Global Hydrogen Review 2026: Assumptions Annex

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Global Hydrogen Review 2026: Assumptions Annex

This annex collects the various assumptions that underpin the analyses throughout the Global Hydrogen Review 2026. Global averages are presented for technologies, unless otherwise stated. However, several analyses in the report present regional examples, for which costs will vary with material and labour inputs and differ from the global average. These input parameters reflect choices made by the IEA on the basis of different sources of information consulted.

Renewable electricity cost and full load hours

Solar PV

Region	LCOE (USD/MWh) 2025	LCOE (USD/MWh) STEPS 2030	Full load hours (hr)
China	23	18	2550
Europe	37	30	2170
India	23	18	2550
Japan	155	128	1200
Korea	88	70	1390
North America	37	30	2480

Offshore wind

Region	LCOE (USD/MWh) 2025	LCOE (USD/MWh) STEPS 2030	Full load hours (hr)
China	43	36	4120
Europe	78	62	4440
India	85	73	4100
Japan	142	117	4530
Korea	268	204	2960
North America	86	70	4940

Onshore wind

Region	LCOE (USD/MWh) 2025	LCOE (USD/MWh) STEPS 2030	Full load hours (hr)
China	31	30	3130
Europe	49	47	3460
India	50	46	2900
Japan	100	96	3290
Korea	112	109	2640
North America	36	35	3640

Notes: LCOE = Levelised cost of electricity; STEPS = Stated Policies Scenario. Renewable electricity generation costs and full load hours for good resource conditions in a region or country. Additional information on other parameters, including capital expenditure (CAPEX), is available in the IEA Global Energy and Climate Model key input data.

CO_2 prices and costs

CO_2 prices

Region	CO_2 price (USD/t CO_2) 2025	STEPS 2030
Advanced economies	0 - 80	0 - 110
Emerging markets and developing economies	0	0 - 10

CO_2 transport and storage cost for carbon capture, utilisation and storage

Region	(USD/tCO_2) 2025	STEPS 2030
China	14	12
Europe	44	33
Middle East	14	12
United States	14	12
Rest of the world	23	20

Note: STEPS = Stated Policies Scenario.

Production pathways

Hydrogen

Technology	Parameter	Units	2025	STEPS 2030
Water electrolysis	CAPEX* (global average)	**USD/kW$_e$**	1920 - 2500	1440 - 1870
	CAPEX* (China)	**USD/kW$_e$**	550 - 1100	450 - 910
	Efficiency (LHV)	**%**	63%	64%
	Efficiency (LHV) (China)	**%**	59%	62%
	Fixed OPEX	**% of CAPEX**	3%	3%
	Stack lifetime (operating hours)**	**hours**	50000	50000
Natural gas reforming	CAPEX	**USD/kW$_{H2}$**	720	720
	Efficiency (LHV)	**%**	76%	76%
	Fixed OPEX	**% of CAPEX**	5%	5%
Natural gas reforming with CCUS	CAPEX	**USD/kW$_{H2}$**	1420	1420
	Efficiency (LHV)	**%**	69%	69%
	Annual OPEX	**% of CAPEX**	4%	4%
	CO_2 capture rate	**%**	95%	95%
Coal gasification	CAPEX ***	**USD/kW$_{H2}$**	2640	2640
	Efficiency (LHV)	**%**	60%	60%
	Fixed OPEX	**% of CAPEX**	5%	5%
Coal gasification with CCUS	CAPEX ***	**USD/kW$_{H2}$**	2750	2750
	Efficiency (LHV)	**%**	58%	58%
	Fixed OPEX	**% of CAPEX**	5%	5%
	CO_2 capture rate	**%**	95%	95%

* CAPEX includes the electrolyser system, electrical equipment, gas treatment, plant balancing, and engineering, procurement and construction (EPC). CAPEX of the power generation assets is not included.

** Stack lifetime can reach up to 95000 hr. The selected value (50000 hr) comes from the IEA's analysis of the optimum economic lifetime, considering degradation issues.

*** For China, CAPEX is assumed to be 50% of the world average for coal gasification and 52% for coal gasification with CCUS.

Notes: LHV = Lower heating value; STEPS = Stated Policies Scenario; OPEX = operating expenditure; CCUS = carbon capture, utilisation and storage. All CAPEX refers to the installed cost of the technology. 25-year lifetime and a 95% availability factor assumed for hydrogen production from natural gas; 25-year lifetime and 90% availability factor assumed for the production of hydrogen from coal. Availability factors for electrolysis vary depending on the technology considered to supply the electricity and the location of the project. For water electrolysis, water costs and possible revenues from oxygen sales have not been considered in the cost analysis.

Hydrogen-based fuels and industrial products

Ammonia (NH_3)

Technology	Parameter	Units	2025	STEPS 2030
Natural gas reforming	CAPEX	**USD/(t NH_3/yr)**	1390 - 2410	1380 - 2400
	Fixed OPEX	**% of CAPEX**	3%	3%
	Natural gas consumption	**GJ/t NH_3**	32	32
	Electricity consumption	**GJ/t NH_3**	0.30	0.30
Natural gas reforming with CCUS	CAPEX	**USD/(t NH_3/yr)**	1640 - 2850	1620 - 2810
	Fixed OPEX	**% of CAPEX**	3%	3%
	Natural gas consumption	**GJ/t NH_3**	34	34
	Electricity consumption	**GJ/t NH_3**	0.28	0.28
Coal gasification	CAPEX	**USD/(t NH_3/yr)**	2620 - 4560	2610 - 4530
	Fixed OPEX	**% of CAPEX**	6%	6%
	Coal consumption	**GJ/t NH_3**	34	34
	Electricity consumption	**GJ/t NH_3**	3.70	3.70
Coal gasification with CCUS	CAPEX	**USD/(t NH_3/yr)**	3180 - 5520	3140 - 5450
	Fixed OPEX	**% of CAPEX**	6%	6%
	Coal consumption	**GJ/t NH_3**	38	38
	Electricity consumption	**GJ/t NH_3**	0.68	0.68
Haber–Bosch (including air separation unit)	CAPEX	**USD/(t NH_3/yr)**	560 - 980	560 - 980
	Fixed OPEX	**% of CAPEX**	3%	3%
	Hydrogen consumption	**t H_2/t NH_3**	0.18	0.18
	Electricity consumption	**GJ/t NH_3**	2.22	2.22

Notes: LHV = Lower heating value. All CAPEX refers to the installed cost of the technology. The CAPEX of the Haber–Bosch process does not include the CAPEX of the electrolysis plant. A 25-year lifetime is assumed for all technologies.

Methanol (MeOH)

Technology	Parameter	Units	2025	STEPS 2030
Natural gas reforming	CAPEX	**USD/(t MeOH/yr)**	310 - 310	310 - 310
	Fixed OPEX	**% of CAPEX**	3%	3%
	Natural gas consumption	**GJ/t MeOH**	35	35
	Electricity consumption	**GJ/t MeOH**	0.30	0.30
Natural gas reforming with CCUS	CAPEX	**USD/(t MeOH/yr)**	570 - 740	550 - 710
	Fixed OPEX	**% of CAPEX**	3%	3%
	Natural gas consumption	**GJ/t MeOH**	38	37
	Electricity consumption	**GJ/t MeOH**	0.35	0.35
Coal gasification	CAPEX	**USD/(t MeOH/yr)**	750 - 750	750 - 750
	Fixed OPEX	**% of CAPEX**	5%	5%
	Coal consumption	**GJ/t MeOH**	46	45
	Electricity consumption	**GJ/t MeOH**	3.70	3.70
Coal gasification with CCUS	CAPEX	**USD/(t MeOH/yr)**	1660 - 2350	1590 - 2230
	Fixed OPEX	**% of CAPEX**	5%	5%
	Coal consumption	**GJ/t MeOH**	55	54
	Electricity consumption	**GJ/t MeOH**	1.21	1.18
Methanol synthesis (including distillation)	CAPEX	**USD/(t MeOH/yr)**	220 - 220	220 - 220
	Fixed OPEX	**% of CAPEX**	3%	3%
	Hydrogen consumption	**t H_2/t MeOH**	0.19	0.19
	Electricity consumption	**GJ/t MeOH**	4.00	4.00

Notes: LHV = Lower heating value. All CAPEX refers to the installed cost of the technology. The CAPEX of the methanol synthesis process does not include the CAPEX of the electrolysis plant. A 25-year lifetime is assumed for all technologies.

Synthetic liquid fuels (Fischer–Tropsch)

Parameter	Units	2025	STEPS 2030
CAPEX	**USD/(t liquid fuels/yr)**	2770	2400
Efficiency (LHV)	**%**	57%	57%
Fixed OPEX	**% of CAPEX**	5%	5%
Variable O&M	**% of CAPEX**	1.5%	1.5%
Lifetime	**years**	30	30
Electricity consumption	**GJ/t liquid fuels**	0.77	0.77

Notes: LHV = Lower heating value. All CAPEX refers to the installed cost of the technology. The CAPEX of the Fischer–Tropsch process does not include the CAPEX of the electrolysis plant. A 25-year lifetime is assumed for all technologies. Assumed cost of carbon feedstock: biogenic CO_2 USD 30-65/t CO_2.

Infrastructure

Hydrogen onshore pipelines

Parameter	Units	Small	Medium	Large
Lifetime - pipelines	**years**	42	42	42
Lifetime - compressor	**years**	24	24	24
Operation conditions	**% of design capacity**	75%	75%	75%
Diameter	**inch**	20	36	48
Design Capacity*	**GW H_2, LHV**	0.9	3.6	12.7
Inlet pressure	**bar**	30	30	40
Outlet pressure	**bar**	50	50	80
Utilisation	**%**	57%	57%	57%
Compression power	**MW_e/1 000 km**	6	40	183
CAPEX - new pipeline	**MUSD/km**	2.0	3.5	4.8
CAPEX - repurposed pipeline	**MUSD/km**	0.6	0.7	1.0
CAPEX - compressor	**MUSD/MW_e**	4.3	4.3	4.3

* With 75% of design capacity
Notes: MUSD = million USD

Seaborne transport

Tankers

Parameter	Units	Liquefied hydrogen	LOHC	Ammonia
Capacity	**$t_{carrier}$/tanker**	2 700	34 000	50 800
CAPEX	**MUSD/tanker**	110	45	130
Speed	**km/h**	30	28	32
Boil-off rate*	**%/day**	0.20%	0.00%	0.02%
Flash rate**	**%**	1.00%	0.00%	0.02%
Fuel consumption***	**MJ/km/tanker**	-	2 025	2 650

* The boil-off gas is the gas that spontaneously evaporates from liquefied gas due to the extremely low temperatures.
** The flash rate is the rate of loss that occurs upon each loading/unloading of liquefied gas.
*** Ship carrying liquefied hydrogen uses carrier gas for propulsion, so the fuel for the ship would not incur additional energy consumption.
Notes: MUSD = million USD; LOHC = liquid organic hydrogen carrier.

Import and export terminals: storage tanks

Terminal	Parameter	Units	Liquefied hydrogen	LOHC	Ammonia
Import	Capacity	**$t_{carrier}$/tank**	3 375	3 275	36 750
	CAPEX	**MUSD/tank**	410	85	130
	OPEX	**USD/year as a % of CAPEX**	4%	4%	4%
	Electricity consumption	**kWh/kgH_2**	0.190	0.013	0.003
	Boil-off rate	**%/day**	0.01%	0.01%	0.01%
Export	Capacity	**$t_{carrier}$/tank**	3 050	3 275	36 750
	CAPEX	**MUSD/tank**	390	85	130
	OPEX	**USD/year as a % of CAPEX**	4%	4%	4%
	Electricity consumption	**kWh/kgH_2**	0.200	0.013	0.001
	Boil-off rate	**%/day**	0.01%	0.01%	0.01%

Notes: MUSD = million USD; LOHC = liquid organic hydrogen carrier.

Liquefied hydrogen

Technology	Parameter	Units	Value
Liquefaction	CAPEX	**USD/t H_2/day**	NA
	OPEX	**USD/t H_2/day**	NA
	Electricity consumption	**kWh/kg H_2**	8
Regasification	CAPEX	**USD/t H_2/year**	2 900
	OPEX	**USD/t H_2/year**	115
	Electricity consumption	**kWh/kg H_2**	0.06

Note: NA = not available due to confidentiality.

Liquid Organic Hydrogen Carrier (LOHC)

Technology*	Parameter	Units	Value
Conversion to LOHC	CAPEX	**USD/t H_2/year**	795
	OPEX	**USD/year as a % of CAPEX**	3%
	Electricity consumption	**kWh/kg H_2**	0.25
Reconversion to H_2	CAPEX	**USD/t H_2/year**	2 400
	OPEX	**USD/year as a % of CAPEX**	3%
	Electricity consumption	**kWh/kg H_2**	1.50
	Fuel consumption	**kWh/kg H_2**	12.1
	Dehydrogenation rate	**%**	99%
	LOHC loss	**%/cycle**	0.50%

* Conversion: LOHC = Toluene +H_2 → Methylcyclohexane (MCH). Reconversion: LOHC = MCH → Toluene + H_2.

Notes: PSA = Pressure swing adsorption. System lifetime assumed to be 30 years, unless stated otherwise.

Ammonia cracking

Technology	Parameter	Units	Value
Ammonia cracking	CAPEX	**USD/t H_2/year**	2 900
	OPEX	**USD/year as a % of CAPEX**	5%
	Electricity consumption	**kWh/kg H_2**	1.50
	Fuel consumption	**kWh/kg H_2**	10.2
	Dehydrogenation/ cracking rate	**%**	99%
	PSA hydrogen recovery rate	**%**	96%

Notes: PSA = Pressure swing adsorption. Data for ammonia conversion are included in the table on ammonia production above.

References

Data on electrolysis technologies has been gathered through a cost survey with stakeholders across the entire electrolyser supply chain, including original equipment manufacturers (OEMs), EPC companies and project developers.

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