

H-vision

With blue hydrogen towards a green future



In 3 steps towards a sustainable cluster Rotterdam-Moerdijk

Port and industry area Rotterdam-Moerdijk working group report

1. 2018-2025: reduce CO₂-emissions by energy-efficiency, use of residual heat, steam network, CCUS; innovations for steps 2 & 3
2. 2020-2030: towards a new energy system for the industry (electrification, hydrogen)
3. 2030-2050: towards a new materials system (for the industry) and a new fuels system (for mobility)



Decarbonisation of the industry

- Climate targets demand **challenging adjustments** by industry
- Rotterdam-Moerdijk industrial area emits ~33 million tonnes CO₂ annually, equals **17% of national annual CO₂ emissions**
- **Industry is already taking necessary steps:** reducing CO₂-emissions of refineries with 20%, energy-efficiency, re-use of residual heat
- Some industrial processes can switch to **electricity**
- **High temperature-heat processes** (>350°C) demand other options
- **Hydrogen** provides solutions.
H-vision as energy supplier for referies, chemical plants and electricity production



H-vision project



Objectives H-vision

- Support industry to reduce CO₂-emissions
- Support Rotterdam to realise its climate ambitions (Rotterdam Climate Agreement)

Targets

- Short term CO₂ reductions refineries
- Substantial reduction of 2,2 – 4,3 Mton CO₂ from 2026
- Large scale production of blue hydrogen (incl CCS)
- Prepare the road towards Rotterdam's future role as hydrogen hub

Core partners



Support partners



Power Plant Rotterdam

Grey, blue and green: same product, different ways of production



Grey hydrogen

Reform natural gas into CO₂ and hydrogen

CO₂ emitted in the atmosphere



Blue hydrogen

Reform natural gas into CO₂ and hydrogen

Residual gases also in H-vision scope

CO₂ stored or re-used

Link H-vision with Porthos project for storage under the sea



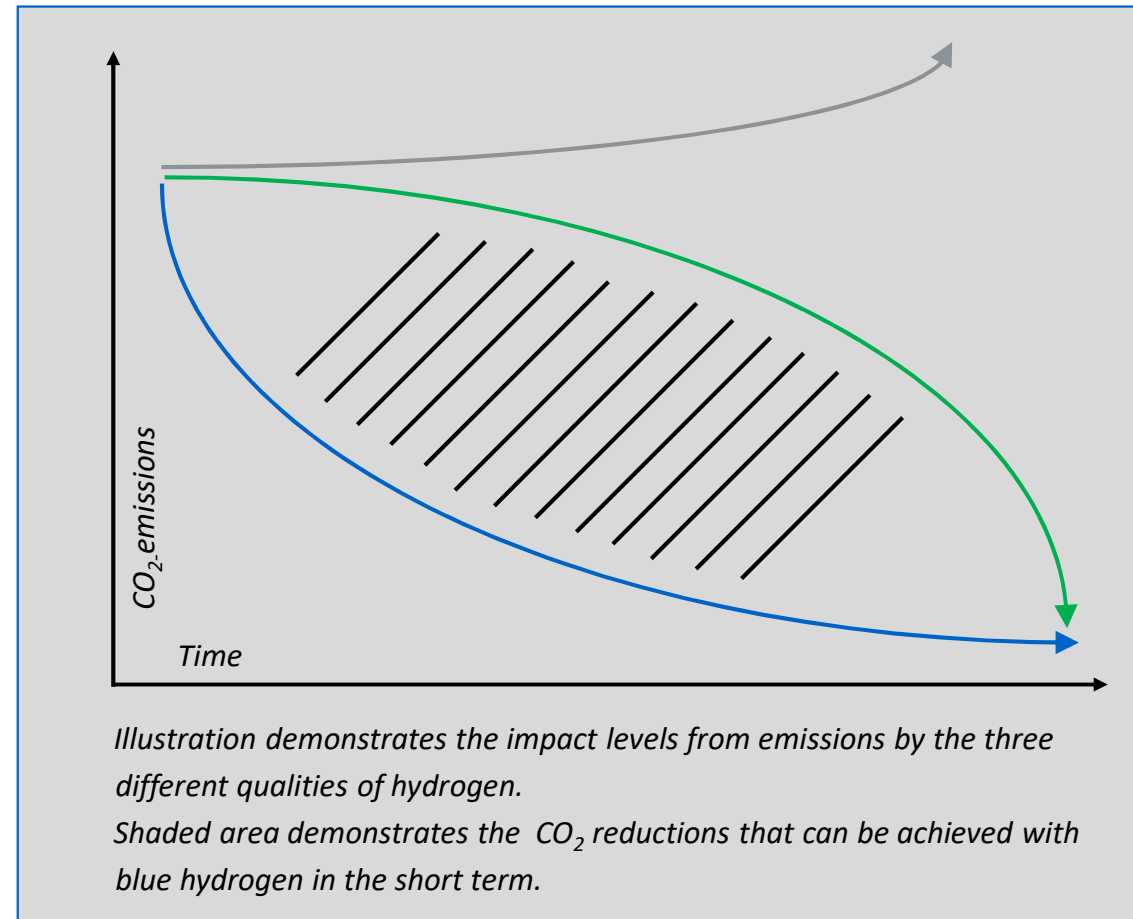
Green hydrogen

Split water into hydrogen and oxygen using electrolysis powered by wind and sun

No CO₂ emitted

H-vision significance

- Increase of grey hydrogen leads to increase of greenhouse gases
- Green hydrogen is climate neutral. To generate the required volumes of green hydrogen, more green electricity is needed than will become available in the coming decades
- Large-scale blue hydrogen available before 2030
- Substantial impact on the carbon budget
 - Like in a bathtub, the atmosphere will be filled with greenhouse gases
 - IPCC recent climate report: within the current trend, if we want to remain within the 2°C goal the world only has 25 years of carbon budget left



Accelerator and pioneer

- **Hydrogen essential in new energy system**
 - Proven technology
 - Fuel for mobility
 - Energy source for industry
 - Storage for flexible electricity supply
- With substantial CO₂-reductions before 2030 H-vision **accelerates the energy transition**
- **Investments** in infrastructure and installations for **blue and green hydrogen** applicable (no lock-in)
- **Back-up solution**
after large scale green hydrogen introduction
- Improved infrastructure **attracts new industry** in the Rotterdam harbour



Results of the feasibility study demonstrate H-vision as ...

<ul style="list-style-type: none"> ✓ Substantial 	<p>16% CO₂-emission reduction</p>	<p>2,2 – 4,3 Mton CO₂ reduction in 2026 – 2031 annually</p>	<p>3200 MW 20% Heat and electricity demand Rotterdam industry</p>
<ul style="list-style-type: none"> ✓ Fast 			
<ul style="list-style-type: none"> ✓ Pioneer 	<p>Market Refineries and electricity production</p>	<p>2030 Before 2030 substantial reductions</p>	<p>2 Billion euro investment</p>
<ul style="list-style-type: none"> ✓ Accelerator 	<p>Hub Start R'dam hydrogen hub</p>	<p>15-20 Years forward to large scale H₂ use</p>	<p>€ 110/ton Avoidance costs for reference – as usual case</p>