Low Pressure, Catalytic Conversion of Biogenic Feedstocks (Katalytische Niederdruck Verölung - KNV)

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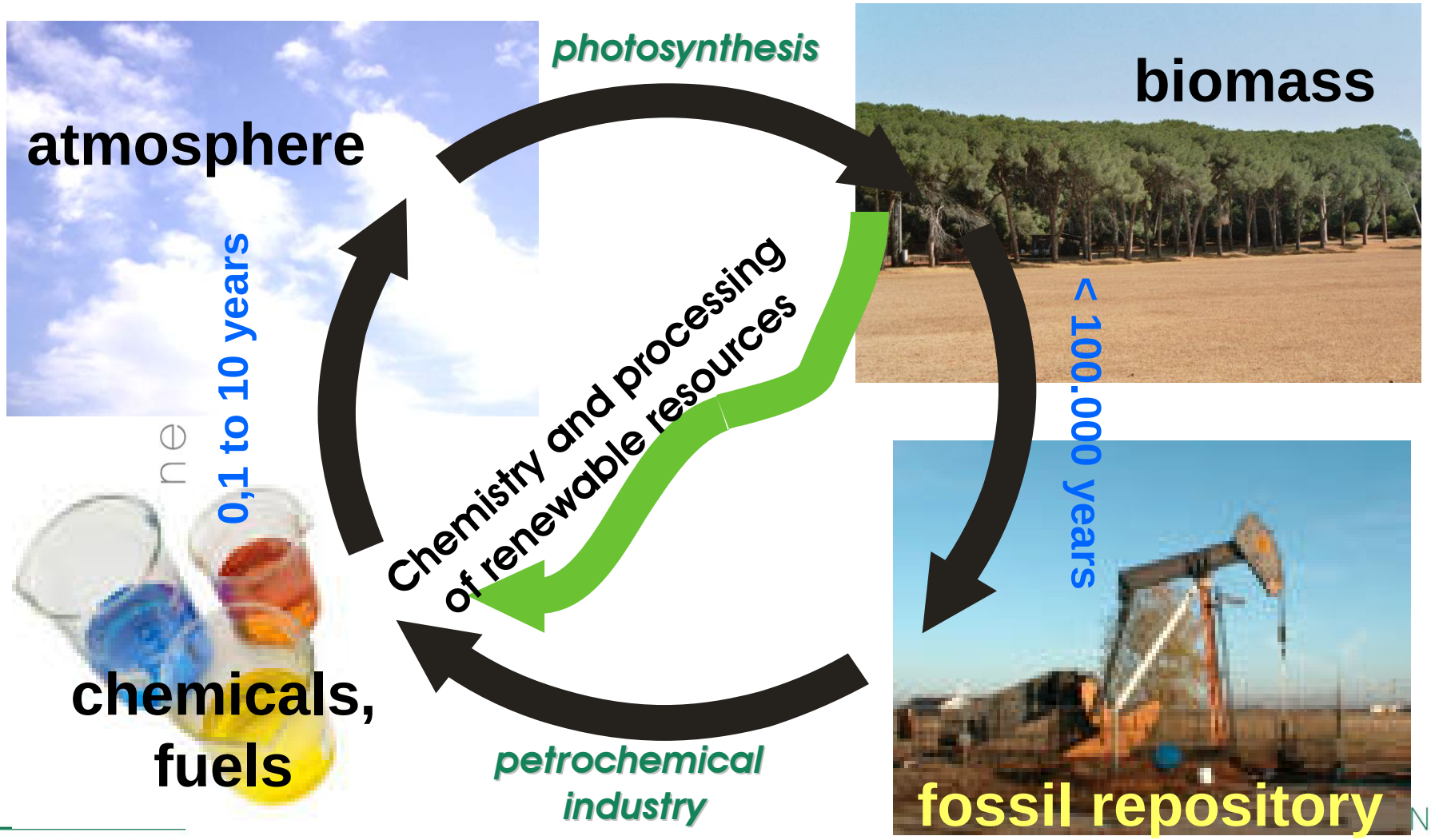
Organic chemistry is always based on biomass



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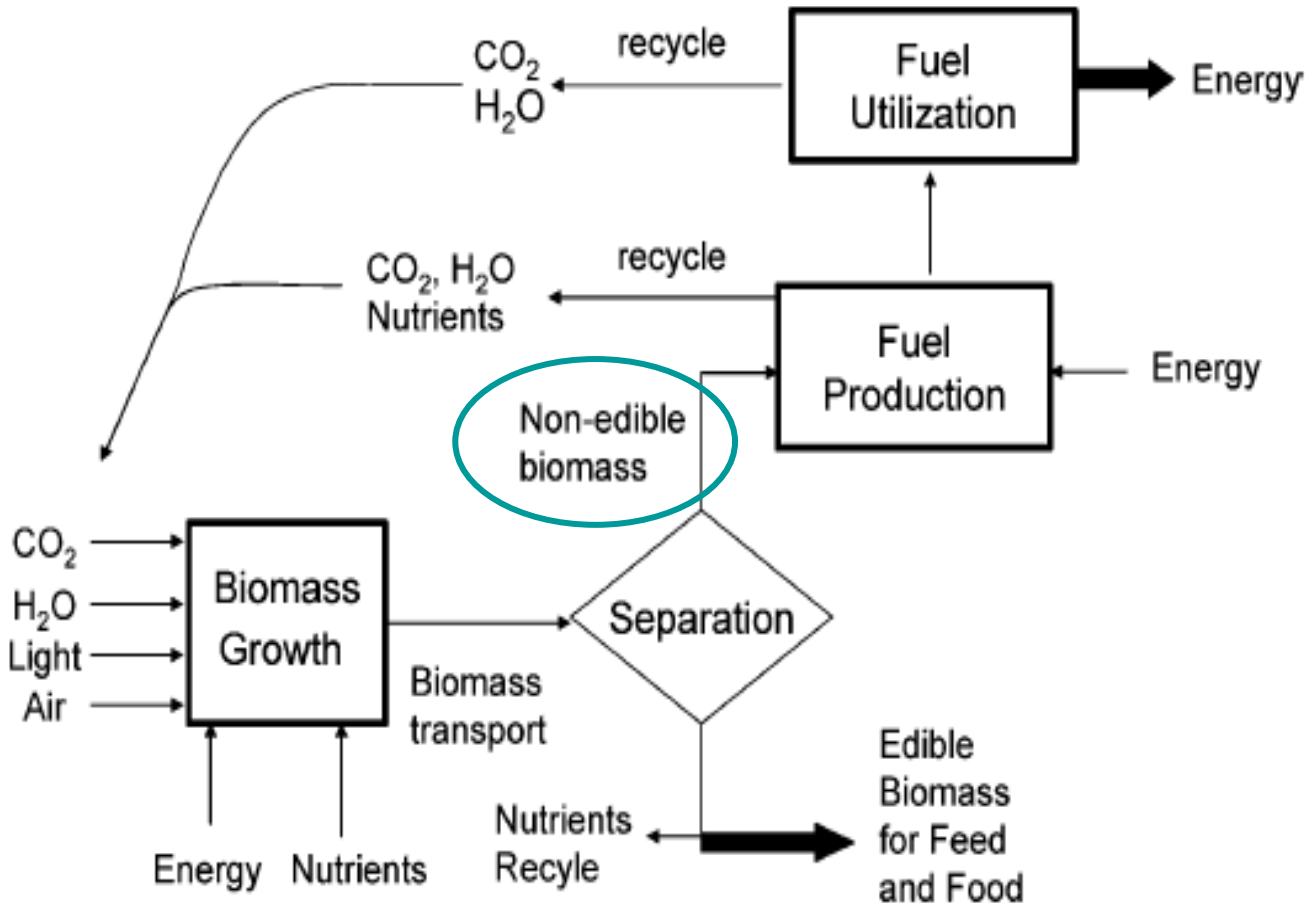
Sustainable production of biofuels



Huber et al.

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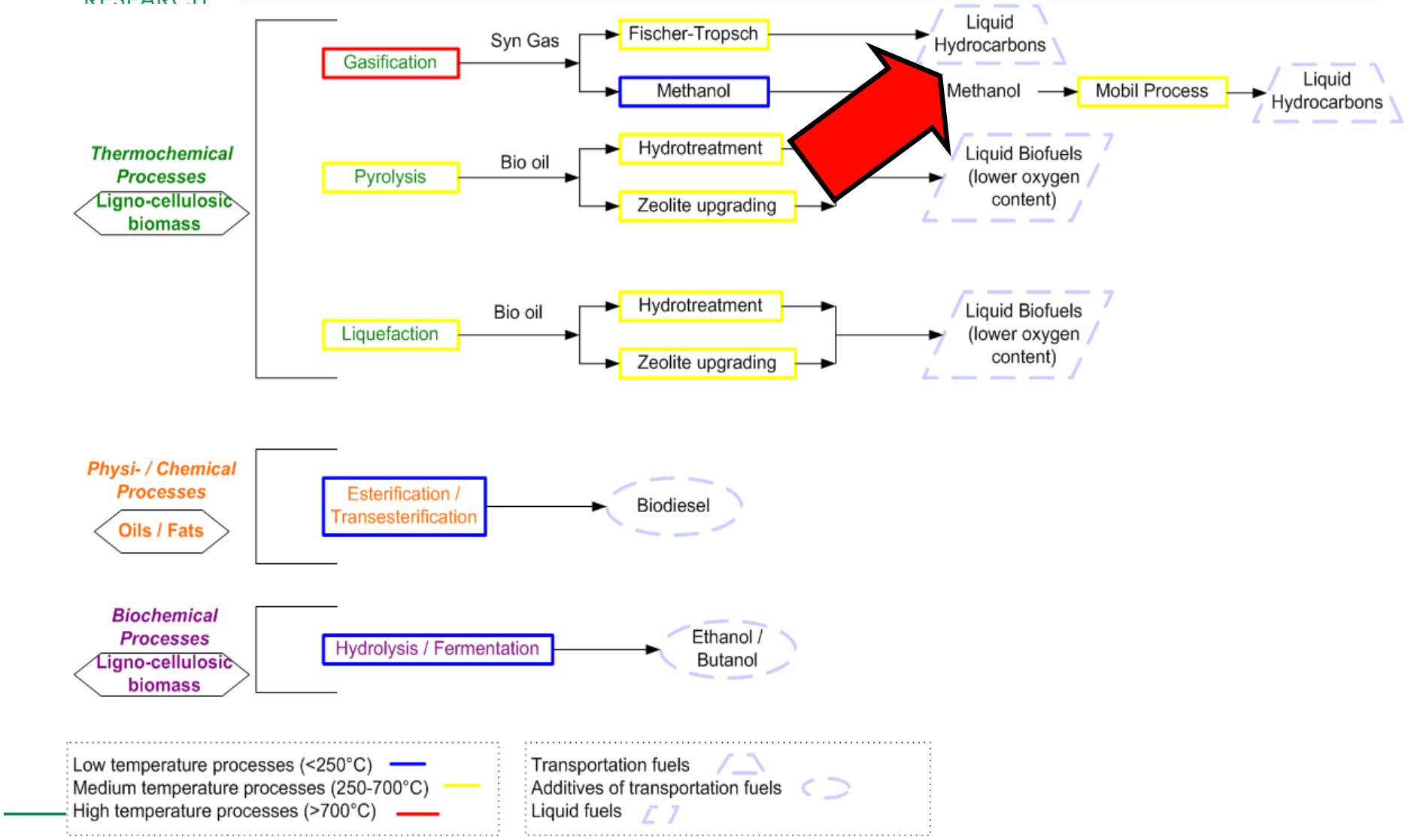
Conversion routes to liquid biofuels



KNV

Pre-treatment (physico-chemical treatment)

KNV (Conversion)

- **thermochemical conversion of biogenic feedstocks in the presence of N_2**
- **use of solid catalysts (zeolites)**
- **temperature: <450°C**
- **pressure: slight vacuum**

Gas products

- CO_2
- light organic components: C_2-C_6

Liquid products

- organic phase
- aqueous phase

Solid products

- charcoal

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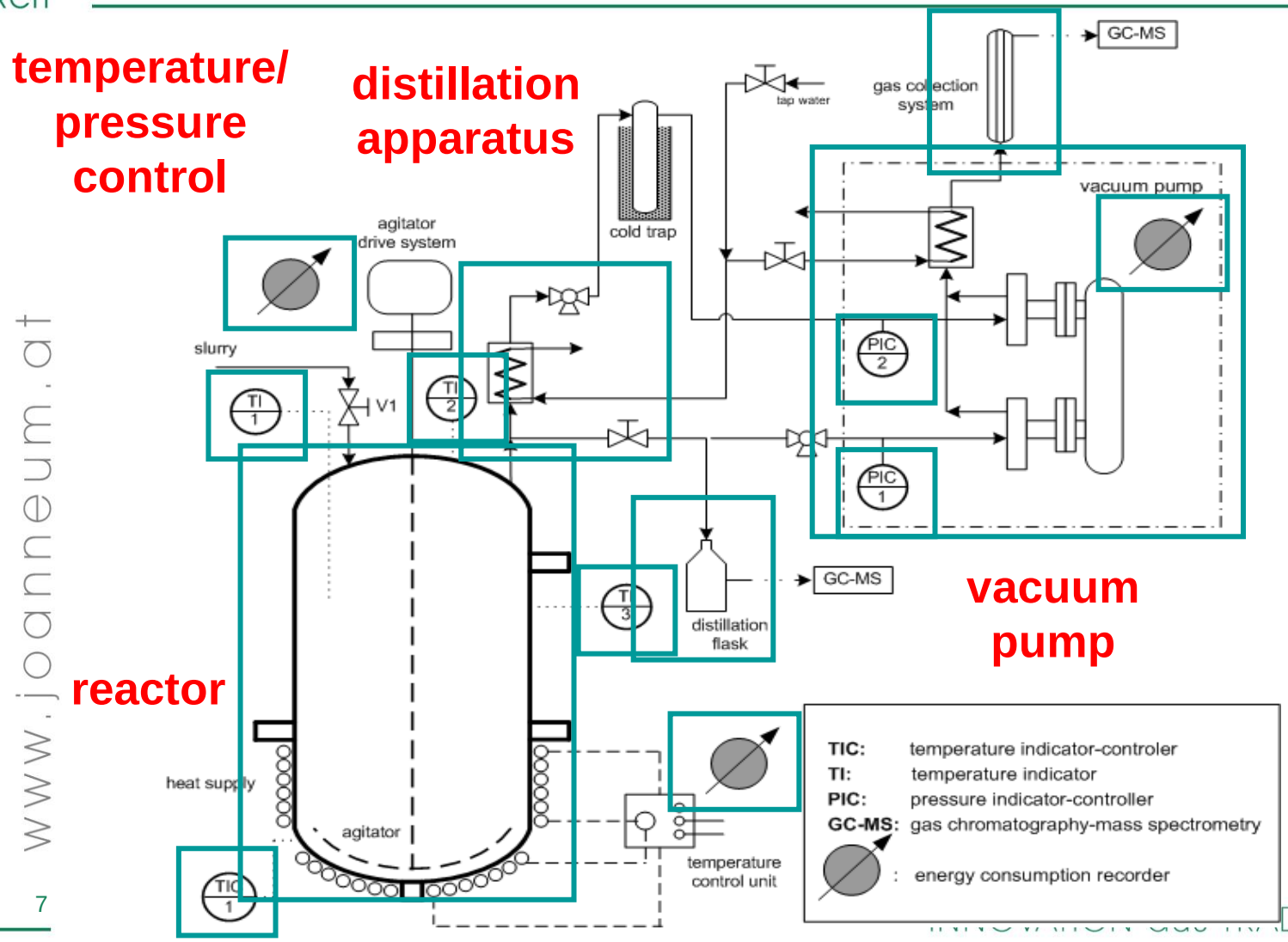
KNV - Products

Type		Content		Post-treatment	Further use
Gas 		**Light Hydrocarbons**	**C_1-C_6**	**-**	**On site: as a fuel for production of heat to cover the thermal energy needs of the process (Heat Integration)**
		Non-condensible gases	**e.g. CO_2**	**-**	**-**
Liquid	Organic phase	**Long-chain Hydrocarbons**	**C_7-C_{17}**	**Post-treatment in refineries to meet the standards of transportation fuels**	**Fuel**
		Long-chain Acids/ Esters/ Nitrils			
	Aqueous phase 	**Heterocycles and Aromatic compounds with oxygen**		**Reduction of the oxygen content and furhter use as a liquid biofuel** **Extraction of chemicals**	**Fuel/ Fuel additive** **Chemicals**
		Heterocycle compounds with oxygen			
		Short-chain Acids/ Esters/ Nitrils			
Solid residue		**Carbon** 			**As a fuel for thermal energy production (Heat Integration)**

Laboratory Scale Testing Facility (LSTF) - Setup



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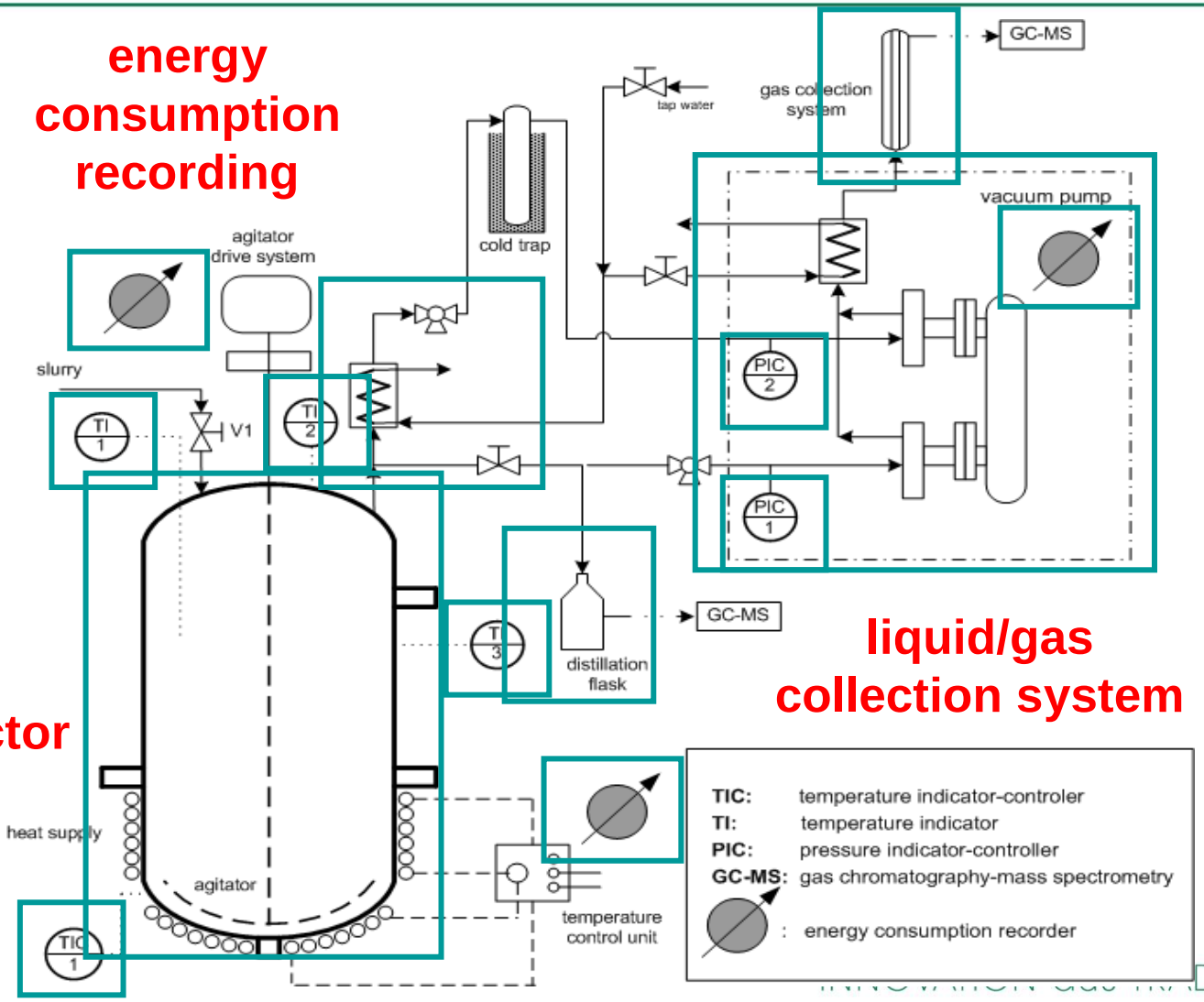
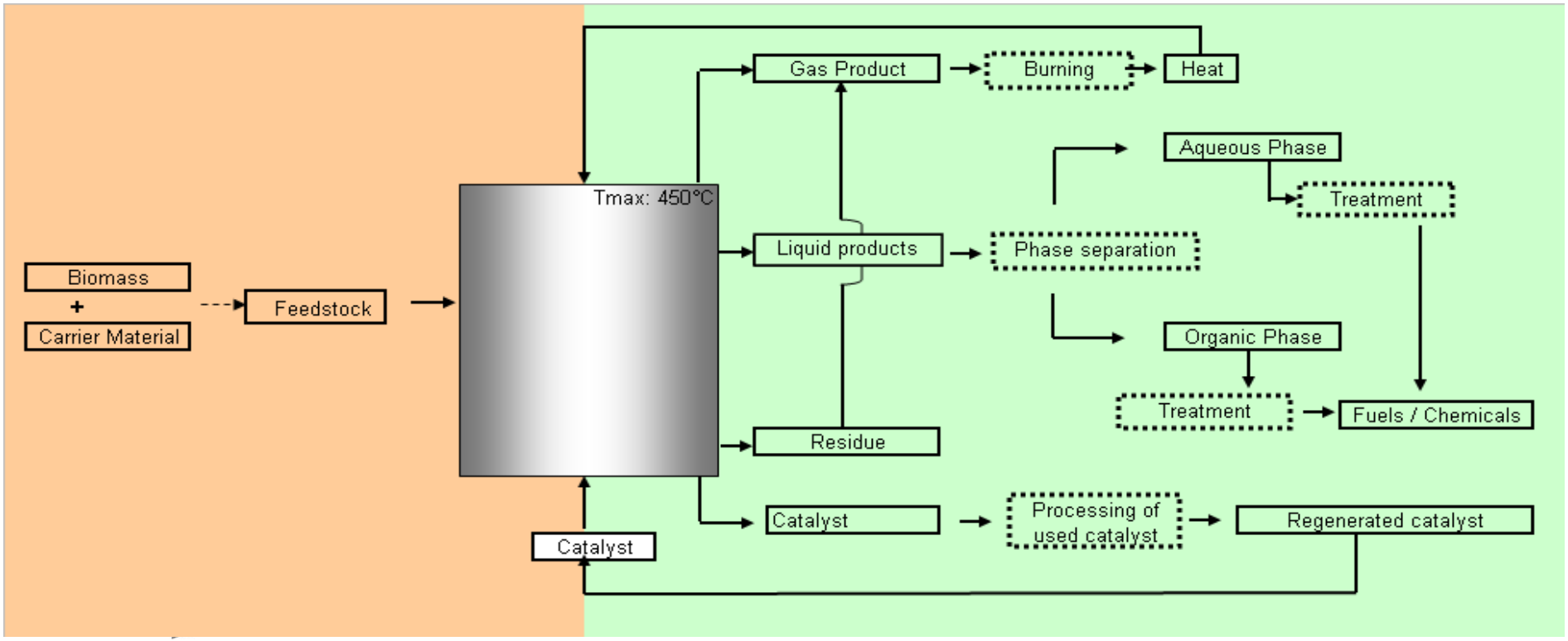
Laboratory Scale Testing Facility (LSTF) - Setup



KNV – Exp. Procedure and Product Utilization



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KNV – Liquid Product

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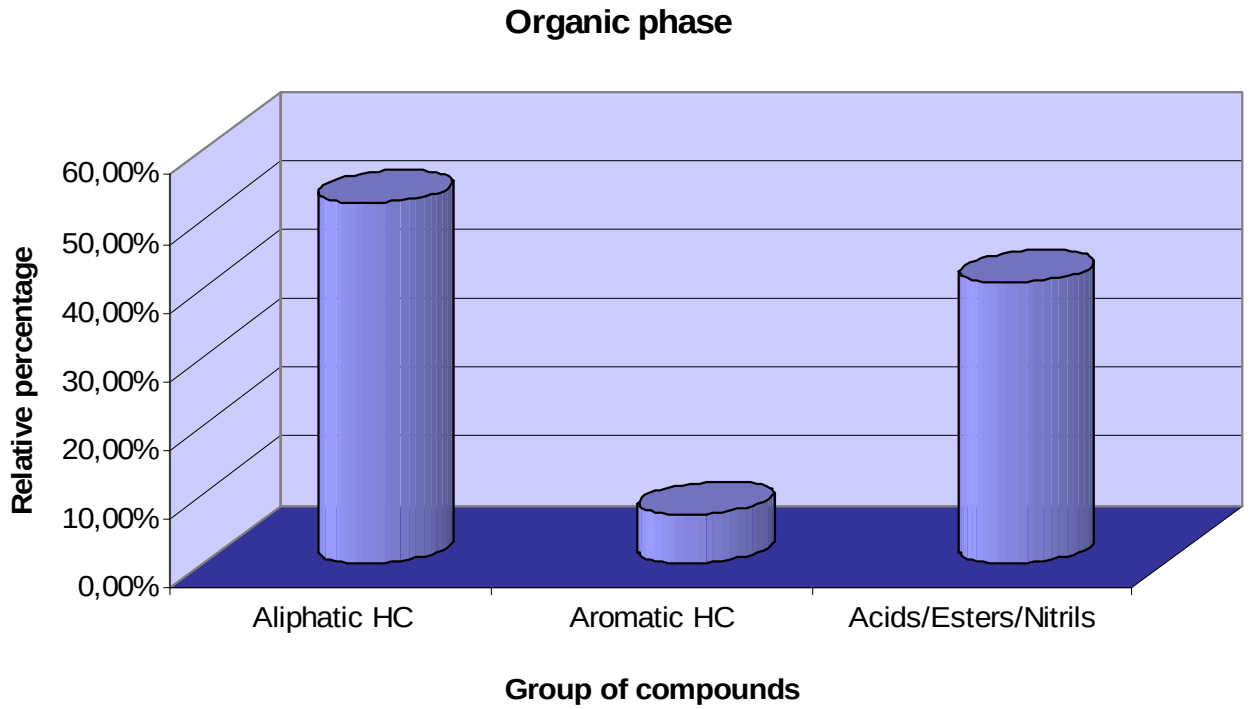
KNV - Organic phase



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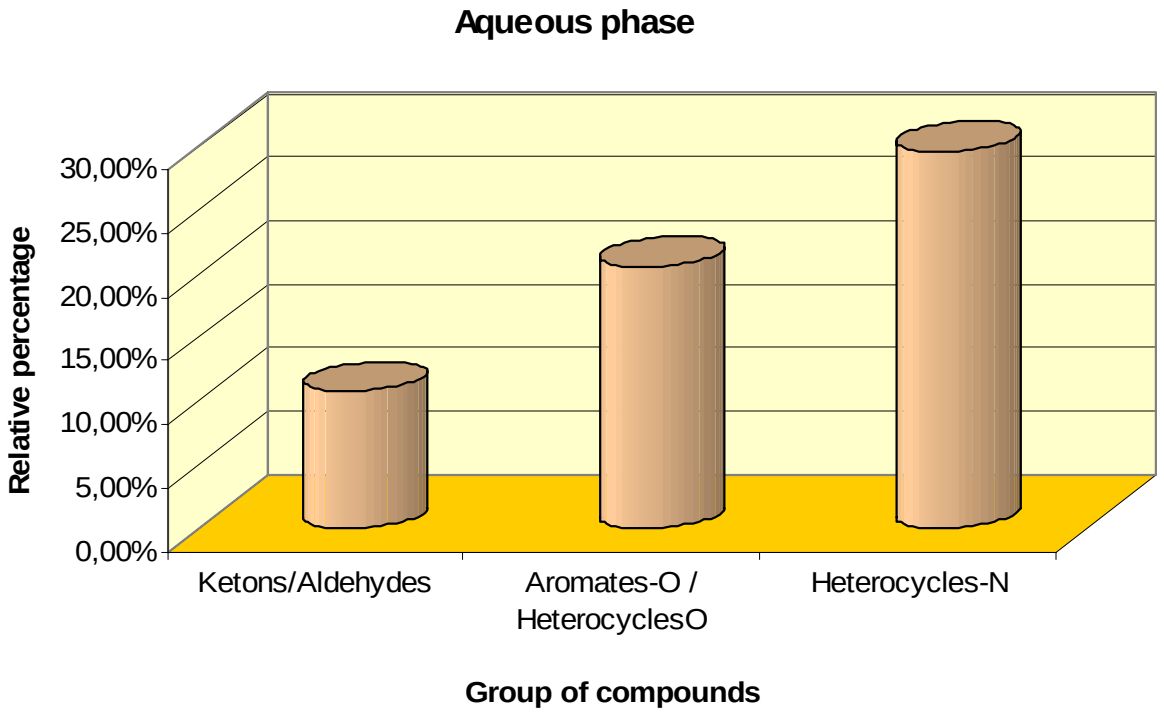
KNV - Aqueous phase



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Open issues - Outlook

- operational parameter optimization
- energy efficiency optimization
- clarification of the effect of different types of zeolite catalysts to the reactor system

- ➢ utilization of algae -> integrated CO_2 mitigation concept
- ➢ utilization of brewery by-products (used brewer seeds, yeast) -> Green Brewery [Heineken]
- ➢ focus on biomass pre-treatment methods
- ➢ process intensification

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Thank you for your attention!

Funded by: Land Steiermark

Partners: *TU Graz*

KF Uni Graz

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