

Netherlands Innovation Network

Connecting Innovation Worldwide

Hydrogen in the Netherlands

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Outline

- ▶ NL top energy sector
- ▶ NL energy hubs
- ▶ NL hydrogen value chain
- ▶ Policy, projects and tenders
- ▶ IDIC activities

The Netherlands Topsectors



Outline

- ▶ NL top energy sector
- ▶ NL energy hubs
 - ▶ Rotterdam (West NL)
 - ▶ Groningen (North NL)
 - ▶ Arnhem (East NL)
 - ▶ Eindhoven (South NL)
- ▶ NL hydrogen value chain
- ▶ Policy, projects and tenders
- ▶ IDIC activities

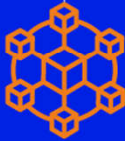
Hightech hubs in the Netherlands - Energy



The Hague
Security Delta



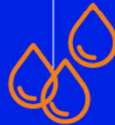
Leiden
BioTech



Leiden
Healthy People
Healthy Environment
Healthy mind



Friesland
Water Technology



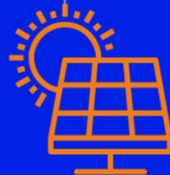
Twente
High Tech
Systems & Materials

Delft
Industrial Solutions
CleanTech
MedTech
IT



Wageningen
Food
Agriculture

Groningen
Data Services
Energy
Healthy Aging



Rotterdam
SmartPort
CleanTech
MedTech
Energy
Food



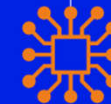
Limburg
Logistics
Agro-Food
Manufacturing Industry
Smart Materials



Amsterdam
Creative
Mobile
Internet
HighTech Systems
Sharing Economy
FinTech



Brainport Eindhoven
High-Tech Systems
& Materials
Smart Mobility
Health
Energy
Design

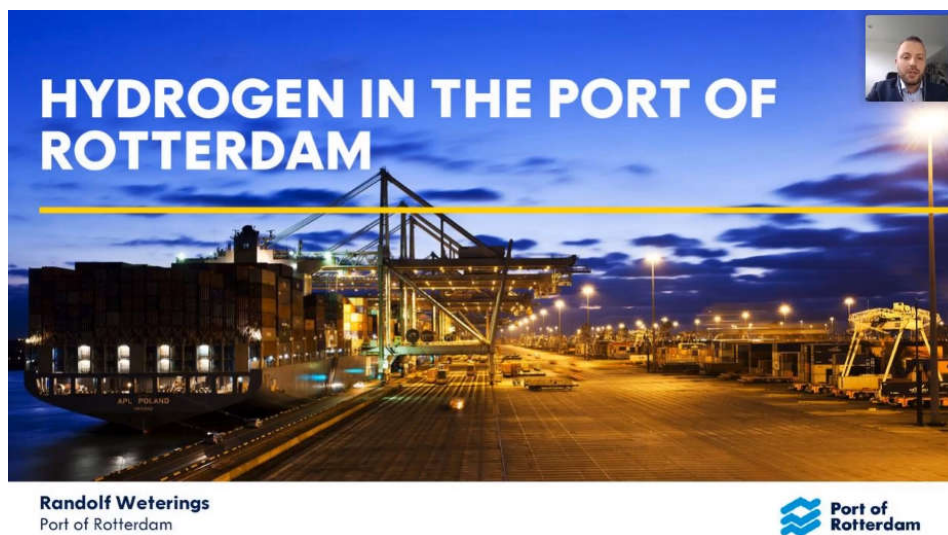


**Arnhem/
Nijmegen**
HealthTech
Life Science
Energy
Smart Manufacturing

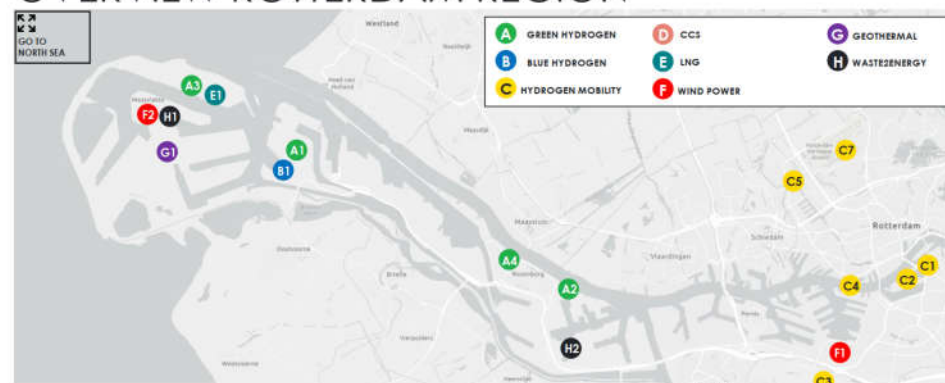


Port of Rotterdam 20 million tons Hydrogen flow by 2050

- ▶ The Port of Rotterdam will move from fossil energy to carbon neutral hydrogen and with renewable energy (source: [Randolf Weterings](#), Program Manager Electrification and Hydrogen at Port of Rotterdam)
- ▶ 2050 mission is to have a flow of 20 million tons of H₂ through the Port of Rotterdam

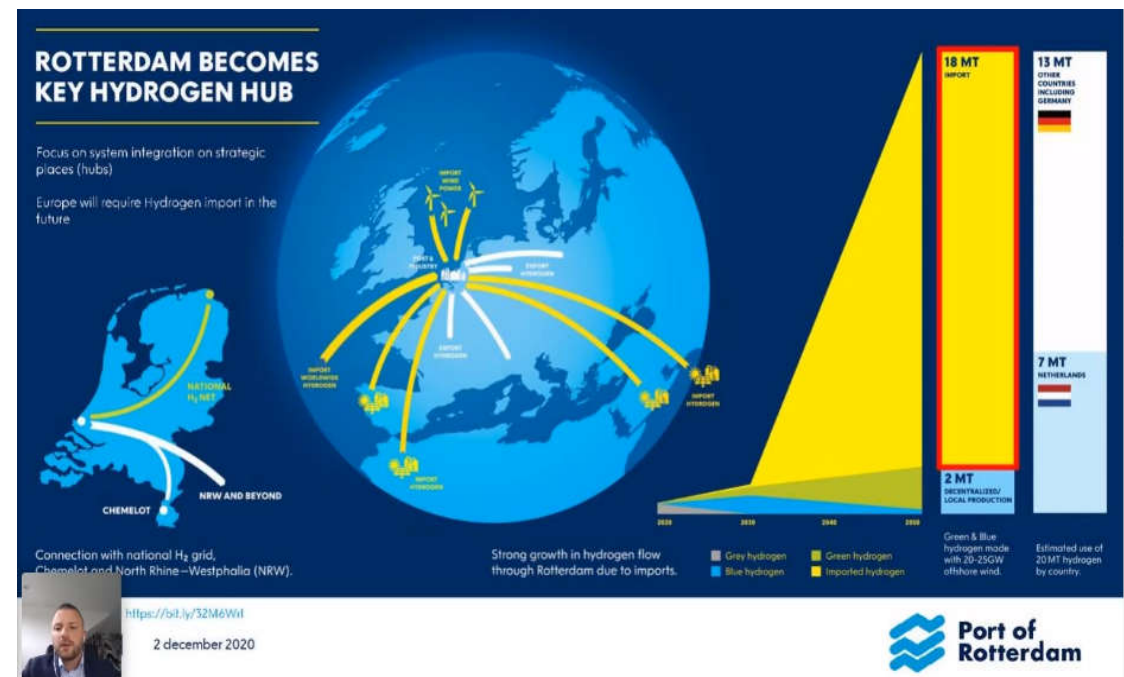


ENERGY TRANSITION DEVELOPMENTS OVERVIEW ROTTERDAM REGION



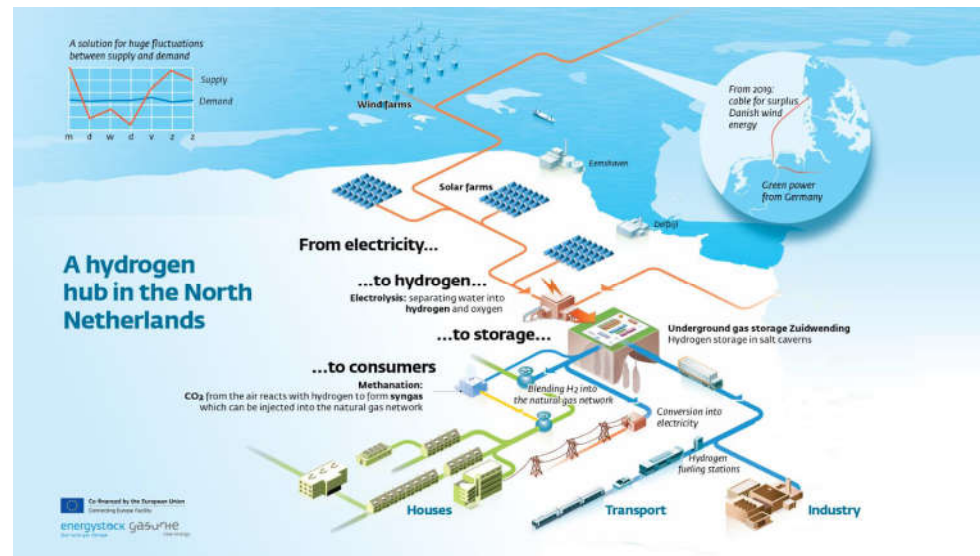
Rotterdam Becomes a Key Hydrogen Hub

- ▶ Part of the H₂ production will be done locally
 - ▶ Need 20 million tons
 - ▶ 18 million ton will be imported
 - ▶ 2 million tons will be produced locally
- ▶ Expect 7 million tons to be use in NL and 13 million in the rest of Northwestern Europe



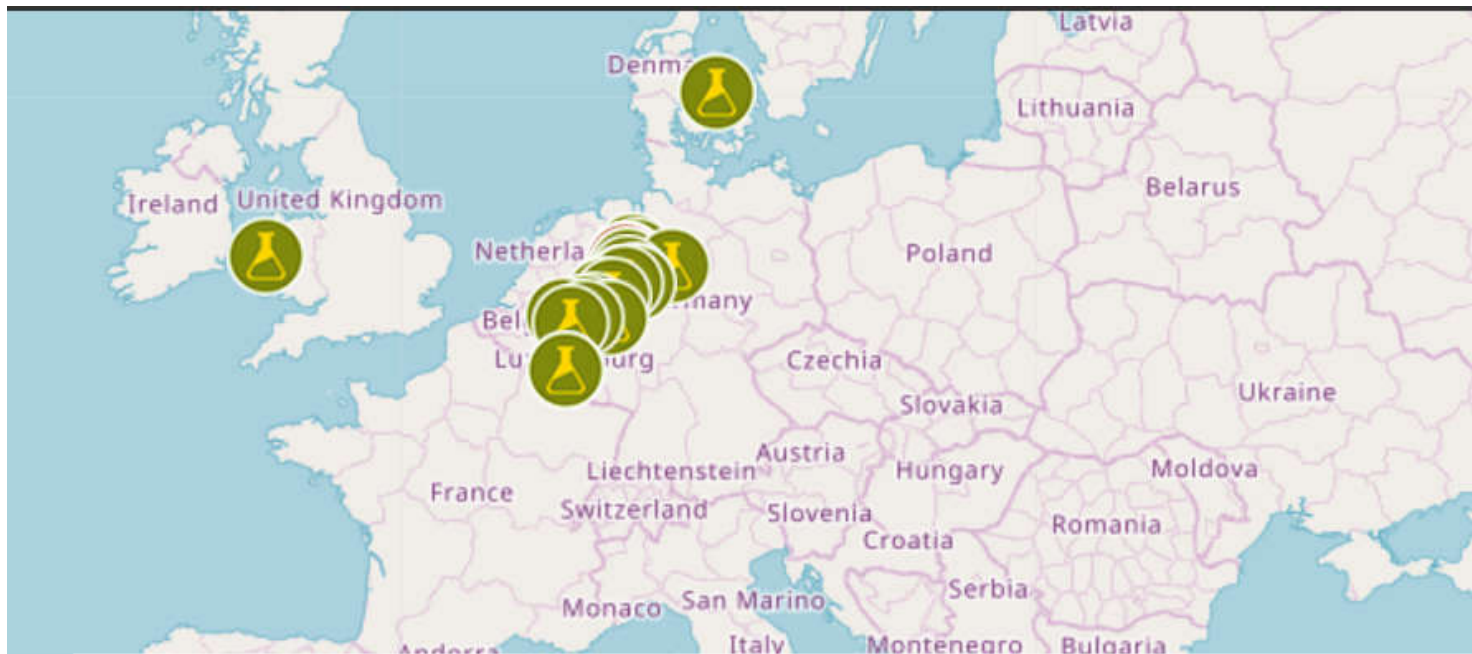
Groningen Becomes a Hydrogen Hub by 2026

- By 2026, the Northern Netherlands region aims to become a “Hydrogen Valley”, a geographical area hosting an entire hydrogen value chain – from production to distribution, storage and local end-use



Groningen Becomes a Hydrogen Hub by 2026

- ▶ FCH-JU recently funded HEAVENN project (“Hydrogen Energy Applications in Valley Environments for Northern Netherlands”) (€20 million) to further develop Northern NL hydrogen valley
- ▶ HEAVENN, coordinated by NL New Energy Coalition, brings together 29 public and private parties from 7 European countries



Hydrogen and Energy Storage in East Netherlands



Eindhoven Region: Basic and Applied R&D

- ▶ DIFFER – Fundamental Research: co-develop with Toyota a system for solar conversion of aerial H₂O to H₂
- ▶ On automotive campus in Helmond – 1st Hydrogen fueling station
- ▶ Hydrogen and mobility
 - ▶ VDL busses
 - ▶ DAF/Paccar trucks
 - ▶ E-Trucks garbage trucks



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Hydrogen Production in the Netherlands

- ▶ Biomass to hydrogen - 50 MW Gasification Plant in Terneuzen (Zeeland)
- ▶ Biohydrogen production from biogenic waste streams and wastewater
- ▶ Turning grey hydrogen into blue hydrogen
- ▶ Hydrogen Delta Gigawatt Factory in the Delta Region (blue to green)
- ▶ NorthH2 Production of Green Hydrogen from a GW Windfarm in the North Sea
- ▶ Electrolyzer
 - HyNetherlands 100 MW Electrolyser in the Eemshaven
 - Rotterdam 200 MW electrolyzer
 - 1 GW - hydrohub GigaWatt Scale electrolyzer
 - Hygear produces equipment for electrolysis (Arnhem region)

NorthH2

The Production of Green Hydrogen from a GW Windfarm in the North Sea
The objective is to generate 3 to 4 GW of wind energy for hydrogen production by 2031, and possibly 10 GW in 2040. Green hydrogen production of 800,000 tons, prevents around 7 megatons of CO₂ emissions per year.



Category:	production of H ₂
Capacity:	3 - 4 GW wind - 0.8 Mm H ₂ /y
Process phase:	feasibility study
Project period:	2020 - 2040
Project costs:	unknown
Contact:	info@gasunie.nl

Partners:

HyNetherlands

Building a 100 MW Electrolyser in the Eemshaven

The factory will also have an important function for the balance in the electricity system. If the wind farms supply more electricity than is currently needed, it can be converted into hydrogen and stored. If necessary, the hydrogen can be converted back into electricity.



Category:	production
Capacity:	100 MW to 1 GW
Process phase:	feasibility study
Project period:	FID 2021-2022
Project costs:	50 - 100 M
Contact:	info@gasunie.nl

Partners:

HYGEAR

Hydrohub GW

The Hydrohub GigaWatt Scale Electrolyser

Conceptual design of a many - electrolyser system of gigawatt size - the size that bridges large-scale renewable power production in offshore wind parks and industrial-scale use of hydrogen for feedstock and energy purposes.



Category:	production of H ₂
Capacity:	1 GW
Process phase:	FEED-study
Project period:	2018 - 2021
Project costs:	TKI subsidy
Contact:	carol.xiao@sept.eu

Partners:

The Rotterdam Electrolyser

Realisation of ~200 MW Electrolyser in Rotterdam

The green hydrogen produced will initially be used at the Shell refinery in Pernis to partially decarbonise the production of fossil fuels. This saves a minimum of 200,000 tonnes of CO₂ per year. This hydrogen can later be used to decarbonise trucks in the transport sector.



Category:	production of hydrogen
Capacity:	200 MW / 50,000 kg H ₂ /day
Process phase:	FEED-study, FID 2021
Project period:	2020 - 2023
Project costs:	unknown
Contact:	Imtiyaz.Ramjanbeg@shell.com

Partners:

Hydrogen Delta

Aiming for a Gigawatt Factory in the Delta Region

Realisation of a large pilot (on a ~ 100 MW scale) and a large-scale green hydrogen factory (on a ~ GW scale) by 2025. Blue hydrogen is used in the transition to green. In addition, realisation of a hydrogen network in the port area, which is connected to the national network.



Category:	production, distribution
Capacity:	1 GW
Process phase:	concept
Project period:	2020 - 2030
Project costs:	>100 M
Contact:	www.smartdeltaresources.com

Partners:

Hydrogen Transportation in the Netherlands

Re-use the natural gas pipelines to transport hydrogen

- ▶ Gasunie will convert natural gas pipelines into a hydrogen backbone pipeline infrastructure, connecting hydrogen production sites (i.e., offshore wind at the North Sea), to hydrogen storage in salt caverns and to the demand in industrial clusters (awaiting final decision)
- ▶ NSWPH: Modular hubs in the North Sea connect offshore wind farms with interconnectors to bordering North Sea countries



Figure 5 Hydrogen Backbone the Netherlands – Existing natural gas transport pipeline will be converted into a hydrogen transport pipeline that connects hydrogen supply to hydrogen storage and demand in industrial clusters (Gasunie, 2019)

NSWPH



North Sea Wind Power Hub; a Chain in Future Energy Supply

The Hub-and-Spoke concept consists of modular hubs in the North Sea connecting offshore wind farms with interconnectors to bordering North Sea countries and facilitates sector coupling through power-to-hydrogen conversion.



Category:	distribution
Capacity:	10 > 30 GW
Process phase:	FEED-studies
Project period:	2020 -
Project costs:	unknown
Contact:	info@northseawindpowerhub.eu

Partners:



HyWay27

Using Existing Gas Network for the Transport of Hydrogen

From the point of view of cost-effectiveness it is important that the existing natural gas infrastructure is reused (in phases) where possible for the transport of hydrogen. How and under what conditions the existing natural gas network can be used is being investigated.



Category:	transport, distribution
Capacity:	125 Billion Nm ³ n.g.u.
Process phase:	Feasibility-study
Project period:	2020
Project costs:	unknown
Contact:	www.gasunie.nl

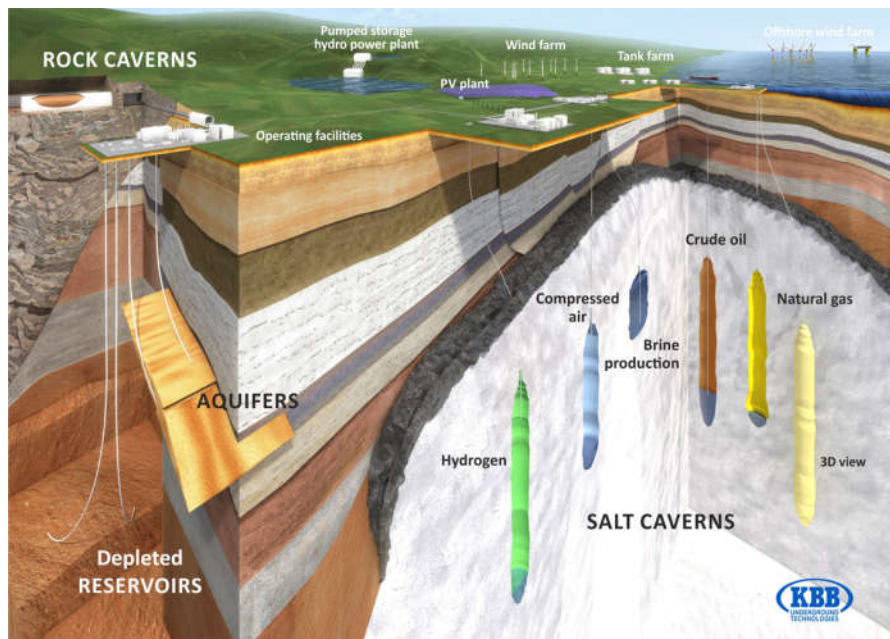
Partners:



Hydrogen Storage in Salt Caverns in the Netherlands

Underground storage, in salt caverns or in porous media (i.e., in aquifers or in depleted oil and gas fields) is the only way to cope with big storage capacities

- ▶ Microbial sulfate reduction poses a risk to H₂ storage in salt caverns
- ▶ Prevention: increase the pH of the brine in the cavern as well as increasing the iron concentration in the brine



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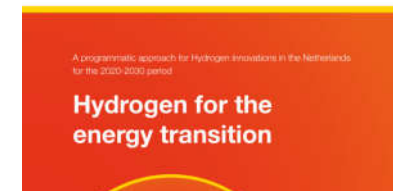
Netherlands's Hydrogen Policy

► Important milestones

- June 2019: Climate Agreement (-49% in 2030, carbon neutral in 2050)
- January 2020: Release of Innovation Roadmap for hydrogen ('Hydrogen for the Energy Transition')
- March 2020: Release of Government Strategy on hydrogen

Klimaatakkoord

De complete versie van het Klimaatakkoord, dat op 28 juni 2019 gepresenteerd werd, en de begeleidende brieven.



News

Dutch Ministry Presents Clean and Green Hydrogen Vision for the Netherlands

By FuelCellWorks | April 3, 2020 | 4 min read (234 words)

0 Comments 13 Likes



hydrogen

On Monday the 30th of March 2020, The Minister of Economic Affairs and Minister Wubbe submitted the Dutch Cabinet's vision on hydrogen to the House of Representatives.

Netherlands's Hydrogen Policy

▶ Legislation & regulation

- Infrastructure, role of network operators, certification, safety



▶ Cost reduction & scaling up green hydrogen

- Support schemes, linking hydrogen and offshore wind, blending obligation



▶ Sustainability of end use

- Ports and industry clusters, mobility, built environment, electricity sector, agriculture

▶ Supporting and flanking policy

- International strategy, regional policy, research and innovation



List of Dutch Hydrogen Projects

► [PowerPoint-presentatie \(topsectorenergie.nl\)](https://topsectorenergie.nl)



Overview of Hydrogen Projects in the Netherlands

Peter de Laat for TKI Nieuw Gas

Summer 2020

Dutch Hydrogen Tenders

Possible international cooperation

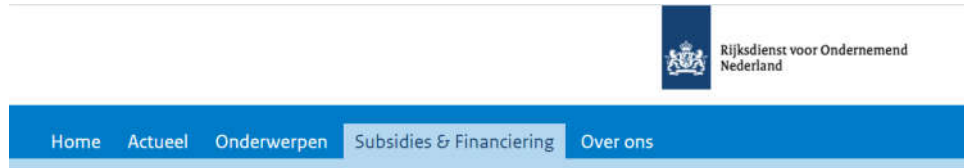
► TSE: Waterstof tender

► Regelingen Topsector Energie (rvo.nl)

► Tender currently closed; Intl companies

Need business presence in NL

**Netherlands Foreign
Investment Agency**



TSE: Waterstof tender

Tijdelijk gesloten

De kenmerken van de Topsector Energieregelingen 2019										Versie maart 2019
Kenmerk	BBG innovatie	Herbruikbare energie	Waterstof	Geo-energie	Energie en industriële Bt's	Urban Energy	DE+	Wind op zee R&D-projecten	TSE-studies industrie	
Paragraaf v.d. regeling	§4.2.2	§4.2.3	§4.2.8	§4.2.6	§4.2.12	§4.2.9	§4.2.10	§4.2.13	§4.2.17	
Toegestane activiteiten*	IO, EO	IO, EO, demo	IO, EO	IO, EO	IO, EO	FO, IO, EO	EO (pilots) of Demo	IO, EO	IO, EO	Haalbaarheidsstudie voortgezet aan een pilotproject of een milieustudie voortgezet aan een demo
Per voeder	geen eisen	geen eisen	geen eisen	geen eisen	geen eisen	geen eisen	geen eisen	geen eisen	geen eisen	
Samenwerking verplicht, minimaal 1 ondernemer	+	+	+	+	+	+	+ 1 ondernemer alleen mag ook	+	+ 1 ondernemer alleen mag ook	
Max. subsidie/project	€ 100.000	€ 6.000.000	€ 100.000	€ 100.000	€ 2.000.000	€ 1.000.000	€ 6.000.000 voor flexibilisering van het elektriciteitsstelsel	€ 750.000	€ 500.000 (geen CCUS), € 2.000.000 (CCUS)	
Beoordeling: volgorde van binnenkomst	n.v.t.	+	n.v.t.	n.v.t.	n.v.t.	n.v.t.	+	n.v.t.	+	
Beoordeling: tender	+	n.v.t.	+	+	+	+	n.v.t.	+	n.v.t.	
Scorechaal (tender)	1-5	n.v.t.	1-5	1-5	1-5	1-10	n.v.t.	1-5	n.v.t.	
Minimale score per criterium (tender)	3 punten	n.v.t.	3 punten	3 punten	3 punten	5 punten	n.v.t.	3 punten	n.v.t.	
Minimale totaalscore (tender; vóór weging)	n.v.t.	n.v.t.	n.v.t.	n.v.t.	n.v.t.	23 punten	n.v.t.	n.v.t.	n.v.t.	
Hogere score op rangschikkingscriterium "prospectiviteit" etc.	Bij een omvangrijk project of voor-onderzoek op lab-schaal gedaan is; zie verder PL-besluitgeving	n.v.t.	n.v.t.	n.v.t.	Het beschrijven van de kennisoverdracht aan een venster, incl. welke communicatie ertussen worden gedaan en waarom	n.v.t.	n.v.t.	Bij de verdeling van het subsidiepotentieel verdeelt de minister eerst € 2.750.000 over projecten die passen binnen programma's 1. Kostenreductie en optimalisatie	n.v.t.	
Weging van de scores van toepassing (tender)	nee	n.v.t.	n.v.t.	n.v.t.	n.v.t.	ja	n.v.t.	ja	n.v.t.	
Max. looptijd (jaar)	4	4	4	4	4	4	Energie-innovatie: 4 De rest: 1 (alle details, < € 125.000 subsidie) of einde 31-12-19	4	1 (alle details, < € 125.000 subsidie) of einde 31-12-19	
Beoordelingstermijn (welken, verlenging kaart)	13	8	13	13	13	13	8	13	8	
Samenwerking international	Subsidie aan een buitenlandse ondernemer is mogelijk, mits zijn activiteiten ten goede komen aan de Nederlandse economie of andere Nederlandse belangen. Voor ondernemingen geldt verder dat ze aan vaste vestiging of een dochteronderneming in Nederland moeten hebben. In de DE kunnen deelnemers van de BBG-landen ook in aanmerking, vermelding in BI, daar niet verplicht.									

* FO=fundamenteel onderzoek, IO=industriële onderzoek, EO=experimentele ontwikkeling, demo=demonstratie (zie de beschrijving hoofdstuk 5 voor de definitie)

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Knowledge Transfer and EU Partner searches

- ▶ Knowledge transfer <https://idic.org.il/events>
 - 1-2 Sep 2020 H2 course
 - 13 Jan 2021 Renewable energy mini symposium
 - 2 Feb 2021 Hydrogen and renewable energy

- ▶ EU Partner searches <https://idic.org.il/opportunities>
 - Searches for partners for EU projects



Thank You

Contacts

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