



Expert view on clean Hydrogen opportunities

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Hydrogen – Present and Future in Mobility - ZalaZONE

Making our world more productive



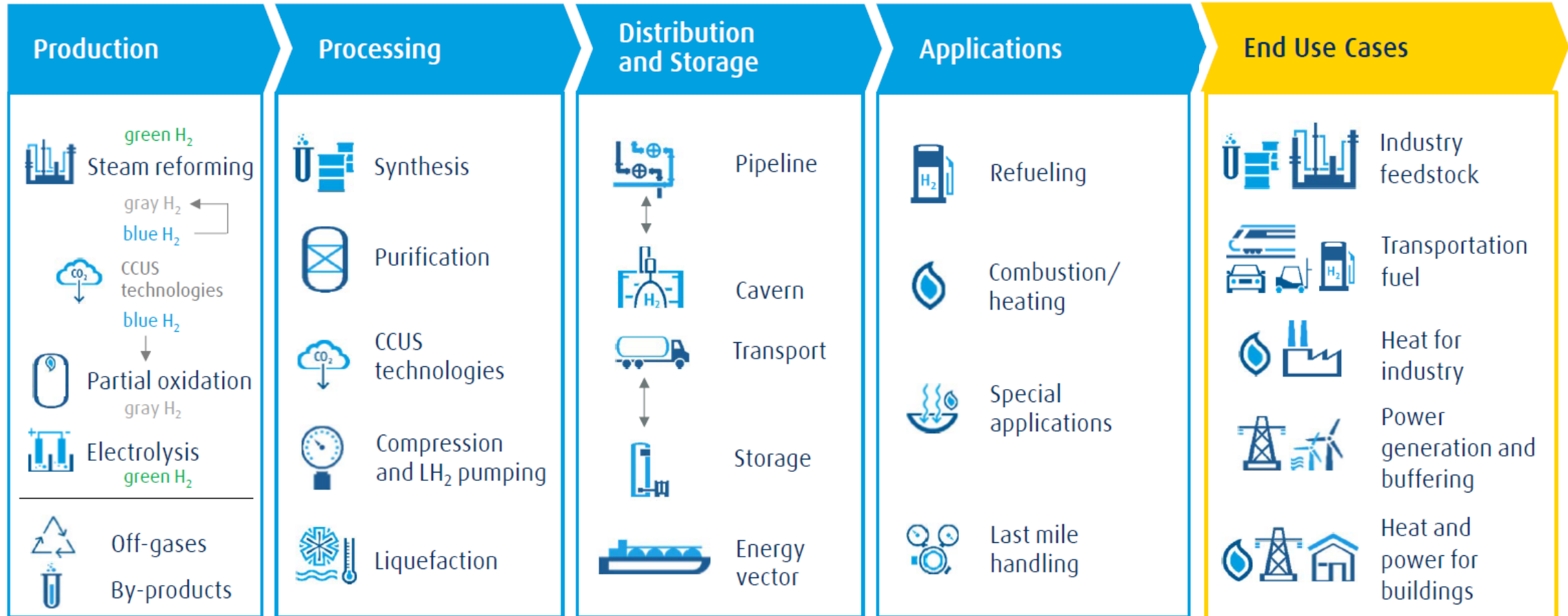


Extensive hydrogen mobility cannot exist without a sustainable hydrogen ecosystem.

Linde's engagement



Linde's Hydrogen Value Chain





Ultimate goal: decrease CO2 emission

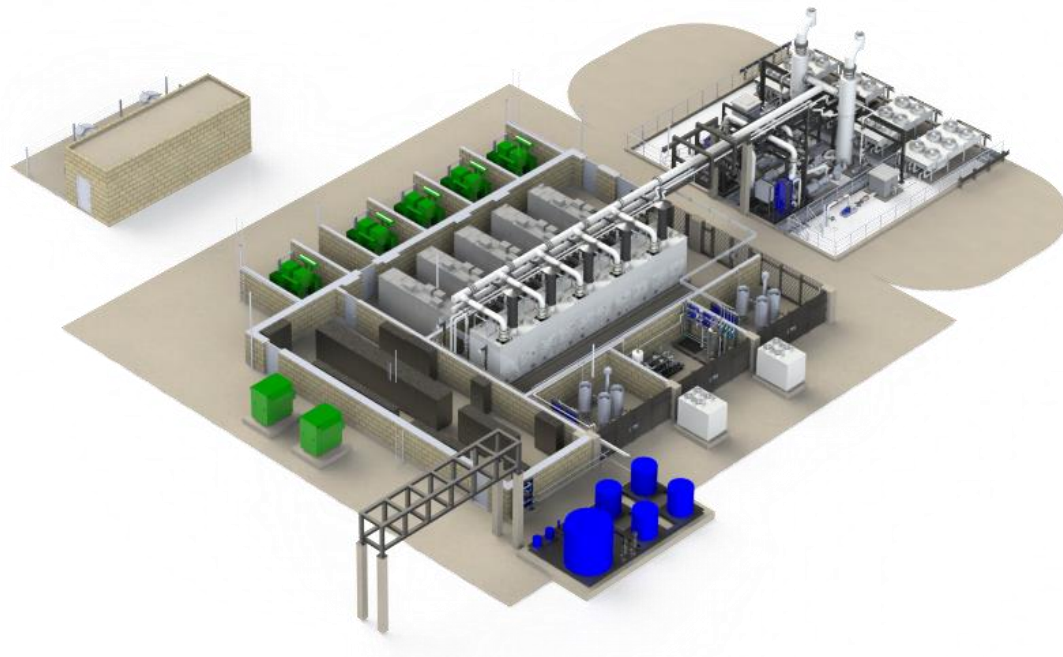
CO2 emission can be decreased where arises:

- NH3 production
 - Refineries
- Fertilizer production
- Metallurgy (Steel Mills)
- Synthetic material (plastic) production

Initial action: CO2 recycling /capture

- **Following action: Clean Hydrogen**

Centralized / Decentralized Green Hydrogen Sources ?



**Example 10MW Electrolysis System as
H₂ generation a refinery**

Business / commercial perspective:

Business case is only viable in case of integration !

Lower CAPEX/OPEX in larger volumes
(Hydrogen Valleys vs. Small-size, isolated assets)

Clean Hydrogen production / transport magnitudes



Production:

with medium and large scaled Electrolysers:
close to final users

Benefit: Modular systems

Note: Hydrogen usage for **mobility** alone
can not maintain the base load of
integrated production facilities.



Transport:

Short distances: pipeline

Medium distances: pressurized gas
(Refueling stations)

Long distances: liquified gas

Hydrogen mobility

Main focus on commercial vehicles / heavy machinery
(Tucks, Buses, Trains, Forklift fleets, etc.)

Main transport corridors and city/industry park services

Less focus on personal cars





Main challenges:

Renewable energy availability: PV or wind power

Industry-size Offtakers



Commercial sustainability

Main cost contributors of

SMR H2 (Grey/ Blue)

- Natural gas price
- Carbon Tax

Electrolyser H2 (Green/Yellow)

- Electric power price

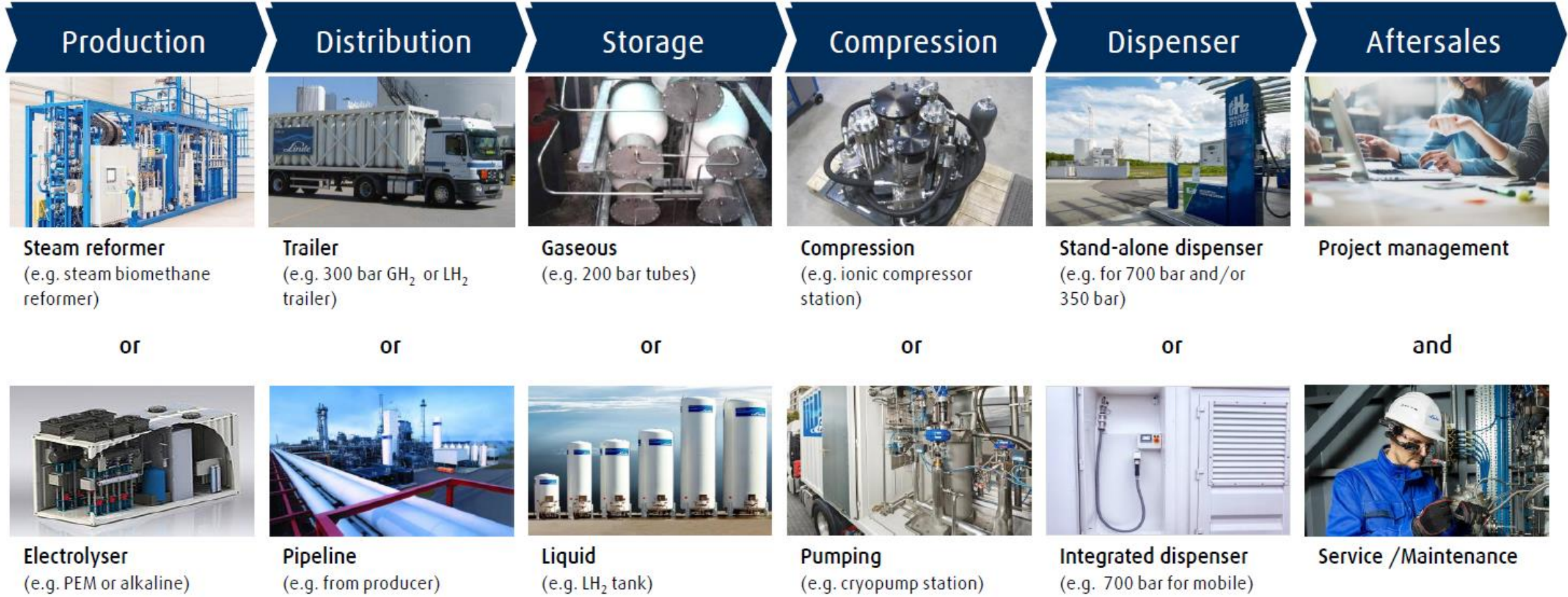
at present energy cost level:

< 3 X

Positive NPV / Self sustaining projects

Hydrogen technologies at Linde.

We cover the entire hydrogen value chain.



First H2 fuelling station in Hungary





Thank you for your attention.

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