Potential of Power-2-Gas for Refineries (P2G2R)

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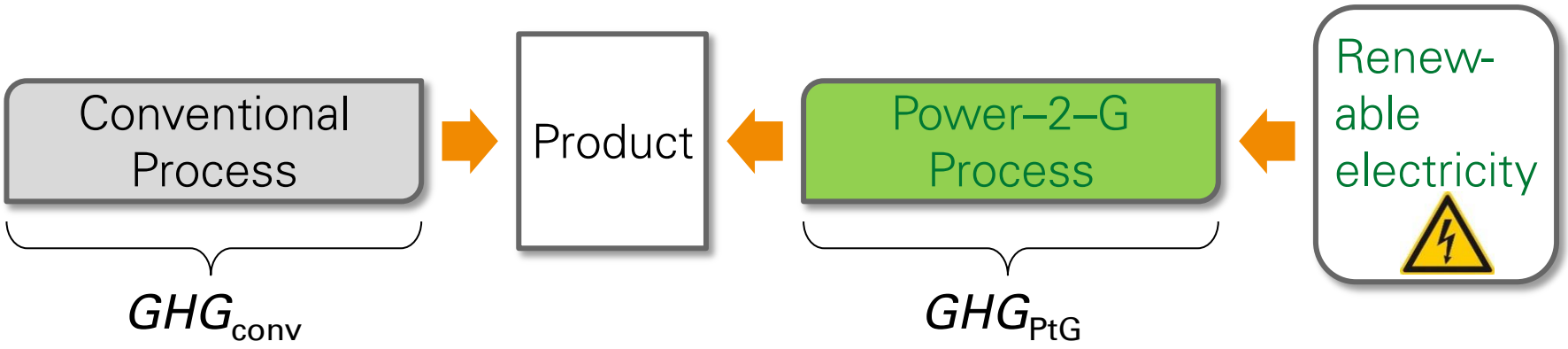
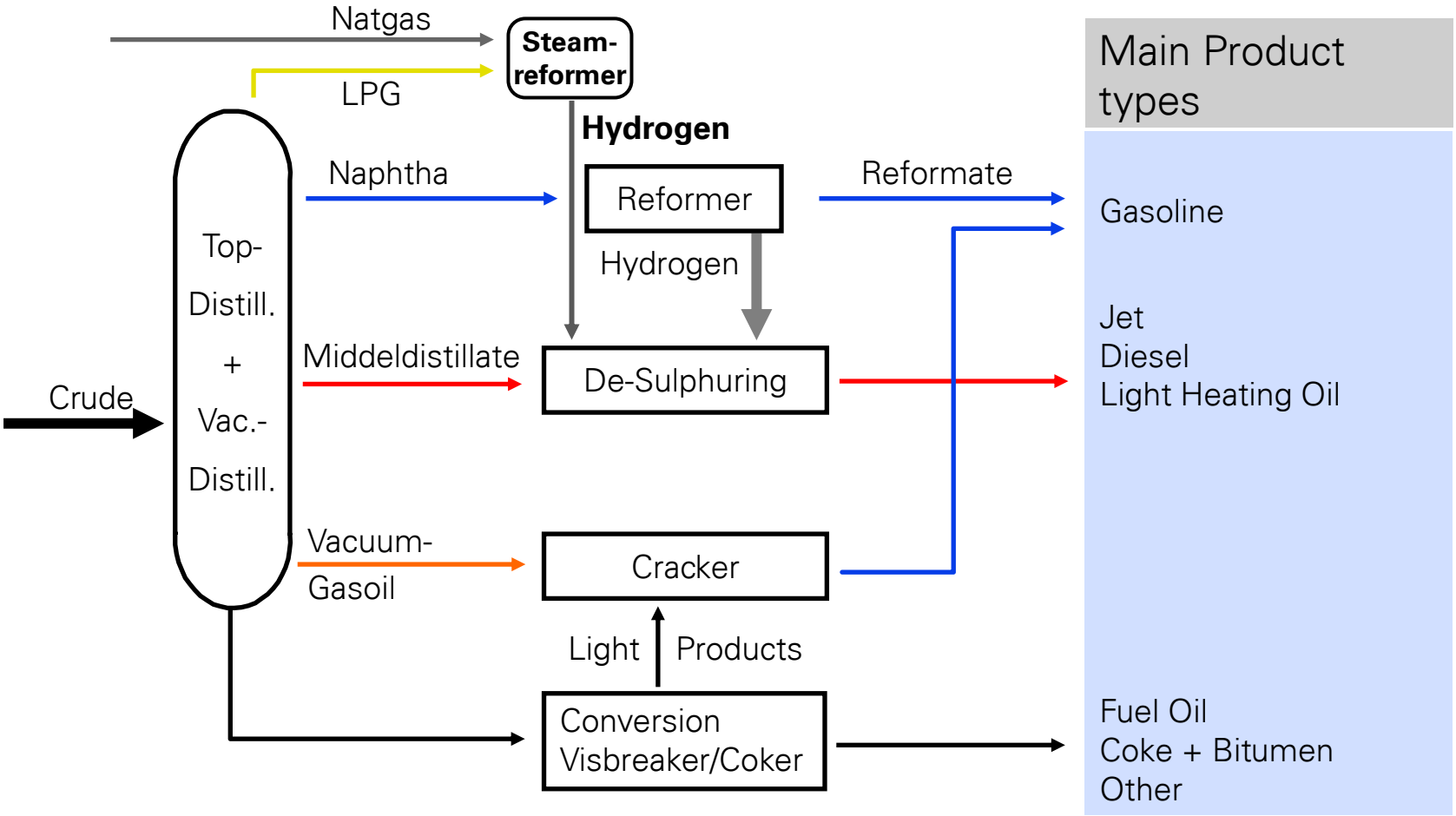
Why substitute existing processes?



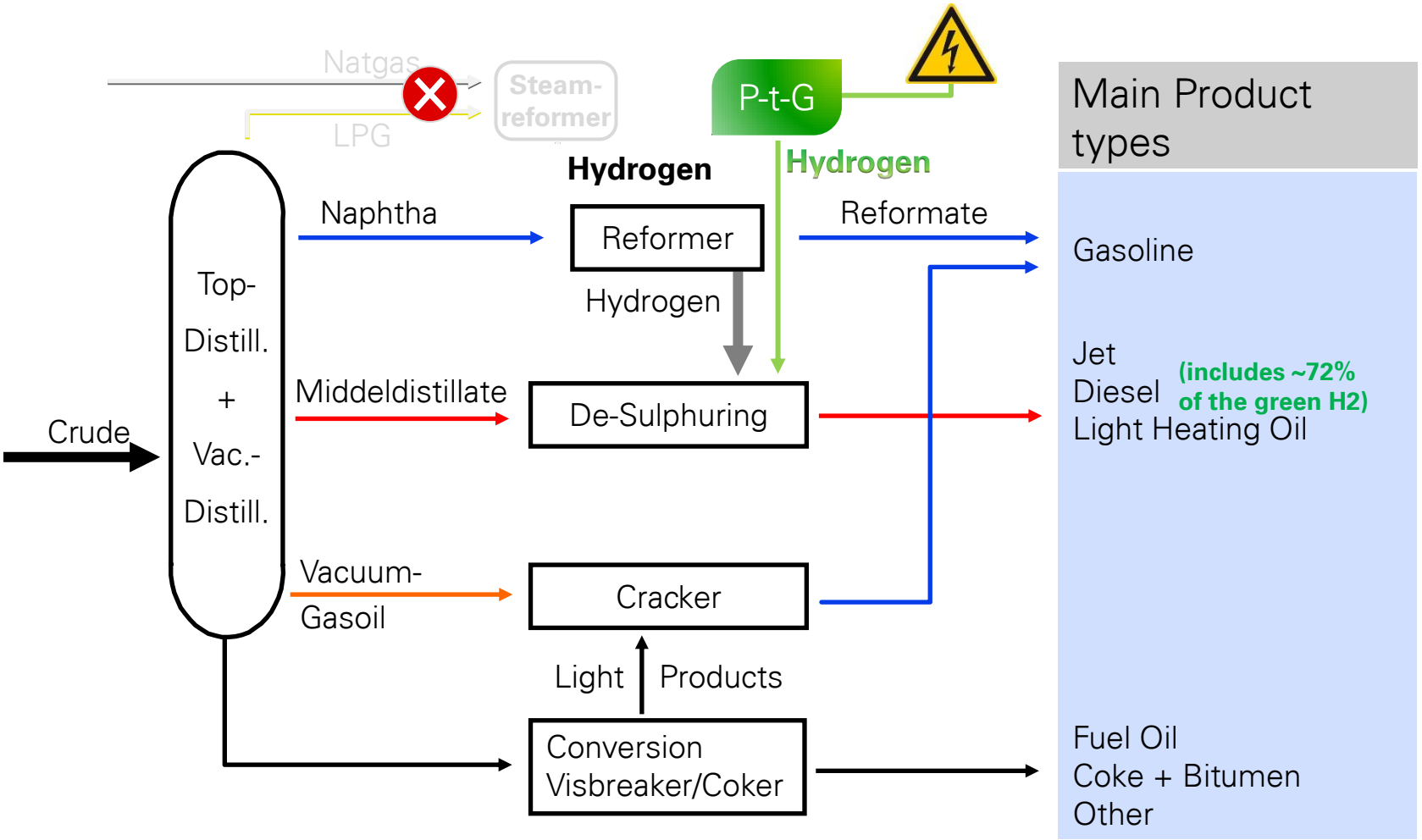
$$GHG\ \text{reduction}_{abs} = GHG_{conv} - GHG_{PtG}$$

GHG: Greenhouse gas emissions, mostly calculated as CO_2 equivalents

H_2 in refineries (simplyfied)



Renewable H_2reduces Natgas demand



Potential assessment for Germany

Assumptions:

- Refineries GY: 13
- Crude capacity: 106 mt/a
- Externeral/additional H_2 demand assumed at: ~100 kt/a
- Scenarios for substitution: 10% – 40% – 100%
- Annual hours for electrolysis: 8.200h/a

Any additional H_2 demand of refineries usually is supplied with H_2 from steam reforming of fossil gases (NG, naphtha).

Condition of GHG quota system:
GHG reduction regime since 2015;
min. 4% in 2017-2019, 6% from 2020

Property	Unit	Level of H_2 substitution 10%	40%	100%
Hydrogen demand	t/a	10.000	**40.000**	100.000
Size of electrolysis unit	MW	68	**271**	678
Annual power consumption	GWh/a	555	**2.222**	5.555
CO_2 saved	t/a	74.550	**298.000**	745.500
Contribution to GHG savings	% GHG	0,04	**0,15**	0,37

P2G2R – what would be required besides changes in regulatory environment?

- An additional, volatile source of renewable hydrogen substituting fossil hydrogen requires SMR operation to change from flat output to a volatile mode (SMR's aren't designed for).
- The higher the temporaily available share of renewable hydrogen, the more difficult keeping control of the SMR it gets. Research required!
- A hydrogen buffer would help to mitigate the problem as well, but refineries don't like to store hydrogen close to or within their assets.

- BP would like to make use of renewable electricity for production of renewable hydrogen to supply to FCV's (but market develops very slowly). In the meantime we propose use of renewable H_2 for certain refinery processes producing road fuels, which wouldn't cause any infrastructural problems and would bring renewable energy via well accepted liquids to the market.