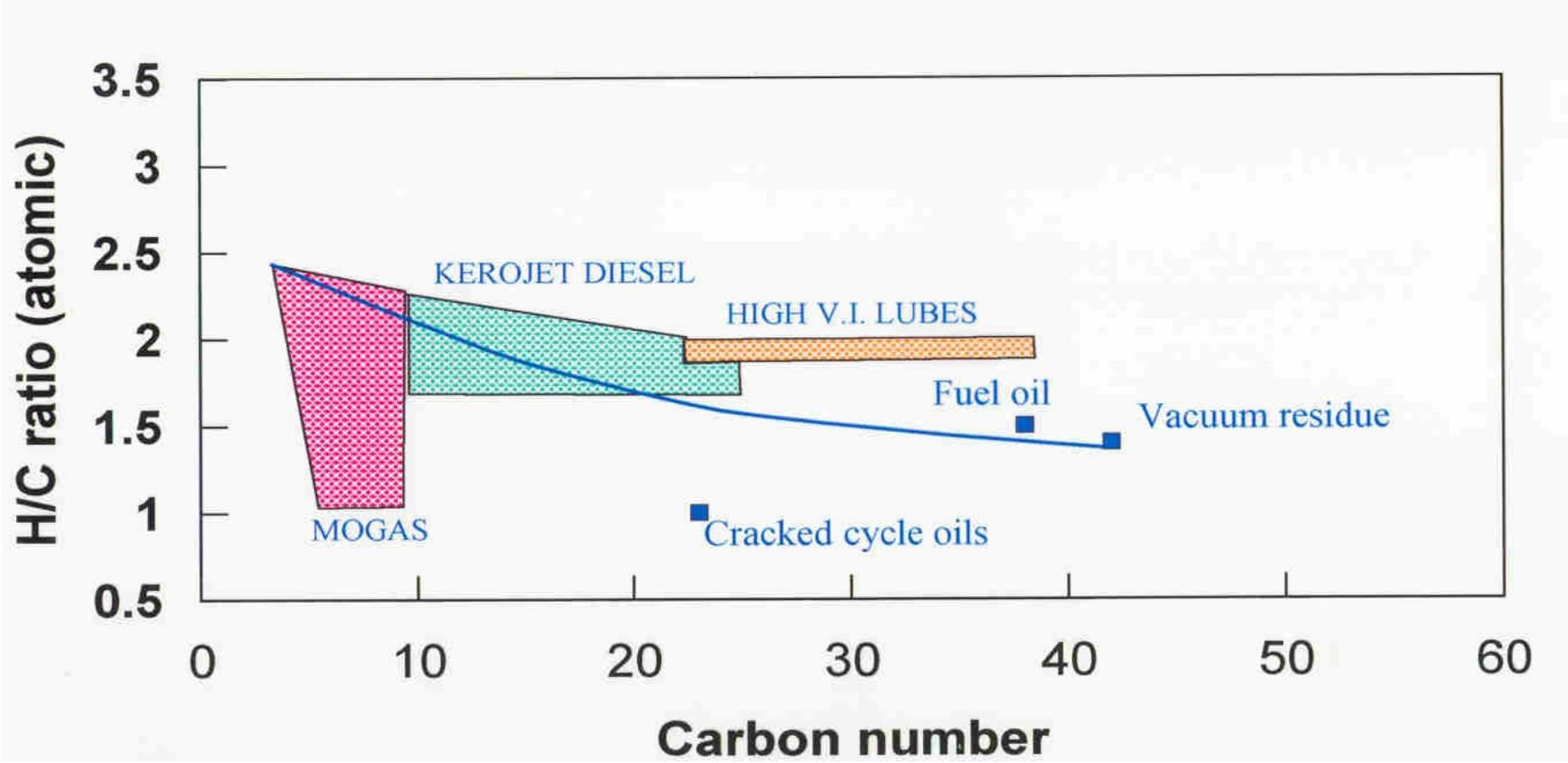
Principle refinery operations

Refineries

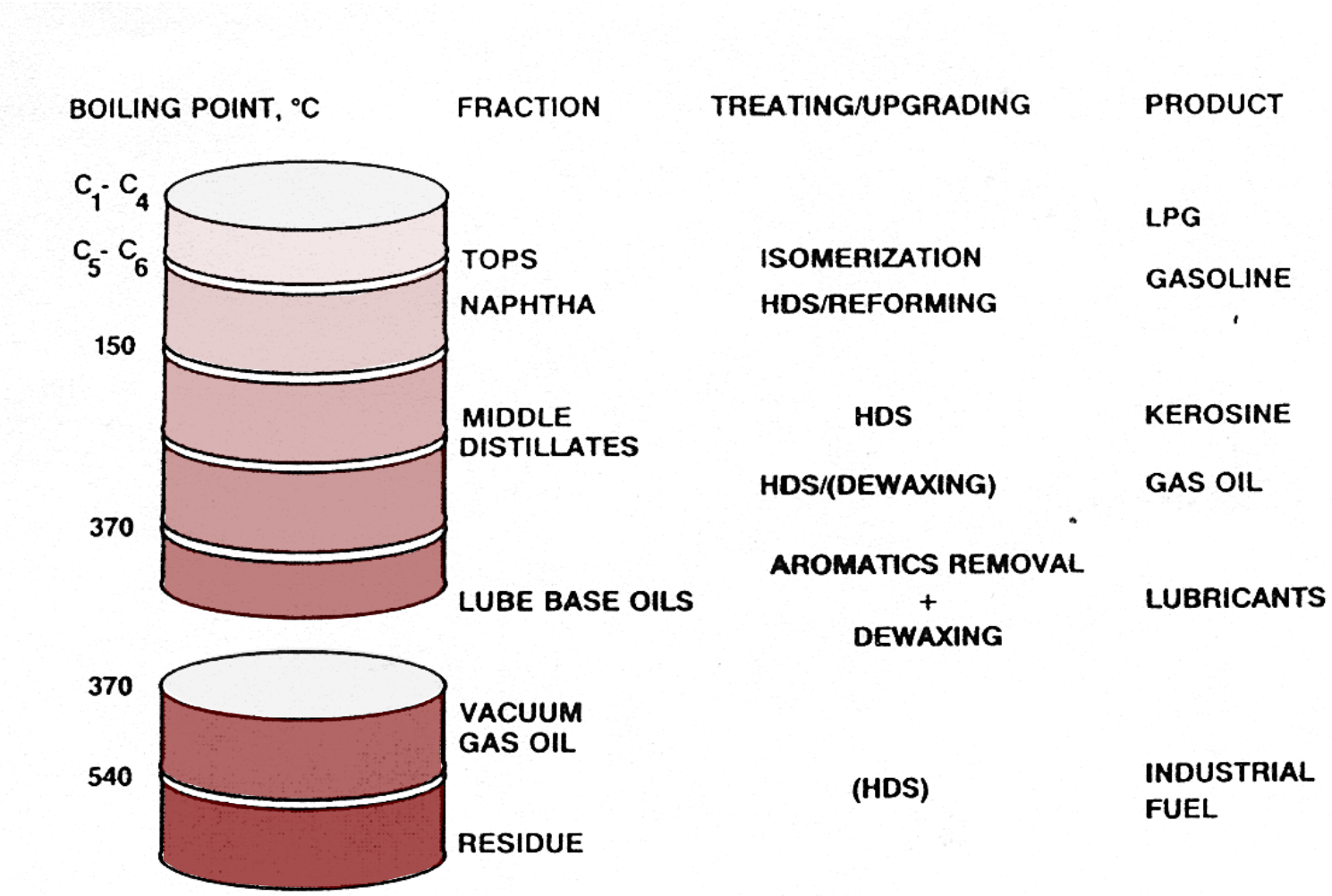
- Refineries are operated **continuously** and with high degree of **automation**
- **High processing capacities** compared to other chemical industries
- A medium-sized refinery e.g. has a crude capacity of 10.000 t per day
- The crude distillation determines the refinery capacity

H/C ratio versus carbon number

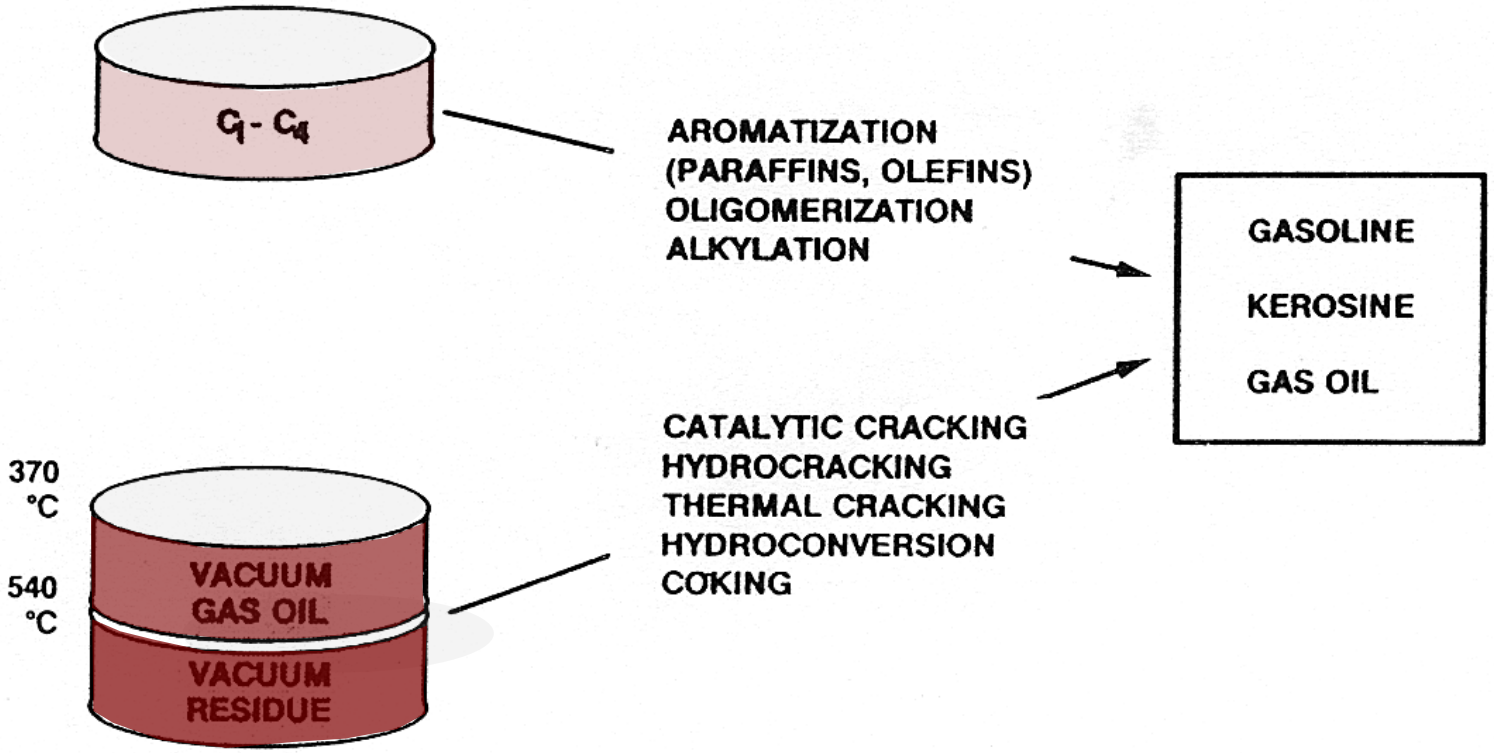


- Refinery operations balance H/C ratio and carbon number
- Hydrogen needed in general

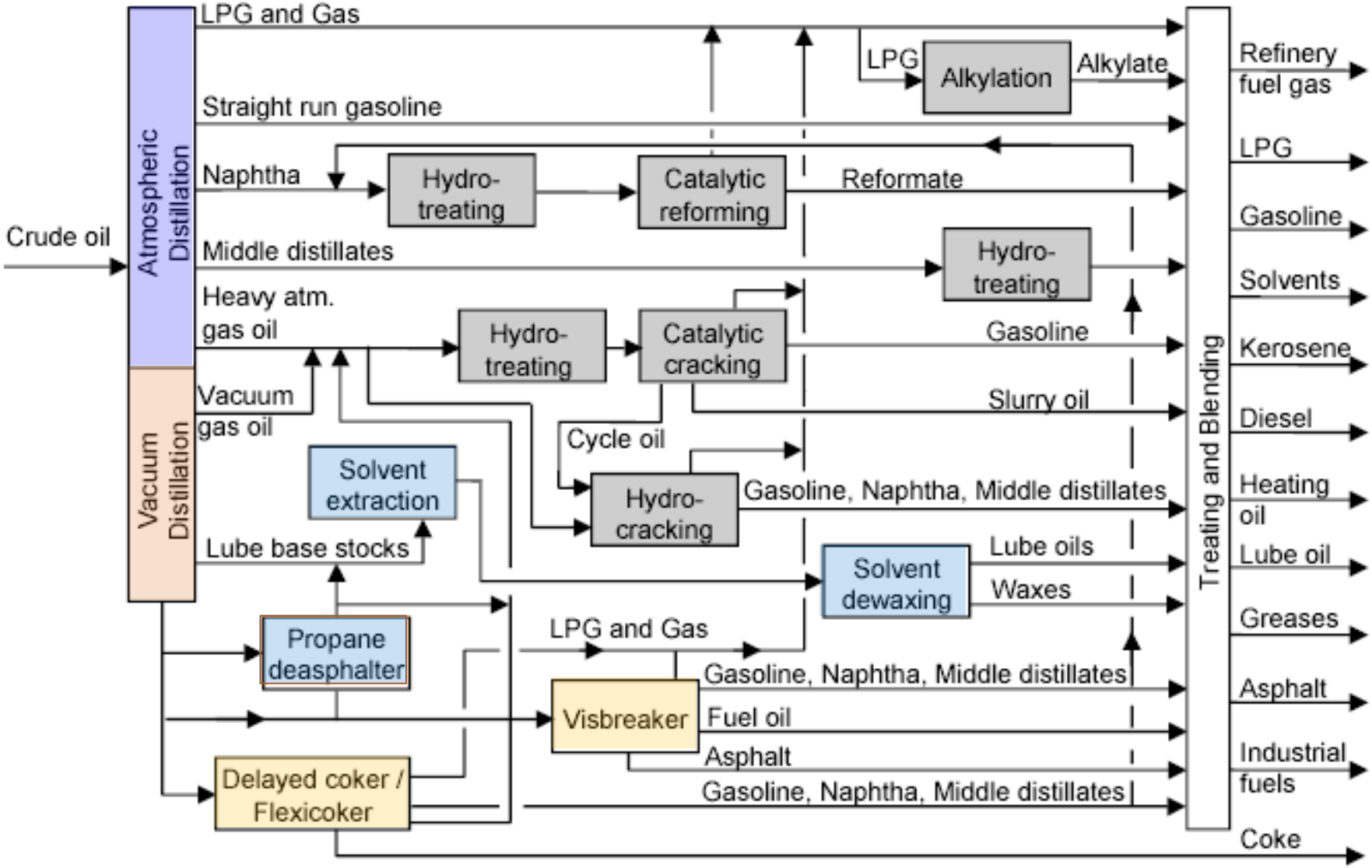
Process scheme of a simple refinery



Process scheme of a complex refinery



Process units in a refinery



Some definitions

- bbl = barrel (volume measurement)
  - 1 bbl = 159 ltr
  - 1 to = ca 7.5 bbl
  - 100.000 bbl/day = 5 mln to/a
- API Grade = density measurement
  - Low API = high density = high residue content
- 1 $/bbl = ca 6,- Euro/to

Crude oil grades

- > 45 API NGL
- 25-45 API conventional crude oil
- 10-25 API heavy crude oil
- < 10 API extreme heavy crude oil, oil sand, et

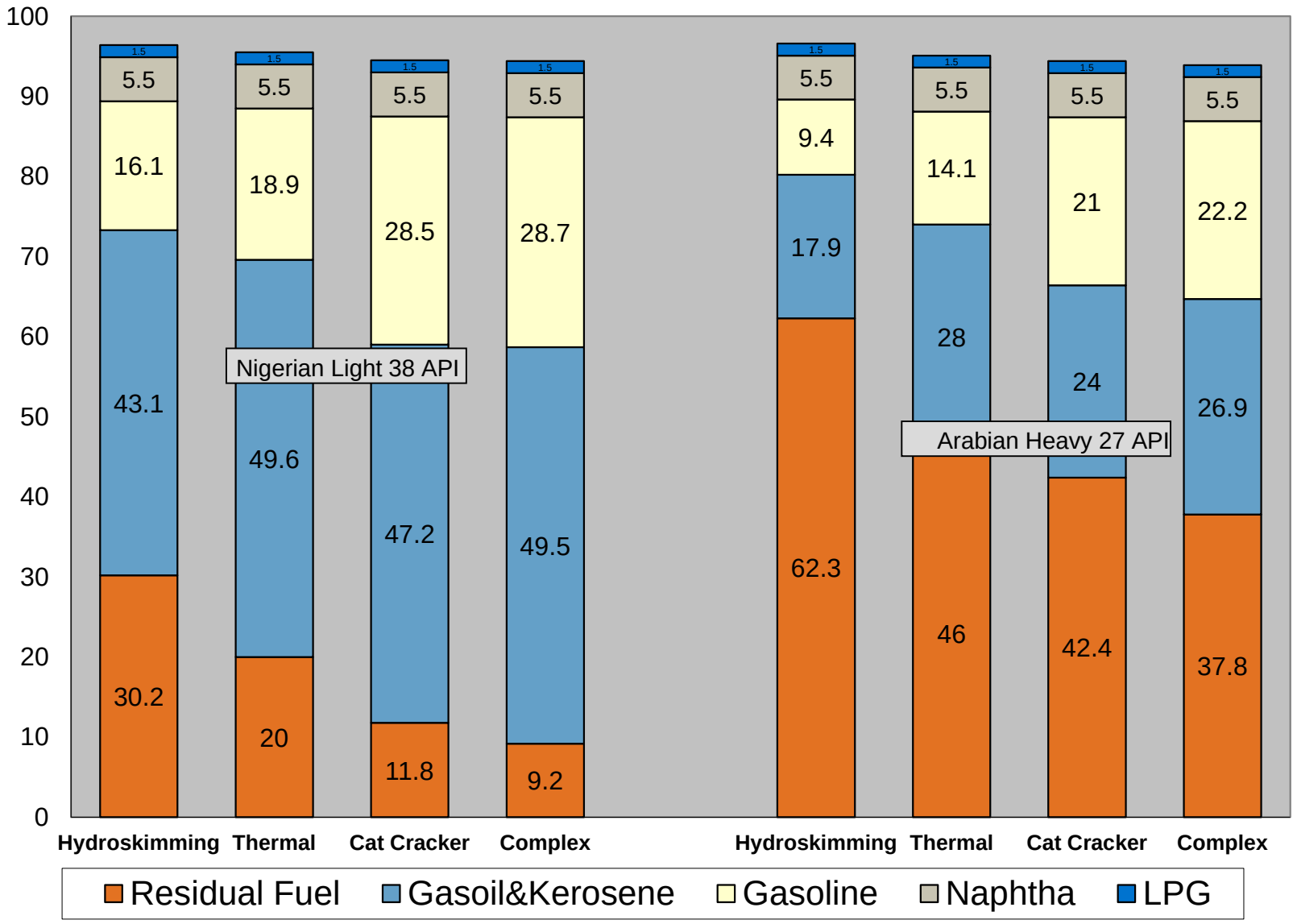
Gasoline pool characteristics - European refineries

Gasoline specifications in Europe

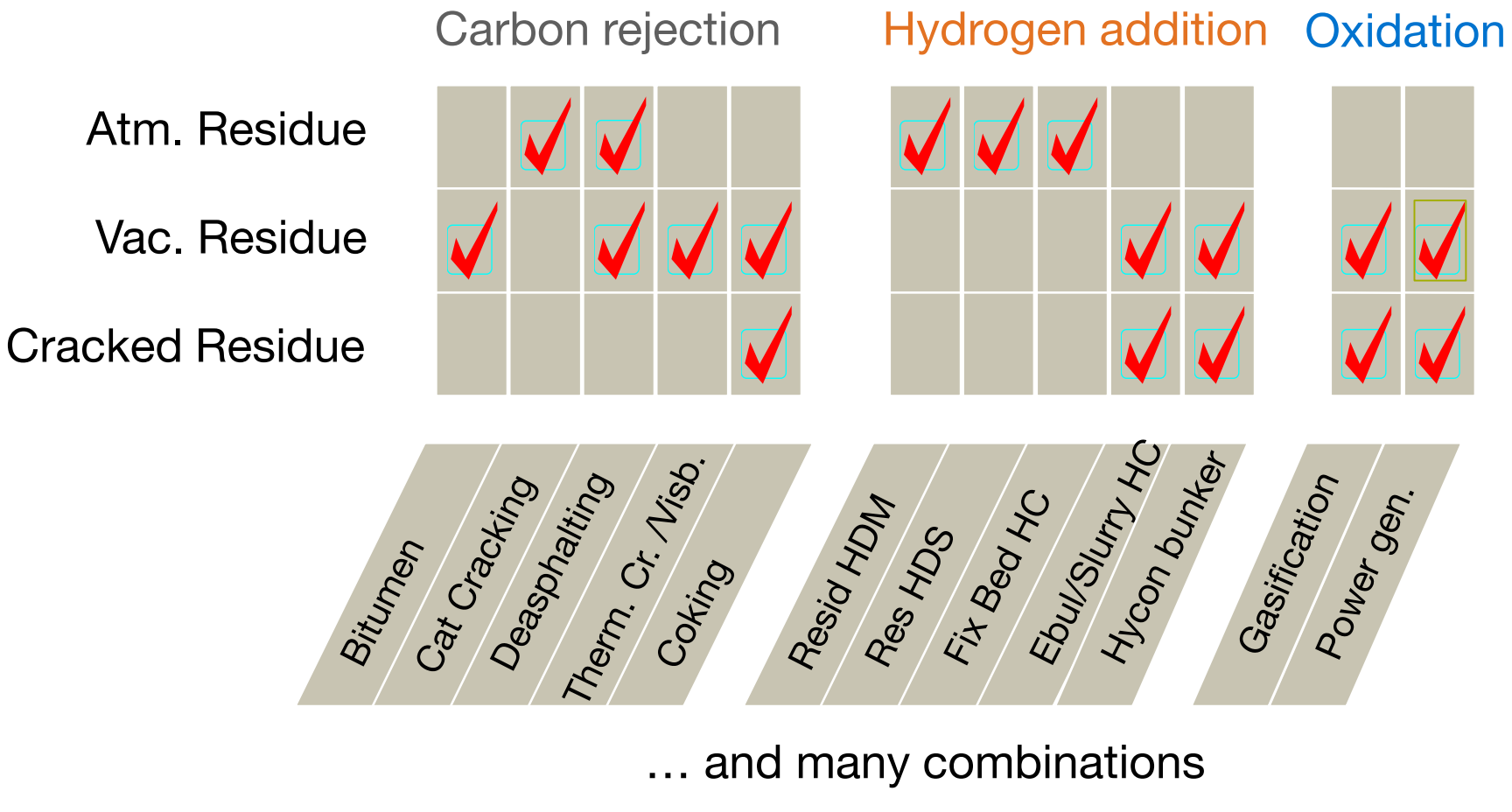
	1999	2000	2005
Sulfur, max ppm wt.	500	150	50 (10)*
Aromatics, max vol.%	no spec.	42	35
Benzene, max vol.%	5	1	1
Octane RON min	95/98	95/98	95/98
Olefins, max vol.%	no spec.	18	18
RVP max kPa	80	60	60

*“Sulfur free“

Yield structure by refinery type



Identify suitable residue conversion options



… and many combinations

Driving forces steer best fit-for-purpose option

Conventional FCC based refinery

Chemistry integrated FCC based refinery