

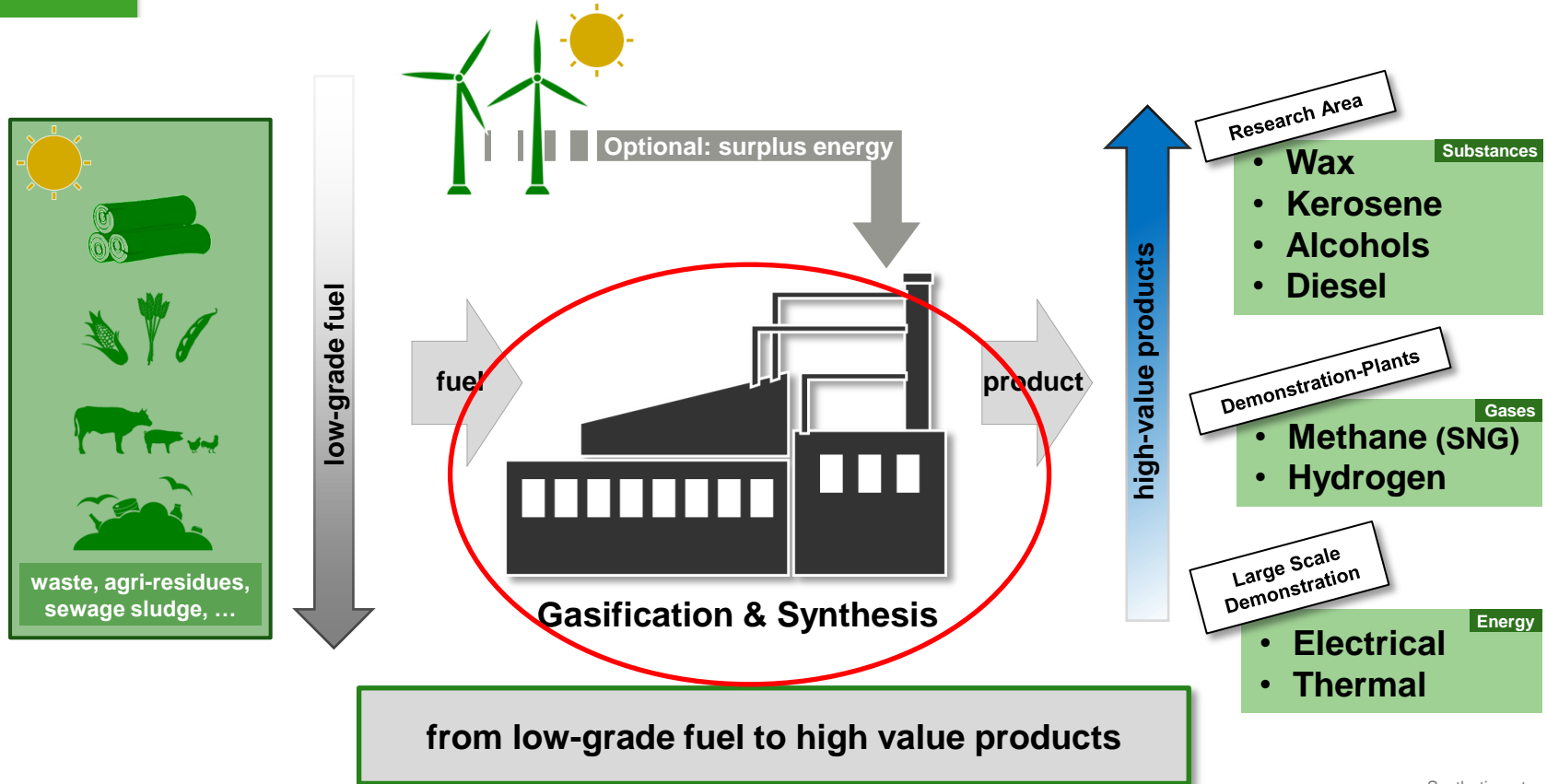
Product flexibility from biomass steam gasification applying gas upgrading and synthesis processes

Graz, 22.01.2020

Matthias Binder

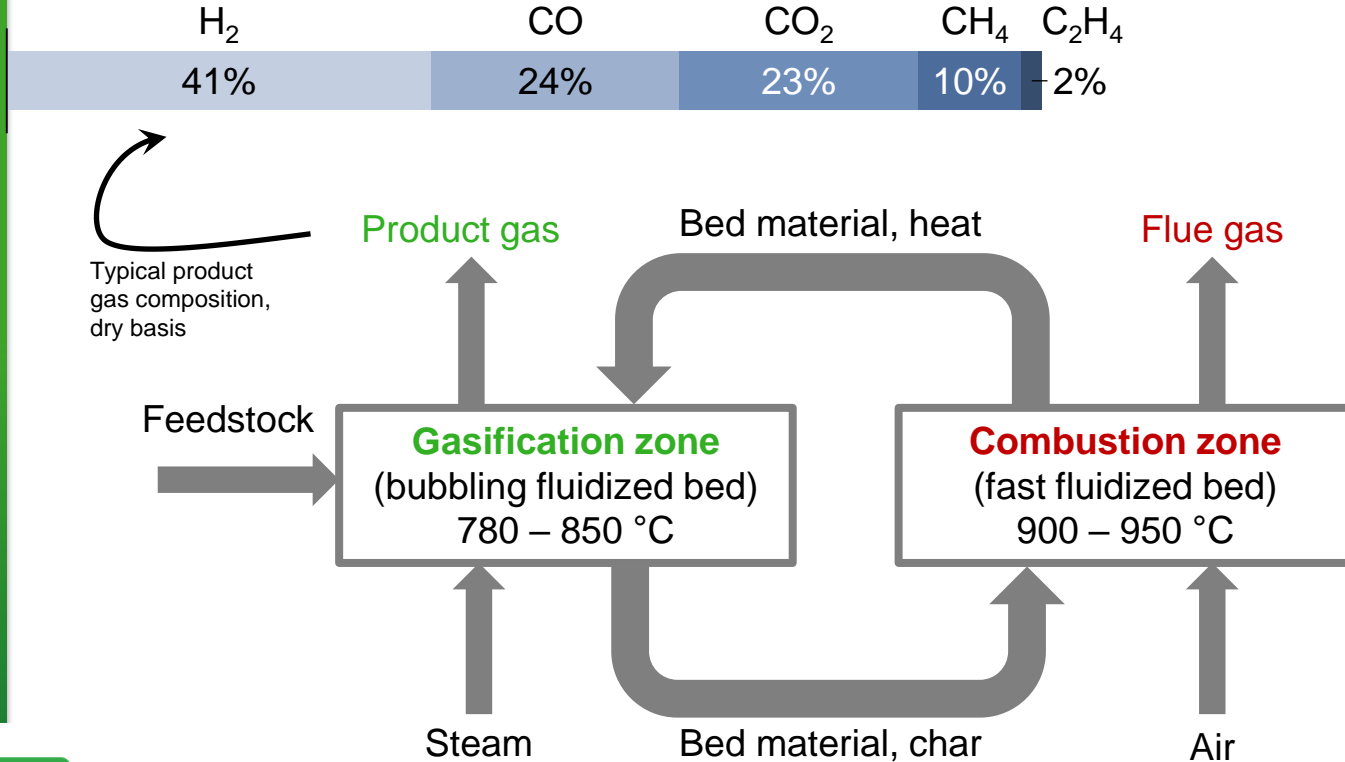


Concept in a nutshell





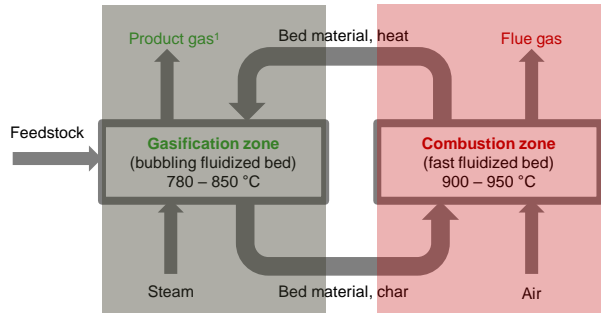
Dual fluidized bed (DFB) steam gasification



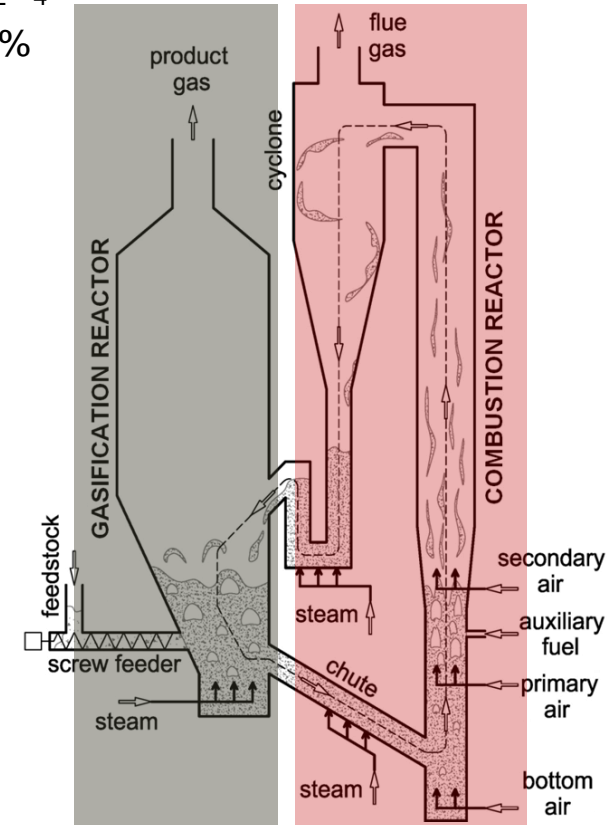


Dual fluidized bed (DFB) steam gasification

H_2	CO	CO_2	CH_4	C_2H_4
41%	24%	23%	10%	2%



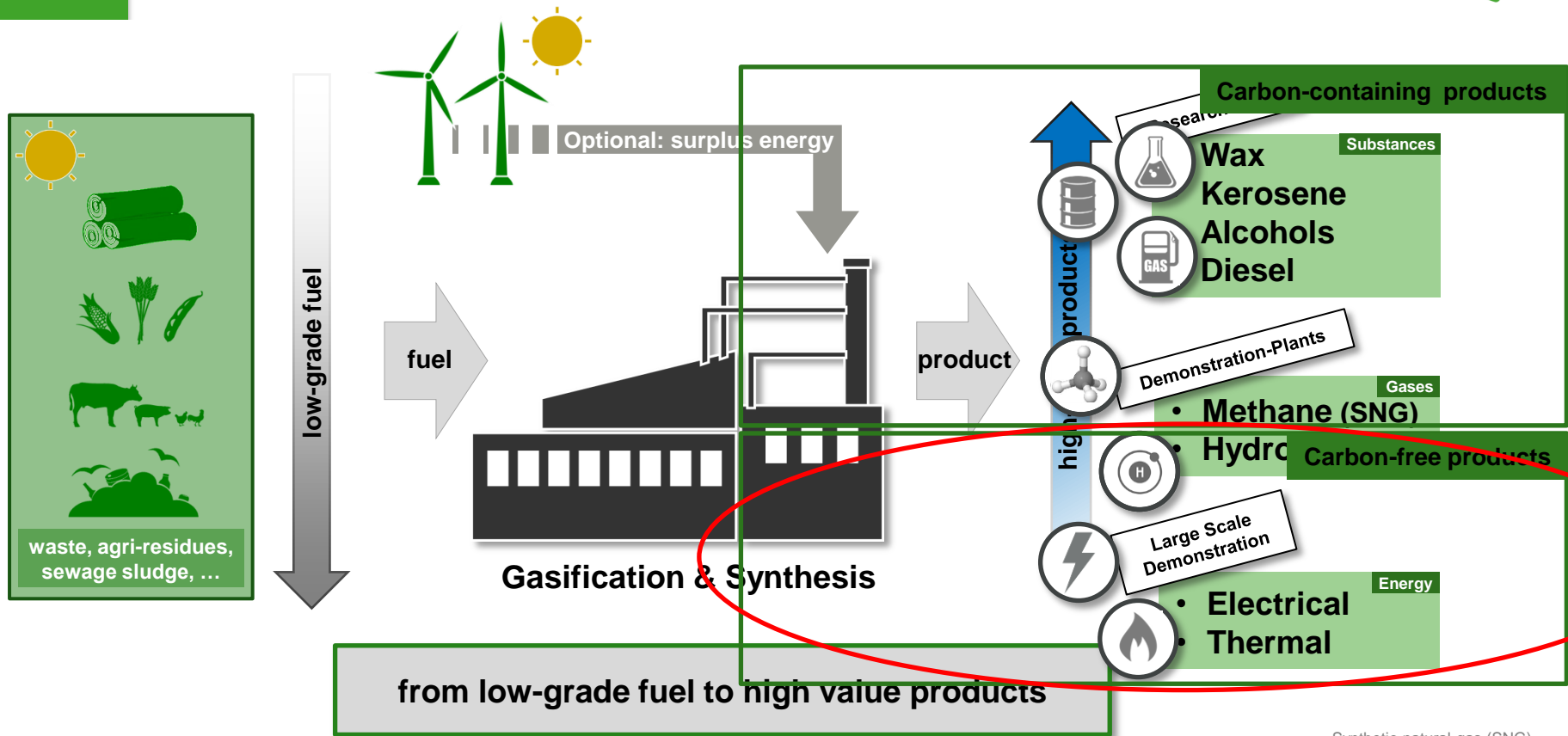
implementation



ICEBE
IMAGING
NATURE

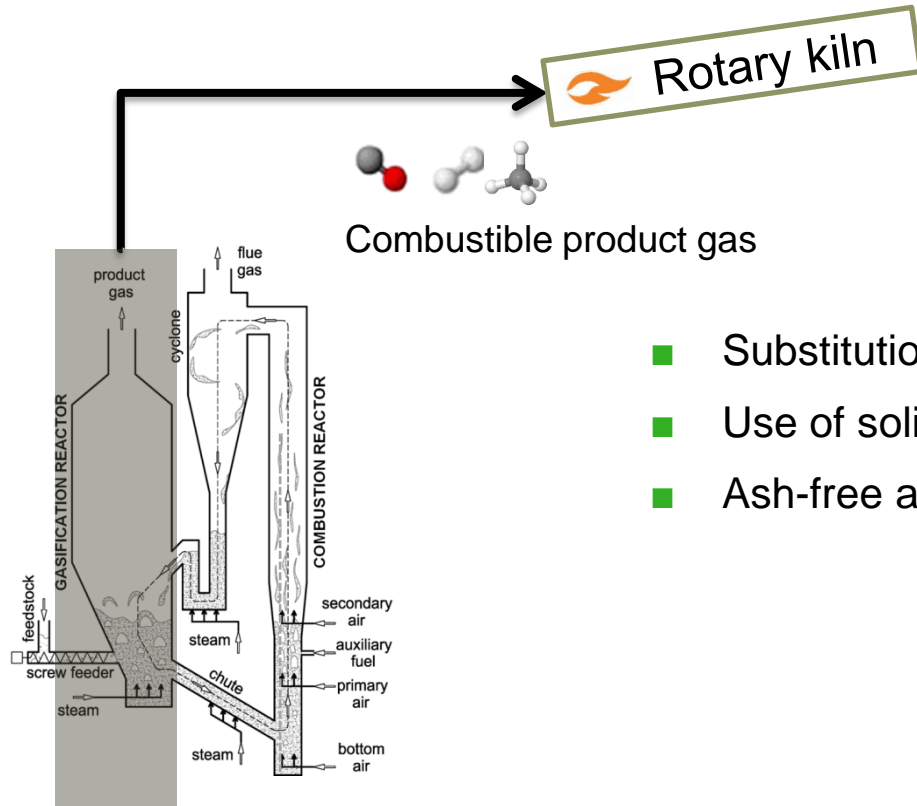
¹ Tar (incl. BTEX): 20-30g/m³, H₂S ~100 ppm for biomass fuel before any gas cleaning for downstream processing

Concept in a nutshell





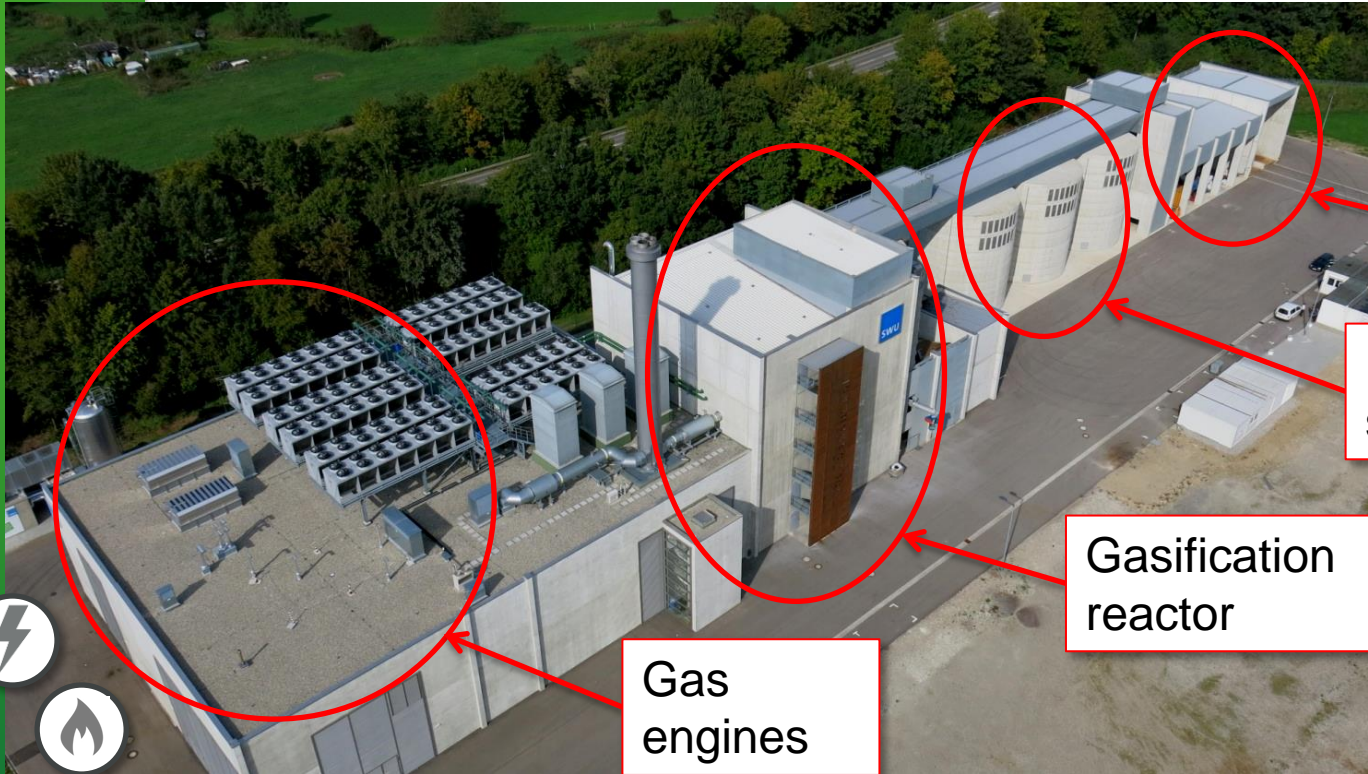
Direct combustion of product gas



- Substitution of fossil fuels (natural gas)
- Use of solid feedstocks in gaseous form
- Ash-free and pre-cleaned applications



Combined heat and power plant Senden



Fuel delivery

Fuel storage

Gasification reactor

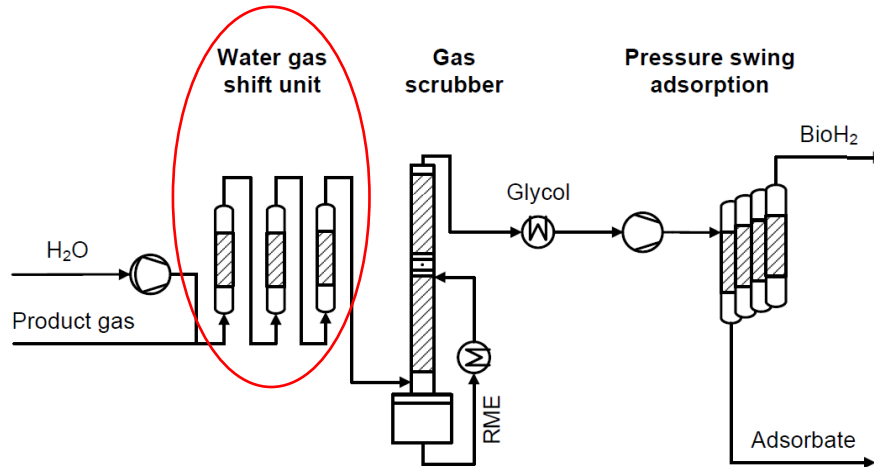
Gas engines

>100k Operating hours in Güssing, up to 6500 hours per year in Senden with increasing trend.





Experimental hydrogen process chain

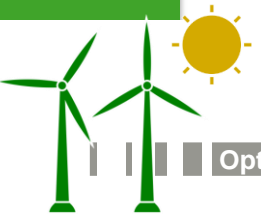


- Commercial Fe-Cr based catalyst
- CO conversion rates > 95%
- More than 3200 hours of WGS operation



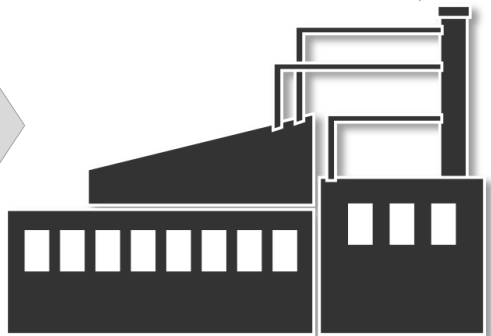


Concept in a nutshell



Optional: surplus energy

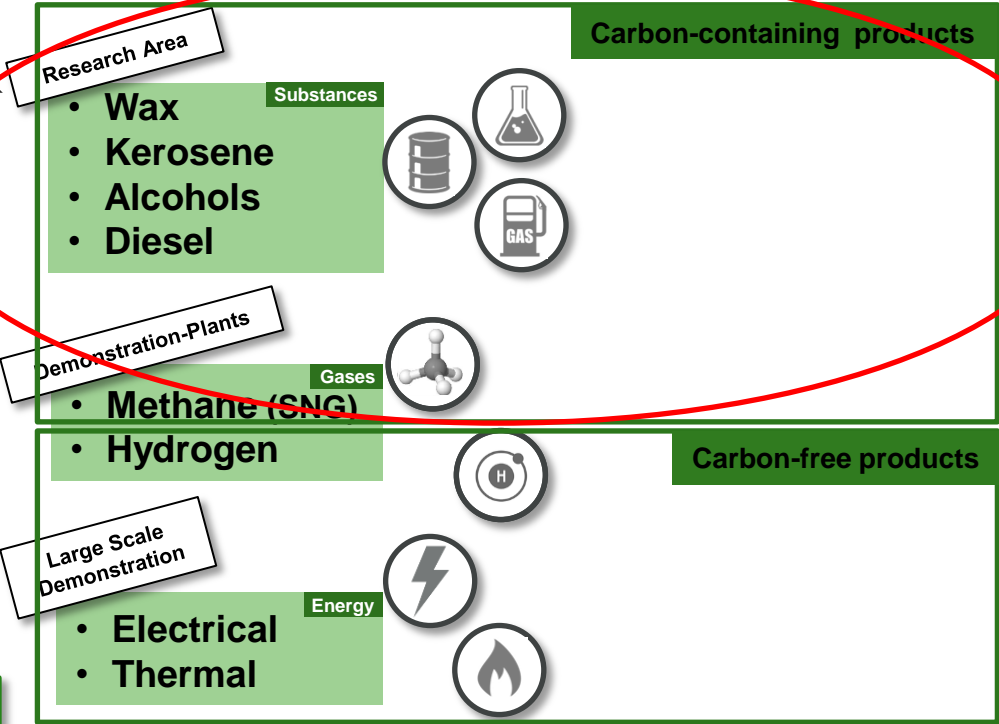
fuel



Gasification & Synthesis

product

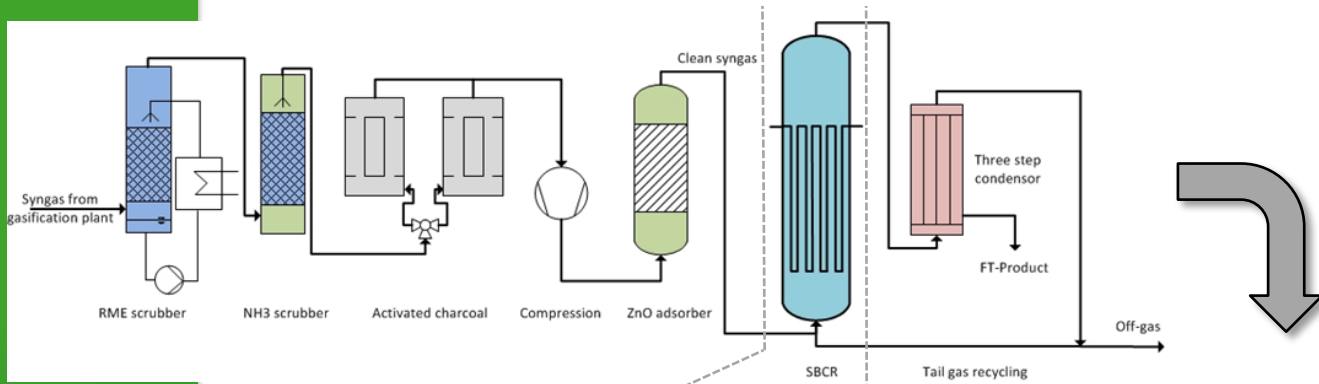
high-value products



from low-grade fuel to high value products



Fischer-Tropsch (FT) synthesis



1

Gas cleaning and conditioning:
removal of tar, water, BTEX, sulfur and ammonia

2

FT reactor:
slurry bubble column reactor

3

FT product condensation:
liquids and wax





Upscaling to one barrel per day FT plant

2019/2020

Full relocation and concentration near research facilities



2005

10 liter per day FT pilot plant was erected

2016

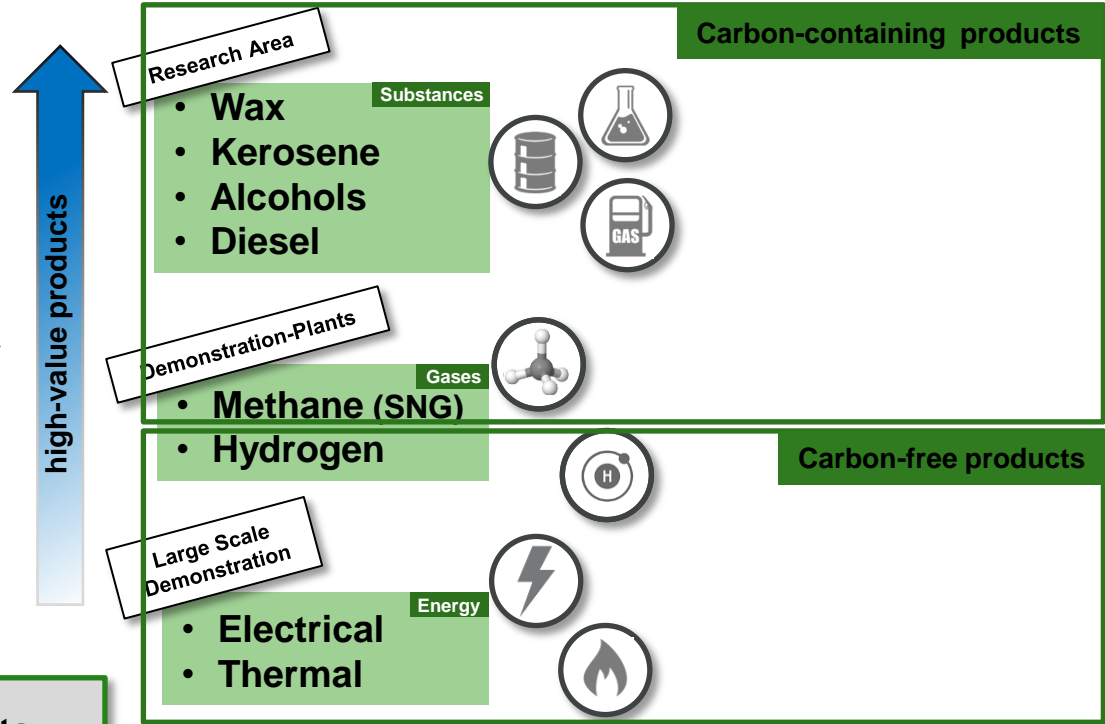
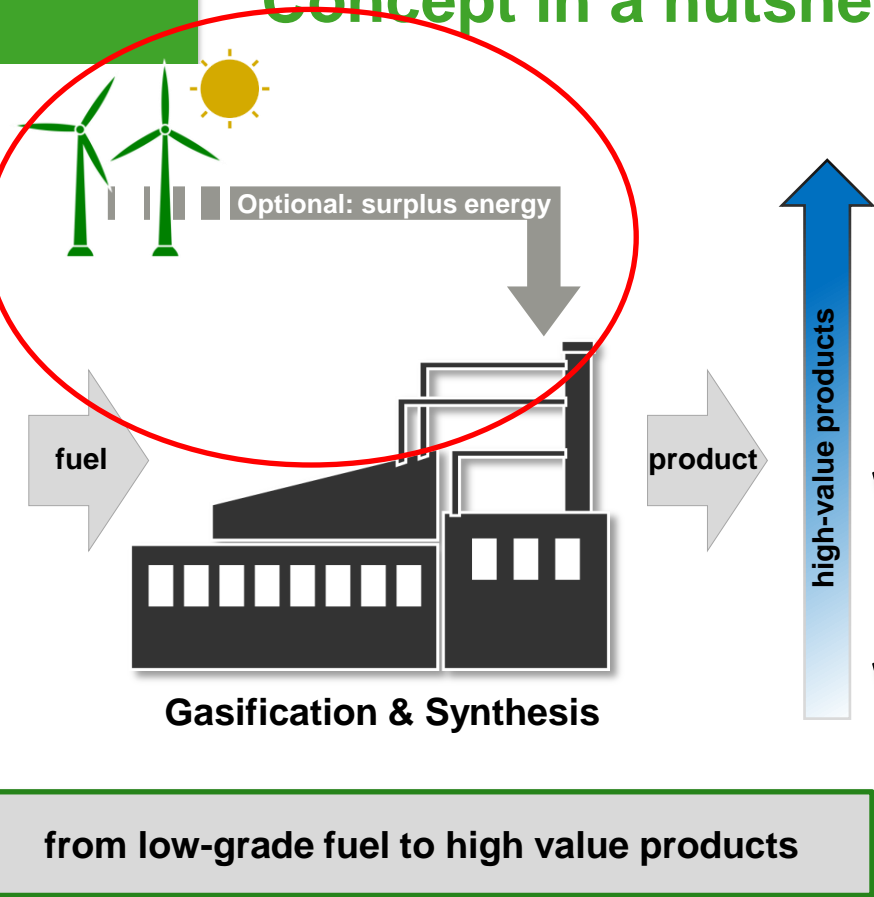
Up-scaling to one barrel per day pilot scale was successfully finished

Idea to industrial implementation



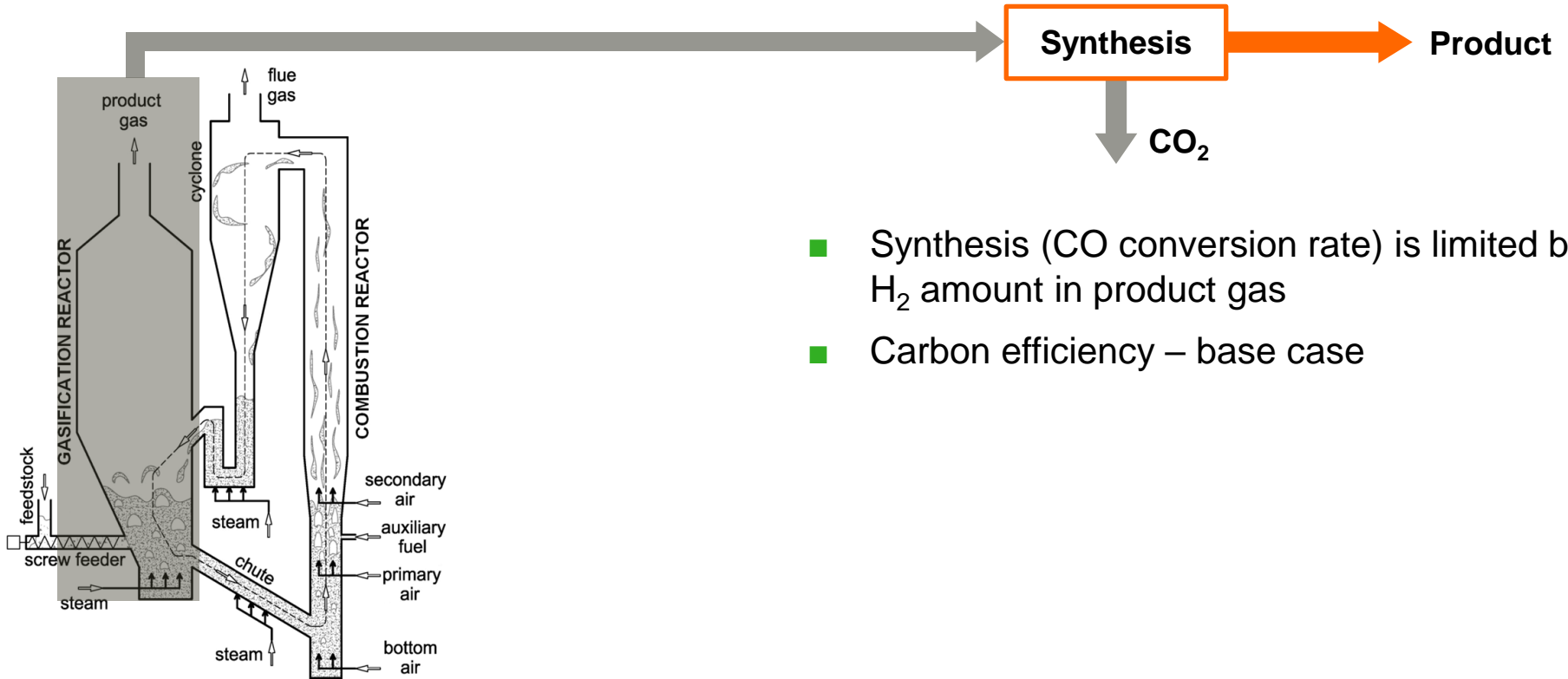


Concept in a nutshell





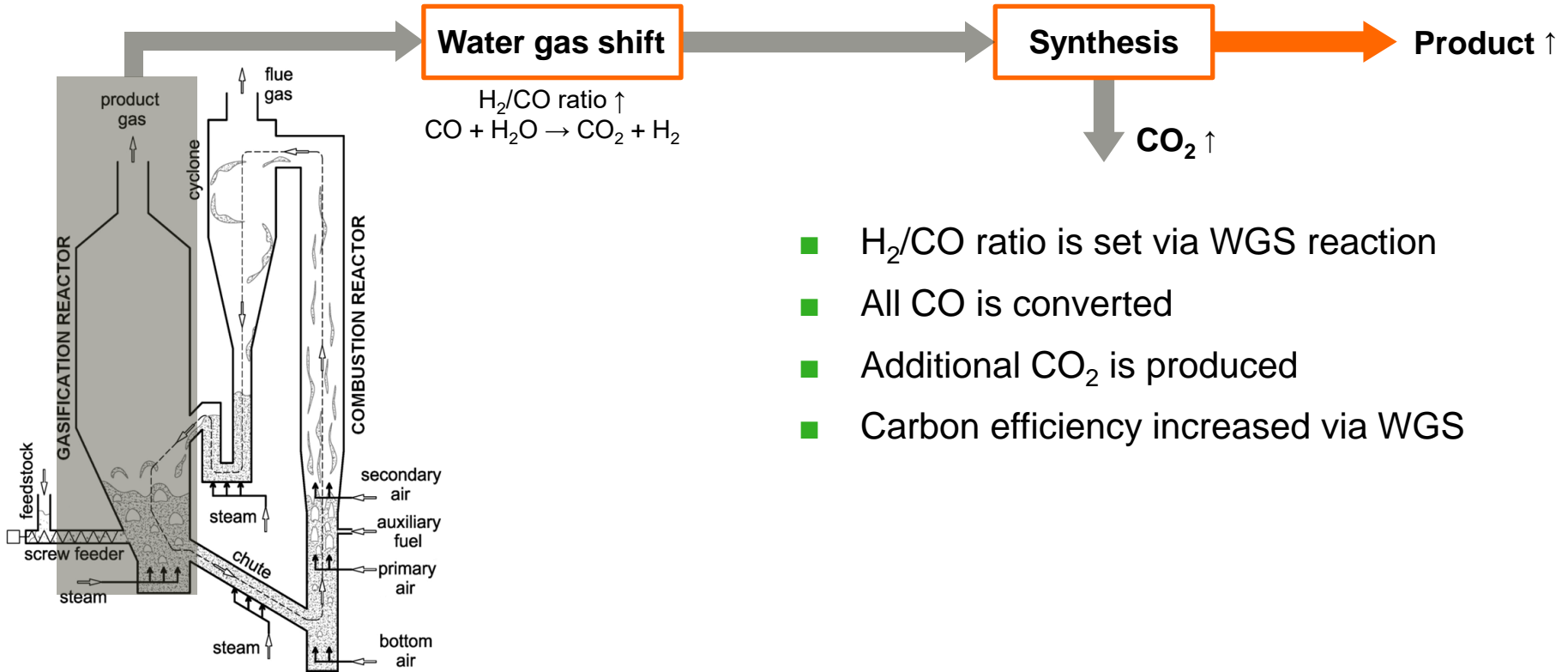
Enhanced system via hydrogen addition



- Synthesis (CO conversion rate) is limited by H₂ amount in product gas
- Carbon efficiency – base case



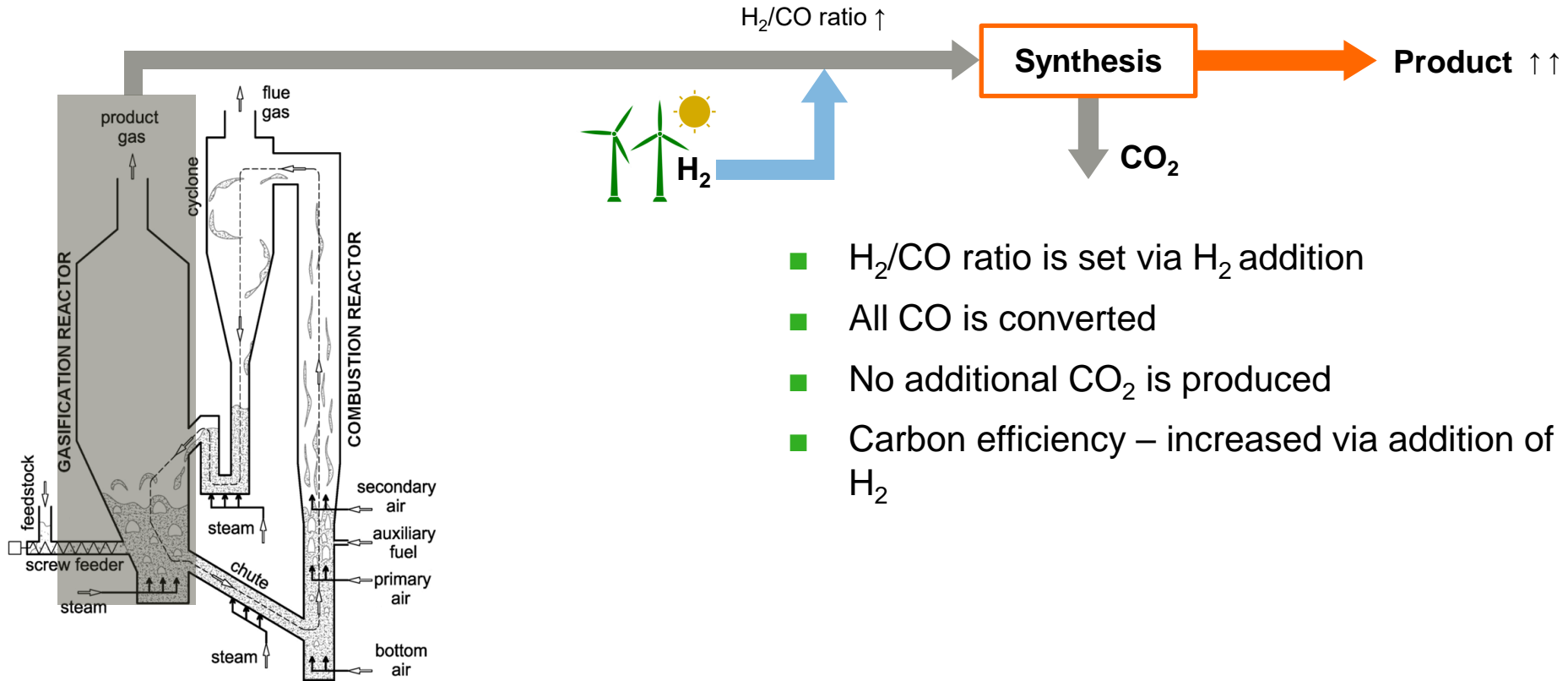
Enhanced system via hydrogen addition



- H_2/CO ratio is set via WGS reaction
- All CO is converted
- Additional CO_2 is produced
- Carbon efficiency increased via WGS



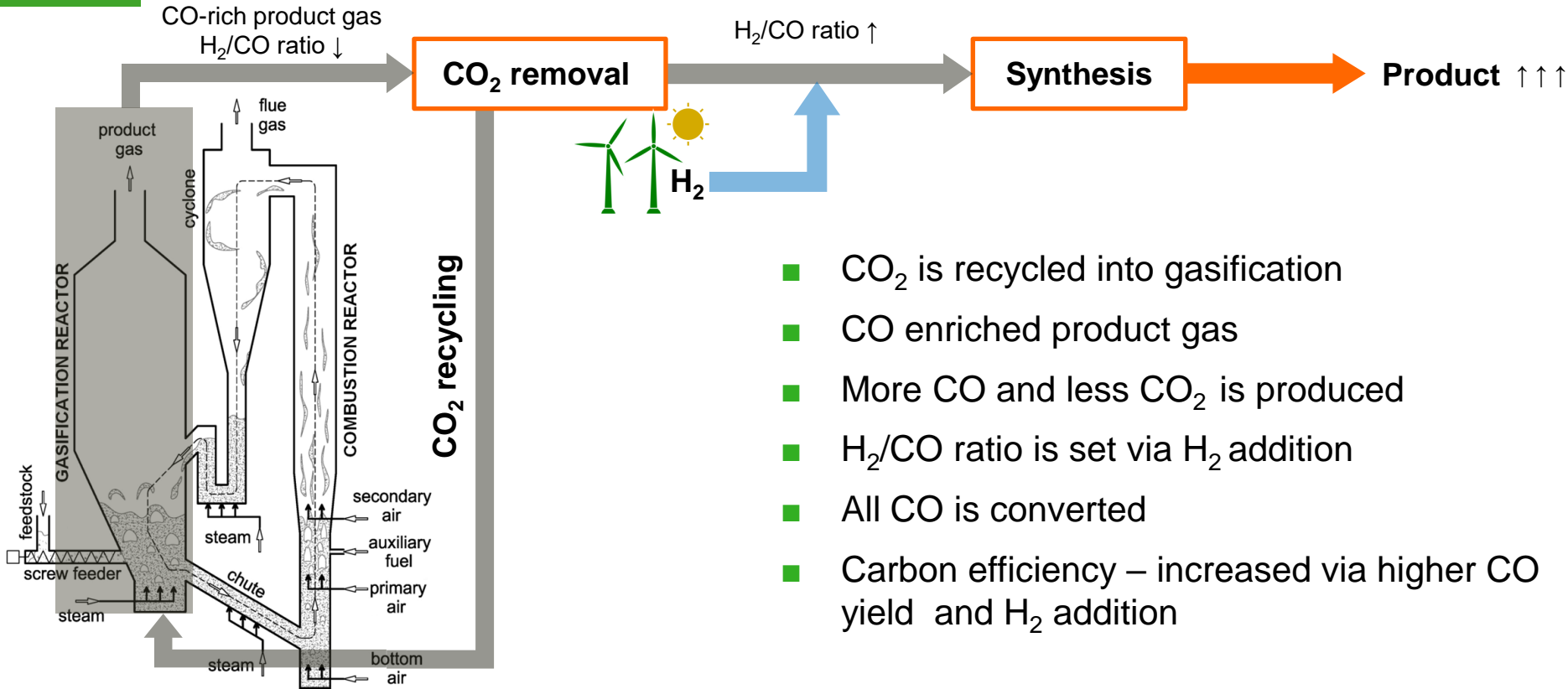
Enhanced system via hydrogen addition



- H₂/CO ratio is set via H₂ addition
- All CO is converted
- No additional CO₂ is produced
- Carbon efficiency – increased via addition of H₂

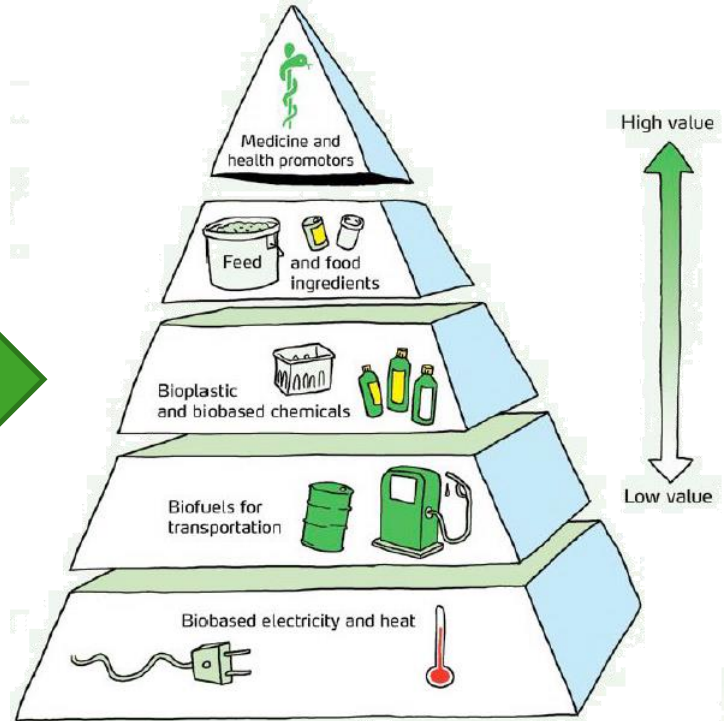
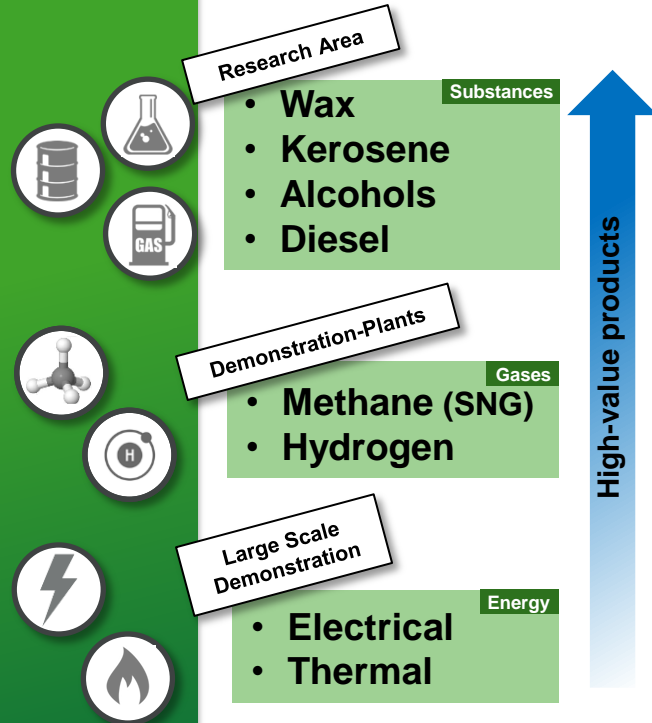


Enhanced system via hydrogen addition





Shifting the focus towards higher-value products





BEST

Bioenergy and
Sustainable Technologies



Ein Fonds der
Stadt Wien

