

SYNOVA

A short route to produce virgin plastic from plastic waste



IEA Task 33
2 December 2021
Bram van der Drift

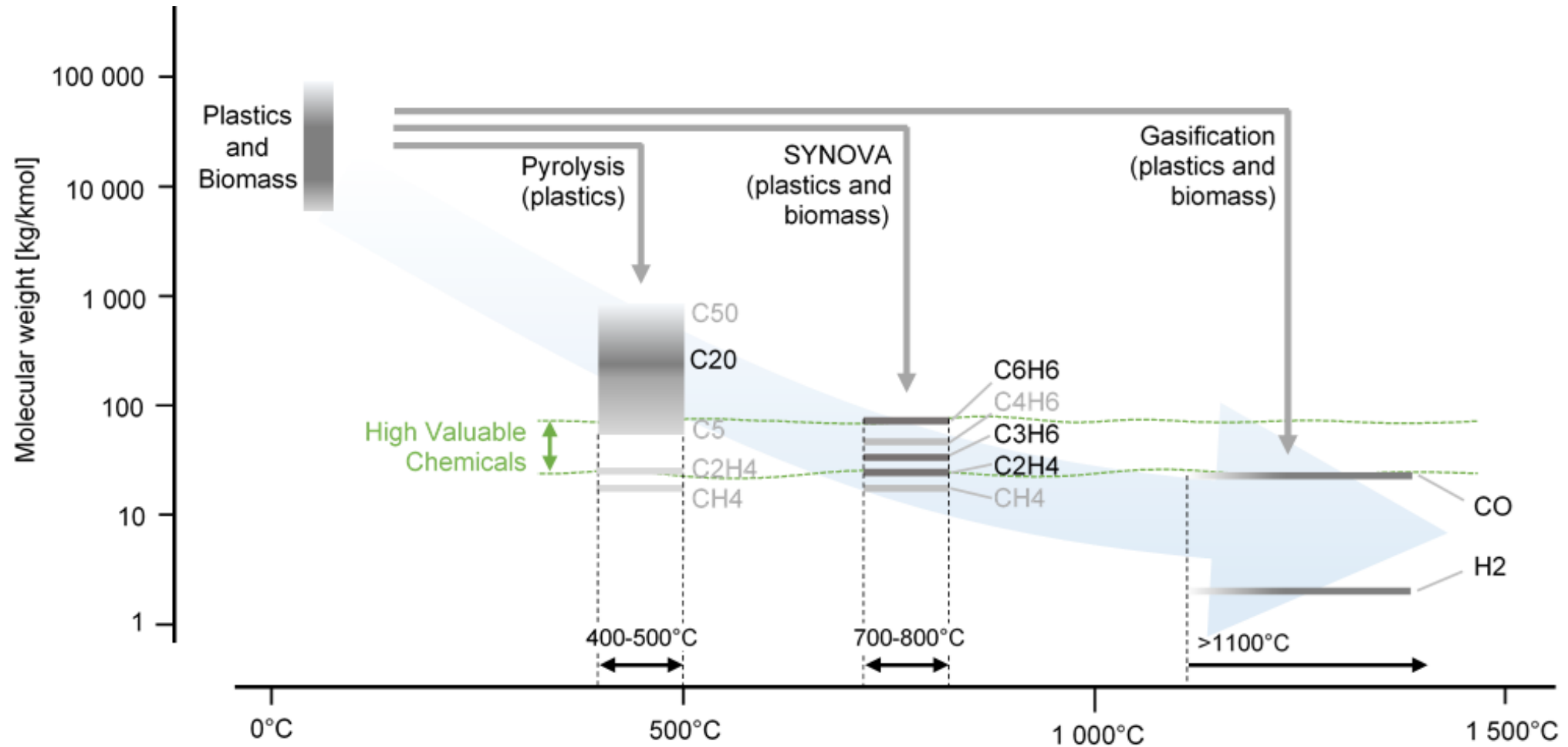


If you like high-value hydrocarbons,
choose 700-800°C



SYNOVA's SOLUTION

MEDIUM TEMPERATURE = DIRECT CHEMICALS



At 700-800°C,
hetero-atoms mostly end up in small molecules
(CO, CO₂, H₂S, NH₃, HCl, ...)



700-800°C CREATES FREEDOM in FEEDSTOCK



Plastics waste

PE, PP, PS, PET,
PC, PA, PLA, ...
(PVC limited)

Biogenic material

paper, cotton,
food residues,
grass, ...

Multi-materials

foil/cardboard,
paper/plastic,
cotton/PET, ...

Water

up to 30%
moisture

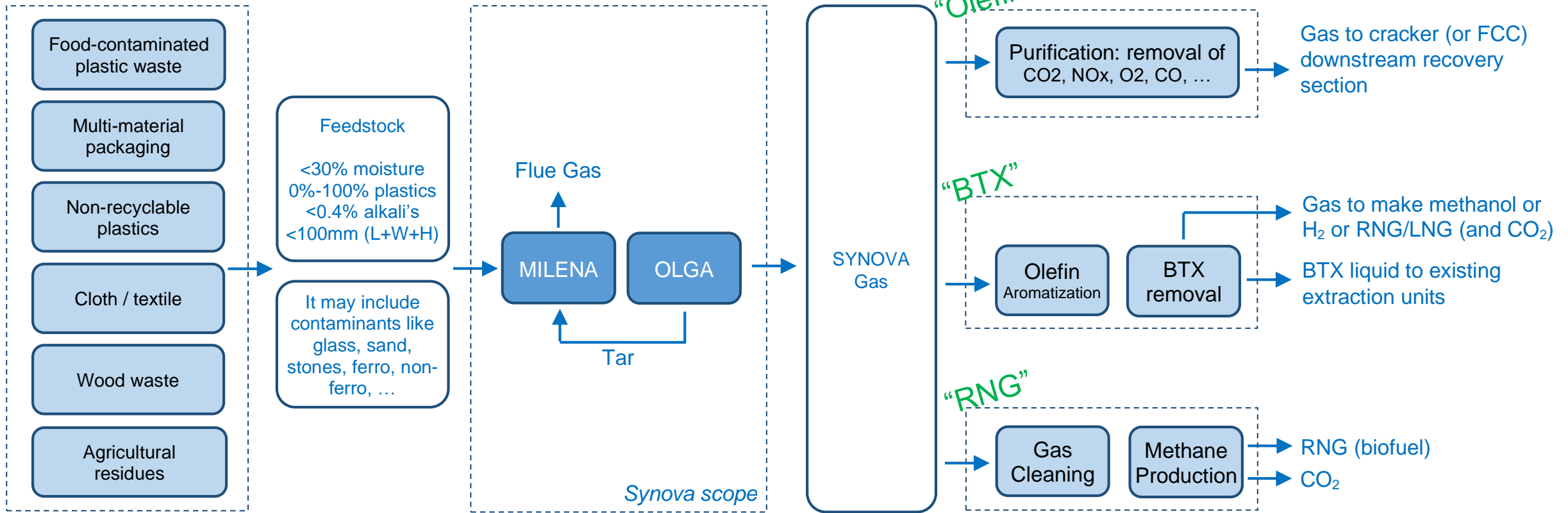
Inert material

sand, metal,
glass, ...

PROCESS



SYNOVA'S UNIT IN DIFFERENT PROCESSES



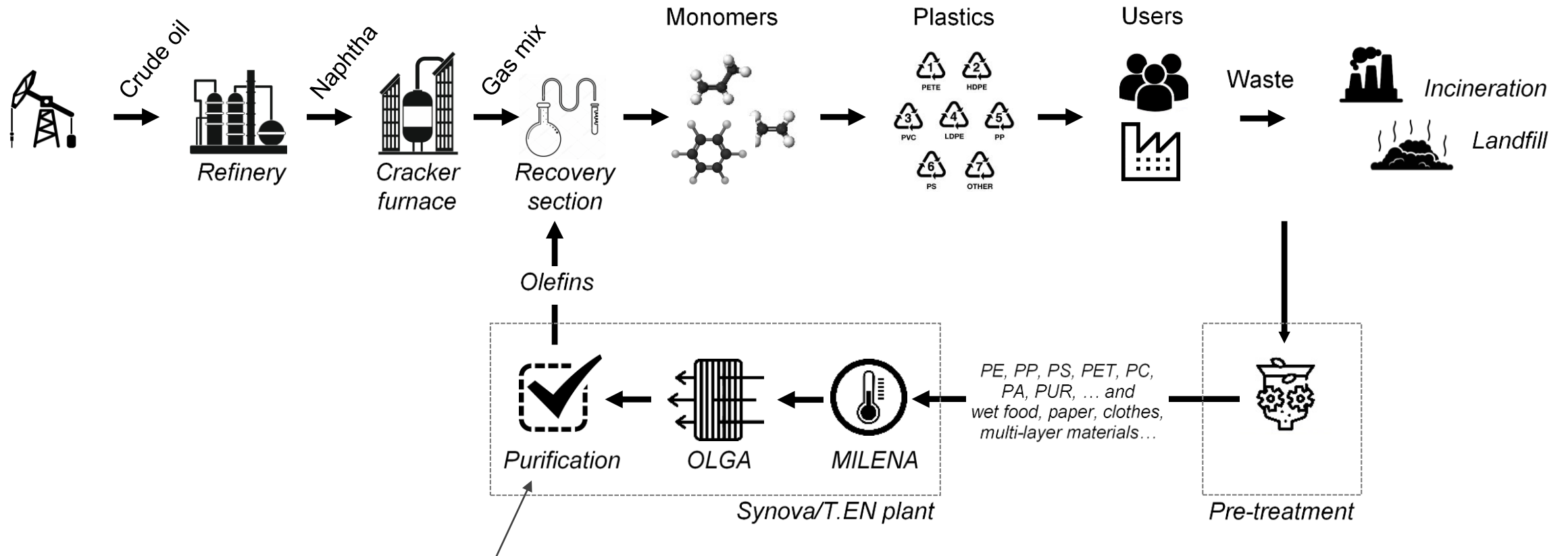
PRODUCTS

Name	Main Molecules	Main Market	Main Drivers
Olefins	Ethylene, Propylene, Butadiene, Benzene	Chemical industry, Refineries	Circularity, CO2
BTX	Benzene, Toluene, Xylenes	Chemical industry, Refineries	Circularity, CO2
RNG	Methane	Gas industry, Refineries	CO2

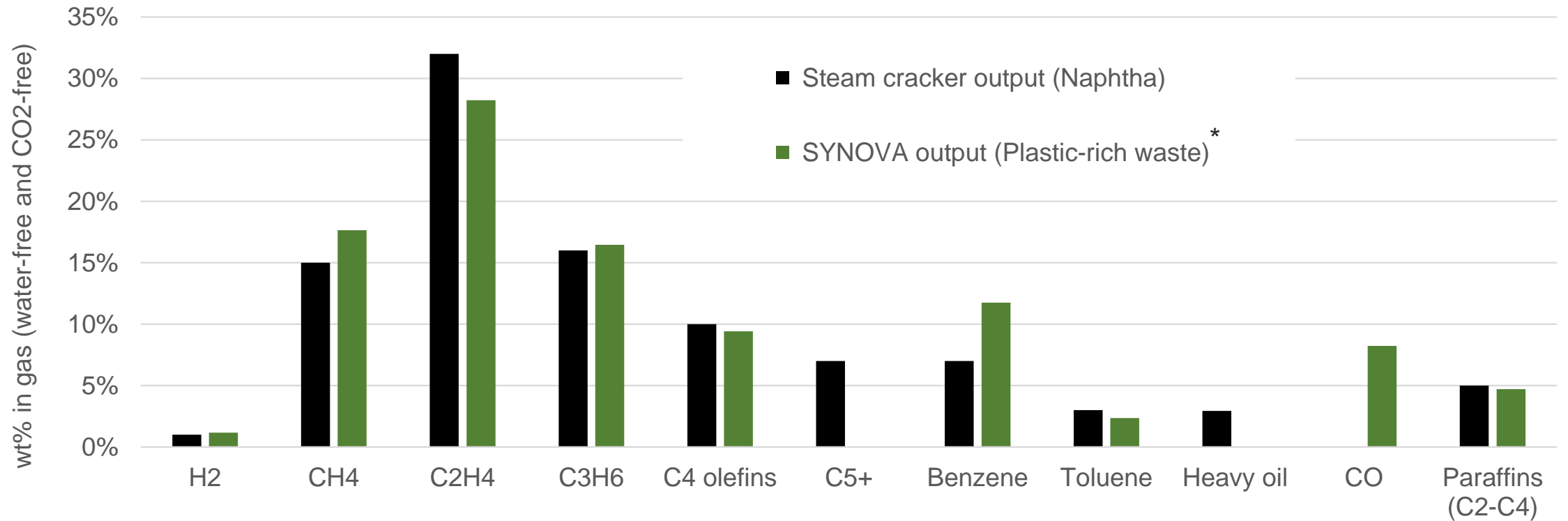
OLEFINS



SYNOVA/T.EN's SOLUTION REPLACING THE CRACKER FURNACE



GAS FROM SYNOVA PROCESS IS SIMILAR TO GAS FROM NAPHTHA STEAM CRACKER



* Example feedstock as tested in PDU: 59% plastic mass, 29% biomass, 11% ash, 1% water

PERFORMANCE

HIGH CO₂ REDUCTION

- Report by independent party: CE Delft
- 2.5 kg CO₂ / kg HVC (High Value Chemicals)
- Note: report includes numbers with landfill reference for waste

LOW COSTS

- Cheaper than virgin plastics (from non-renewable feedstock)

HIGH YIELD

- 65% Plastic-to-HVC (High Value Chemicals)
- Biomass in the contaminated waste provides additional chemicals
- No chemical detour: direct chemicals

CHEAP and AVAILABLE FEEDSTOCK

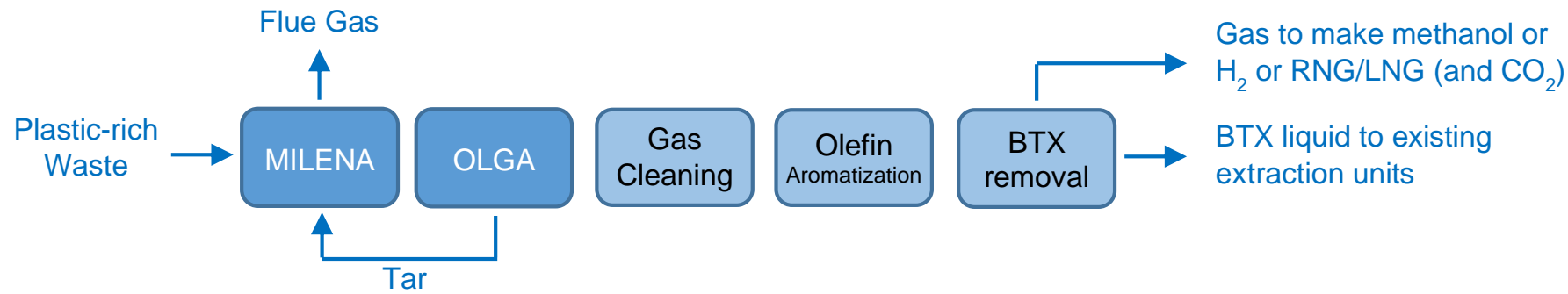
- Relatively relaxed feedstock preparation (waste processing): little plastic mass loss
- Cheap



BTX



BTX PRODUCTION



- Complete conversion of olefins to aromatics
- Technology and zeolite catalyst from Koch Technology Solutions
- BTX yield as high as 60% (Plastic-to-BTX)
- Tailgas consists of mainly methane, ethane, propane, hydrogen





SYNOVA's TECHNOLOGIES





MILENA CRACKER/GASIFICATION

- MILENA technology based on FCC technology coupled fluidized beds
- Heat transfer via circulating sand, no catalyst
- Operating at 700-800°C
- Coke and PAH's from downstream OLGA are burned to provide the energy for the cracking/gasification
- No external fuels required
- >7000h accumulated in Process Design Units (PDU's) and initial trial with ~1 tonne/h plant

OLGA GAS CLEANING

- OLGA technology based on Coke Oven Gas cleaning: gas/liquid contactors and Electrostatic Precipitator (ESP)
- Removes 99.9% of Poly Aromatic Hydrocarbons (tars) and particles
- >7000h accumulated in Process Design Units (PDU's) and initial trials with several ~1 tonne/h plants

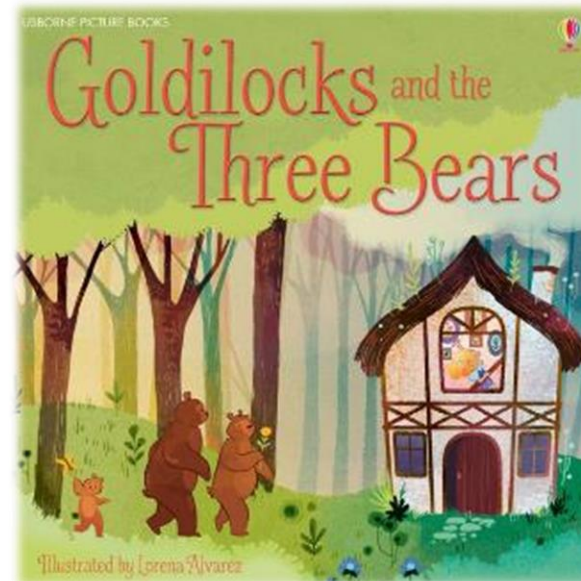
CONCLUDING REMARKS

- Synova offers affordable next generation plastic recycling with high circularity and high CO₂ reduction
- The temperature is:
 - High enough to break down to a few high-value molecules irrespective of the type of plastics and biomass content
 - Low enough to keep the molecules in play
- The feedstock can handle biogenic material:
 - Increases the output of high-value molecules
 - Improves the CO₂ reduction
 - Avoids expensive upstream separation
 - Keeps the losses low and circularity high
 - Keeps the feedstock cheap and highly available



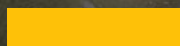
REMEMBER THIS

*Not too cold...
Not too hot...
But just right!*





SYNOVA



www.synovatech.com