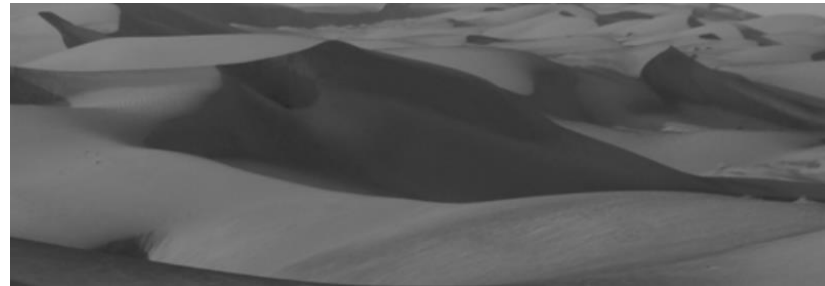


Progressing the Energy Transition and CO₂ reduction

Insights into an industrial cluster approach – The Netherlands, Rotterdam

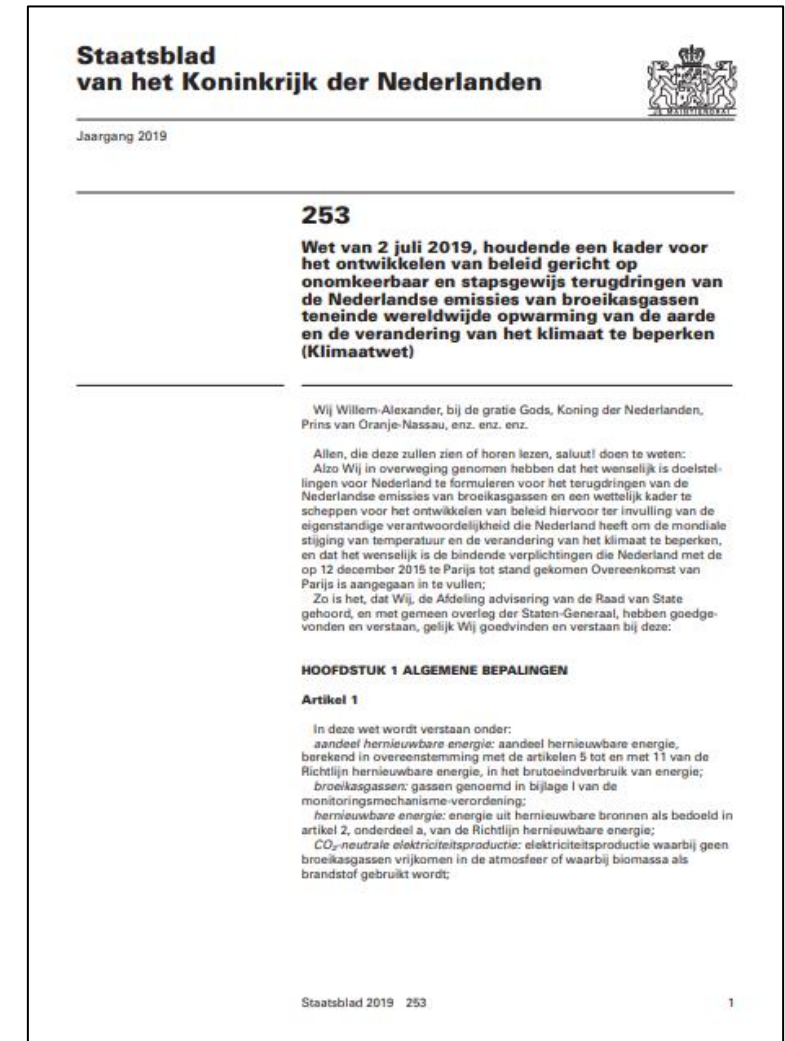


March 2021

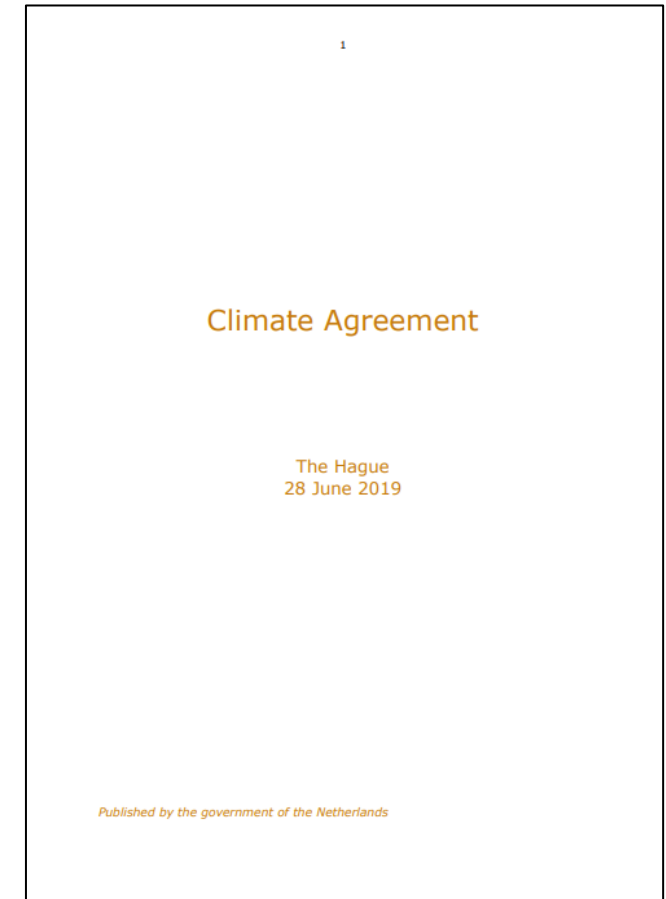
Tim Bertels, sr. partner DAREL Group (www.darel.nl), sr. consultant to CATF (www.catf.us)

- It appears that the Energy Transition (ET) and reduction of CO₂ emissions progress best in industrial clusters, enabled by scale, momentum, synergies, and cluster championship
- This begs questions, such as :
 - How is ET delivery through industrial clusters structured, organized, owned, governed, and funded ?
 - What are the insights from this and how can we learn from that and replicate success ?
- This slide pack aims to provide some insights, using the Netherlands as case in point ;
 - In the Netherlands the Energy Transition is governed by a “Climate Law” and “Climate Agreement”, and it is structured by five emissions sectors and by CO₂ reduction plans for six industrial clusters.
- One of these clusters is Rotterdam-Moerdijk, where the Energy Transition is progressing well ;
 - The Port of Rotterdam provides leadership, convenes various private sector entities and plans for shared infrastructure
 - The Port engages in collaborations with other Ports around the world on decarbonization initiatives
 - Climate policy drivers and considerable funding are coming from outside the Port region (e.g., national programs)

- The **Climate Act** (wetten.nl - [Regeling - Klimaatwet - BWBR0042394](https://overheid.nl) (overheid.nl)) sets legally binding greenhouse gas (GHG) emissions reduction targets for the Netherlands.
- It mandates the government to reduce its total GHG emissions by 95%, compared with a 1990 baseline, in the long run and to achieve carbon neutrality in the electricity sector by 2050.
- It also requires the government to reduce its emissions by 49% by 2030 in the medium run.
- The law contains provisions for developing an implementation plan, measuring progress, and monitoring compliance and accountability.



- The **Climate Agreement** ([Climate Agreement | Report | Government.nl](#)) is part of the Dutch climate policy.
- It is an agreement between many organisations and companies in the Netherlands to combat climate change.
- The government's central goal with the National Climate Agreement is to reduce greenhouse gas emissions in the Netherlands by 49%* by 2030 compared to 1990 levels.
- To date most organisations and companies that were involved in the negotiations have signed the Climate Agreement ; [Overzicht van ondertekenaars | Publicatie | Klimaatakkoord](#)
- The Dutch Government will not need the signatures of all stakeholders to use the Climate Agreement as the roadmap for ET and CO₂ reduction delivery



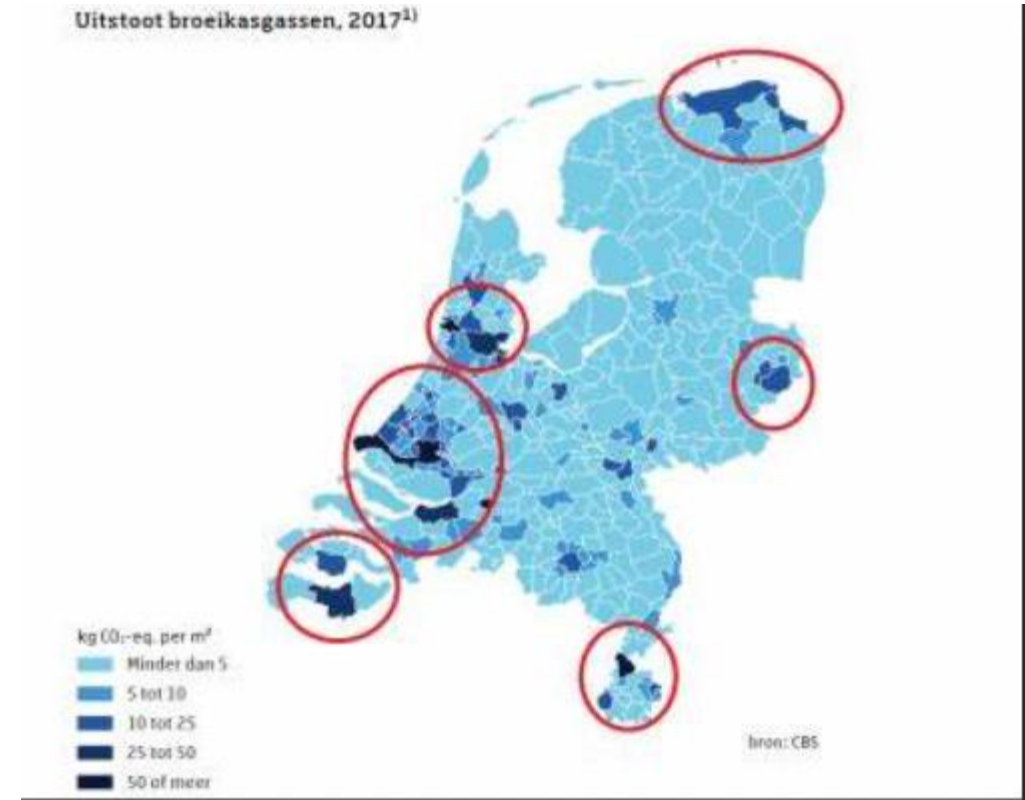
* Upward adjustment expected in the near future to fit with the 55% EU target

- Five emissions **sectors** negotiated for more than a year with all relevant stakeholders how to achieve their allocated CO₂ reduction targets to reach the overall goal of the Climate Agreement to reduce GHG emissions in the Netherlands by 49% by 2030 compared to 1990 levels.

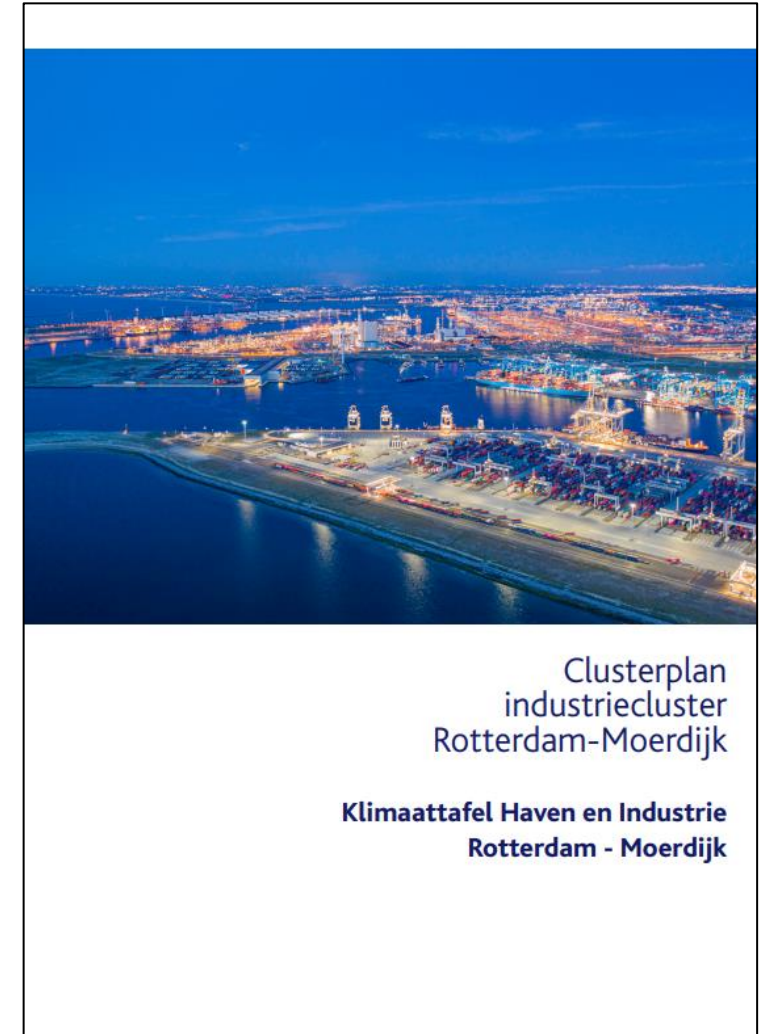
- These sectors are ;
Power,
Mobility,
Industry,
Agriculture,
Built Environment.



- Six **industry clusters** have formulated their Energy Transition (ET) plans for presentation to the minister of Economic Affairs & Climate ; [Industriële clusters publiceren plannen 2030-2050 | Nieuwsbericht | Klimaatakkoord](#)
- These clusters are ;
 - Rotterdam-Moerdijk,
 - Noordzeekanaal area (Amsterdam/IJmuiden),
 - Chemelot (Limburg),
 - Smart Delta Resources (Zeeland)
 - Noord-Nederland (Groningen).
 - Aggregation of other industrial companies spread over The Netherlands.
- All clusters have identified a set of Energy Transition projects which should deliver on the overall CO₂ reduction target for industry of 14,3 million tons per annum by 2030.



- In 2020 the Rotterdam-Moerdijk industry cluster delivered its cluster plan, including a set of planned Energy Transition projects : [Koploperprogramma cluster Rotterdam Moerdijk | Publicatie | Klimaatakkoord](#)
- The plan was compiled by (local) industries & stakeholder organisations gathered in the Climate Actions (negotiations) Table (“Klimaattafel”), see slide #10 for its members
- The plan provides the Dutch Government, companies and other stakeholders insight into the plans, and the conditions and enablers to progress the Energy Transition in the Rotterdam-Moerdijk industrial cluster.



Example: the Rotterdam-Moerdijk Cluster plan (2)

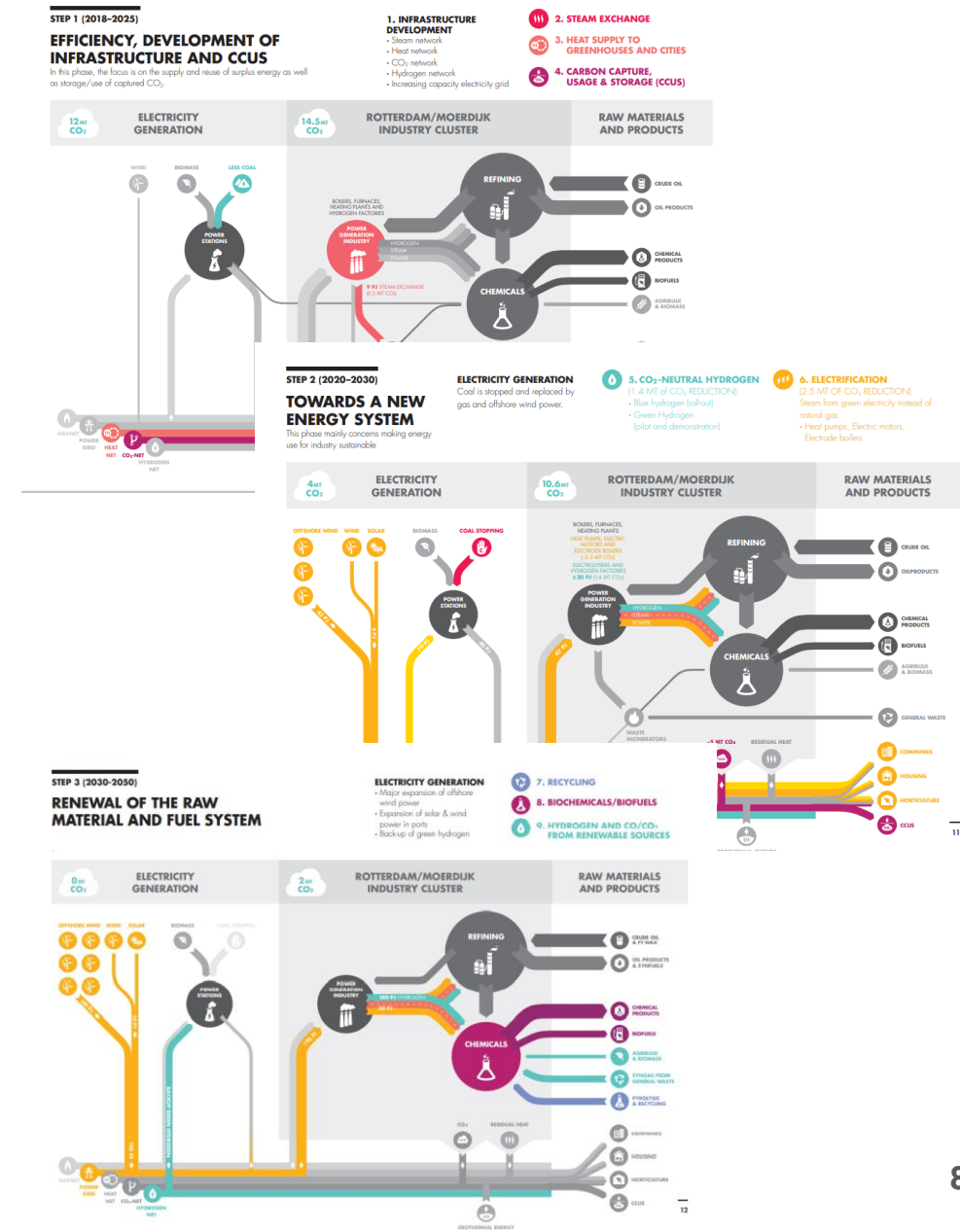
- The Rotterdam-Moerdijk industry cluster plan is based on a **three-step strategy** to move towards a sustainable industry cluster ; [three-steps-towards-a-sustainable-industry-cluster-rotterdam-moerdijk-2050.pdf](https://portofrotterdam.com/three-steps-towards-a-sustainable-industry-cluster-rotterdam-moerdijk-2050.pdf) (portofrotterdam.com)

Step 1 - Efficiency, developing infrastructure and CCUS. In this phase, between 2018 and 2025, the focus will be on the supply and reuse of surplus energy and storage/use of captured CO₂

Step 2 - Towards a new energy system. This phase (2020-2030) is mainly concerned with making energy use by industry sustainable

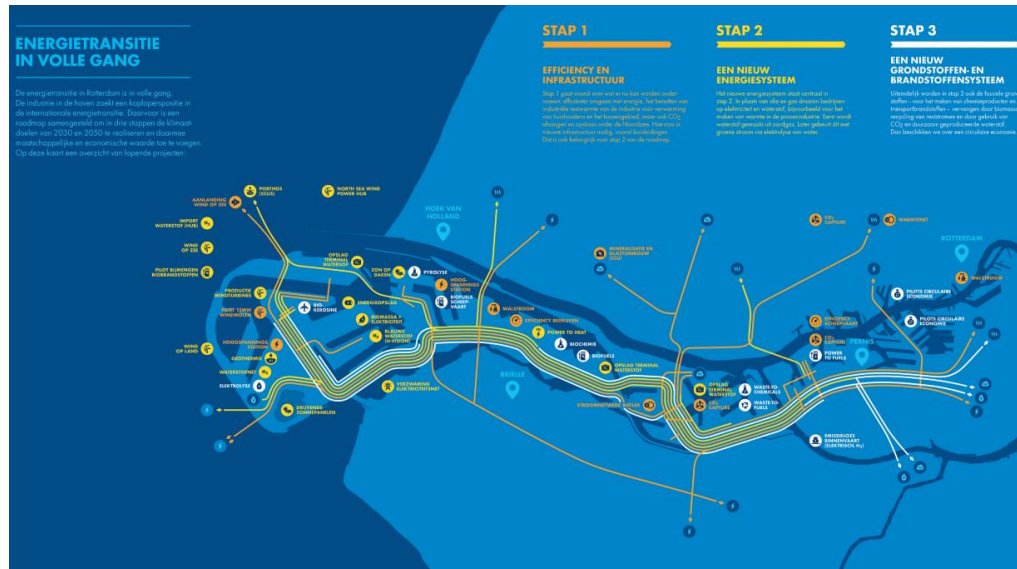
Step 3 - Renewal of raw materials and fuel system (2030-2050)

- This aligns with industry's views on the appropriate pace, path, scale, and economics of making the energy transition and meeting the CO₂ emissions reduction targets and ensures **industry ownership** of the plan.



A broad portfolio of energy transition projects phased over time in three steps ;

- From energy efficiency, expansion of existing waste heat and steam distribution grids, through CO₂ capture and storage, geothermal energy, industry electrification, hydrogen manufacturing and distribution, to waste-to-products, renewable fuels, zero-carbon shipping, etc. etc.



	Stap 1 Efficiëntie, ontwikkeling infra en CCUS	Stap 2 Naar een nieuw energiesysteem	Stap 3 Vernieuwing van het grond- en brandstoffenstelsel
Na 2030	<ul style="list-style-type: none"> • Warmte uit duurzame processen • Elektrificatie stoom, groene stroom • Van CCS steeds meer naar CCU • Van waterstof/CCS steeds meer naar elektrificatie/groene waterstof 	<ul style="list-style-type: none"> • Naar NSWPH* met groene waterstof • Verdere uitrol elektrificatie • Uitrol groene waterstof • Uitrol geothermie 	<ul style="list-style-type: none"> • Steeds meer duurzame chemie o.b.v. afval, biomassa en waterstof • Steeds meer duurzame brandstoffen: biobrandstoffen, synthetische brandstoffen, waterstof, elektriciteit
Binnen 5 jaar	<ul style="list-style-type: none"> • Levering restwarmte • Uitwisseling stoom • Levering CO₂ (CCUS) • Aanleg backbone voor waterstof 	<ul style="list-style-type: none"> • Start aanleg NSWPH* • Uitrol elektrificatie • Uitrol blauwe waterstof • Opschaling groene waterstof • Opschaling geothermie 	<ul style="list-style-type: none"> • Opschaling waste-to-chemicals • Opschaling pyrolyse, bionafta • Opschaling emissieloos varen • Opschaling biokerosine
Nu beginnen	<ul style="list-style-type: none"> • Uitbreiden warmtenetten • Uitbreiden stoomnetten • Aanleg CO₂-netten & opslag • Energie-efficiënte bedrijven • Energie-efficiënte scheepvaart • Duurzaam wegtransport 	<ul style="list-style-type: none"> • Aanlanding wind op zee/eerste elektrificatieprojecten • Verzwaren elektriciteitsnet • Start ontwikkeling waterstofnet • H-vision • Pilot ultradiepe geothermie 	<ul style="list-style-type: none"> • Eerste waste-to-chemicals fabriek • Eerste pyrolyse projecten • Biobased chemicals projecten • Pilot emissieloze binnenvaart • Pilot biokerosine

* North Sea Wind Power Hub

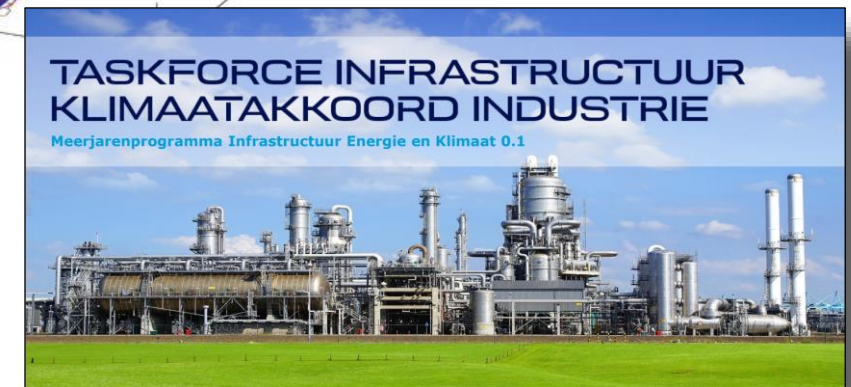
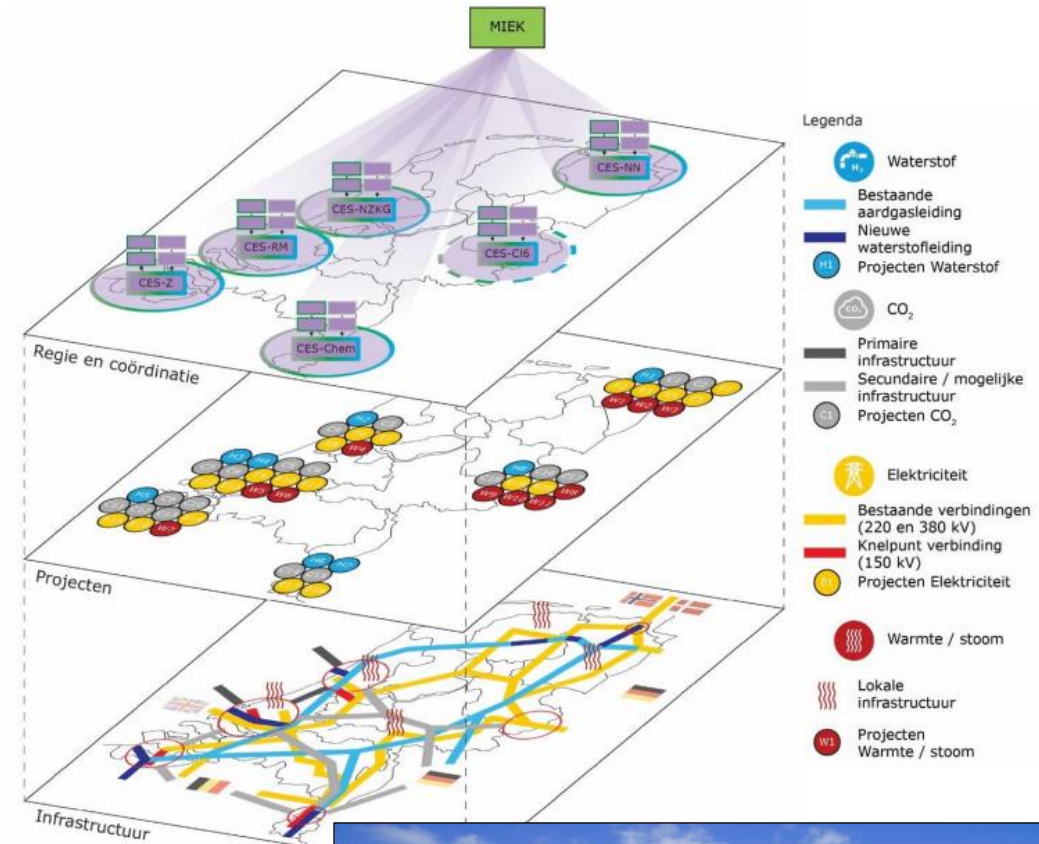
- The (local) CEO's of the leading industries in the Netherlands have all underwritten
i) the Climate Agreement, and
ii) the Industry Cluster plans.
- The Cluster Plans and Climate Agreement are public and many projects are co-funded by the Dutch government
- Most projects are progressed by JV consortia, involving a varying mix of these leading industries
- This leads to commitment for industries to deliver on the plans



Members of the "Klimaattafel", April 2020

(source: [Koploperprogramma cluster Rotterdam](#) | [Moerdijk](#) | [Publicatie](#) | [Klimaatakkoord](#))

- The Netherlands' Government keeps **grip on progress and delivery** of the ET and CO₂ reduction through ;
 - the Climate Agreement, signed by most industries
 - the underlying (six) Industry Cluster ET plans & programs
 - co-funding of the underlying projects (see slide 11) and application of CO₂ emissions penalties : [Dutch government to press ahead with controversial CO2 tax for industry \(yahoo.com\)](#)
- The government furthermore facilitates delivery on Energy Transition projects and potential connection of clusters through identifying, progressing, and potential co-funding of the required critical **infrastructure** : [Adviesrapport Taskforce Infrastructuur Klimaatakkoord Industrie | Rapport | Rijksoverheid.nl](#)



To kickstart the often sub-commercial Energy Transition and CO₂ reduction projects, and to develop the required connecting infrastructure several national and EU funding schemes are available for a subset of these projects ;

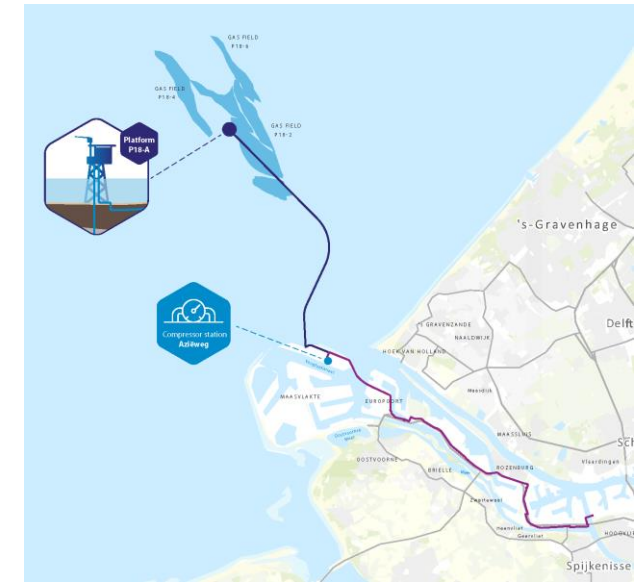
National (The Netherlands) ;

- SDE++ mechanism ; [Aanvragen Stimulering Duurzame Energieproductie en Klimaattransitie \(SDE++\)](#) | RVO.nl | Rijksdienst
- National Growth (aka “Wobke-Wiebes”) fund ; [Welke projecten doen een gooi naar de miljarden uit het Wopke-Wiebes-fonds? \(change.inc\)](#)
- Invest-NL, financing ET projects at attractive T&C’s ; [Invest-NL \(invest-nl.nl\)](#)
- RVO energy innovation RD&D funds ; [Subsidies energie-innovatie - Topsector Energie](#) | RVO.nl | Rijksdienst

The **EU** provides several funding mechanisms to progress the Energy Transition and infra development, of which some in the context of EU’s post-Covid recovery and transition to a green economy ;

- Connecting Europe Facility (CEF) : [Connecting Europe Facility | Innovation and Networks Executive Agency \(europa.eu\)](#)
- EU Innovation Fund : [Innovation Fund | Innovation and Networks Executive Agency \(europa.eu\)](#)
- Just Transition Fund : [Just Transition funding sources | European Commission \(europa.eu\)](#)
- The Recovery & Resilience Facility : [Recovery and Resilience Facility | European Commission \(europa.eu\)](#)
- Horizon Europe : [Horizon Europe | European Commission \(europa.eu\)](#)

- A joint initiative by (semi-state owned parties) Port of Rotterdam Authorities, Gasunie, EBN to build & operate an **open-access CO₂ transport and storage infrastructure hub** in Rotterdam and offshore the Netherlands to tackle the capture/storage “catch22”
- Anchored into the Rotterdam-Moerdijk industrial cluster plan
- Planning to deliver at least 2,5 million tons per annum on the Netherlands’ industry’s target to achieve 14,3 million tons per annum CO₂ reduction by 2030. FID planned for Q1 2022
- Co-funding by the EU Connecting Europe Facility mechanism and anticipated SDE++ funding by the Dutch Government
- Project investments planned by:
 - EBN, Gasunie, PoR (transport, compression & storage facilities),
 - Shell, ExxonMobil, Air Liquide, Air Products (capture facilities)
- Potential for connection to neighbouring industrial clusters, such as Port of Antwerp, North Sea Port, Chemelot, and NordRhein Westphalia

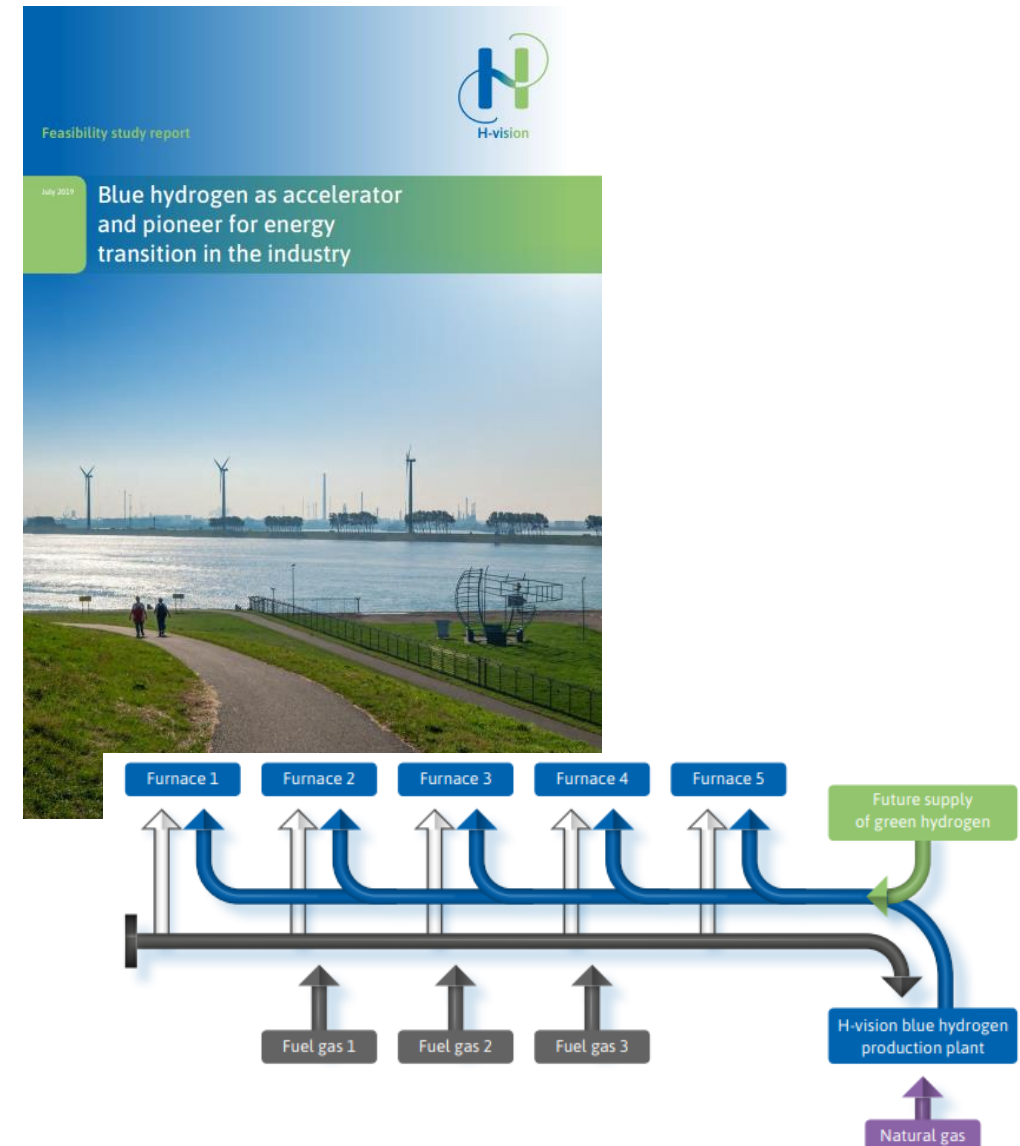


www.porthosco2.nl

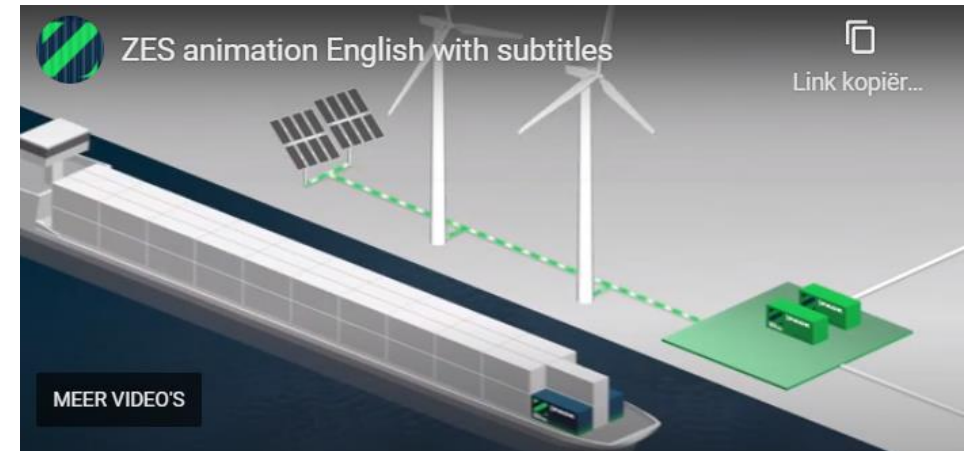


- Production and use of **low-carbon Hydrogen** for a rapid and significant cut in CO₂ emissions from industry in the Port of Rotterdam
- The hydrogen is suited for use as an energy carrier for industrial processes, and will be primarily produced from refinery gases supplied by local refineries, supplemented by natural gas off the grid.
- H-vision will be based on proven technology, the hydrogen network will drive the uptake of hydrogen in industrial processes, transport and other uses.
- H-vision partners: Air Liquide, BP, Deltalinqs, EBN, ExxonMobil, Equinor, Gasunie, Port of Rotterdam, Onyx Power, Shell, Uniper, Vopak

Sources: [Home :: H-vision \(h-vision.nl\)](https://www.h-vision.nl) and [h-vision feasibility study report - Bing](#)



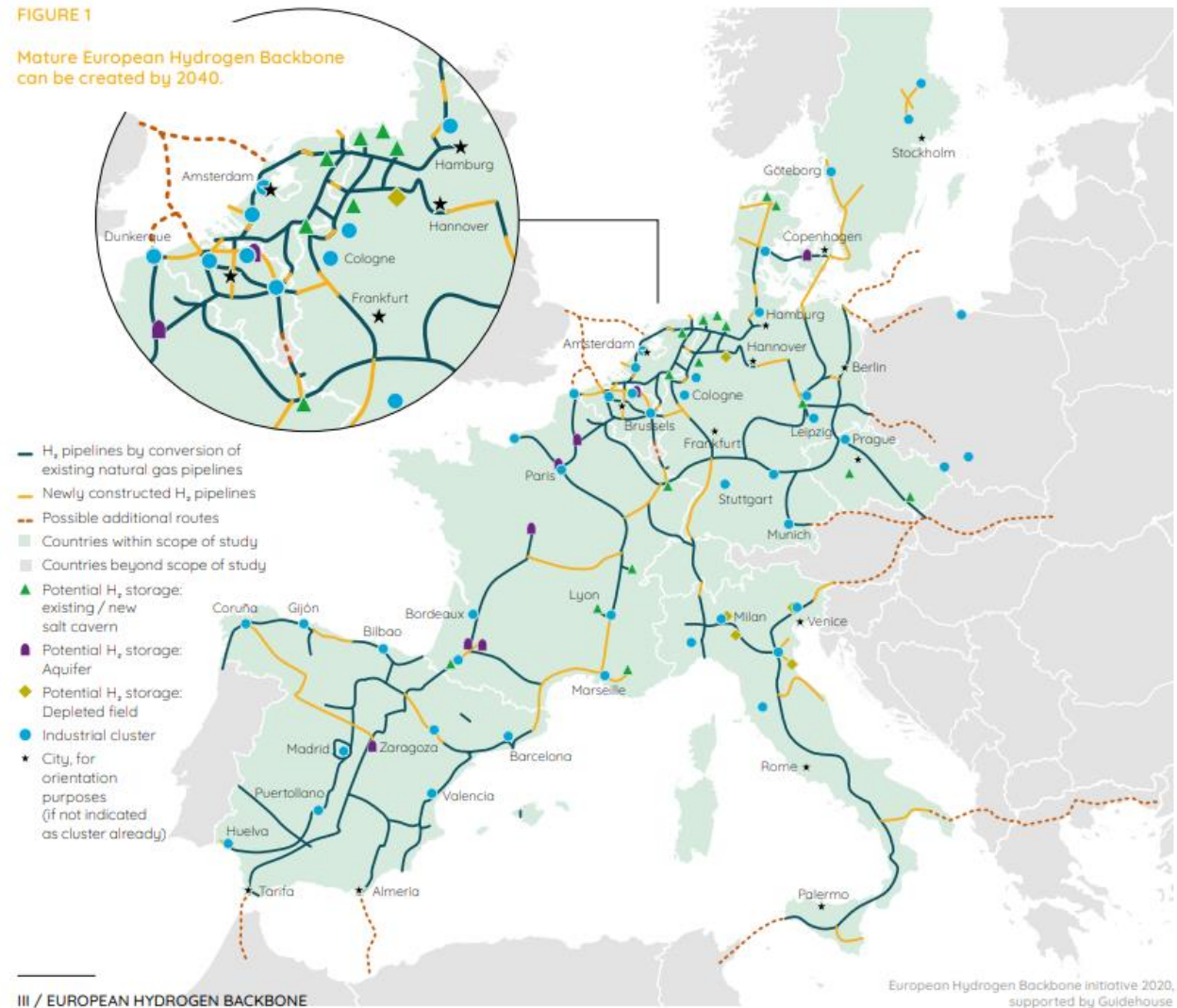
- ZES supplies interchangeable energy containers for new and existing inland vessels to **make inland shipping & short sea sailing clean and climate neutral**
- The containers - “ZES Packs” - are charged using renewable power.
- Depleted containers can be exchanged for full containers at exchange and loading stations, equipped with an ‘open access’ network and used to stabilise the electricity grid or meet temporary local demand for electricity.
- ZES is a partnership between Engie, ING, Port of Rotterdam, and Wärtsilä



- Industry clusters seek further expansion of Energy Transition critical infrastructure for H₂, CO₂, electricity, etc. and connection to other (inter)national clusters
- Expansion and connection are facilitated by Projects of Common Interest (PCI) and/or Important Projects of Common European Interest (IPCEI's), attracting potential national and EU funding.

FIGURE 1

Mature European Hydrogen Backbone can be created by 2040.



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