

# HYCLICX-NL Q1-2026

Hydrogen cost indicator for the Netherlands

*HYXCLICX is a product developed by HyXchange. This indicator is an instrument to estimate marginal production cost of hydrogen in the Netherlands.*

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# 1. Key insights: Q1-2026

## **1. Green structurally more expensive in winter months**

In the first two months of the year, both the marginal and total cost of green hydrogen (driven by limited availability of renewable electricity) were significantly higher than those of grey and blue hydrogen. Grey and blue hydrogen (with CCS) benefited during this period from relatively stable gas prices and existing large-scale installations with lower capital costs per MWh/kgH<sub>2</sub>.

## **2. March: increased volatility and shifting dynamics**

In March, two clear changes emerged. First, we observed strong daily variation in the cost of green hydrogen. This was a direct result of volatile electricity prices driven by fluctuating weather conditions. Second, rising natural gas prices played a major role. The spot market cost of grey and blue hydrogen increased sharply following supply disruptions from the Middle East. As a result, the traditional cost advantage of grey and blue production over green hydrogen narrowed.

## **3. Convergence of marginal costs in March**

Notably, in March – assuming approximately 3,000 full-load hours per year (35% best hours) – the marginal cost of green hydrogen declined to the level of blue hydrogen and was only about 10% higher than that of grey hydrogen. This indicates that under favorable electricity market conditions and with limited operating hours (optimized for low-price periods), green hydrogen can become more competitive than was evident in the first months of the year.

## **4. Effect of full-load hours on the average cost of green hydrogen**

As expected, the average cost of green hydrogen increases significantly when the number of full-load hours rises toward, for example, 50% of total available hours. Higher utilization implies that electrolysers operate more frequently during hours with higher electricity prices, thereby reducing the cost advantage of producing hydrogen during low-price periods.

# 2. The HyXchange Initiative

**Introduction:** Hydrogen is increasingly attracting interest as an important part of the energy transition. No greenhouse gas is released when hydrogen is used. Hydrogen is therefore regarded by many as a climate-neutral energy carrier for the future. Due to the position that hydrogen will occupy in the future and the many ways in which it can be produced and used, with a variety of producers and users, the development of the trade in hydrogen will become important. To support this development parties from the sector have started the “HyXchange” Initiative.

**Partners:** HyXchange is supported by Gasunie, Port of Rotterdam, Port of Amsterdam, Groningen Seaports, North Sea Ports and a large growing number of interested market parties involved in meetings, pilots, simulations and/or other activities.

**Our focus areas:** HyXchange works together with various actors to improve the functioning of the (future) hydrogen market. In our view several key preconditions must be in place:

- 1. First**, open and non-discriminatory access to transport infrastructure is essential. A hydrogen backbone network, complemented by adequate storage capacity, enables producers, traders and offtakers to connect to the system and move volumes efficiently across regions.
- 2. Second**, the market requires a diverse and reliable supply base. This includes domestic green hydrogen production, imports (e.g. via ammonia or other carriers), and low-carbon hydrogen from industrial processes.
- 3. Third**, a dependable and transparent trading platform significantly improves market functioning. By pooling liquidity, standardising products and reducing transaction and counterparty risks, organised trading lowers barriers to entry and facilitates price discovery.
- 4. Finally**, the market depends on clear, workable regulatory frameworks, including the practical tradability of hydrogen certificates. If certificate trade is overly complex or administratively constrained, liquidity and investment signals will suffer.

## 2. HYCLICX: the hydrogen index for NL

**Introduction:** On June 7<sup>th</sup> (2023) HyXchange published its first issue of the hourly HYCLICX spot market indicator for hydrogen based on lowest-priced electricity hours during its EU Green Week event in Brussels. The indicator is an instrument to estimate marginal and full production cost for renewable hydrogen from electrolysis in the Netherlands.

**Approach:** The renewable HYCLICX indicator is linking the marginal and/or full cost component of hydrogen to the hourly electricity (green) and gas (grey/blue) spot market. By selecting the lowest set of volatile hourly power prices - mostly occurring in two varying blocks per day in the Netherlands - hydrogen can be produced in the cheapest way. The hours are largely coinciding with a high share of renewable electricity production from wind and solar, also providing alignment with certificate rules and the EC Delegated Act on hydrogen. In our annual report, and other specific reports, this linkage is further explored.

**Selected indicators:** HYCLICX publishes on a monthly interval a selection of relevant indicators for hydrogen:

- **HYCLICX green (daily 2x 6 hour blocks & monthly):** The marginal cost price for 12 fixed hours of electricity each day: hours 1-6 and 12-17 (0.00-6.00 and 11.00-17.00)
- **HYCLICX green best 50% (month):** The marginal cost price for the lowest-priced 50% of hours each month.
- **HYCLICX green best 35% (month):** The marginal cost price for the lowest-priced 35% of hours each month.
- **HYXCLICX blue (daily):** The marginal cost price for blue hydrogen. to allow for comparison.
- **HYXCLICX grey (daily):** The marginal cost price for grey hydrogen. to allow for comparison.

See also: [www.hyxchange.org](http://www.hyxchange.org). Here we publish on a daily basis both the marginal and the full cost index, providing all market parties with insight in (spot-market based) hydrogen cost price development.

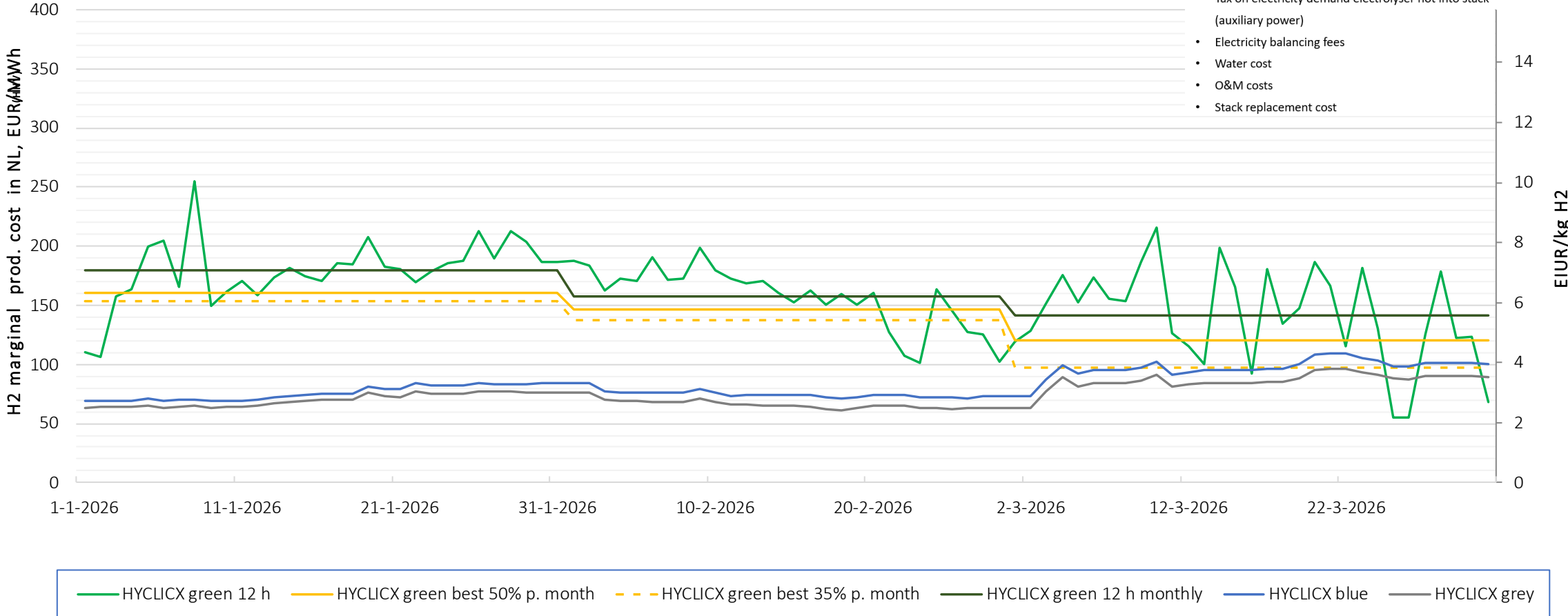
# 3. HYCLICX marginal H2 cost :

Q1-2026 | Prices in €/MWh HHV (higher heating value)

### HYCLICX: what is included

**Marginal-price costs associated with producing additional MWh of hydrogen**

- Electricity spot price (hourly variable)
- Green guarantee of origin for renewable electricity (monthly)
- Tax on electricity demand electrolyser not into stack (auxiliary power)
- Electricity balancing fees
- Water cost
- O&M costs
- Stack replacement cost



\*Fixed OPEX (stack replacement and O&M) is kept equal between green 12h, green 12h monthly, green best 50% p. month and green best 35% p. month.

# 3. HYCLICX PLUS (OPEX+CAPEX)

Q1-2026 | Prices in €/MWh HHV (higher heating value)

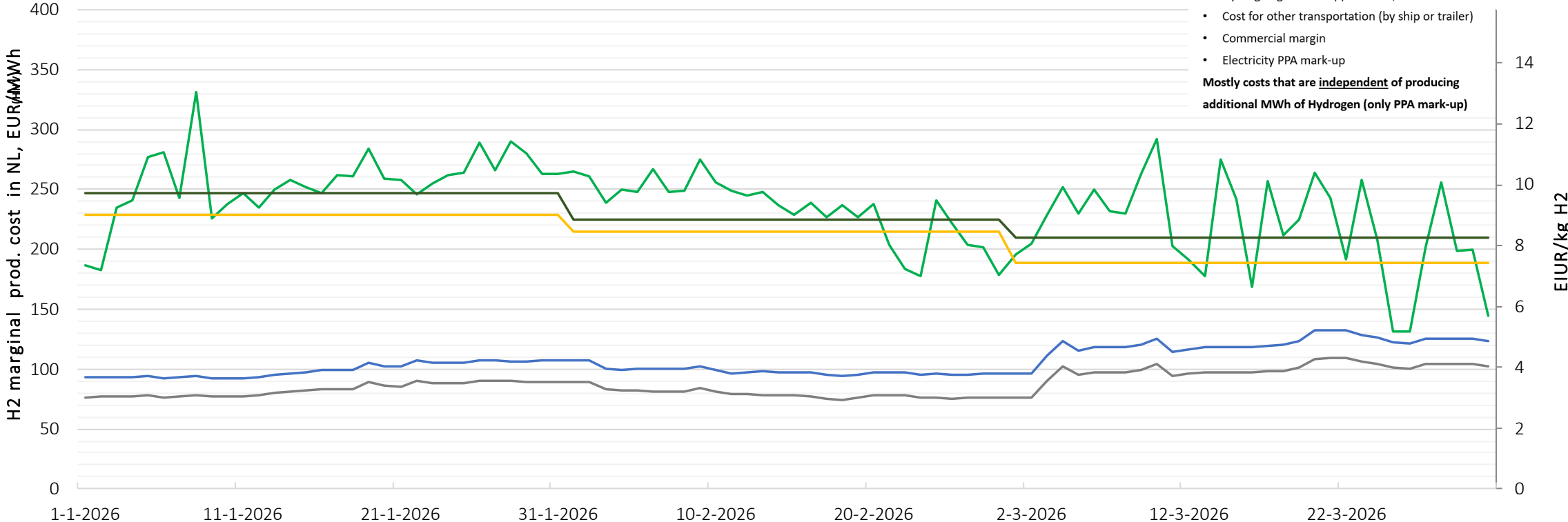
### HYCLICX+: what is additional?

- Capital cost of investment of electrolyser
- Upfront project preparation cost (EPC)

### What is not included

- Fixed administration and overhead cost
- One-time electricity grid connection fee or cost
- Yearly fixed electricity grid tariff, capacity related
- Hydrogen grid: all shipper tariffs, connection fees
- Cost for other transportation (by ship or trailer)
- Commercial margin
- Electricity PPA mark-up

Mostly costs that are independent of producing additional MWh of Hydrogen (only PPA mark-up)



# 3. HYCLIX: spread Q1-2026

Month	HYCLIX Green best 2x6h €/MMh HHV marginal cost	HYCLIX Green best 50% €/MWh HHV marginal cost	HYCLIX Green best 35% €/MWh HHV marginal cost	HYCLIX BLUE €/MWh HHV marginal cost	HYCLIX GREY €/MWh HHV marginal cost
January	179,23	160.58	153.38	75.91	69.99
February	157,02	146.36	137.92	74.93	66.32
March	141,37	120.40	97.10	96.99	85.86
April					
May					
June					
July					
August					
September					
October					
November					
December					

- Prices primarily in Eur/MWh HHV higher heating value. full H2 energy content
- Aligned with indexes for natural gas (e.g. TTF). rules of Dutch H2 grid and green G.O
- Conversion factor P/MWhHHV to P/kg:  $0.03939 \sim 4 / 100$
- Conversion factor MWhHHV to MWhLHV: 1.182

# 4. HYCLICX: marg. and total cost formula

The marginal costs for hydrogen production are determined according to the following methodology (hourly).

$$\text{HYCLICX} = \underbrace{\sum \text{fixOPEX} + \frac{\text{Elec Price} + \text{Elec tax} + \text{GO}}{\text{HHV}} + \frac{\text{Spec Water Cost} \cdot \text{Spec Water Demand}}{\text{HHV}}}_{\text{OPEX for HYCLICX}} + \underbrace{\frac{\text{Spec invest cost} \cdot \text{Annuity}}{\text{Full - load hours} \cdot \text{HHV}}}_{\text{CAPEX for HYCLICX PLUS}}$$

Selected cost parameters*		HYCLICX Green	HYCLICX Blue	HYCLICX Grey
	Unit	Electrolysis	CH4 + CCS	CH4 (no CCS)
Operation & Maintenance (O&M), <i>fixed part</i>	EUR/MWh	18.73	8.29	6.82
Efficiency (HHV)	%	76.83	82.74	88.65
Electricity and gas levies (incl. Green GOe)	EUR/MWh	4.435	4.01	4.01
Water cost	EUR/m <sup>3</sup>	4	-	-
Spec invest cost	EUR/kW_e or EUR/kW_H2	2531	1600	900
Annuity	%	0.1019	0.1019	0.1019
Full-load hours ( <i>12h. 2 6h blocks per day</i> )	h/a	4380	7000	7000

\*Basic calculation method and most parameters provided by consultant E-bridge. In line with their HYDEX index for hydrogen in Germany. Approach to assess green hydrogen product cost per hour (and select blocks of operational hours) for HYCLICX provided by HyXchange based on its hydrogen market simulation project and discussions with market parties.

# 4. Detailed parameters for the calculation

Selected cost parameter	Unit	HYCLICX green	HYCLICX blue	HYCLICX grey
		Electrolysis	Reformer + CCS	Reformer w/o CCS
Lifetime/depreciation period	a	20	20	20
WACC	%	8.00	8.00	8.00
Annuity	%	0.1019	0.1019	0.1019
Specific invest cost (01-2025 – 08-2025 bandwidth was 1970-2530)	EUR/kW_e or EUR/kW_H2	2530	1600	900
OPEX Component for stack replacement	EUR/MWh_H2	14.14	-	-
Operation & Maintenance (O&M)	EUR/MWh_H2	18.73	7.51	6.06
Lower heating value Hi / LHV	kWh/kg_H2	33.32	33.32	33.32
Higher heating value Hs / HHV	kWh/kg_H2	39.39	39.39	39.39
Efficiency (ref. to lower heating value Hi / LHV)	%	65.00	70.00	75.00
Efficiency (ref. to higher heating value Hs / HHV)	%	76.83	82.74	88.65
Full-load hours (12h. 2 6h blocks per day)	h/a	4380	7000	7000
Water cost	EUR/m <sup>3</sup>	4	-	-
Water demand	m <sup>3</sup> /kg_H2	0.01	-	-
CO2 transport and storage cost (only operational part. no CAPEX)*	EUR/t_CO2	-	90.6	-
CO2 emissions for natural gas	t_CO2/MWh_NG	-	0.201	0.201
Sequestration rate for CCS	%	-	90	0
Electricity tax, e-GOs and balancing fees	EUR/MWh_e	0.115 + 0.46 + 3.86	-	-
Additional cost for natural gas (Gas tax)	EUR/MWh_NG	-	4.01	4.01

\*Green electricity GO is updated at a quarterly interval. For 2025 Q4 the value is EUR 0.46/MWh\_e

# HYCLICX: what is included

## Marginal-price costs associated with producing additional MWh of hydrogen

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- Yearly fixed electricity grid tariff, capacity related
- Hydrogen grid: all shipper tariffs, connection fees
- Cost for other transportation (by ship or trailer)
- Commercial margin
- Electricity PPA mark-up

## Mostly costs that are independent of producing additional MWh of Hydrogen (only PPA mark-up)

For blue and grey hydrogen:

- Gas price (daily variable), CO2 price (daily variable) and/or CCS storage cost

# 4. Literature list

No.	Source
1a	Efficiency Electrolysis: IEA 2020/Platts Methodology and Specifications Guide Global Hydrogen Latest update: October 2020
1b	Reformer with CCS: IEA 2020/ Platts Methodology and Specifications Guide Global Hydrogen Latest update: October 2020
1c	Efficiency Reformer without CCS: IEA 2020/Platts Methodology and Specifications Guide Global Hydrogen Latest update: October 2020
2a	OM Electrolysis 3.2 % of invest: European Hydrogen Observatory, Electrolyser cost 2023; <a href="https://observatory.clean-hydrogen.europa.eu/hydrogen-landscape/production-trade-and-cost/electrolyser-cost">https://observatory.clean-hydrogen.europa.eu/hydrogen-landscape/production-trade-and-cost/electrolyser-cost</a>
2b	OM Reformer with CCS: IEA 2020/ Platts Methodology and Specifications Guide Global Hydrogen Latest update: October 2019
2c	OM Reformer without CCS: IEA 2020/ Platts Methodology and Specifications Guide Global Hydrogen Latest update: October 2020
3a	Invest Electrolysis: European Hydrogen Observatory, Electrolyser cost PEM 2023; <a href="https://observatory.clean-hydrogen.europa.eu/hydrogen-landscape/production-trade-and-cost/electrolyser-cost">https://observatory.clean-hydrogen.europa.eu/hydrogen-landscape/production-trade-and-cost/electrolyser-cost</a>
3b	Invest Reformer with CCS: IEA 2020 Platts Methodology and Specifications Guide Global Hydrogen Latest update: October 2020 (EUR/\$ = 1.15)
3c	Invest Reformer without CCS: Platts Methodology and Specifications Guide Global Hydrogen Latest update: October 2020 (EUR/\$ = 1.15)
4	Benutzungsstunden für Elektrolyse und SMR nach Prognos-Studie (Kosten und Transformationspfade für Strombasierte Energieträger S. 88; <a href="https://www.bmwk.de/Redaktion/DE/Downloads/Studien/transformationspfade-fuer-strombasierte-energetraeger.pdf?__blob=publicationFile">https://www.bmwk.de/Redaktion/DE/Downloads/Studien/transformationspfade-fuer-strombasierte-energetraeger.pdf?__blob=publicationFile</a> )
5	Sequestration rate of CCS: IEA 2020/ Platts Methodology and Specifications Guide Global Hydrogen Latest update: October 2022
6	Electricity tax - Tabellen tarieven milieubelastingen. <a href="https://www.belastingdienst.nl/wps/wcm/connect/bldcontentnl/belastingdienst/zakelijk/overige_belastingen/belastingen_op_milieugrondslag/tarieven_milieubelastingen/tabellen_tarieven_milieubelastingen?projectid=6750bae7%2D383b%2D4c97%2Dbc7a%2D802790bd1110">https://www.belastingdienst.nl/wps/wcm/connect/bldcontentnl/belastingdienst/zakelijk/overige_belastingen/belastingen_op_milieugrondslag/tarieven_milieubelastingen/tabellen_tarieven_milieubelastingen?projectid=6750bae7%2D383b%2D4c97%2Dbc7a%2D802790bd1110</a>
7	Gas tax - Tabellen tarieven milieubelastingen. <a href="https://www.belastingdienst.nl/wps/wcm/connect/bldcontentnl/belastingdienst/zakelijk/overige_belastingen/belastingen_op_milieugrondslag/tarieven_milieubelastingen/tabellen_tarieven_milieubelastingen?projectid=6750bae7%2D383b%2D4c97%2Dbc7a%2D802790bd1110">https://www.belastingdienst.nl/wps/wcm/connect/bldcontentnl/belastingdienst/zakelijk/overige_belastingen/belastingen_op_milieugrondslag/tarieven_milieubelastingen/tabellen_tarieven_milieubelastingen?projectid=6750bae7%2D383b%2D4c97%2Dbc7a%2D802790bd1110</a>
8	CO2 emission acc. BAFA (2021) Informationsblatt CO2-Faktoren, S.6
9	Porthos CCS - Cost for transport and storage. <a href="https://zoek.officielebekendmakingen.nl/blg-947442.pdf">https://zoek.officielebekendmakingen.nl/blg-947442.pdf</a>
10	Xodus: 2024 SDE++ Aramis Carbon Capture and Storage Free Review. <a href="https://www.rijksoverheid.nl/documenten/rapporten/2024/06/20/2024-sde-aramis-carbon-capture-and-storage-fee-review-public-summary-june-2024-rapport-xodus">https://www.rijksoverheid.nl/documenten/rapporten/2024/06/20/2024-sde-aramis-carbon-capture-and-storage-fee-review-public-summary-june-2024-rapport-xodus</a>
11	TNO; Renewable Hydrogen Cost Element Evaluation Toll (RHycEET); 2024; excluding contingency of 17%; <a href="https://publications.tno.nl/publication/34642511/mzKClN/TNO-2024-R10766.pdf">https://publications.tno.nl/publication/34642511/mzKClN/TNO-2024-R10766.pdf</a>

The logo for HyXchange features the word "Hy" in blue, a stylized green and white graphic element, and "Xchange" in grey. The background of the slide is a photograph of large industrial pipes in a field, with a green hillside on the left and industrial structures in the distance.

# HyXchange

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