

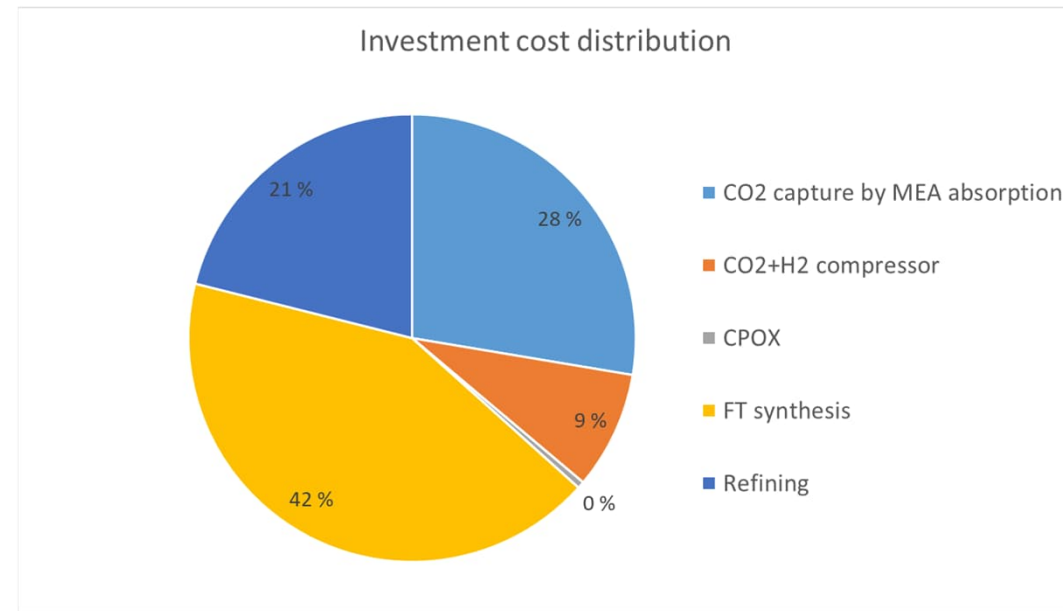
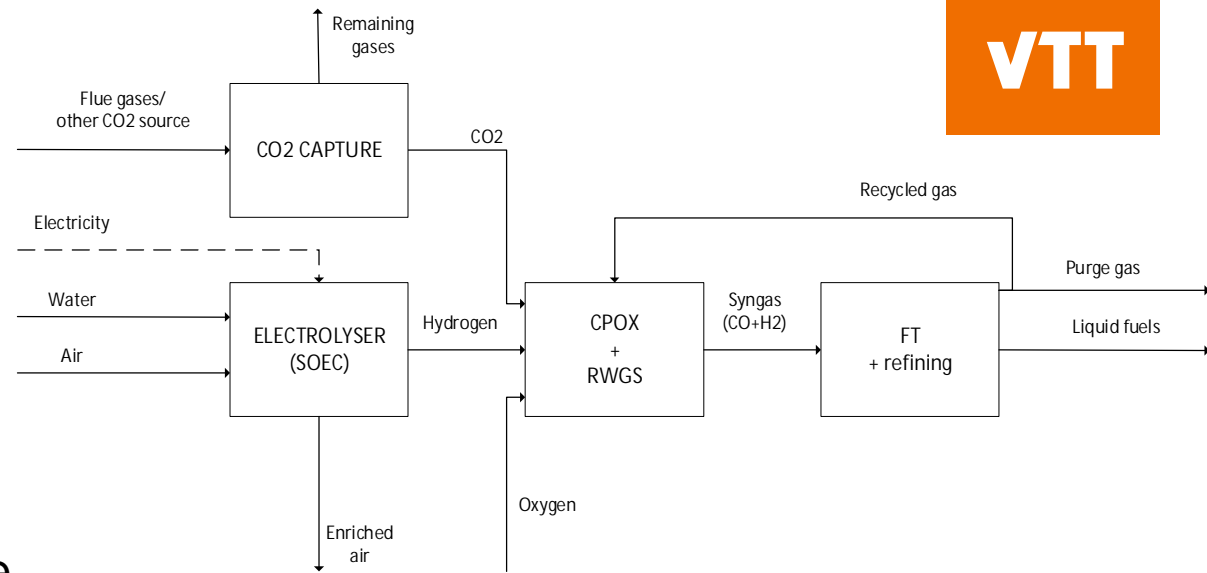
Efuel
Mid-term workshop
Techno-economics:
CO₂ from flue gas and
hydrogen to kerosene via
CPOX+FT

27/06/2022 VTT – beyond the obvious



High capacity Kerosene production from flue gas via CPOX+FT

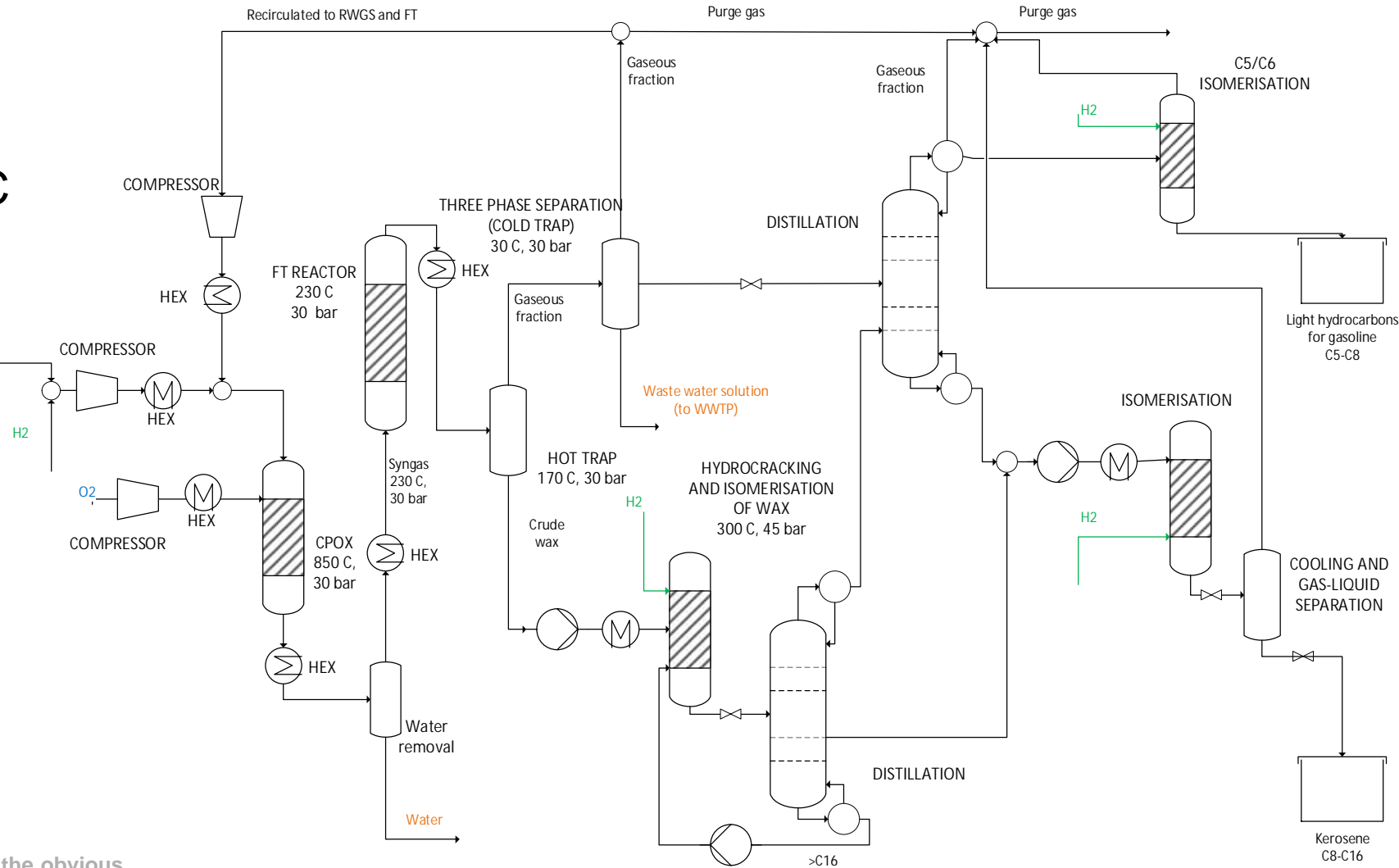
- Raw materials
 - Hydrogen 11t/h
 - Carbon dioxide 63 t/h (captured from flue gas)
 - Oxygen 6t/h
- Products
 - Kerosene 12 t/h
 - Gasoline 1.6 t/h
 - Purge gas 10 t/h (LHV 40 MJ/kg)
 - Waste water 55 t/h
- Estimation for Total capital investment (excluding electrolyser) 400 M€



From flue gas to kerosene CPOX+FT flow sheet



- CPOX
 - temperature 850 C
- FT reactor
 - Operation at 30 bar
 - H₂/CO feed ratio 2.00
 - Alpha 0.93
 - CO conversion 0.66
- Gas recycling rate
 - 90%
- System modelled in Aspen Plus





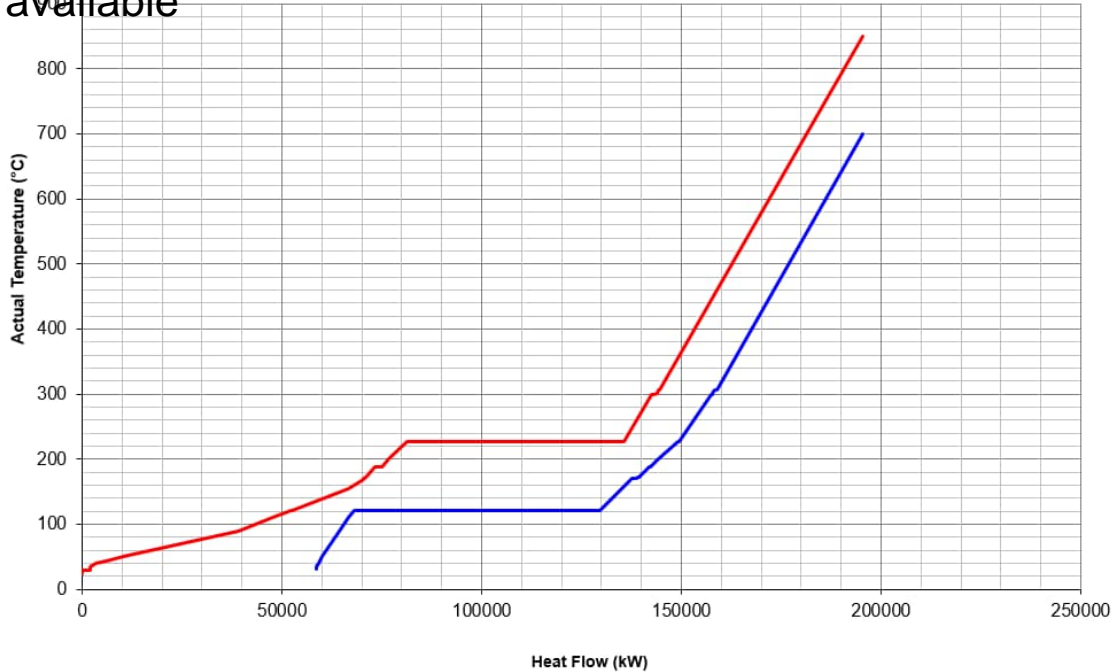
Kerosene production from flue gas via CPOX+FT Energy integration

Electricity demand		
CO2 capture by MEA	MW	1.1
CO2+H2 compressor	MW	19.8
Other FT related	MW	4.4
Total	MW	25.4

- Electricity demand 25.4 MW (electrolyser excluded)
- Heat integration by pinch analysis (electrolyser excluded)
 - Excess heat available, but not sufficiently for producing steam (150 C, 3.5 bar) to SOEC
 - If CO2 capture by MEA absorption is excluded
 - sufficient amount of heat for steam production is available

RESULTS		
Min Hot Utility	kW	0
Temperature range	C	-
Min Cold Utility	kW	58 700
Temperature range	C	130-20
Divided to heating ranges:		0
Medium grade heating potential	kW	0
Temperature range	C	-
Low grade heating potential	kW	27 700
Temperature range	C	130-80
Cooling demand	kW	32 000
Temperature range	C	80-20

Hot and Cold Composite Curves



Kerosene production from flue gas via CPOX+FT

The cost distribution

- Kerosene production cost range 1970-2130 €/t
 - Hydrogen cost most significant
 - Annualised CAPEX has also considerable effect
- Revenues from by-products important
- To improve feasibility:
 - PSA to purge gas stream to recycle hydrogen
 - Heat pump to produce district heat
- Effect of pressurised SOEC (H₂ at 15 bar pressure)
 - Decrease in the investment cost
 - Decrease in the electricity cost

