TECHNOLOGY to CONVERT WASTE to VALUE

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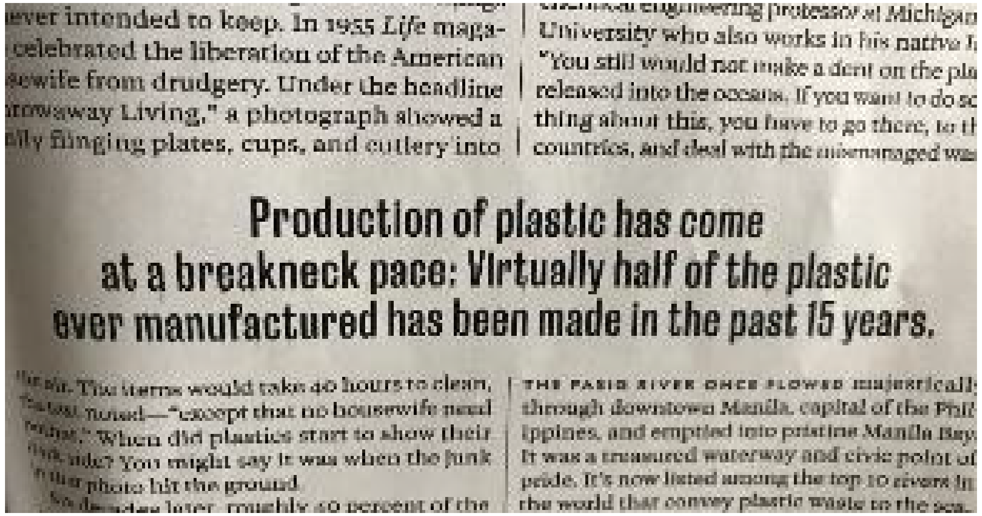
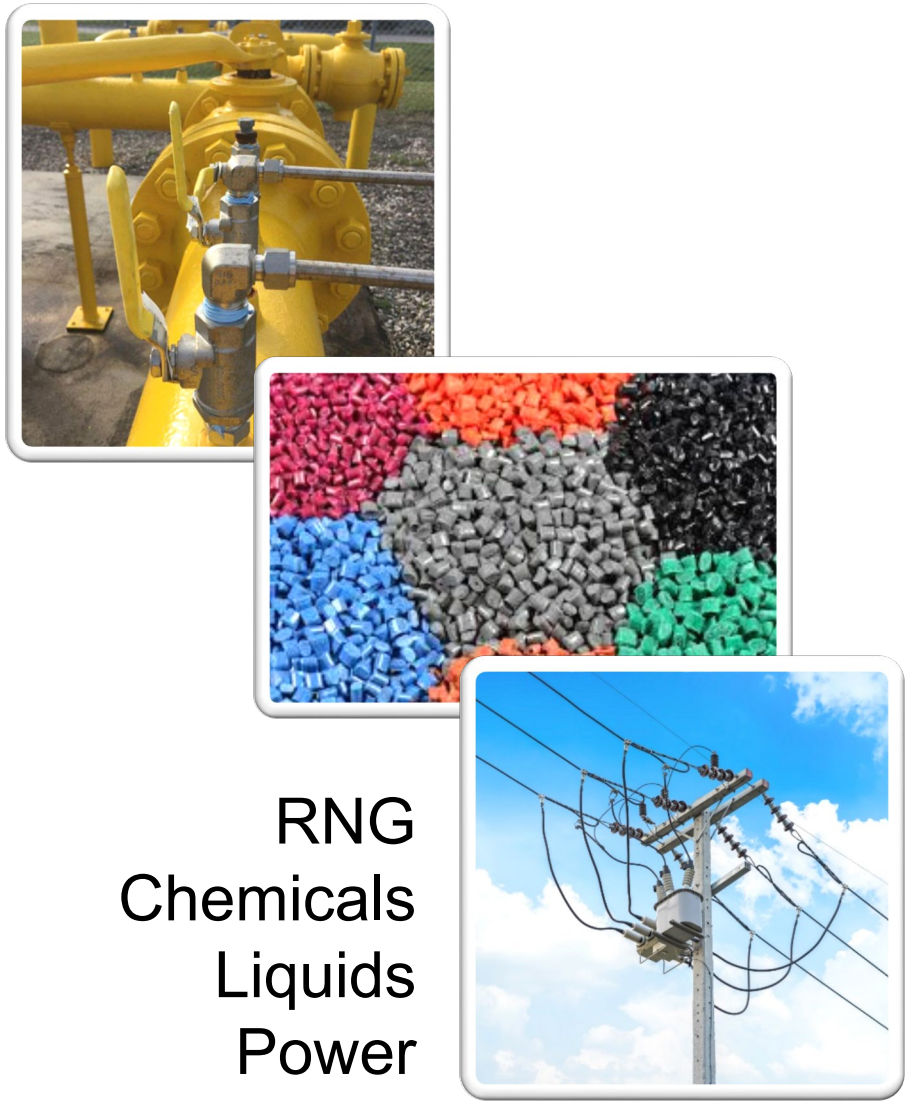
8 October 2019, TCBiomass^{plus}, Chicago


Production of plastic has come at a breakneck pace: Virtually half of the plastic ever manufactured has been made in the past 15 years.

SYNOVA

LOW-VALUE FEEDSTOCK to HIGH-VALUE PRODUCTS

Waste
Plastic
Biomass



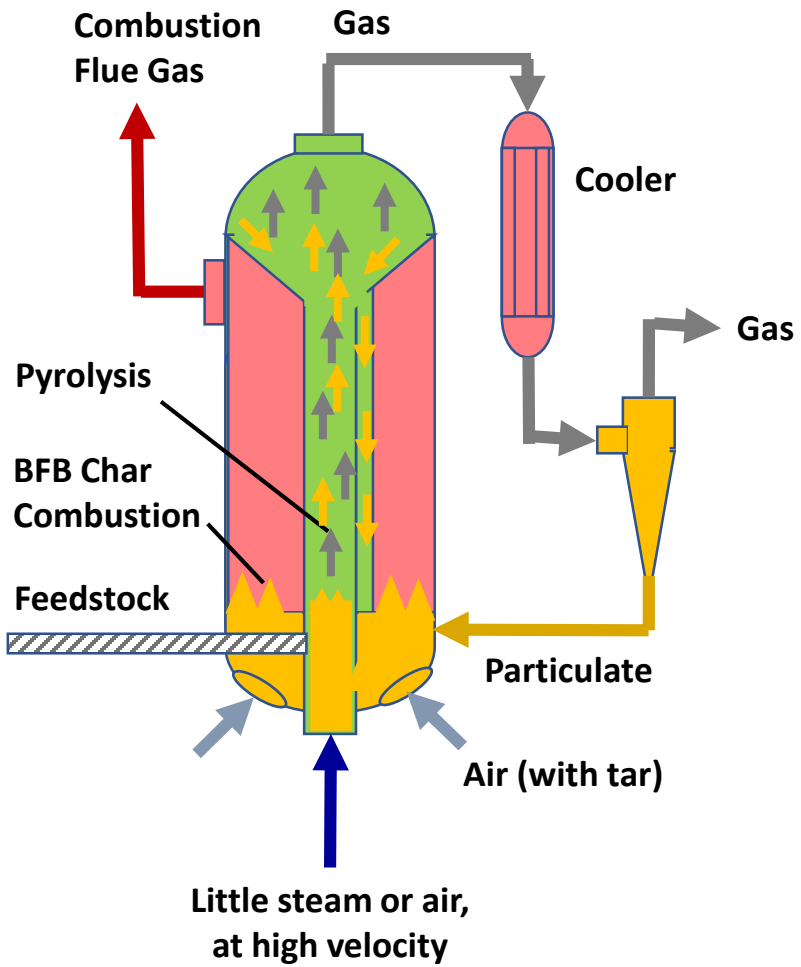
RNG
Chemicals
Liquids
Power

SYNOVA

THE PROCESS

- Devolatilization/ depolymerization
- Gas is rich in hydrocarbons
- Efficient removal of tars
- Gas suitable for:
  - Boiler/kiln/furnace
  - Electricity
  - RNG via methanation
  - Chemicals without synthesis

THE PROCESS – STEP 1



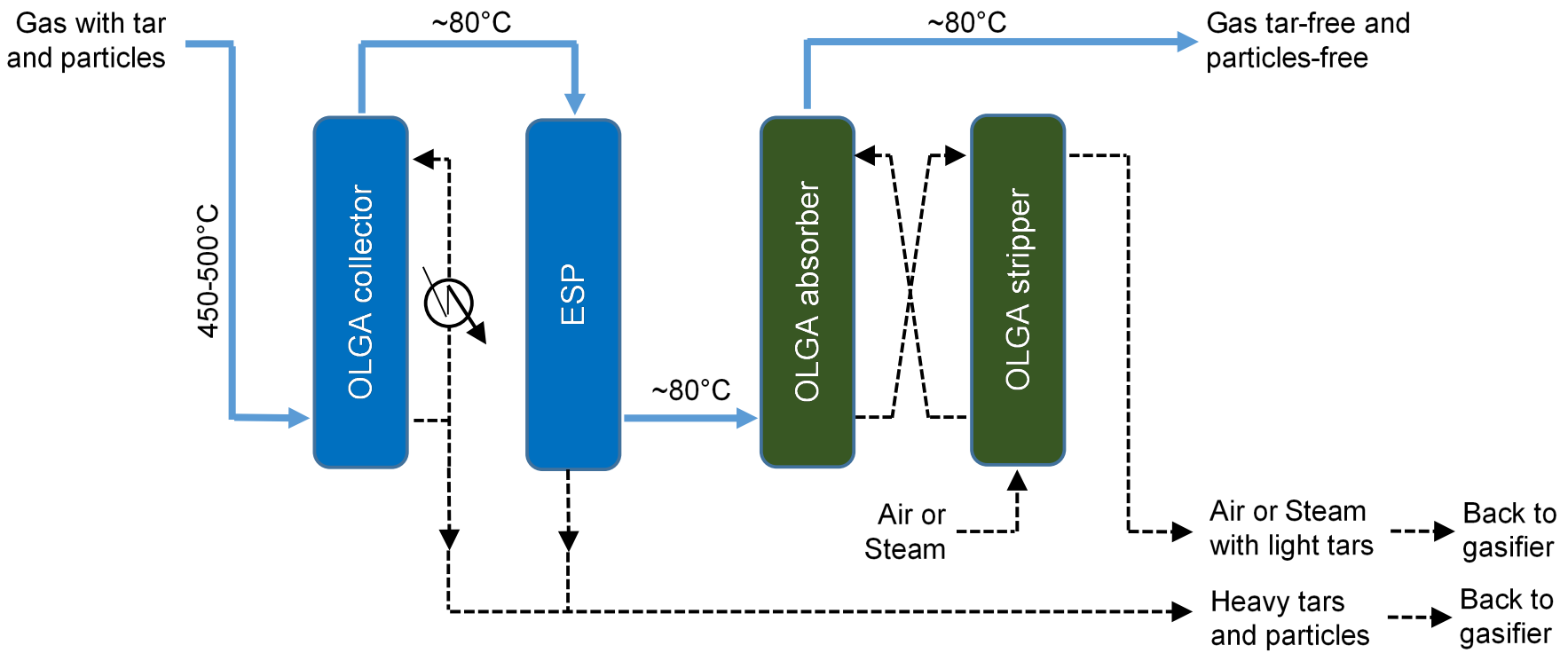
Step 1: Solid to gas

- Devolatilization/ depolymerization
- Feedstock is heated by hot sand
- Sand is heated by burning char and tar
- Gas is essentially free of N_2
- Without oxygen plant

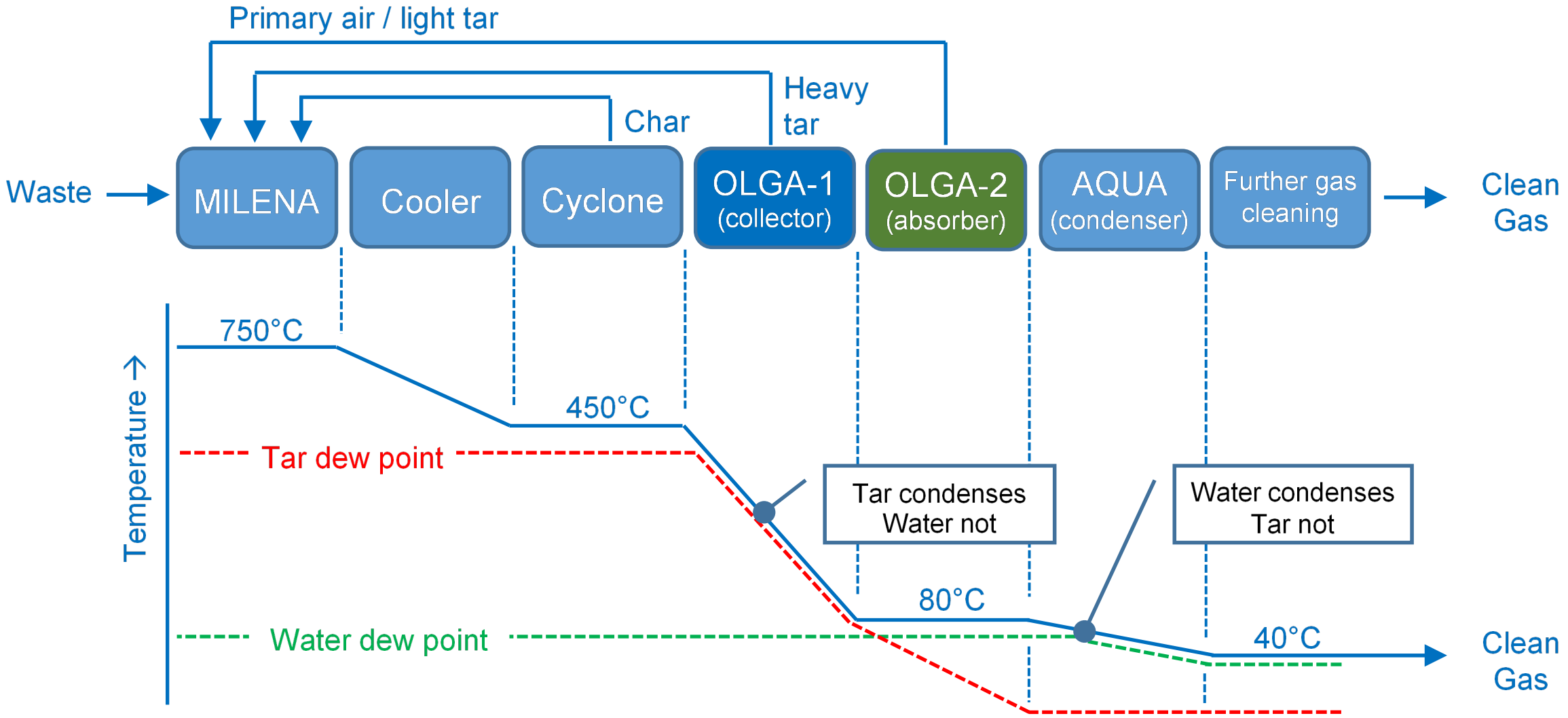
THE PROCESS – STEP 2

Step 2: Cleaning the gas

- Condensation of heavy tar
- Absorption of light tar
- Chemicals can be harvested



THE THING with DEW POINTS



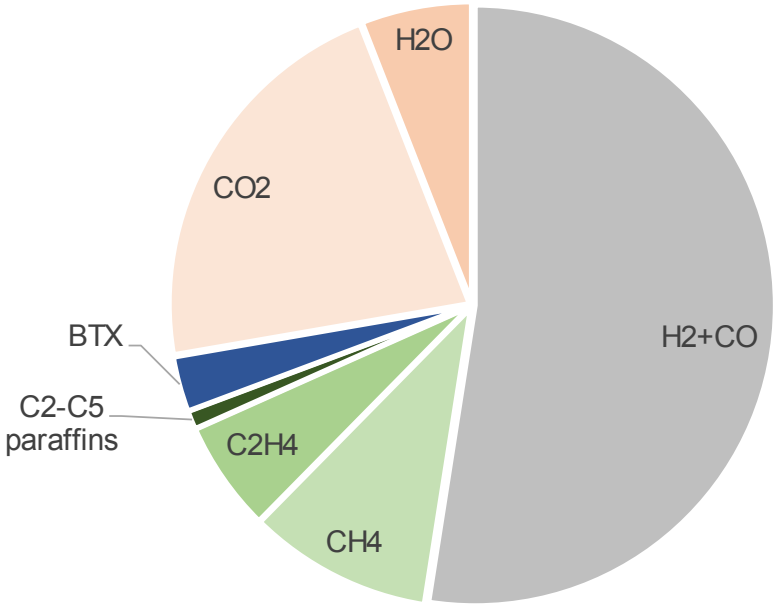
SYNOVA

ECN/TNO

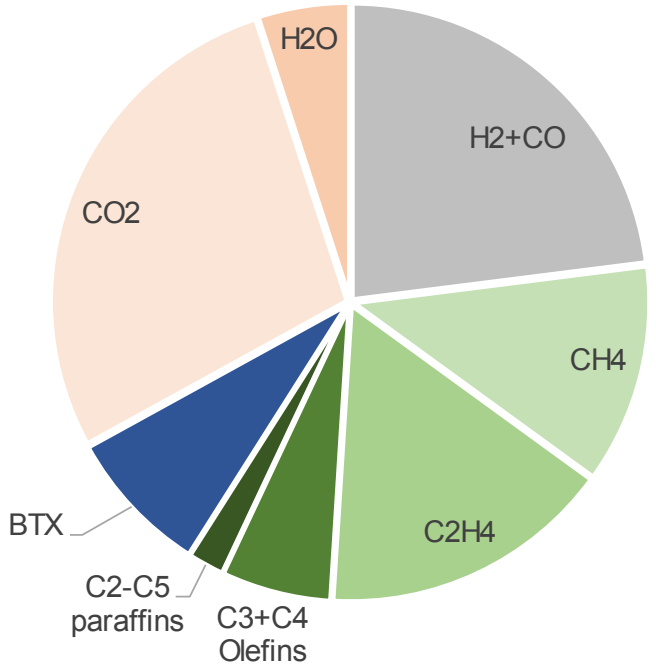
Ongoing cooperation with leading innovation institute on energy and chemistry

THE GAS (mass%)

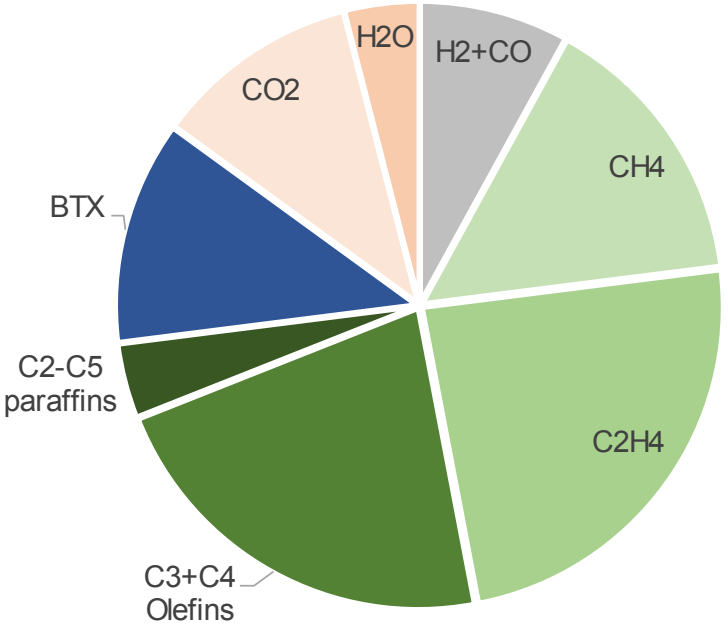
WOOD [wt%]



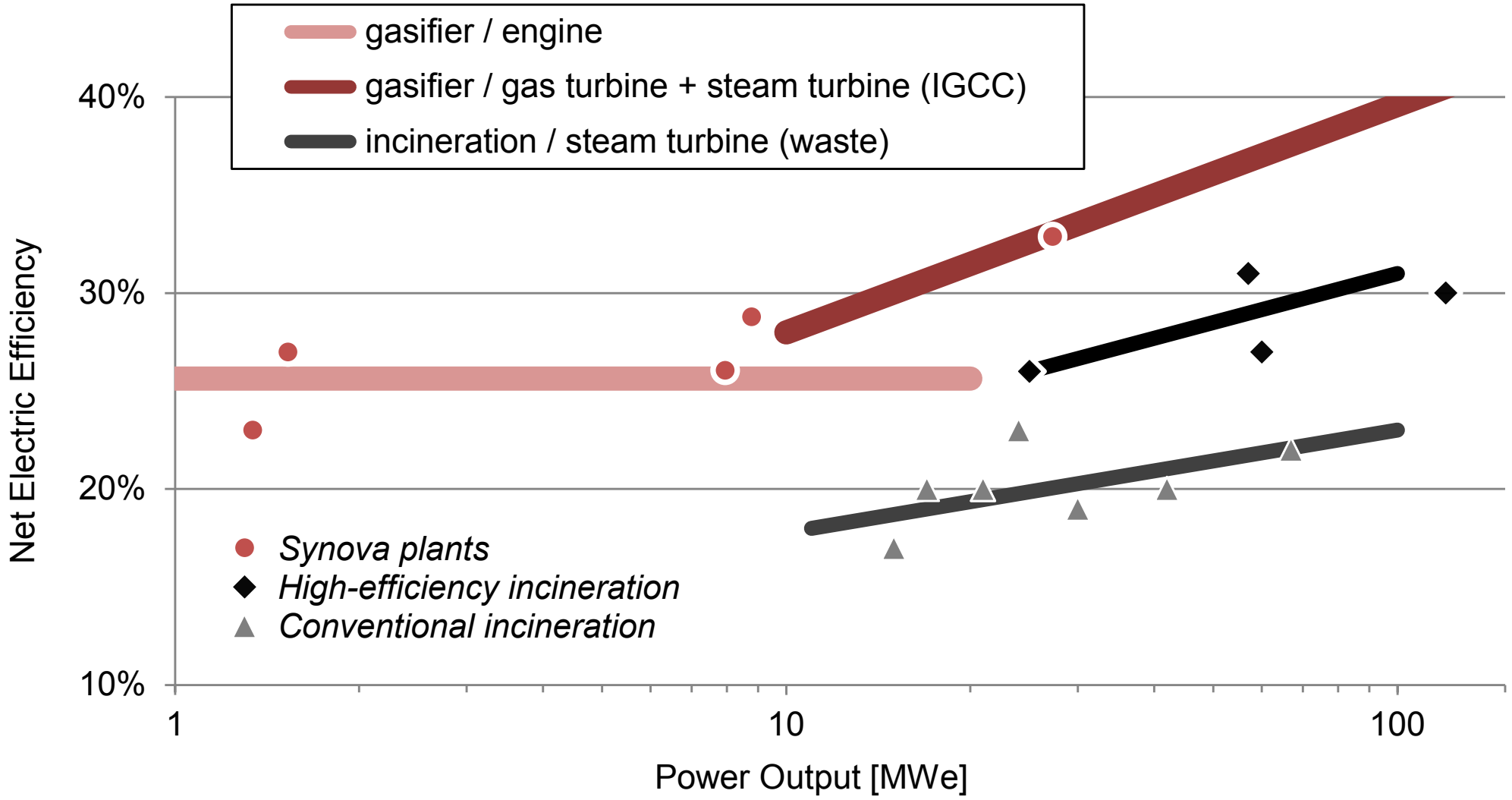
RDF (WOOD/PLASTIC) [wt%]



MIXED PLASTICS [wt%]



ELECTRICITY with HIGH EFFICIENCY



SYNOVA

HIGH EFFICIENCY – SMALL FOOTPRINT

- Modularized unit for 25-30 tonnes/day
- Pre-assembled
- Footprint <1000 m^2
- Short delivery time
- Larger units developed for 160 and 400 tonnes/day

- Efficiency and output to power:
  - 1.5 MWe net power output
  - >24% net efficiency

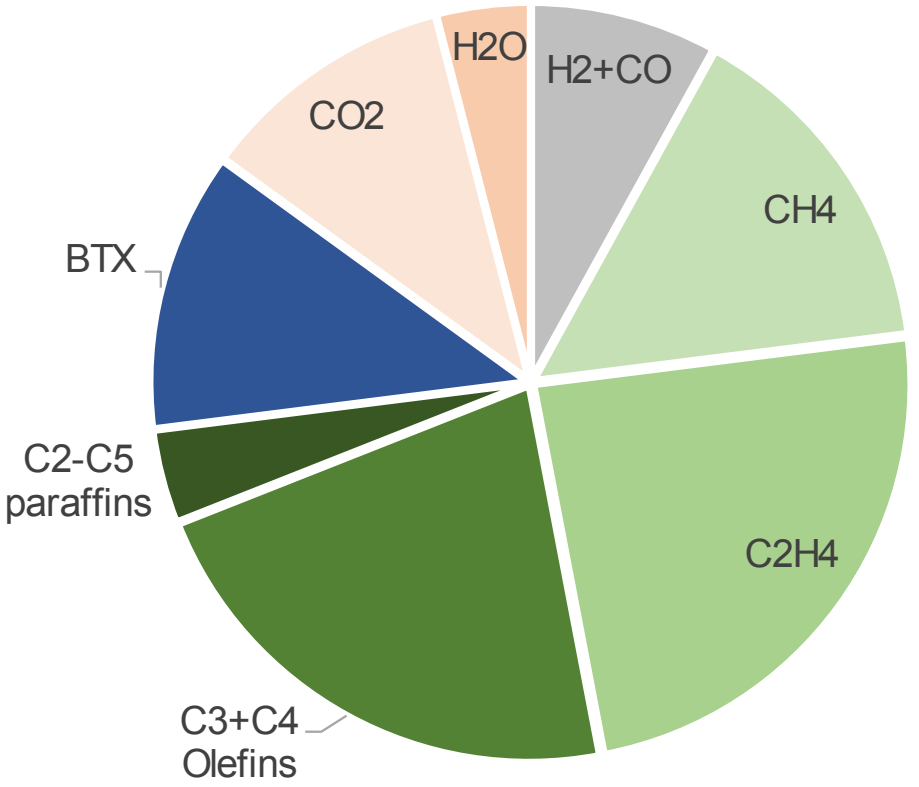
RNG: RENEWABLE NATURAL GAS (or as CNG or LNG)

- 65-70% efficiency
- 1 tonne biomass → 350 m^3 RNG
- Process proven at ECN
- Validated by methanation partners

VALUABLE CHEMICALS WITHOUT SYNTHESIS

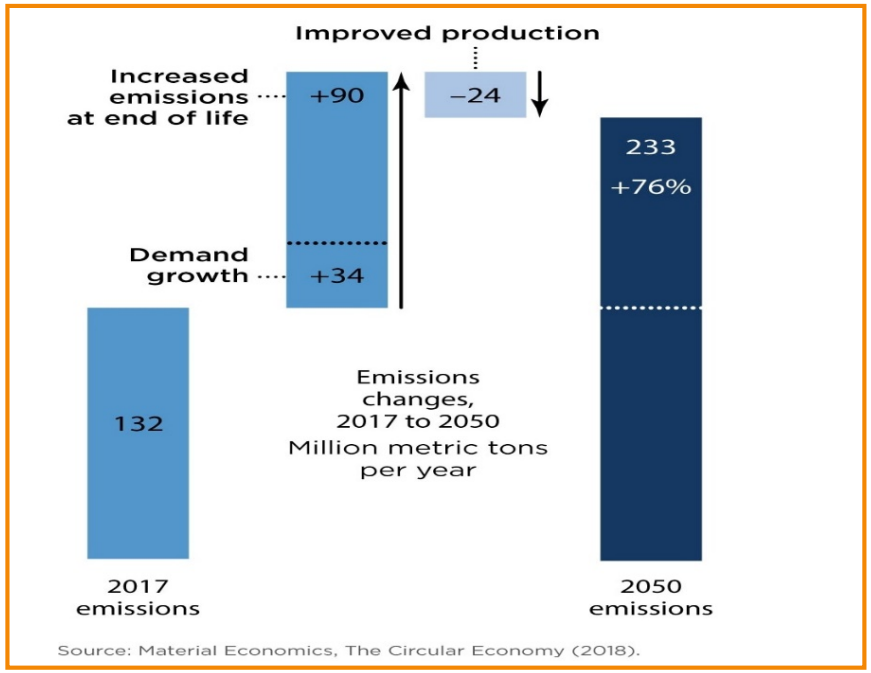
- No synthesis means cost-effective at smaller scale
- Ethylene, propylene, BTX
- Olefin aromatization for boosting BTX yield

- Plastics circularity via chemical recycling
- Adding biomass provides “renewability”

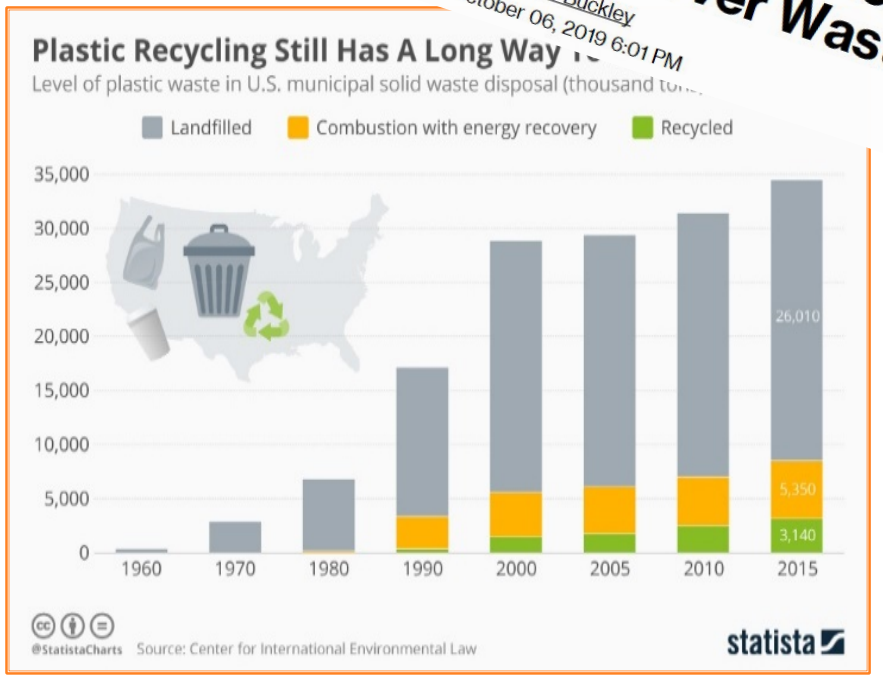


IMPACT

EU Plastics Lifecycle emissions



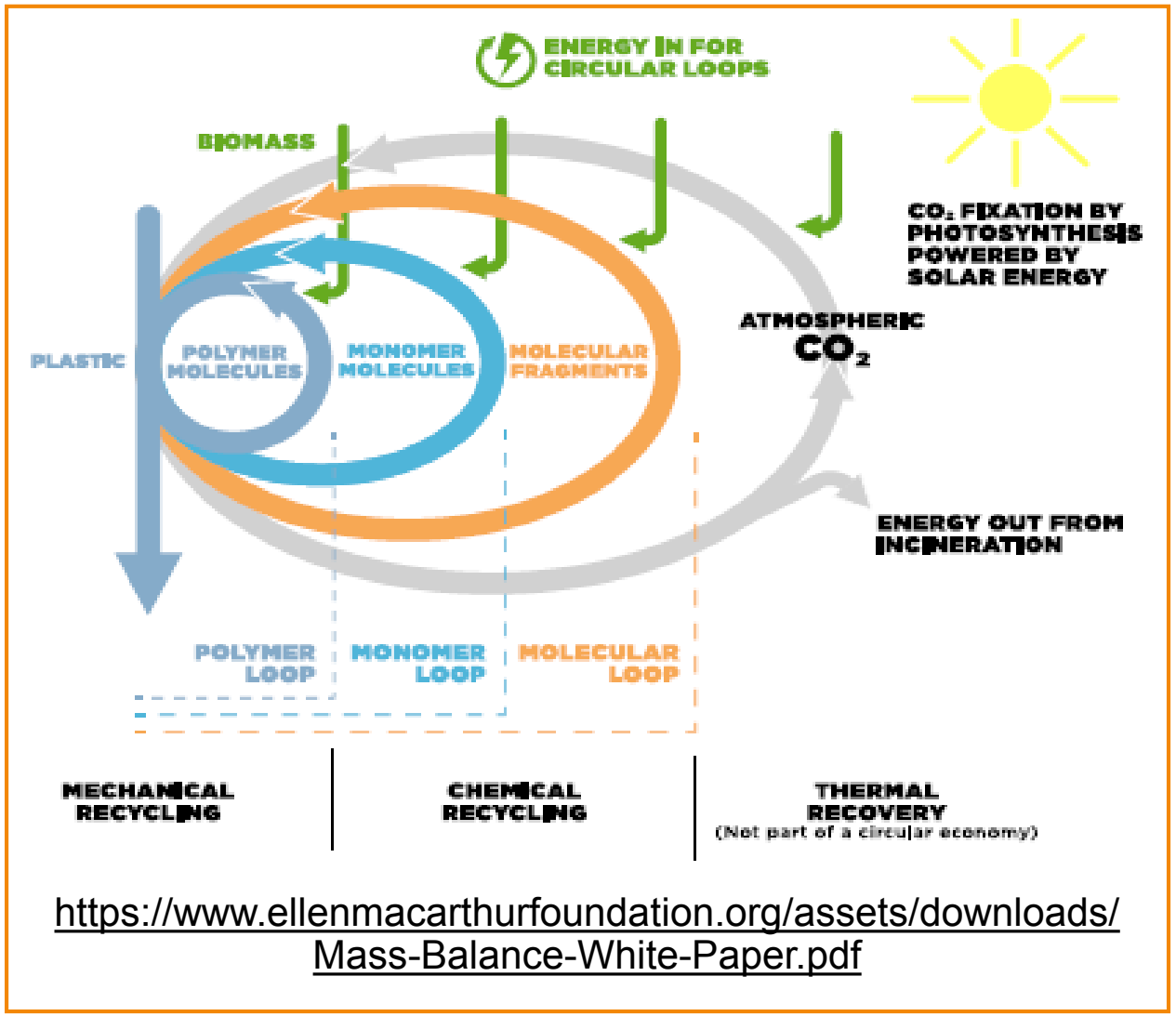
US Recycling



Global waste converted to chemicals, would equal 45% of all plastics production

SYNOVA

CONTACT



https://www.ellenmacarthurfoundation.org/assets/downloads/Mass-Balance-White-Paper.pdf

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