Reakce rafinérsko-petrochemického komplexu na budoucí výzvy v rámci Green Deal

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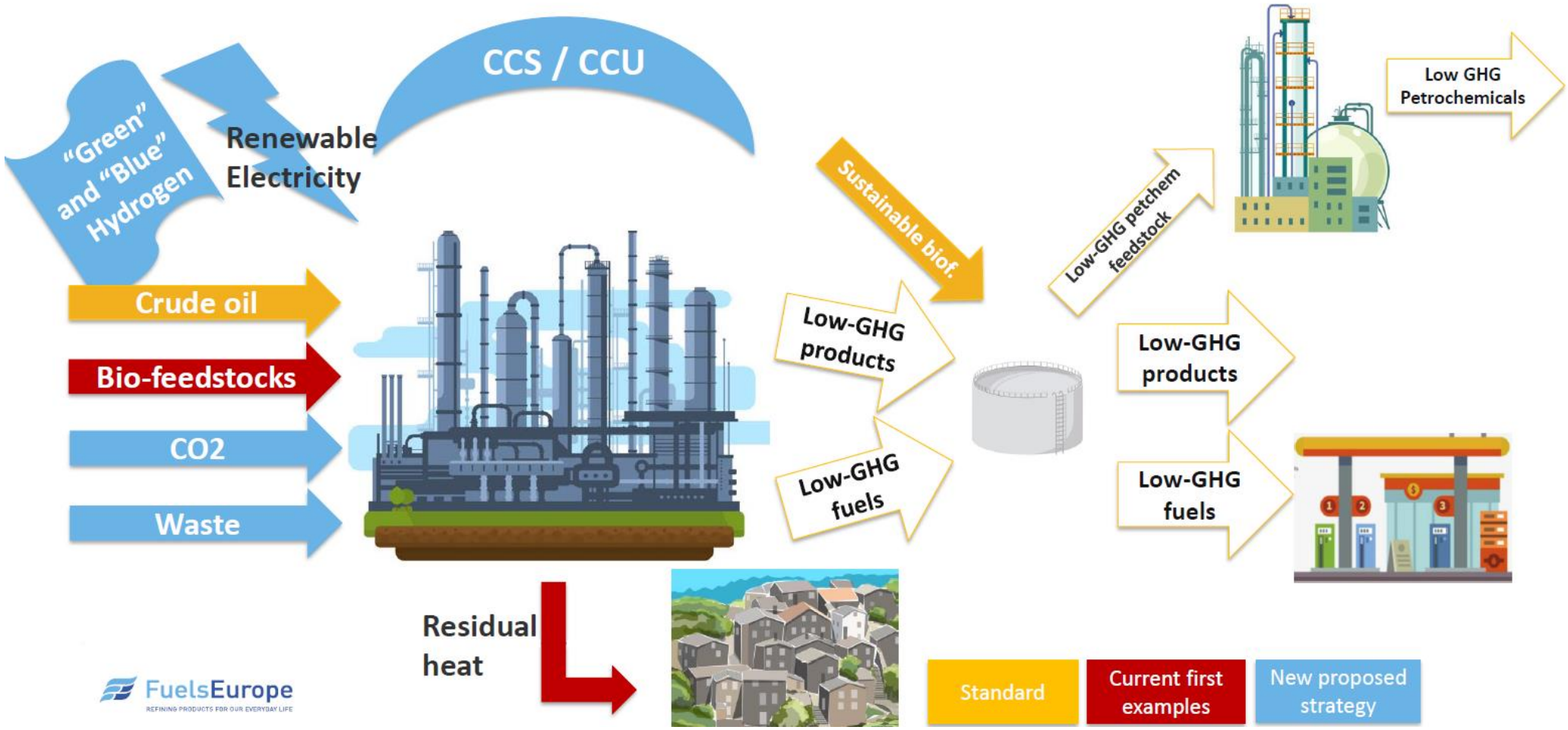
Fuels production vision 2050



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Utilization of new attractive opportunities

Hydrogen

Advanced biofuels (biogenic and municipal waste)

Renewable sources of energy

Waste plastic recycling

E-mobility

Green NH_3 as energy caries

Steam-gas energy block

Bio-petrochemicals and recycled polymers

Bio-products from existing refinery asset

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Biofuels production

Ambition:

- ✓ RED II (III) compliance;
- ✓ Reduction of carbon footprint related to automotive, marine and aviation fuels utilization;

Focus:

- ❑ Forest and agriculture residuum, municipal waste;

Key challenges:

- ➢ Waste biogenic feedstock provision → effective collection, storage, analysis, pretreatment;
- ➢ Technology maturity → TRL level, feedstock flexibility, feed quality sensitivity, yield of desired products, energy and hydrogen consumption, undesired product/waste utilization;
- ➢ Co-processing vs stand alone installation;
- ➢ Blending potential with existing fuels → RON, CI, stability, oxygen content;

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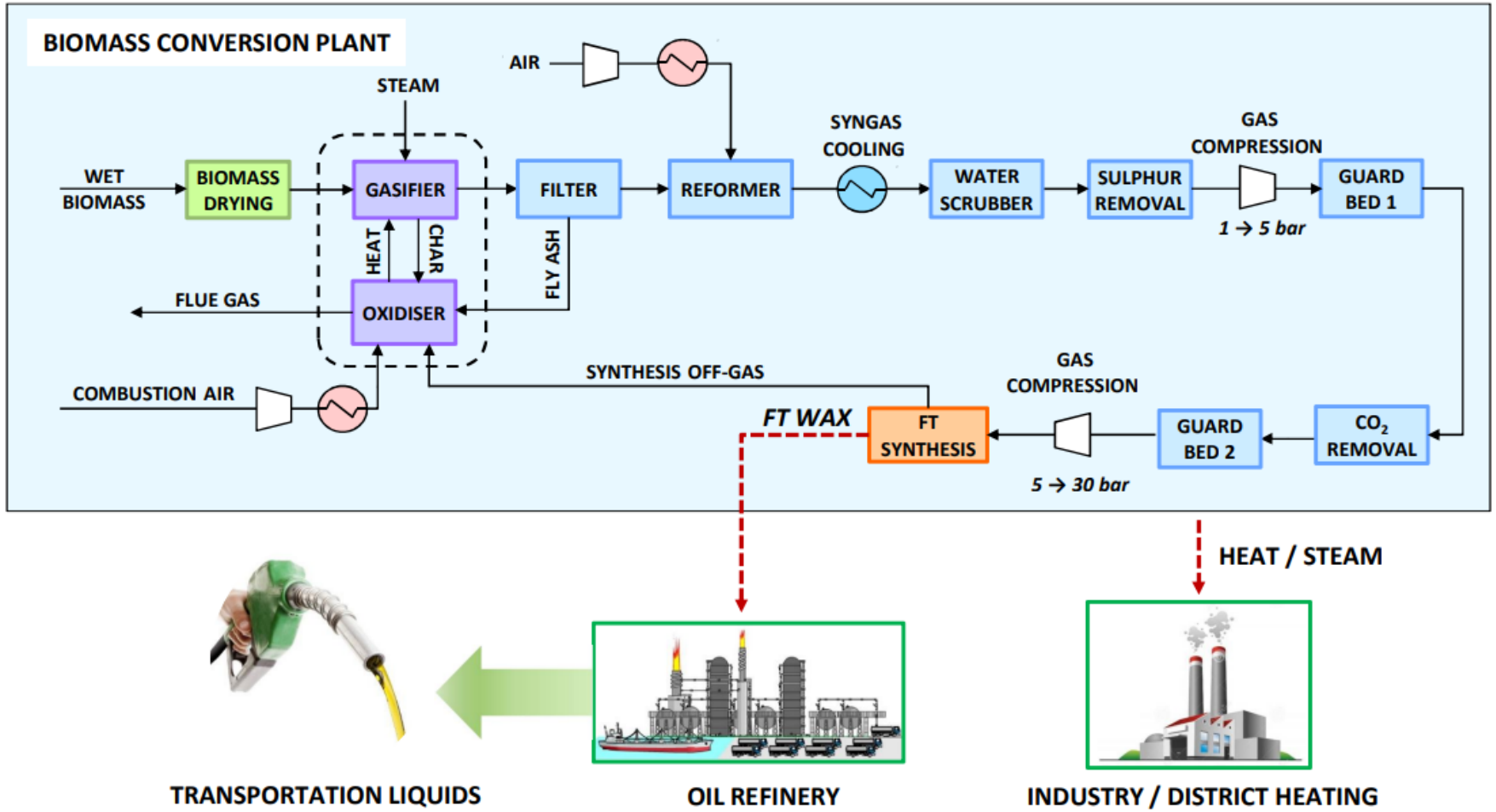
COMSYN process concept

Main Targets :

- Concept: decentralized primary conversion of biomass in 30 – 150 MW units.
- Target: reduction of biofuel production cost up to 35% compared to alternative routes → production cost for diesel lower than 0.80 €/l.
- GHG savings: 80 %
- Overall efficiency to FT biocrude + heat: 80%

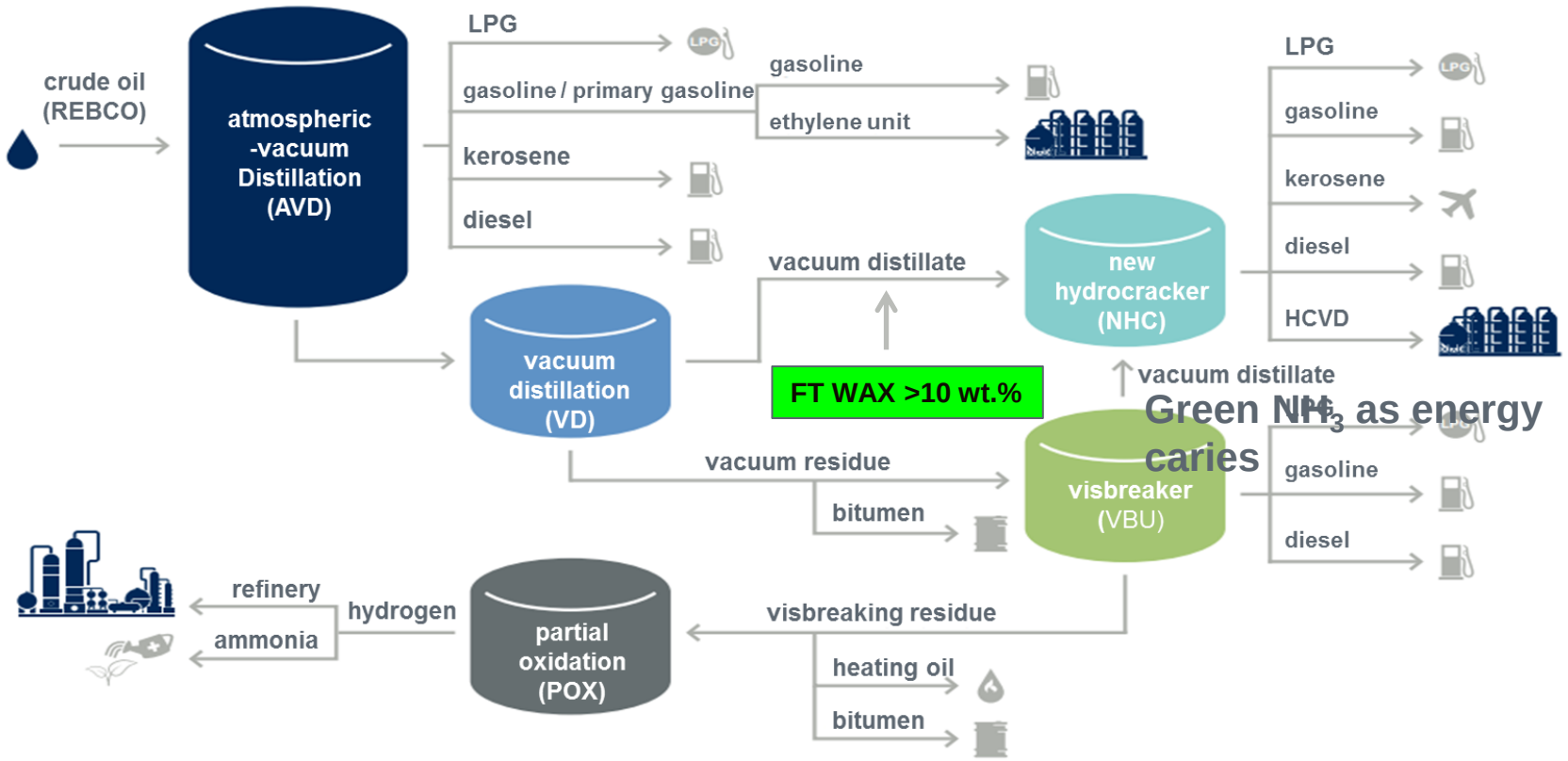


Simulation processing in existing refinery

80% reduction in the GHG emissions was reached for studied case

Obtained Production cost for biofuel is 1.10 EUR/l

The Break-even price of FT Biofuels after refining upgrade is at 1.7 EUR/kg



BENEFIT	84 wt. % of FT Oil+Wax is converted to motor fuels.
No benefit CURRENTLY	14 wt. % of FT Oil+Wax is converted to Steam cracker feedstock. 2.6 wt. % of FT Oil+Wax converted to fuel gas

Chemical recycling of waste plastics & EoL tires

Project description:

To develop/implement concept of chemical recycling via pyrolysis scalable to production capacities of from 90 ktpa (2030) to 180 ktpa (2040) of pyrolysis oil.

Focus on key challenges:

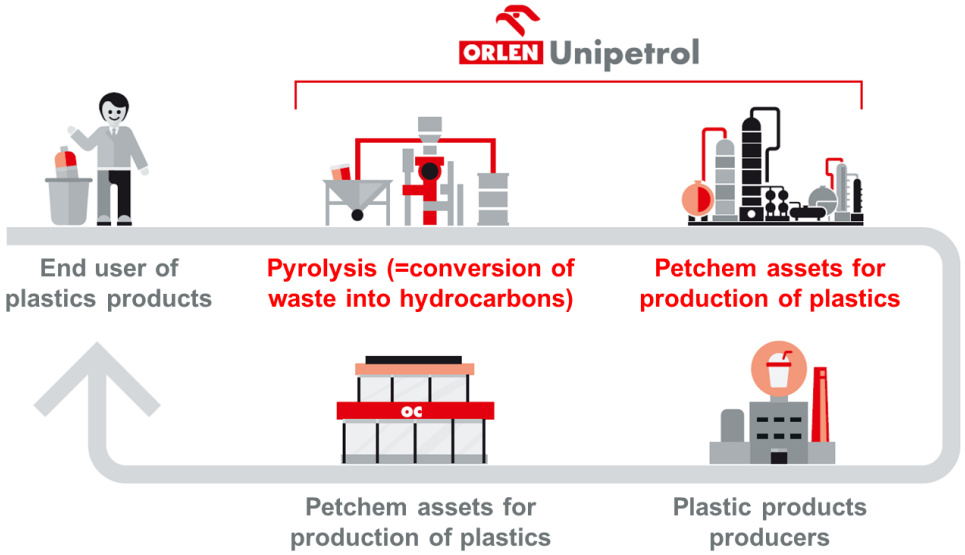
- Establish strategic partnerships with waste management sector → **Challenge 1 – sourcing the feedstock**.
- Remove „high“ risk contaminants (fluorine, chlorine, bromine, metals) → **Challenge 2 – technology itself**:
  - Option 1 – „smart pyrolysis“ – in-house or external technology.
  - Option 2 – „on-line“ dehalogenation.
  - Option 3 – „off-line“ dehalogenation.
- How to plan utilisation of current/new assets to achieve the most cost-effective solution for chemical recycling with short time-to-market → **Challenge 3 –asset management with chemical recycling.**

Opportunities:

- To introduce sustainable feedstock into production of petrochemicals (company level).
- Recognize responsibility and offer solution for sustainable plastics (company + global level).
- Reduce GHG emissions from waste plastic incineration (global level).

Current status:

- Challenge 1 – dialogue with waste management sector – ongoing.
- Challenge 2 (refer to roadmap in appendix section) – all options under development (lab-scale PoC), joint activity with ORLEN CG (Case Razem/Spolu).
- Challenge 3 – bussines cases in preparation, first PIMS calculations carried out, characterisation methods developed.



Key enablers? Solving following challenges:

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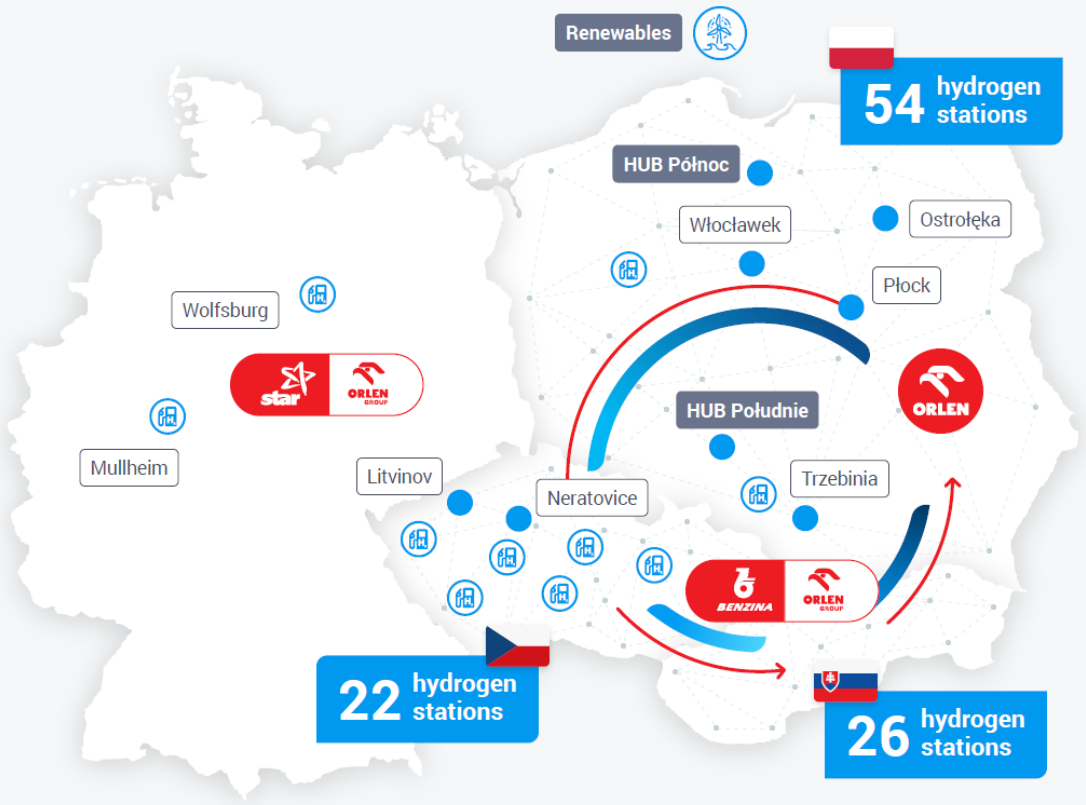
Hydrogen Eagle – green hydrogen for CEE



Poland
- 54 HRS,
- 110 MW electrolysis capacity,
- 15 kt H_2 from municipal waste,

Czech Republic
- 22 HRS,
- 80 MW electrolysis capacity,

Slovakia
- 26 HRS,
- 60 MW electrolysis capacity,

The most important project parametres:

- **102** HRS
- **250 MW** electrolysis capacity
- **15 kt H_2** / year from municipal waste
- over **1 mln tonnes CO_2** emission reduction annualy

Hydrogen Production Units (existing and under development)

Hydrogen Refuelling Station (existing and under development)

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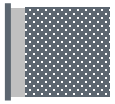
LCA of ICE / BV / FCV

	Production, distribution and energy consumption *g CO_2 / km*		Vehicle production and post-treatment *g CO_2 / km*		Total life cycle emission *g CO_2 / km*	
ICE	 **140-210**	mainly production and combustion of fossil fuels	 **40-60**	relatively lowest	 **180-270**	lowering (mainly advanced)
BV	 **10-100***	as per energy source, higher efficiency then FCV	 **~ 150**	battery production and limited recycling potential	 **160-250**	future reduction via new ECO friendly batteries with higher recycling potential
FCV	 **20-120**	as per the source of energy and hydrogen production technology	 **~ 110**	battery Production and carbon fibers in high pressure vessels	 **130-230**	dynamic development, future emission reduction

* Emission during life cycle relay on energy source where coal represents the highest and RES the lowest.

Source: Deloitte, Ballard – Fueling the future of mobility, 2020

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Thank You for Your attention