

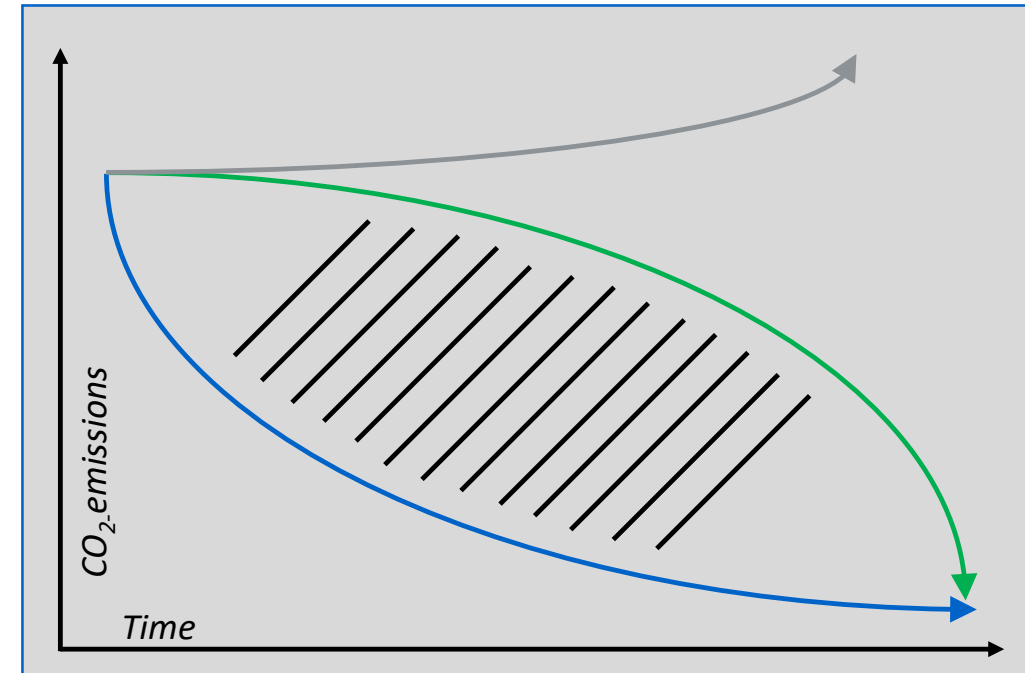
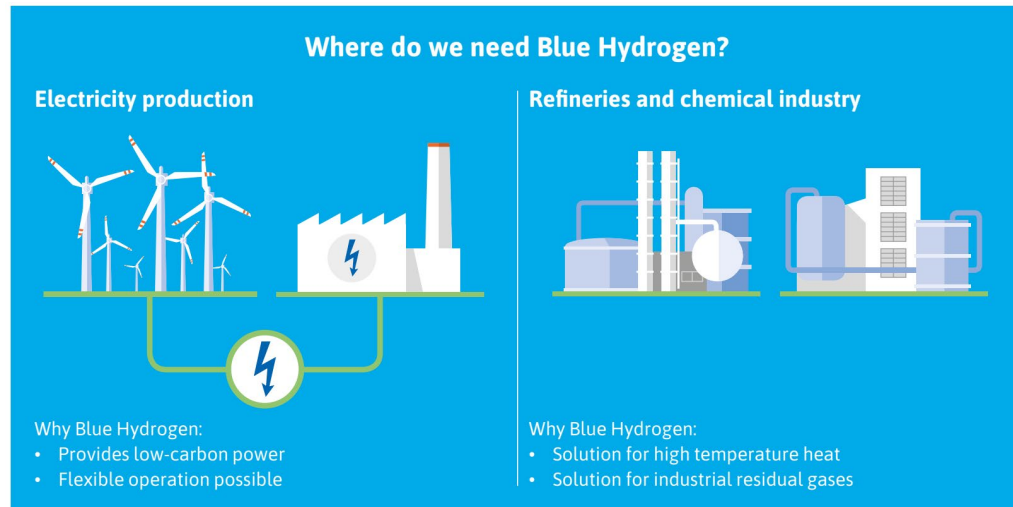


Hydrogen
Europe

H-VISION

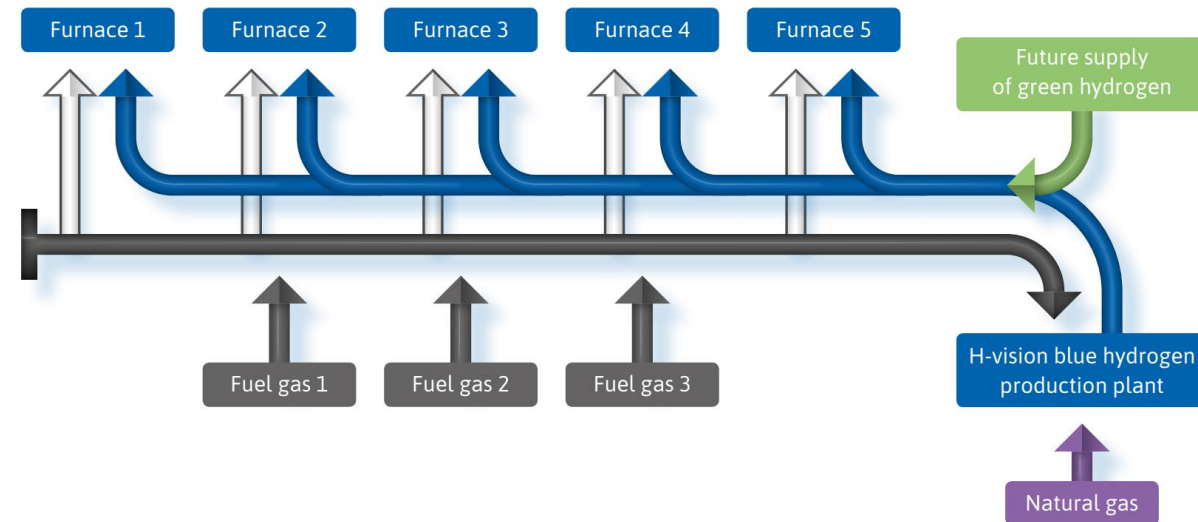
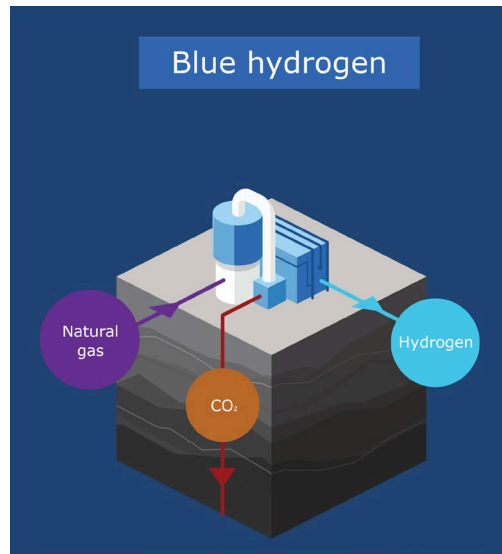
H-vision – Context & significance

- Decarbonize port industry rapidly using pre-combustion blue H₂ for high temperature processes & electricity generation
- Pave the road for the Green Hydrogen Economy
 - Develop market for hydrogen
 - Make user innovation with hydrogen possible



H-vision – General project idea

- New combination of existing technologies (H_2 from natural gas, CCS, hydrogen burning)
- Use of hydrogen to replace natural gas/coal burning & decarbonize refinery fuel gases
- All core technologies TRL 8-10
- No similar projects on this scale have been built (several studies such as H2M, HyNet, H21)



16%

CO₂-emission reduction of
port area (ref. 2018)

**2,2 (2026) –
4,3 (2031)**

Mton CO₂ avoided annually
(reference scope)

3200 MW

Capacity (reference scope) →
20% of energy demand of
port industry

Market

Refinery and electricity
production

2030

Before 2030 substantial
reductions

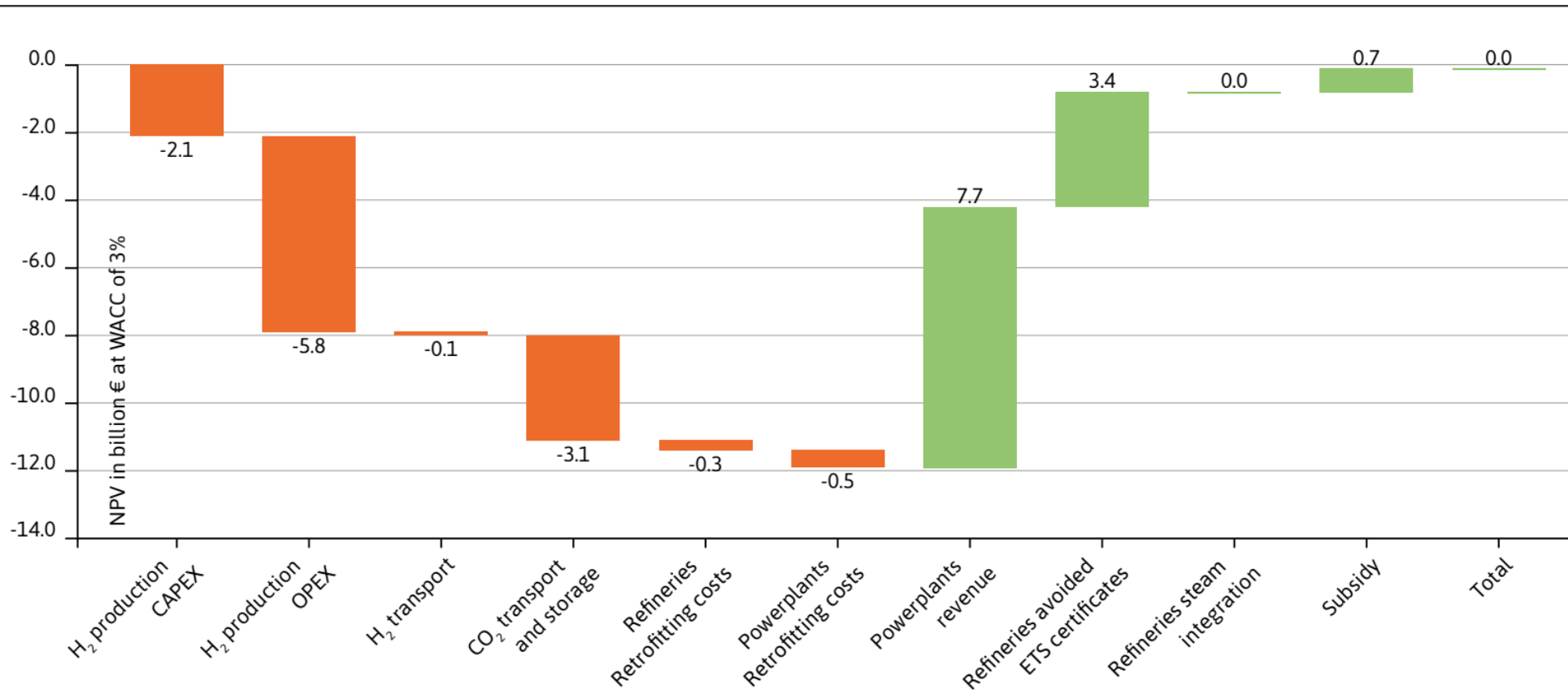
Hub

Start R'dam hydrogen hub

H-vision – Participants & location



H-vision – Investments & revenues



2

Billion Euro
investment

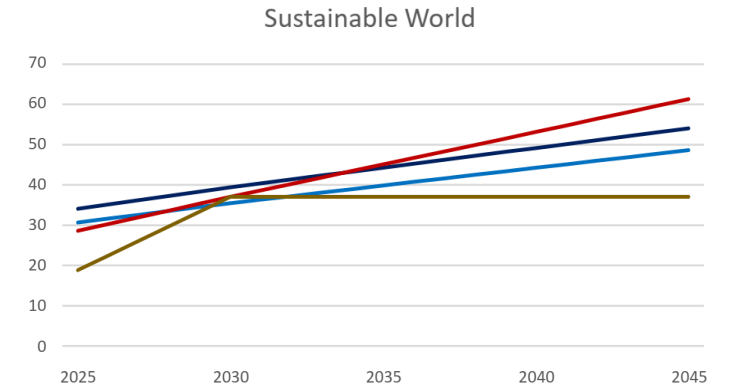
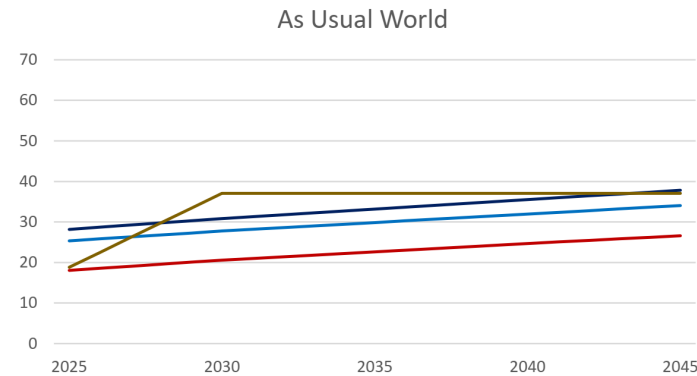
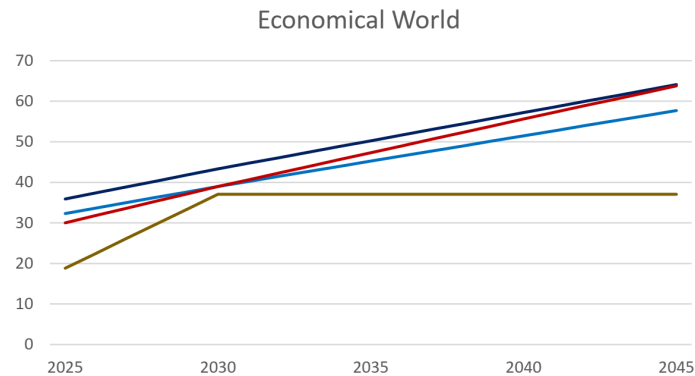
€ 110/ton

Avoidance costs
for reference
– as usual case

H-vision – Scenarios & range



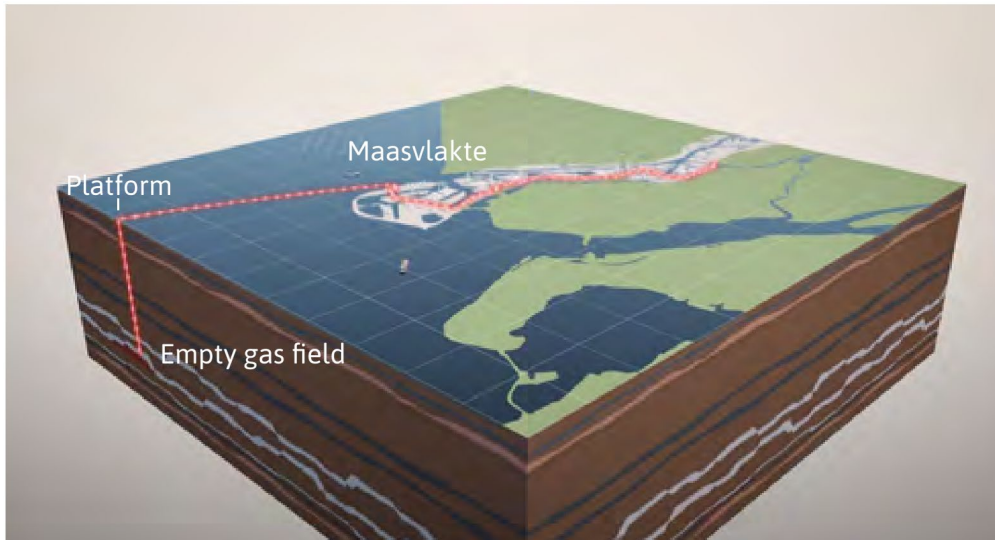
			Minimum scope	Reference scope	Maximum scope
	CO ₂ abatement	Mt	27	79	130
As Usual	NPV (WACC 3%)	Billion €	-1.8	-2.8	
	Avoidance costs	€/t CO ₂	146	111	
Economical	NPV (WACC 3%)	Billion €	-1.3	-0.7	-2.1
	Avoidance costs	€/t CO ₂	190	146	151
Sustainable	NPV (WACC 3%)	Billion €		2.5	3.1
	Avoidance costs	€/t CO ₂		86	91



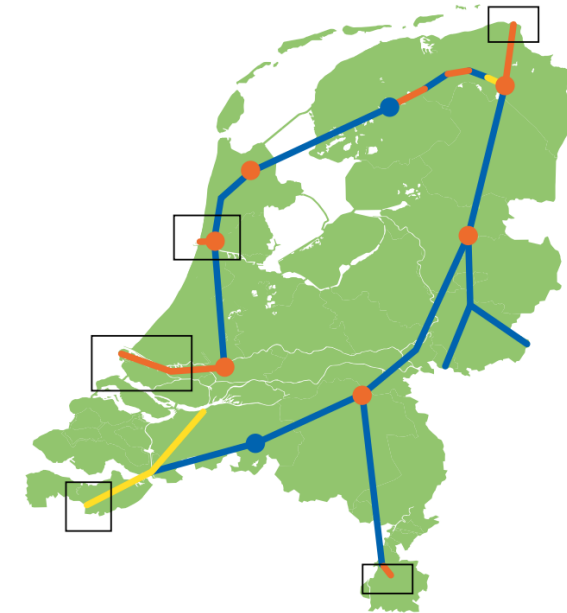
— H₂ price (€/MWh) — Gas price incl. CO₂ (€/MWh)
— Coal price incl. CO₂ (€/MWh) — Biomass price (€/MWh)

Next step: improve business case and lower uncertainties

H-vision – Dependencies



Porthos (CCS)



— Existing pipelines — New pipelines — Third parties □ Large industrial area

Hydrogen backbone (only for maximum scope)

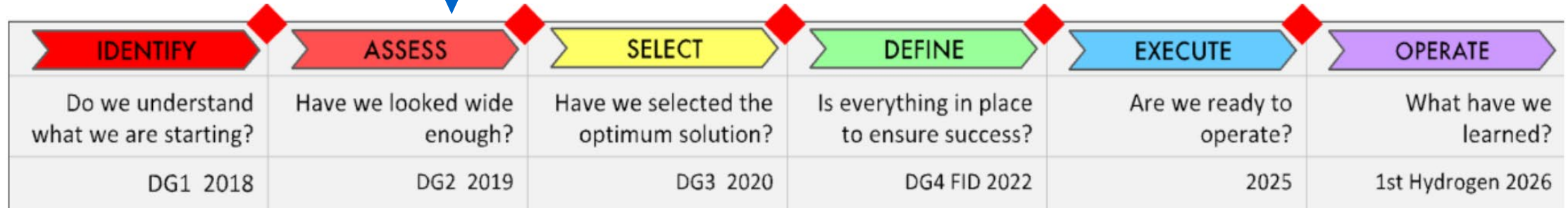
Other dependencies

- Financial support to close gap
- CO₂ price
- Regulation regarding CCS & CO₂ transport (international)

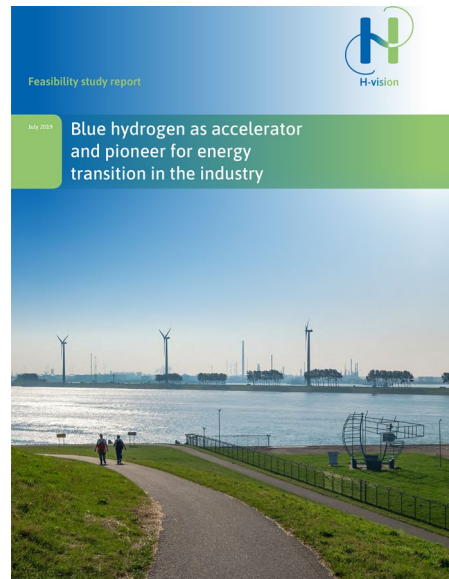
H-vision – Maturity



We are here



Feasibility study ↑ July 2nd 2019



Next steps & future

- Working towards SELECT phase
- Kickstart hydrogen economy & innovation in Rotterdam → Europe
- Project economics look good compared to other CO₂ reduction solutions
- Financial & policy support needed