

Hydrocarbons and Fuels

Classification and Definition



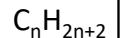
Hydrocarbons (HC)

Consists only of H- and C-atoms; Classification according to their structure

Aliphatic HC

linear (n-) and branched (iso-)

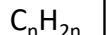
Alkanes



= Paraffine

- ⇒ Saturated due to C-C-bonds only
- Important for fuels

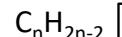
Alkenes



= Olefins

- ⇒ Unsaturated, due to C=C-bond
- Of minor importance for fuels

Alkynes

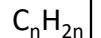


= Acetylenes

- ⇒ Unsaturated, due to C≡C-bond
- No relevance for fuels

Cycloaliphatic HC (also alicyclic)

Cycloalkanes



= Naphthenes

- ⇒ Saturated due to C-C-bonds only
- Important for fuels

Cycloalkenes

- ⇒ Unsaturated, due to C=C-bond
- No relevance for fuels

Cycloalkynes

- ⇒ Unsaturated, due to C≡C-bond
- No relevance for fuels

Aromatics

Monoaromatics

- ⇒ Benzene as „asic structure
- ⇒ Different substituents possible (alkyl, -OH, -NH₂, -SH, ...)
- Important for fuels

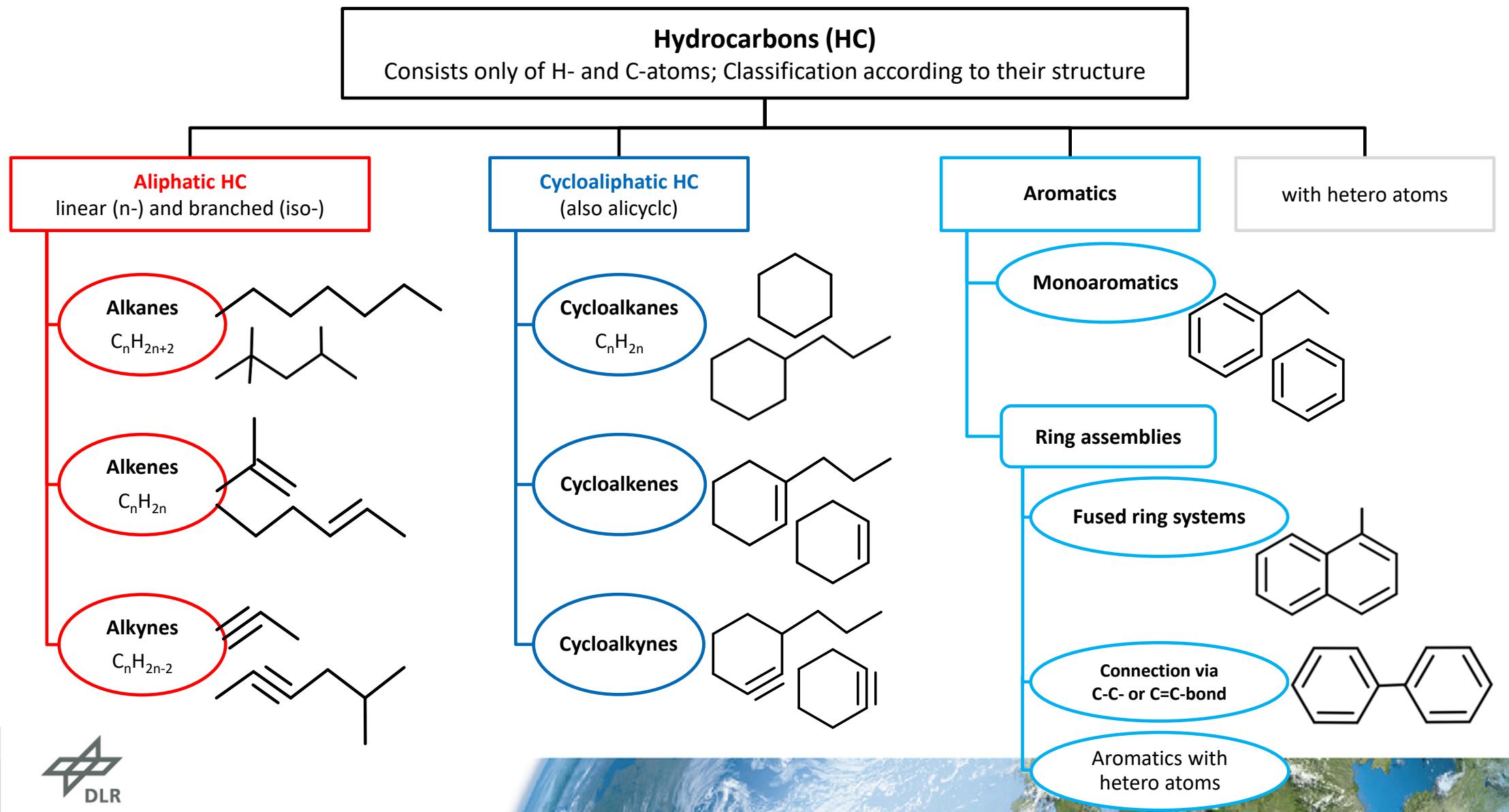
Ring assemblies

Fused ring systems

- ⇒ Di- (bi-, tri-, polyaromatic compounds
- ⇒ Cyclo- and hydroaromatic compounds
- Important for fuels (polya. in heavy fuel oil only)

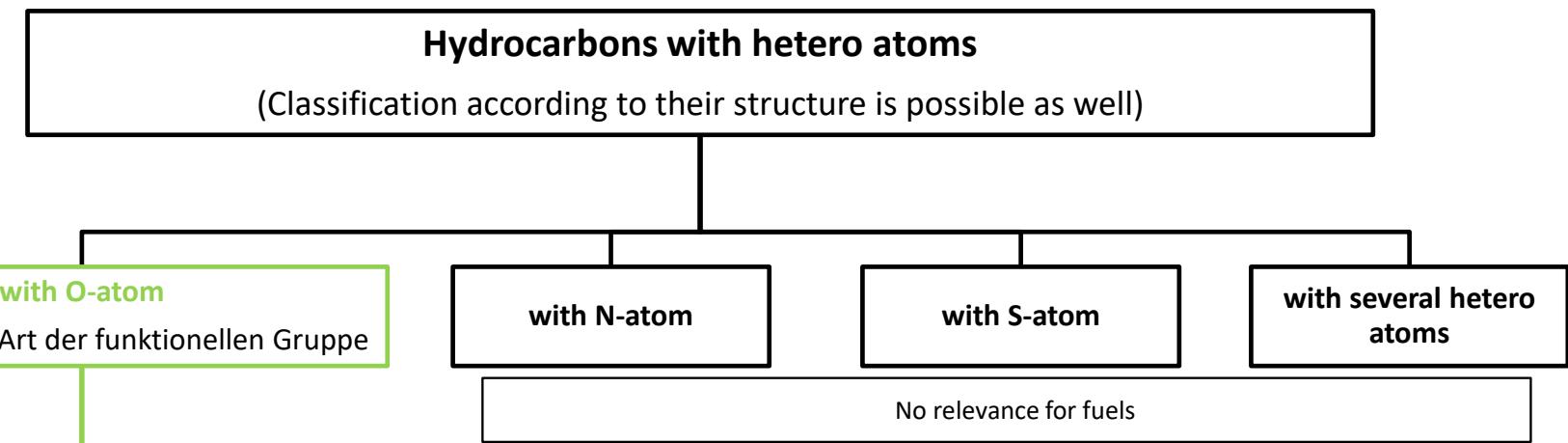
Connection via C-C- or C=C-bond

Aromatics with hetero atoms



Hydrocarbons with hetero atoms

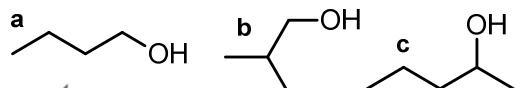
(Classification according to their structure is possible as well)



Alcohols



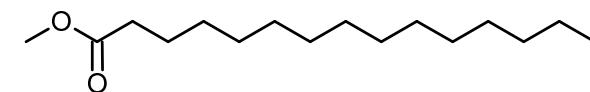
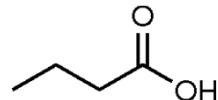
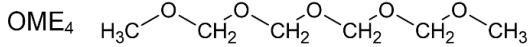
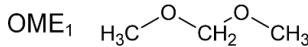
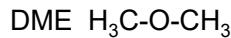
⇒ Classification according to branching and position of OH-group:
 – n-(1-)Alkylalkohols (**a**)
 – iso-Alkylalkohols (**b**)
 – sec-(2-)Alkylalkohols (**c**)
 – tert-Alkylalkohols (**d**)
 – neo-Alkylalkohols (**e**)
 → Important for fuels: C₁, C₂, C₄, and C₈



Ethers



⇒ minimum 2 C-atoms
 → Oxymethylene ethers (OME_n) considered as sustainable fuel

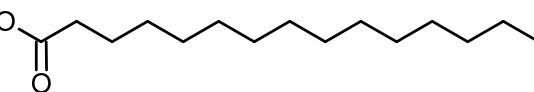
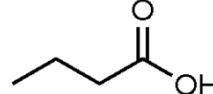


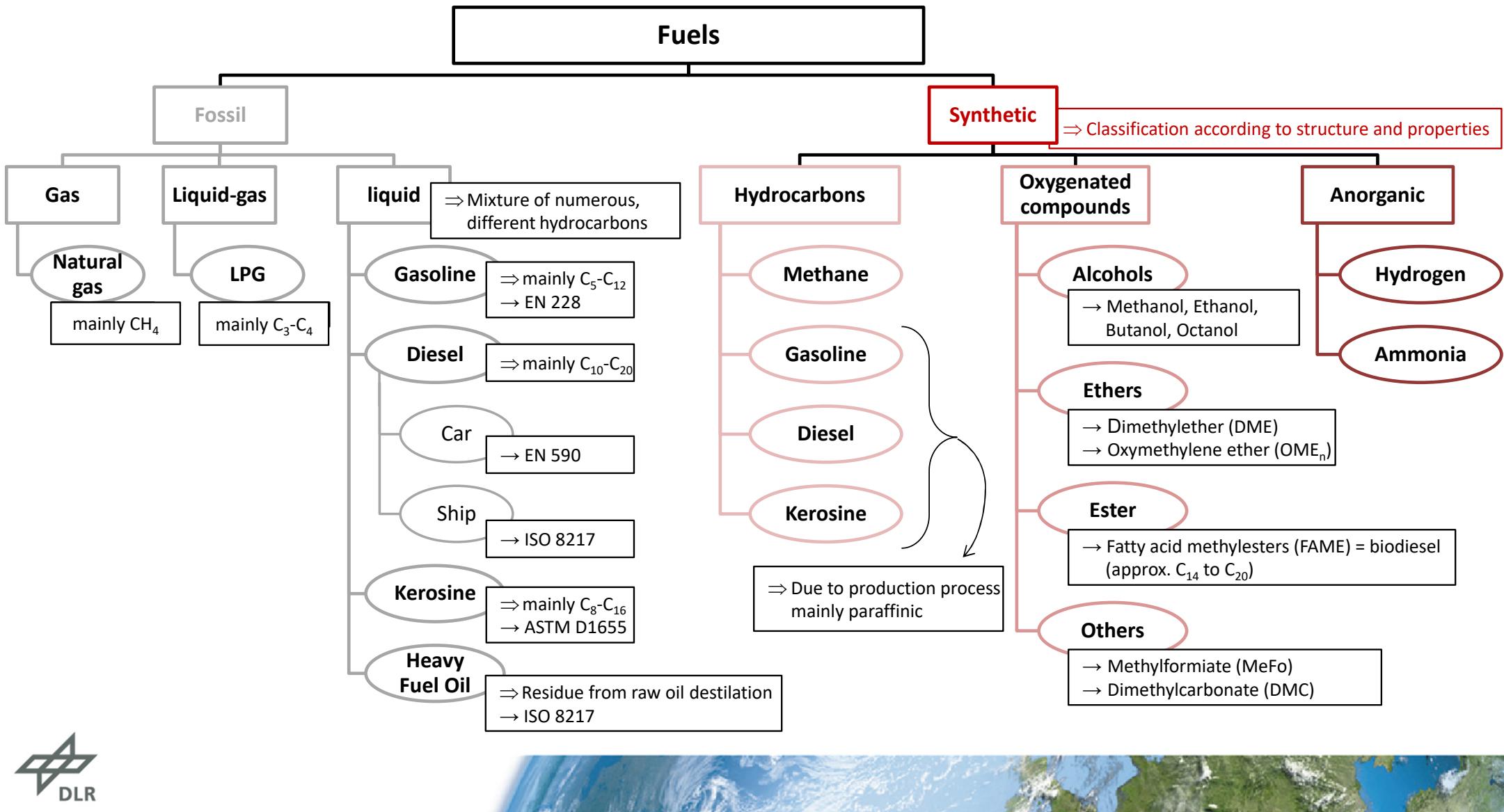
Carboxylic acids

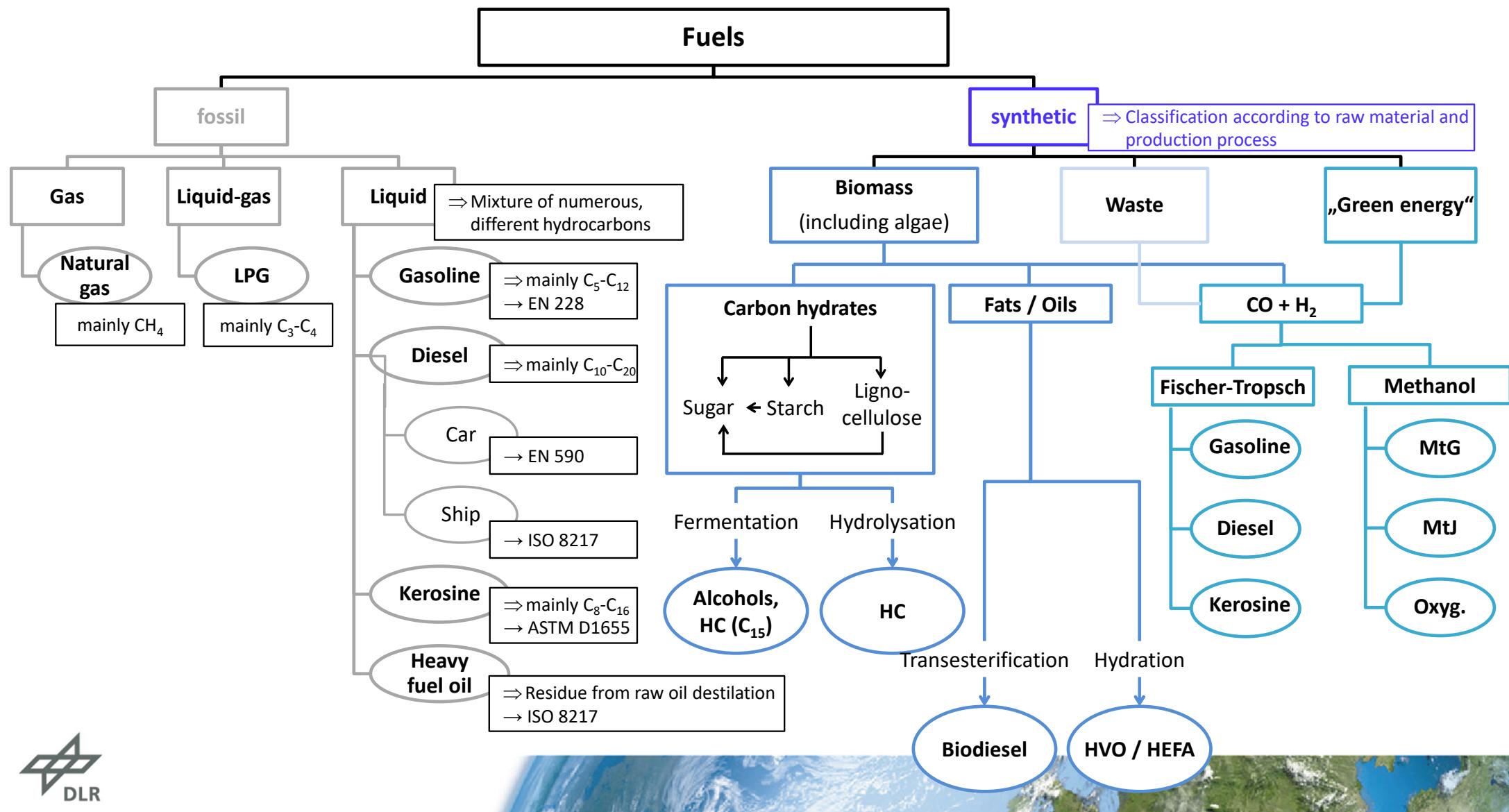


= Fatty acids
 → No relevance for fuels

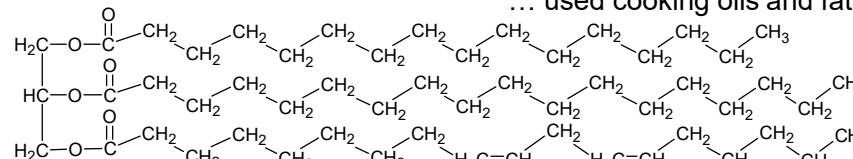
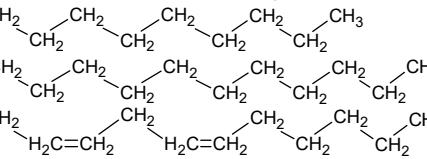
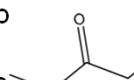
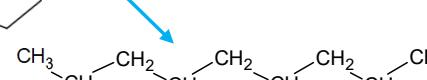
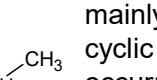
No relevance for fuels







Extra: Differences of diesel

	Fossil diesel (road transport)	Biodiesel (FAME)	HVO	FT-Diesel	Marine diesel (MGO)
Name		Fatty Acid Methyl Ester	Hydrogenated Vegetable Oil	Fischer-Tropsch-Diesel	Marine Gas Oil
Origin	Raw oil distillation	<p>Transesterification of vegetable oils with methanol</p> 	<p>Hydration of ...</p> <p>... Vegetable oils (old)</p> <p>... used cooking oils and fats</p> 	FT-Synthesis	<p>Raw oil distillation (contrast to HFO (= heavy fuel oil) being a residue of raw oil distillation)</p>
Structure	mainly linear but also branched, cyclic and aromatic compounds occur				mainly linear but also branched, cyclic and aromatic compounds occur; average C-number slightly higher than in road transport

Important differences in fuel properties

Boiling point	360 °C (FBP)	345-354 °C	360 °C (FBP)	360 °C (FBP)	460 °C (FBP)
Density	820-845 kg/m³	860-900 kg/m³	765-810 kg/m³	765-810 kg/m³	890-900 kg/m³
Standard	EN 590	EN 14214 EN 590 (→ Usage as B7)	EN 15940	EN 15940	ISO 8217

