marginal efficiency 56-75%
- GWP 10 g CO2-eq/MJ

Fossil-based Jet A1: 89 g CO2-eq/MJ



BIOSHARE

Summary: Co-production - Competitive edge

BioShares solutions based on deep integration CHP plants gives several benefits compared to competing greenfield/brownfield solutions:

i. Efficiency
Deep integration enables residual streams/energy to be captured and utilized in the CHP plant

ii. Decoupling quality from efficiency
Quality often comes at the expense of primary efficiency. Full utilization of residue streams enables focus on product quality

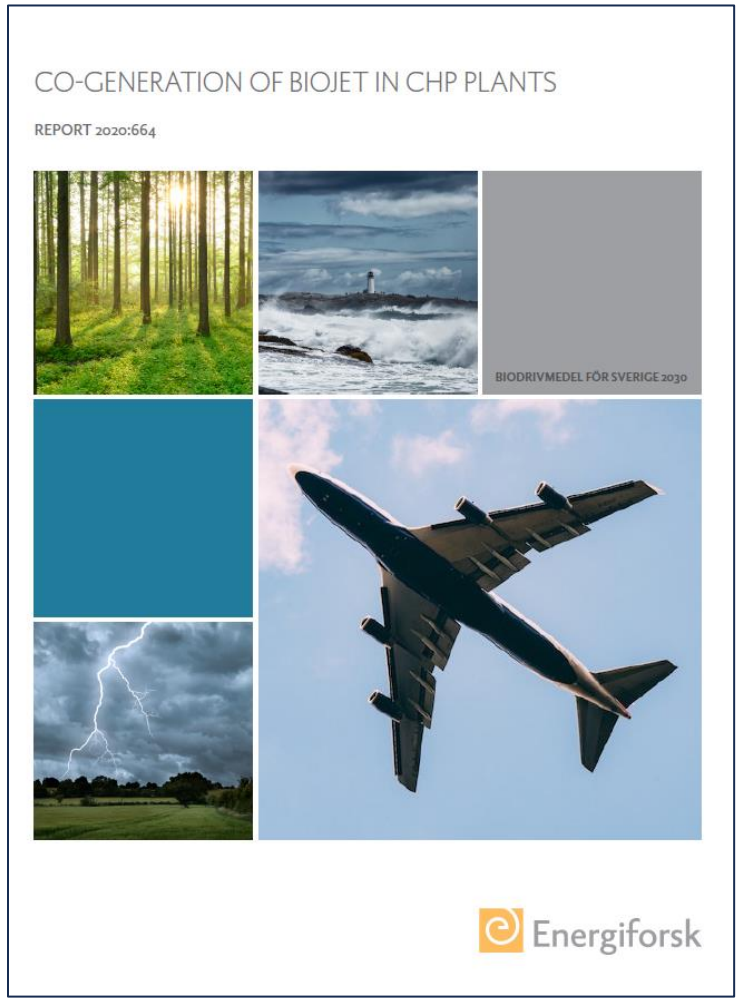
iii. Capex
Taking advantage of existing infrastructure and process system enables considerable investment cost savings

iv. Opex
Significant savings can be achieved when utilizing already existing organization for operation, maintenance, HSE etc.

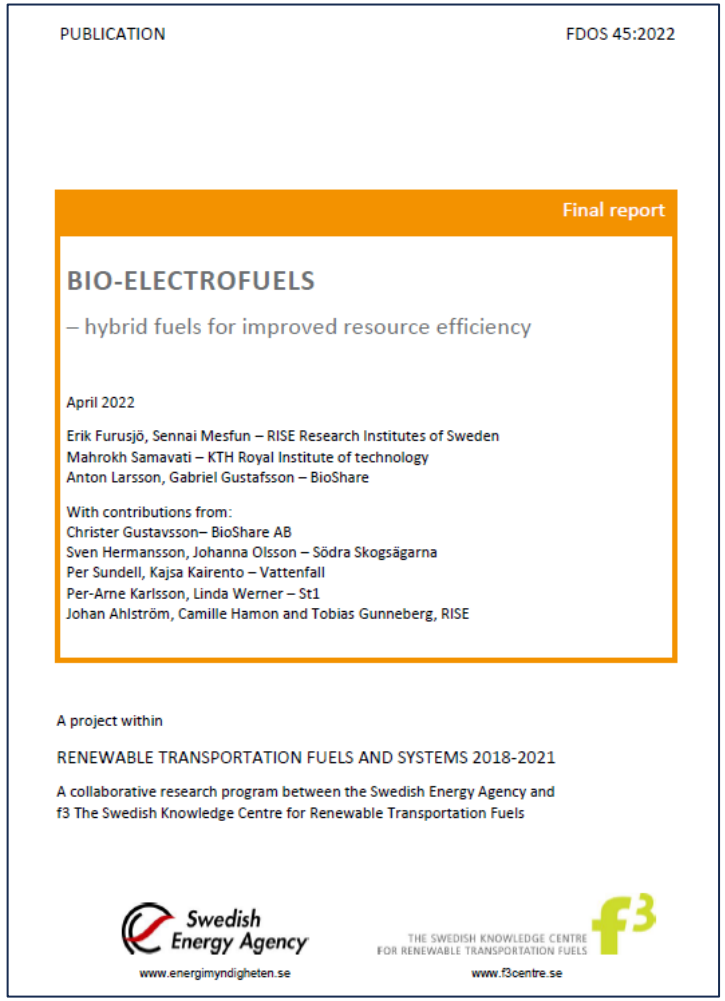
v. Flexibility
Co-production enables flexibility to meet varying supply/demand and cost for biomass and electricity

BIOSHARE

Further info



https://energiforsk.se/media/28207/co-generation-of-biojet-in-chp-plants-energiforskrapport-2020-664.pdf



https://f3centre.se/en/research/bio-electro-fuels-technology-that-can-offer-improved-resource-efficiency/

BIOSHARE

Visit us: bioshare.se
Contact: christer.gustavsson@bioshare.se