Industrial Gases

Most preferred
Air Liquide | TP € 197
Linde | TP $ 366

Taking the hydrogen opportunity

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Price 10/25/21	Reco.	Curr.	Price	TP
Air Liquide	Outperform	EUR	142.92	197.00
Linde plc	Outperform	USD	316.84	366.00

Next Events		
30/11/2021	Linde plc	Q3 Results

After our deep-dive into the green hydrogen (H2) opportunity - banking on the planned and transforming H2 scenarios of IRENA - we reinstate our Outperform ratings on both Air Liquide and Linde. They are ideally positioned to exploit the – admittedly long/er-term – H2 opportunity, for which we calculate an NPV uplift potential of € 13-73 per share for AI and $ 27-154 for LIN. This adds 7% and 8% to our respective fair values in our base case to the legacy business (AI: €184 / LIN: $ 339 - excl. H2; SOTP/DCF based) making ('green') H2 a highly relevant opportunity for both.

Ample political / industrial support to credibly grant green H2 growth

Thanks to both ample regulatory support in the quest to decarbonise the economy (EU funding 2020-30: up to € 400bn) and significant scale gains making green H2 also economically attractive, the International Renewable Energy Agency (IRENA) is projecting green H2 consumption to rise from virtually nothing in 2020 to 9m and 25m tons in the planned and transforming scenarios by 2030. With costs expected to drop to € 1.31/kg by 2030 (CAGR: -5.7%), this should push the boundaries of the potential fields of application further from initially replacing fossil-fuel based H2 (2020: ~120m tons), over the use in industry (steel makers at the forefront) and transport to buildings. This results in our modeled EU hydrogen forecast of 54m tons by 2050 (global 'green' H2 = 25m-160m tons by 2050).

NPVs of € 63-859bn for major industrial gases players

Based on the favorable position along the H2 value chain (encompassing production, liquefaction, distribution and carbon storage) and incorporating our price trend forecasts for for H2 (CAGRs 2024-50E: down 2-3%), we calculate NPVs of € 63-859bn for the gases market segment. Judging by each company's positioning in the respective sub-sectors, we find Linde is better off than Air Liquide in the overall H2 market due to scale and its strong SMR footprint within the gases vertical, whereas Air Liquide is ahead in 'green' H2 (representing 78% of modeled 11.6mt H2 top-up by 2030) based on a manifold and tangible order pipeline, like the evolving Air Liquide Normand'Hy H2 ecosystem in France.

Adj. EBIT 2023 estimates up by 5%/ 4% for AI/LIN and more to come

At Air Liquide, comparable growth in gases & service should benefit from continuing strength in merchant markets, leading to an increase of 6.6% in 2021e vs -1.2% in 2020. We increase our EBIT estimates for 2023 by 5% (LIN: +4%) to € 5.1bn ($ 8.3bn). For Linde, we expect that the newly announced CEO Sanjiv Lamba, who will take over in March 2022, will leverage on the superior margin level going forward. This leads to forecasted adjusted EBIT growth of 12.5% (CAGR 2020-2023e), triggering EBIT-margin acceleration by an additional 290bps to 24.2% between 2020-2023e. We forecast hydrogen related EBIT contribution of € 600m and $ 400m for Air Liquide and Linde by 2030, respectively.

Air Liquide and Linde – Outperform! TP raised

In our valuation framework, we start from our base case fair values for the legacy business, i.e. before including any meaningful contributions from, 'green & grey' H2 and related infrastructure activities. We find that the relevant upside opportunity is equally spread between Air Liquide (9%/~50% in the planned/transforming scenario) and Linde (9%/~49% in the planned/transforming scenario) prompting our Outperform confirmation. We raise our target price for Air Liquide/ Linde to € 197/ $ 366 based on equal-weighted SotP/DCF valuation and an attached hydrogen business NPV of at least € 13/ $ 27 per share.

	Currency	Market Cap (m)	Rating		TP		EPS		PE (x)	
			Revised	Former	Revised	Former	2021e	2022e	2021e	2022e
Air Liquide	€	67 402	Outperform	Outperform	197.0	190.0	5.71	6.40	25.0	22.3
Linde plc	$	163 927	Outperform		366.0	296.0	10.19	11.24	31.1	28.2

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OUTPERFORM RATING FOR AIR LIQUIDE AND LINDE

We rate both industrial gases players, Air Liquide and Linde, an Outperform within our chemicals universe, and increase their target price to € 197 (vs € 190) and $ 366 (vs $ 296), respectively. The industrial gases business is characterized by foreseeable margin-levels backed by widely spread 'take-or-pay' contracts, historical top-line growth in-line with GDP as well as high-barriers to entry fueled by high capex requirements which ensure a long-term return ahead of the cost of capital. This highly attractive business model is now supplemented by an additional growth angle in terms of the upcoming hydrogen economy. 'Green' hydrogen becomes an economically viable option and is pushed forward by ample political and industrial support as well as surging CO2 prices. In our bullish scenario, the addressable NPV for the industrial gases industry reach values of up to € 859bn.

Air Liquide (Outperform, TP: € 197 vs € 190) : First mover in the 'green' H2 energy transition

We consider Air Liquide to be the key beneficiary of the emerging 'green' H2 market, representing 78% of modeled 11.6mt H2 top-up by 2030. We forecast H2 revenues to increase by 2.5x to ~€ 5bn (company target: >3x by 2035), implying an adj. EBIT increase of c.€600m (16% of the group) by 2030 in our planned scenario. Heading into 2022, we like the more cyclical portfolio based on 44% IM exposure with forecast vol/price growth of 3.7%/3.1% (H1 21: 9%/2%). We expect these two drivers to lift comparable growth to 2.7% (CAGR 2020-23E) and fuel an adj. EBIT increase of 10.2% (CAGR 2020-23E) to € 5,067m. We maintain our Buy rating backed by outlined hydrogen guidance released at the company's Sustainability Day, which included hydrogen revenues surging >3x by 2035, accompanied by 3GW of electrolyser capacity to be installed by 2030. The substantial 'green' hydrogen order pipeline, including the just recently raised stake (now 100%) in the >200MW Normandy electrolyser capacity H2V project (now renamed: Air Liquide Normand'Hy), is supplemented by initiatives like 'carbon capture-as-a-service', where CO2 is captured by Air Liquide and afterwards stored in decommissioned natural gas fields in the North Sea by oil & gas companies like Total. We have raised our TP to € 197 based on equal-weighted SotP/DCF valuation and an attached hydrogen business NPV of at least € 13/share.

Air Liquide main data

Air Liquide	2018	2019	2020	2021e	2022e	2023e	2018	2019	2020	2021e	2022e	2023e	CAGR
P&L	*absolute values (LC m, except EPS)*						**Growth / margins** (y/y for sales, EPS | % sales for all other KPIs)						
Total Sales	21 011	21 920	20 485	22 392	23 413	24 788	n/a	4.3%	-6.5%	9.3%	4.6%	5.9%	7%
Adj. EBIT	3 448	3 794	3 790	3 965	4 585	5 067	16.4%	17.3%	18.5%	17.7%	19.6%	20.4%	10%
Adj. EPS (€)	4.49	4.76	5.16	5.57	6.26	6.69	n/a	6.0%	8.4%	7.9%	12.4%	6.9%	9%
Cash Flow / Balance sheet							**Valuation**						
Op. FCF	2 565	2 660	2 657	1 892	2 414	2 671	EV/sales	3.4x	3.4x	3.6x	3.7x	3.5x	1%
Capex	-2 249	-2 636	-2 630	-2 811	-2 933	-3 111	EV/EBITDA	12.7x	12.7x	13.4x	12.9x	11.8x	-2%
Net fin. debt	-12 535	-13 705	-11 797	-11 207	-10 190	-9 163	P/E	26.4x	26.2x	25.9x	23.0x	21.5x	-6%

Table 1 – Sources: ODDO BHF Securities, FactSet

Linde (Outperform, TP: $ 366 vs $ 296): Winning from grey to blue in H2

Margin expansion story continues, while unprecedented H2 top-line effects grant necessary operational leverage. In our view, Linde's share price only partly reflects H2-related appreciation potential of $ 27-$ 154/share. The greater exposure to 'grey' ('blue' in future) H2 production could be a blessing as we expect this transition technology to last for longer (64% in 2050). We expect Healthcare and Electronics end-markets (~27% exposure) to defend recent growth rates and to remain buoyant heading into 2022 with forecast comparable growth rates of 4-6%. We like the strong profitability focus, resulting in an adj. EBIT CAGR 20-23E of 12.5% to $ 8,251m by 2023E, which puts us in line with consensus. We forecast adj. EPS of $ 10.19 in 2021E, up 23.2% y/y, of which 4pp attributable to ongoing share buybacks. Our target price is based on two pillars, first operational excellence which should yield a fair value of $ 339; and second a $ 27/share top-up to capture the discounted NPV potential of our 'conservative' H2 base case. Our new SotP/DCF derived TP moves up to $ 366, providing 17% upside potential. Linde trades at 14.4x EV/EBITDA 23E, a 9% discount to three-year historical trading (15.9x).

Linde main data

Linde	2018	2019	2020	2021e	2022e	2023e	2018	2019	2020	2021e	2022e	2023e	CAGR
P&L	**absolute values (LC m, except EPS)**												
Total Sales	28 084	28 163	27 243	30 817	32 472	34 133	n/a	0.3%	-3.3%	13.1%	5.4%	5.1%	8%
Adj. EBIT	4 796	5 272	5 797	7 117	7 740	8 251	17.1%	18.7%	21.3%	23.1%	23.8%	24.2%	12%
Adj. EPS (€)	7.50	7.43	8.27	10.19	11.24	12.22	n/a	-0.9%	11.3%	23.2%	10.4%	8.7%	14%
Cash Flow / Balance sheet										**Valuation**			
Op. FCF	1 771	2 437	4 029	4 046	4 185	4 449	EV/sales	3.8x	3.8x	5.6x	5.2x	4.9x	9%
Capex	-1 883	-3 682	-3 400	-3 760	-3 910	-3 960	EV/EBITDA	15.9x	15.9x	16.6x	15.4x	14.4x	-3%
Net fin. debt	-10 830	-11 256	-12 400	-12 151	-11 964	-11 242	P/E	17.4x	21.0x	30.6x	27.7x	25.5x	7%

Table 2 – Sources: ODDO BHF Securities, FactSet

Bull case implies H2 market to quadruple by 2050

As we will show in the next sections, hydrogen is the key element of the energy transition and might be the game-changer for industrial gases players. In this context, the evolution of the hydrogen market offers the potential to bring back material growth to a formerly rather mature industry with historical growth rates in line with GDP. Our bull-case scenario points to surging H2 demand of 426mt by 2050, compared to around 120mt used today in refining, ammonia and methanol production.
The calculation of our three scenarios is based on data provided by BNEF, IRENA and the Hydrogen Council and would imply an installed electrolyser capacity of 64GW (base), 127GW (planned), 812GW (transforming). However, the ramp-up is clearly back-end loaded to the period 2030-50E.

H2 demand and implied electrolyser / SMR+CCS capacity

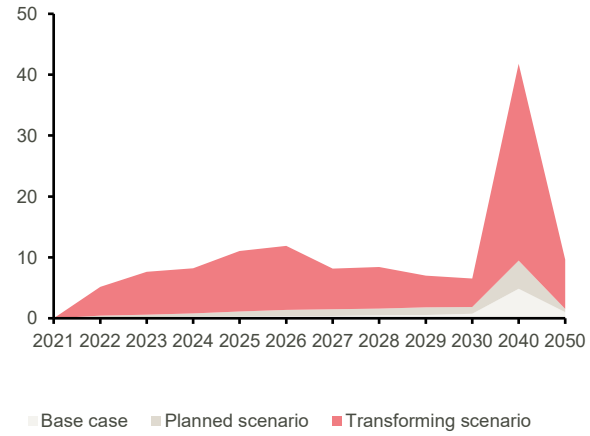
	2030		2050	
Hydrogen demand	**planned**	**transf.**	**planned**	**transf.**
Green H2 (million metric tons)	**9**	**25**	**25**	**160**
Electrolyser demand (GW)	60	167	127	812
H2 (1m tons) vs electrolyser capacity (GW)	6.7	6.7	5.1	5.1
SMR/coal/autothermal + CCS				
# of projects	22.0	500.0	284	1 710
Capacity of production unit (t/p.a.)	116 640	116 640	155 520	155 520
Conventional H2 top up (m t)	**2.6**	**58.3**	**44.2**	**266.0**
Total additional hydrogen demand				
H2 (million metric tons)	**11.6**	**83.3**	**69.2**	**426.0**

Table 3 – Sources: ODDO BHF Securities, IRENA, Hydrogen Council, Hydrogen Europe, company data

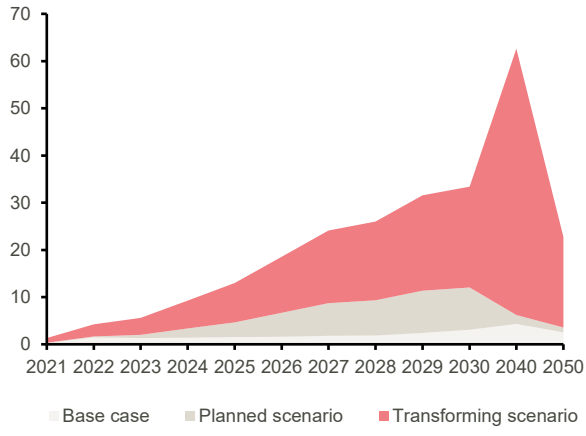
‘Planned’ scenario implies 127 GW electrolyser capacity by 2050

Based on the BNEF project pipeline and scalability options, we apply a technology split of 76% for the alkaline (24% PEM) technology until 2030, which is expected to turn in favour of PEM with targeted market share of 70% by 2050E. Linde in combination with its JV partner ITM Power is currently pursuing the construction of the largest PEM electrolyser in Leuna (Germany) with an expected capacity of 24MW, whereas alkaline electrolysers can easily reach levels of >100MW. Beyond 2030, we expect PEM technology to gain pace and close the gap, with expected market shares of 60%/70% in 2040/2050, respectively. Acceleration of H2 production peaks in 2040. In our bullish scenario, H2 volumes are set to rise from 120mt to 546mt, accompanied by additional electrolyser installations of up to 800GW.

Global new H2 capacity (million tons)



Global new electrolyser capacity (GW)

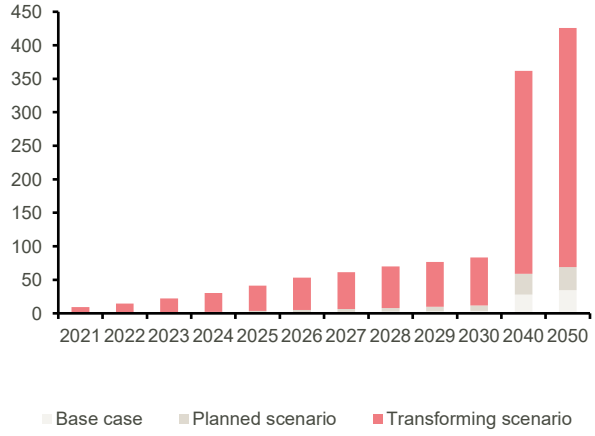


Charts 4 — Sources: ODDO BHF Securities, BNEF, Hydrogen Council, Hydrogen Europe

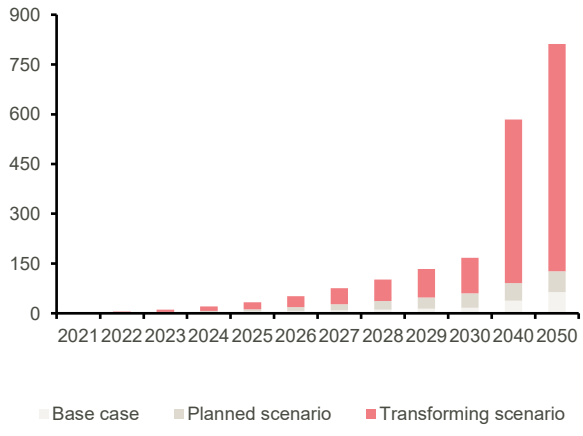
Bull case unlocks € 600bn revenue market, implies H2 to remain <30% of energy mix

After comparing our modelled scenarios, we conclude that the transformation scenario is a real game-changer, implying ~€ 600bn revenues p.a. by 2050 and an additional 426mt H2 demand. However, note that the ‘transforming’ scenario would still imply that >70% of global energy demand comes from energy sources other than hydrogen.

Global cumulative installed H2 capacity (million tons)



Global cumulative electrolyser capacity (GW)



Charts 5 — Sources: ODDO BHF Securities, BNEF, Hydrogen Council, Hydrogen Europe

Electrolyser technology split in the 'planned' scenario (GW)

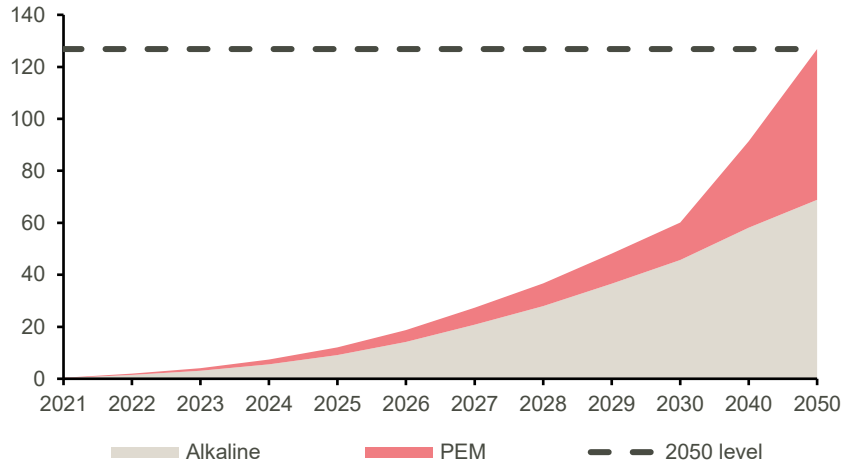


Chart 6 – Sources: ODDO BHF Securities, BNEF, Hydrogen Europe

Valuation - H2 opportunity in industrial gases

We have computed three H2 pathways (encompassing 'green' and 'blue' H2) and their impact on the industrial gases sector. Our scenarios to assess the 'green' H2 market are based on BNEF's base-case electrolyser installation forecasts and reflect IRENA's planned as well as its transforming scenario. The 'blue' H2 production component was approximated with the help of projections from Hydrogen Europe ('transforming') and the Hydrogen Council ('bull'). Among our industrial gases coverage, upside risk is equally spread between Air Liquide (#2 player) and Linde (#1 player) in relative terms. Our mid-case scenario yields an upside potential of $ 27/share for Linde vs. € 13 for Air Liquide, while our bull case would contribute an additional € 60 / $ 127. We set our new TPs at € 197 and $ 366 for Air Liquide and Linde respectively. Furthermore, serving their customers with electrolysers directly – as opposed to current co-operations - would open up another up to € 10bn market, according to our estimates.

Methodology framework :

As shown further, H2 demand could more than quadruple to ~546mt already by 2050E. We expect 38% of this newly generated H2 demand of ~426mt by 2050 to be 'green' and we have modeled a 1.4% efficiency enhancement for electrolysers (CAGR 2030-50E), assuming a 70/30 split in favour of PEM vs. alkaline by 2050. We apply a mixed ('green', 'blue') ASP of € 1,600/t for H2 declining by 3% p.a. through 2030 and by 2% in 2030-50E to determine the revenue potential (1st stage: 51% 'green' H2 price degression by 2030, however at still low volumes; 2nd phase: similar price development). For correlated infrastructure activities (liquefaction, distribution, etc.) we apply an ASP of € 1,250/t and assume a price appreciation of +1.0% annually. However, based on indications provided in AI's annual report, we expect just 35% of H2 to be further processed, and the residual amount is sold directly via a pipeline network to large-scale customers. Our FCF-to-sales ratio stands at 10%. Based on a WACC of 5.9%, we derive an addressable NPV for the H2 market of ~€ 63bn-€ 859bn which compares to LIN's and AI's market capitalization of $ 162bn / € 68bn.

Underlying model assumption

Global new 'green' + (conventional) hydrogen demand and cumulative electrolyser capacity – base, planned and transforming hydrogen scenarios

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040	2050
Base case (BNEF - pilot project level)												
Green H2 (million metric tons)	0.0	0.1	0.2	0.3	0.4	0.6	0.9	1.3	1.8	2.5	7.5	12.6
Implied electrolyser demand (GW)	0.2	1.7	3.1	4.5	6.0	7.6	9.4	11.2	13.6	16.7	38.1	63.8
New production - green H2 (m t)	**0.0**	**0.1**	**0.1**	**0.1**	**0.2**	**0.2**	**0.3**	**0.4**	**0.5**	**0.7**	**1.0**	**0.8**
Conventional H2 top up (m t)	0.2	0.3	0.5	0.6	0.8	1.0	1.1	1.2	1.3	1.3	20.5	22.1
H2 production uplift vs. 2020 (m t)	**0.2**	**0.4**	**0.6**	**0.9**	**1.2**	**1.6**	**2.0**	**2.5**	**3.1**	**3.8**	**28.0**	**34.7**
New demand - total (m t)	0.2	0.2	0.2	0.3	0.4	0.4	0.4	0.5	0.6	0.7	4.8	1.0
Installed capacity												
Alkaline	0.2	1.3	2.3	3.4	4.6	5.8	7.1	8.5	10.3	12.7	21.2	28.9
PEM	0.1	0.4	0.7	1.1	1.4	1.8	2.3	2.7	3.3	4.0	16.8	34.8
Electrolyser total	**0.2**	**1.7**	**3.1**	**4.5**	**6.0**	**7.6**	**9.4**	**11.2**	**13.6**	**16.7**	**38.1**	**63.8**
New installations												
Alkaline	0.2	1.1	1.0	1.1	1.2	1.2	1.4	1.4	1.8	2.3	1.7	0.8
PEM	0.1	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.6	0.7	2.6	1.8
Electrolyser total	**0**	**1.5**	**1.4**	**1.4**	**1.5**	**1.6**	**1.8**	**1.9**	**2.4**	**3.1**	**4.3**	**2.6**
Planned scenario												
Green H2 (million metric tons)	0.1	0.3	0.6	1.1	1.8	2.8	4.1	5.5	7.2	9.0	18.0	25.0
Implied electrolyser demand (GW)	0.3	2.0	4.0	7.4	12.0	18.7	27.4	36.8	48.1	60.1	91.3	126.8
New production - green H2 (m t)		**0.3**	**0.3**	**0.5**	**0.7**	**1.0**	**1.3**	**1.4**	**1.7**	**1.8**	**1.8**	**1.1**
Conventional H2 top up (m t)	0.4	0.6	0.9	1.2	1.6	2.0	2.2	2.4	2.5	2.6	41.0	44.2
H2 production uplift vs. 2020 (m t)	**0.5**	**0.9**	**1.5**	**2.3**	**3.4**	**4.8**	**6.3**	**7.9**	**9.7**	**11.6**	**59.0**	**69.2**
New demand - total (m t)		0.5	0.6	0.8	1.1	1.4	1.5	1.6	1.8	1.9	9.5	1.5
Installed capacity												
Alkaline	0.3	1.5	3.0	5.6	9.1	14.2	20.8	27.9	36.6	45.7	58.2	68.8
PEM	0.1	0.5	1.0	1.8	2.9	4.5	6.6	8.8	11.5	14.4	33.1	58.0
Electrolyser total	**0.3**	**2.0**	**4.0**	**7.4**	**12.0**	**18.7**	**27.4**	**36.8**	**48.1**	**60.1**	**91.3**	**126.8**
New installations												
Alkaline	0.3	1.3	1.5	2.5	3.6	5.1	6.6	7.1	8.6	9.1	2.5	1.1
PEM	0.1	0.4	0.5	0.8	1.1	1.6	2.1	2.2	2.7	2.9	3.7	2.5
Electrolyser total	**0.3**	**1.7**	**2.0**	**3.3**	**4.7**	**6.7**	**8.7**	**9.4**	**11.4**	**12.0**	**6.2**	**3.6**
Transforming scenario												
Green H2 (million metric tons)	0.2	0.8	1.7	3.1	5.0	7.8	11.4	15.3	20.0	25.0	115.2	160.0
Implied electrolyser demand (GW)	1.3	5.6	11.1	20.4	33.4	52.0	76.1	102.1	133.6	167.1	584.5	811.8
New production - green H2 (m t)		**0.6**	**0.8**	**1.4**	**1.9**	**2.8**	**3.6**	**3.9**	**4.7**	**5.0**	**18.0**	**6.7**
Conventional H2 top up (m t)	9.1	13.6	20.5	27.3	36.4	45.5	50.0	54.5	56.8	58.3	246.8	266.0
H2 production uplift vs. 2020 (m t)	**9.3**	**14.5**	**22.1**	**30.3**	**41.4**	**53.2**	**61.4**	**69.8**	**76.8**	**83.3**	**362.0**	**426.0**
New demand - total (m t)		5.2	7.7	8.2	11.0	11.9	8.2	8.4	7.0	6.5	41.8	9.6
Installed capacity												
Alkaline	1.0	4.2	8.5	15.5	25.4	39.5	57.8	77.6	101.6	127.0	293.9	362.1
PEM	0.3	1.3	2.7	4.9	8.0	12.5	18.3	24.5	32.1	40.1	290.5	449.7
Electrolyser total	**1.3**	**5.6**	**11.1**	**20.4**	**33.4**	**52.0**	**76.1**	**102.1**	**133.6**	**167.1**	**584.5**	**811.8**
New installations												
Alkaline	1.0	3.2	4.2	7.1	9.9	14.1	18.3	19.7	24.0	25.4	25.0	6.8
PEM	0.3	1.0	1.3	2.2	3.1	4.5	5.8	6.2	7.6	8.0	37.6	15.9
Electrolyser total	**1.3**	**4.2**	**5.6**	**9.3**	**13.0**	**18.6**	**24.1**	**26.0**	**31.6**	**33.4**	**62.6**	**22.7**

Table 7 – Sources: ODDO BHF Securities, BNEF, Hydrogen Council

Combined (Al/LIN) 12% H2 market share implies up to € 103bn opportunity

Our scenario calculations yield net present values of € 63-859bn for 100% of the market

The following table illustrates the key parameters behind our scenario calculations (base, planned and transforming) with regard to the related H2 volumes in million tons, ASPs (2020E: € 1,600/t (H2) with CAGR 2020-30E: -3%/-2% p.a. thereafter, € 1,250/t infrastructure with of CAGR 2020-50E: +1%). On that basis, and using a WACC of 5.9%, we derive NPVs for 100% of the related market potential of € 63bn in our base case vs. € 134bn and € 859bn in the planned / transforming scenarios, respectively.

H2 market – present value of possible FCFs related to H2 capacity build-out

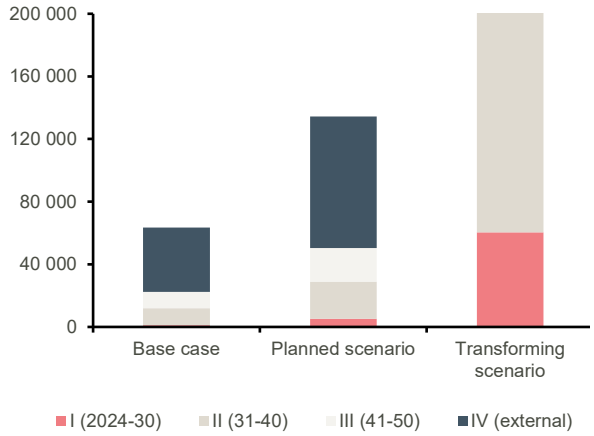
€ m	I (2024-30)	II (31-40)	III (41-50)	IV (external) Exit year		Total
Base case						
H2 sold	15	159	313			487
ASP (€/t)	1 463	1 205	984			
Revenues (H2)	21 323	191 474	308 440			521 236
Revenues (total, incl. infrastructure)	28 137	269 052	469 189	67 027		833 405
FCF	**1 872**	**26 653**	**46 699**	**9 384**	**242 930**	**84 607**
% sales	*6.7%*	*9.9%*	*10.0%*	*14.0%*		*10.2%*
PV FCF	**1 178**	**10 698**	**10 526**		**41 034**	**63 437**
Planned scenario						
H2 sold	46	353	641			1 040
ASP (€/t)	1 463	1 205	984			
Revenues (H2)	65 315	425 057	630 937			1 121 308
Revenues (total, incl. infrastructure)	86 234	597 275	959 761	137 109		1 780 379
FCF	**7 885**	**59 168**	**95 526**	**19 195**	**496 932**	**181 774**
% sales	*9.1%*	*9.9%*	*10.0%*	*14.0%*		*10.2%*
PV FCF	**5 210**	**23 749**	**21 532**		**83 939**	**134 430**
Transforming scenario						
H2 sold	416	2 226	3 940			6 583
ASP (€/t)	1 463	1 205	984			
Revenues (H2)	597 998	2 682 185	3 878 095			7 158 278
Revenues (total, incl. infrastructure)	786 779	3 768 914	5 899 237	842 748		11 297 677
FCF	**87 812**	**373 358**	**587 158**	**117 985**	**3 054 427**	**1 166 314**
% sales	*11.2%*	*9.9%*	*10.0%*	*14.0%*		*10.3%*
PV FCF	**60 452**	**149 862**	**132 349**		**515 936**	**858 599**

Table 8 – Sources: ODDO BHF Securities, IRENA, BNEF, Hydrogen Council Hydrogen Europe

Terminal value contributes ~60% to NPV, sequential growth beyond 2050

Our model and calculation assumptions follow a conservative approach to avoid neglecting prevailing uncertainties (ramp-up, transportation, industrial demand) and overstating the NPV outcome. Thus, we have deployed a phase model encompassing three stages/periods. The period 2024-30 will be characterised by surging electrolyser installations and related 'green' H2 competitiveness and price breakeven with SMR until 2030. Capex and NWC build-up are also inevitable heading into 2040, in our opinion. From 2030-40, governmental regulation is expected to incentivise broad-based H2 deployment in new industries like steel and also for transportation purposes, leading to an NPV contribution of 17-18%. The peak of conventional 'blue' hydrogen should be reached in the period 2040-50, but overall demand should continue to rise, albeit at a slower pace. Our terminal value contributes ~60% to the total NPV because demand does not abate in line with a slowdown of installations but rather remains at sustainably high levels driven by continuing industry demand for H2. Bear in mind that an ~100bp change to our WACC of 5.9% moves the contribution from the terminal value by around seven percentage points.

NPVs in €m of base, blue-sky, bull case (until 2040 for visibility purposes



NPV ranges evolving from H2 opportunity*

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
0	0	0	0	0	0	0	0	0	0
10	**20**	**30**	**40**	**51**	**61**	**71**	**81**	**91**	**101**
20	**40**	**61**	**81**	**101**	**121**	**141**	**162**	**182**	**202**
30	61	91	121	152	182	212	242	273	303
40	81	121	162	202	242	283	323	364	404
51	101	152	202	253	303	354	404	455	505
61	121	182	242	303	364	424	485	545	606
71	141	212	283	354	424	495	566	636	707
81	**162**	**242**	**323**	**404**	**485**	**566**	**646**	**727**	**808**
91	**182**	**273**	**364**	**455**	**545**	**636**	**727**	**818**	**909**
101	**202**	**303**	**404**	**505**	**606**	**707**	**808**	**909**	**1 010**

*Charts 9 – Sources: ODDO BHF Securities, IRENA, BNEF, Hydrogen Council, Hydrogen Europe, *horizontal line 1 = % of market, grey lines = 2 scenarios*

Valuation approach - strong H2 production set up at LIN, AI close behind

Our valuation approach starts from our SotP and DCF derived fair value for the "established/mature" business. Linde made great efforts in expanding its adj. EBIT margin by 420bp from 2018-20, over-delivered on promised Praxair synergies and used the takeover for more incremental organizational changes, while peers struggled to keep pace. Air Liquide has a strong commitment to bring the 'green' hydrogen agenda forward (built the largest PEM electrolyser, 100% stake in Air Liquide Normand'Hy (200MW PEM unit from Siemens Energy), green steel co-operation with Thyssenkrupp, biogas SMR process for mobility in the US), and in this, benefits from its rather European angle, the region where H2 strategies are the rule rather than the exception. On that basis, our fair value increases by $ 70 for Linde to $ 366 per share to account for strong margin steering over the last few quarters and here we also attached $ 27/share to capture the evolving H2 potential. Our target price for Air Liquide moves up to € 197, of which € 13 per share is attributable to surging H2 activities (i.e., H2 revenues up >3x by 2035). The respective further upside potential related to the bull case amounts to € 60 at AI (coming on top of the blue sky) vs. $ 127 in the case of Linde.

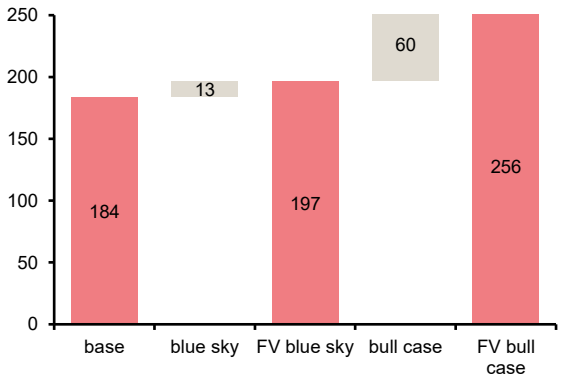
AI best-positioned in the 'green' H2 market, share price of € 197 not too stretched

We regard the upside potential for Air Liquide as materially stronger in the 'green' H2 market than for Linde, which is expected to be the key driving force by 2030 with 78% share of new H2 production in our planned scenario. However, we expect 'blue' H2 admixture to develop as transition technology which might last for longer, also heading into 2050 (64% of H2 production). In this field of conventional H2 production, our perception is that Linde has a stronger position which becomes visible on the number of operated SMR units (LIN: +60, AI: ~50) and H2 sold (LIN: 21bn m³, AI: c.14bn m³), supplemented by strong engineering activities (refuelling stations LIN: 200, AI: c.120). However, Air Liquide is catching up with initiatives like CO2 capture as a service offering in a partnership with Total, where CO2 is stored in decommissioned natural gas fields in the North Sea. Thus, we assign AI a 4% market share of the overall H2 ('green' + 'blue') NPV potential backed by a substantial project pipeline across the upcoming hydrogen industry. Taking the market cap differential with LIN of 2x into account, this still provides material H2 contribution of € 13/€ 73 in our blue-sky and bull-case scenarios, respectively. The grey marked horizontal areas in the table below describe the NPV/share outcome of our two considered scenarios (top-line = market share). Our new target price for Air Liquide moves up to € 197 (previous: € 190).

AI – Fair value ranges H2 scenarios (€/share)*

2.0%	4.0%	6.0%	8.0%	10.0%	12.0%	14.0%	16.0%	18.0%	20.0%
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.3	8.5	12.8	17.1	21.3	25.6	29.9	34.1	38.4	42.6
8.5	17.1	25.6	34.1	42.6	51.2	59.7	68.2	76.8	85.3
12.8	25.6	38.4	51.2	64.0	76.8	89.6	102.4	115.1	127.9
17.1	34.1	51.2	68.2	85.3	102.4	119.4	136.5	153.5	170.6
21.3	42.6	64.0	85.3	106.6	127.9	149.3	170.6	191.9	213.2
25.6	51.2	76.8	102.4	127.9	153.5	179.1	204.7	230.3	255.9
29.9	59.7	89.6	119.4	149.3	179.1	209.0	238.8	268.7	298.5
34.1	68.2	102.4	136.5	170.6	204.7	238.8	272.9	307.1	341.2
38.4	76.8	115.1	153.5	191.9	230.3	268.7	307.1	345.4	383.8
42.6	85.3	127.9	170.6	213.2	255.9	298.5	341.2	383.8	426.5

AI – Fair value upside from H2 scenarios (€/share)



*Charts 10 — Sources: ODDO BHF Securities, IRENA, BNEF, Hydrogen Council, Hydrogen Europe, *horizontal line 1 = % of market, grey lines = 2 scenarios*

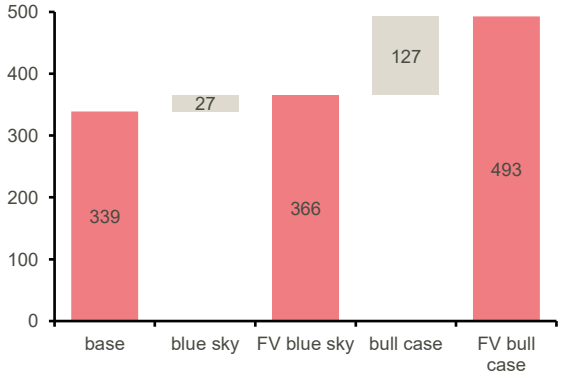
LIN - >50% upside opportunity if bull case materialises and assuming conservative 8% market share

Given its #1 position in the industrial gases space, we consider Linde to be one of the key beneficiaries of an emerging hydrogen industry fuelled by extraordinary engineering capabilities. MoU´s with China Power and SNAM (Italian infrastructure company) indicate the H2 contribution to group revenues in 2030 could double from ~$ 2.0bn to $ 4bn (representing 14.7% of the group) with an additional adj. EBIT contribution of $ 400m (7% of group), assuming the blue-sky scenario (bull case: revenues +$14bn to $ 16bn). That said, and starting from the displayed NPV table for the total H2 market, LIN's share price only partly reflects H2-related opportunities, in our view. Hence, our TP would result in $ 339 per share due to a strong operational overhaul in terms of margin management and is further lifted by $ 27 per share to $ 366 (previous: $ 296) to capture the forecast H2 potential in our planned scenario. We have modelled what we consider to be a rather conservative 8% market share on the newly generated H2 potential as we expect other players from related sectors like the oil&gas exploration companies to step into the market to get a piece of the potential €860bn cake. The transforming scenario would even push the fair value of LIN to $ 493/share.

LIN – Fair value ranges H2 scenarios ($/share)*

2.0%	4.0%	6.0%	8.0%	10.0%	12.0%	14.0%	16.0%	18.0%	20.0%
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.5	9.1	13.6	18.1	22.6	27.2	31.7	36.2	40.8	45.3
9.1	18.1	27.2	36.2	45.3	54.3	63.4	72.5	81.5	90.6
13.6	27.2	40.8	54.3	67.9	81.5	95.1	108.7	122.3	135.9
18.1	36.2	54.3	72.5	90.6	108.7	126.8	144.9	163.0	181.2
22.6	45.3	67.9	90.6	113.2	135.9	158.5	181.2	203.8	226.4
27.2	54.3	81.5	108.7	135.9	163.0	190.2	217.4	244.6	271.7
31.7	63.4	95.1	126.8	158.5	190.2	221.9	253.6	285.3	317.0
36.2	72.5	108.7	144.9	181.2	217.4	253.6	289.8	326.1	362.3
40.8	81.5	122.3	163.0	203.8	244.6	285.3	326.1	366.8	407.6
45.3	90.6	135.9	181.2	226.4	271.7	317.0	362.3	407.6	452.9

LIN – Fair value upside from H2 scenarios ($/share)



*Charts 11 — Sources: ODDO BHF Securities, IRENA, BNEF, Hydrogen Council, Hydrogen Europe, *horizontal line 1 = % of market, grey lines = 2 scenarios*

BIG PICTURE – MANY STARS ALIGNED

Political support and self-initiated projects from major industrial players (e.g. Saudi Arabia – ThyssenKrupp, Air Products, NEOM, Yara / Normandy (France) – Air Liquide, Siemens Energy, Total) together with rising pressure from surging CO2 prices (12-months +149%) lay the ground for rising penetration rates of hydrogen as the key sustainable/ non-fossil fuel based energy source. H2 bear the potential to close ~ 50% of the gap between reference technology scenario (RTS, energy efficiency) and the global 2-degree scenario.

Regulatory framework – It won´t work without H2!

The global community has committed to limit the rise in global warming to below +2°C (EU even ~ +1.5°C) to address the structural challenge of climate change. To achieve this target (i.e., not exceed 1.5°C), emissions must drop by 45% by 2030 (vs. 2010 levels) and to net zero by 2050. In this context, hydrogen will play a key role in the ongoing energy transition and might help to close the CO2 gap between the reference technology scenario (reductions via energy efficiency efforts, etc.) and the 2°C target by 50% or 562mt CO2 by 2050. This could trigger a sharp rise in hydrogen demand from 10EJ (Exajoule) in 2020E to 78 EJ by 2050E, equivalent to 18% of total global energy consumption. Today, just 3% of hydrogen production comes from renewable sources via water electrolysis. We forecast European hydrogen demand will increase almost eightfold from 6.5mt in 2030E to 53.9mt by 2050E, primarily from renewable sources. Capex investments in renewable energy (upstream) and electrolysers (downstream) need to be executed now to lay the groundwork for elevated demand by mid-2020. This should benefit companies along the whole 'green' hydrogen value chain like Siemens Gamesa and Vestas as the leaders in offshore (OF) wind (less relevant for Nordex given its focus on onshore), as well as Siemens Energy (#2 electrolyser manufacturer) and the largest current hydrogen producers/ distributors such as Air Liquide and Linde.

Decarbonization efforts drive H2 expansion – H2 bear the potential to close ~ 50% of the gap between reference technology scenario (RTS, energy efficiency) and 2-degree scenario (2DS)

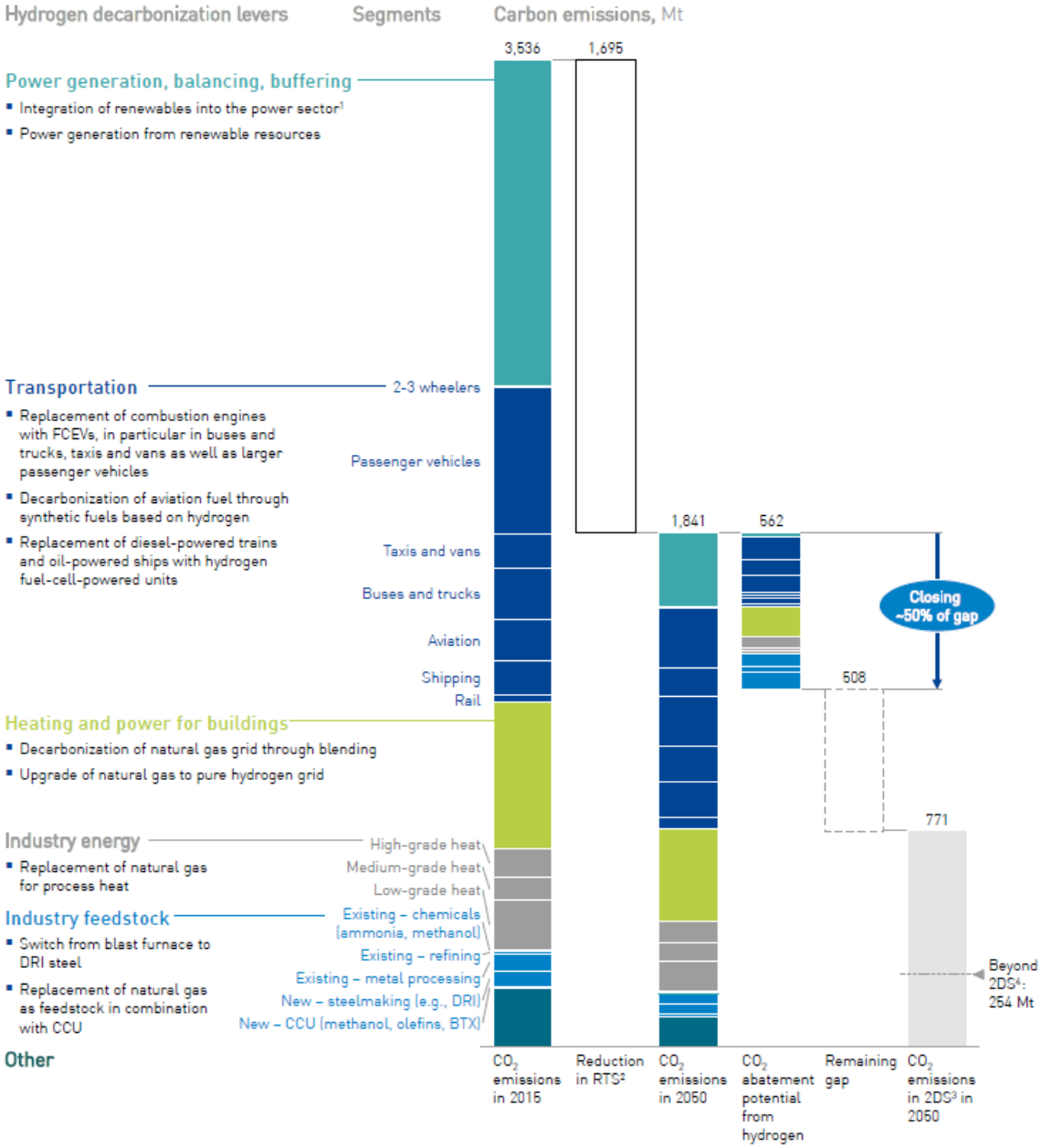
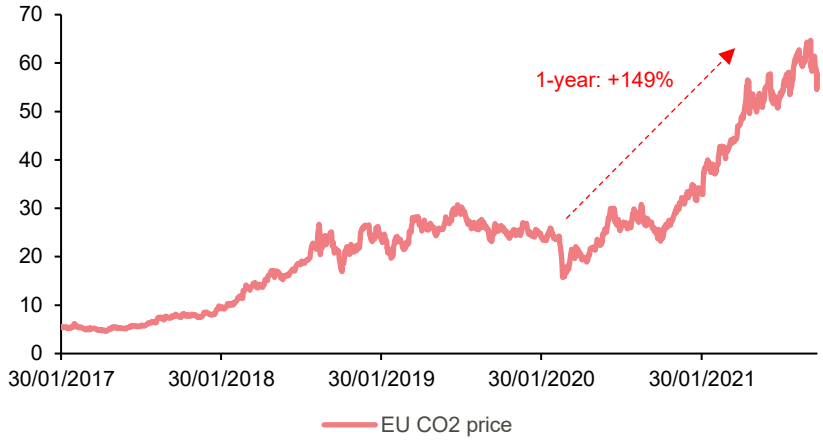


Chart 12 — Source: Hydrogen Roadmap Europe

Helping hand from rising interest in CO2 certificates?

We note a surge of interest in climate investment in general and CO2 certificates in particular, which are tradable at the European Energy Exchange (EEX). The CO2 price per ton already increased by 29%/149% over the respective 6-months/1-year period to a level of €55-€65/ton in October. In thelight of positive price momentum in recent quarters fuelled by partly speculative investments, our base-case CO2 forecast of €58/ton by 2030 appears too conservative, which has even more positive implications for the competitiveness of green hydrogen.

Future curves – CO2 price per ton (EEX)



Charts 13 – Sources: ODDO BHF Research, Bloomberg

Countries are moving in the same direction

Hydrogen is a multifaceted energy carrier, which can play a role in achieving the announced European energy transition and might help to tackle various critical challenges. Hydrogen can be produced from nearly every energy resource, nevertheless the current use of hydrogen in oil refining and chemical production is almost entirely covered by hydrogen from fossil fuels, with significant associated CO2 emissions. The necessity to incorporate hydrogen as an integral component in national energy transition strategies is well recognised across the globe. According to Bloomberg New Energy Finance, one-third of countries across the globe (incl. China/USA, which have the highest CO2 emissions) have or intend to implement hydrogen initiatives, with Europe clearly in the lead.

Overview map - National hydrogen strategies as of September 2021…

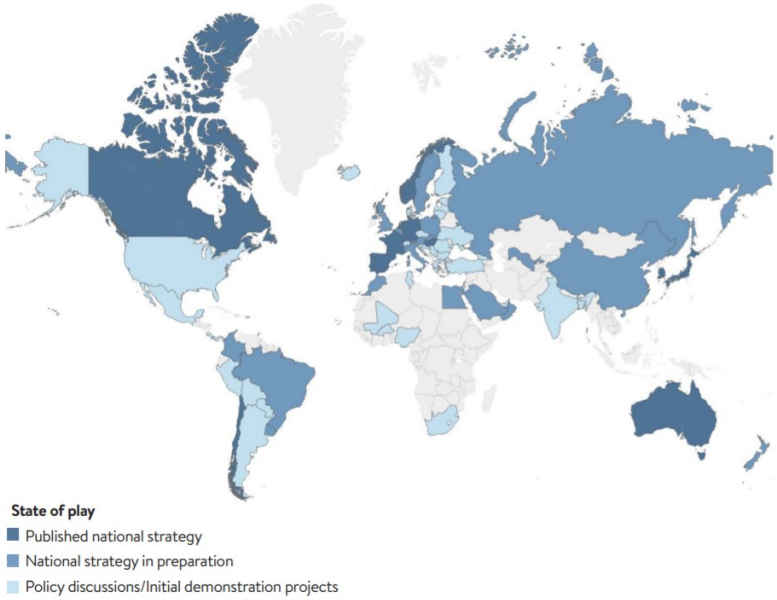


Chart 14 – Source: World Energy Council

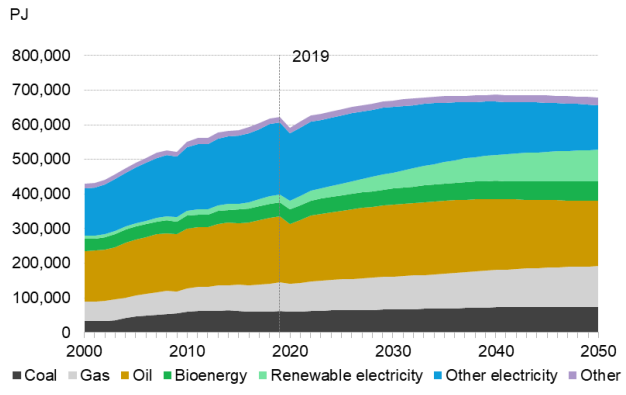
Energy framework – disruption underway

In its New Energy Outlook, BNEF forecasts a ~12TW expansion in total generation capacity to serve an expected 1.5% demand CAGR until 2050. This is likely to be dominated by renewable energies (RE) which should command a ~70% share of the world's electricity by then (2019: 27% | solar/wind: 3%/5% vs. coal at 36%), up from ~60% previously. However, ongoing additions of new coal-fired power plants in the global #1 and #3 energy markets, China and India (~1/3 of total consumption globally) over the next ~5 years are preventing a higher RE contribution than the expected 42% at the end of this decade. Total gas capacity should double over the next 30 years (CCGT/peakers: 1%/5% CAGR), providing backup during RE lulls and seasonal peaks and benefiting from a steady build-out in the US, #2 in global electricity consumption with a share of 16%. BNEF forecasts total power plant capex to reach >$ 12 trillion by 2050, of which >40% and 15% related to wind and gas.

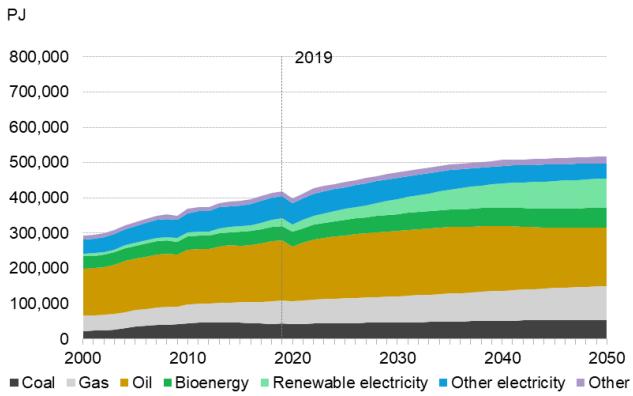
The energy mix – now, then and in the future

The following charts highlight the key contributors to global primary energy consumption, and the key verticals where that energy is ultimately consumed. Our charts indicate potential key areas of application for green hydrogen, in a bid to lower CO2 emissions across various sectors.

Primary energy consumption by source*

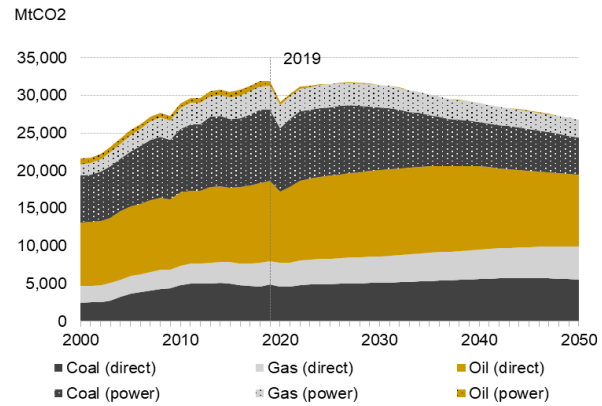


Final energy consumption by source*

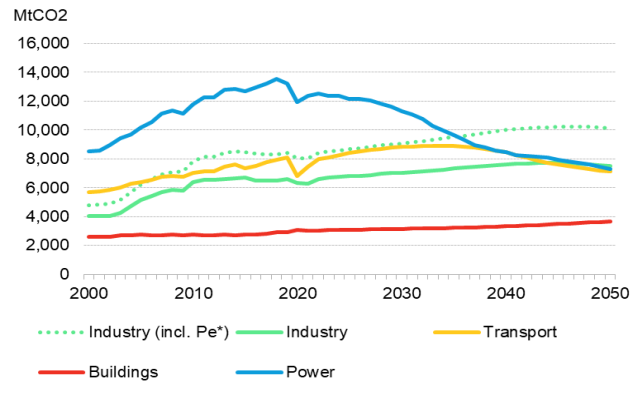


*Charts 15 – Sources: ODDO BHF Securities, BNEF, *PJ = Petajoule, equal to 1.0E+15 joules*

Total emissions by source (MtCO2)



Total emissions by sector (MtCO2)

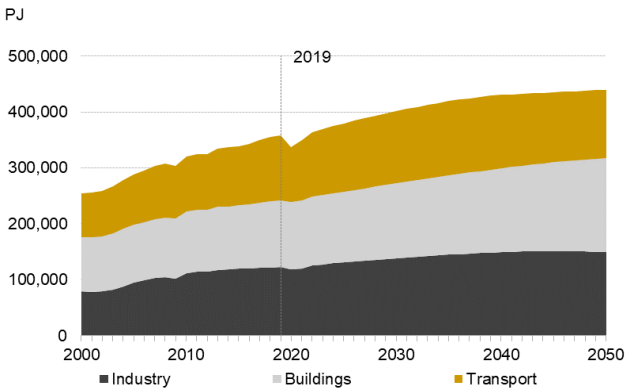


Charts 16 – Sources: ODDO BHF Securities, BNEF

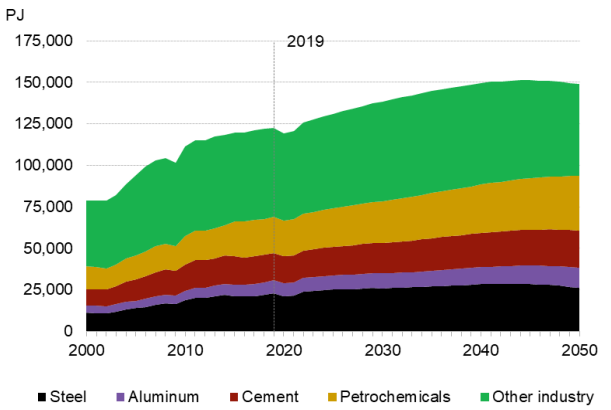
Energy consumption profile – Industry clearly in the lead

Looking at energy consumption across industry, buildings and transport, according to BNEF the final energy consumption of all three sectors Lwas more or less equal. Within the industrial sector, the steel and petrochemical verticals account for almost 20%, followed by the cement end-market at about 15%. With regard to buildings, residential stands at just above 70% whereas in transport, road is the dominant source of energy use at close to 80%, with shipping and aviation ranking second and third at 12% and 9%, respectively. Rail was almost negligible at just 2% in 2020.

Final energy consumption by sector*

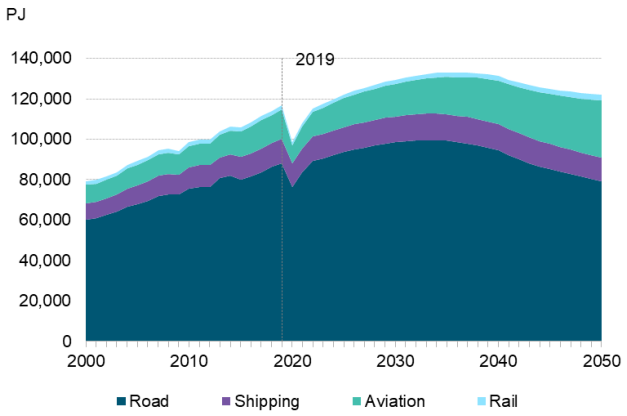


Energy consumption by industry sub-sector*

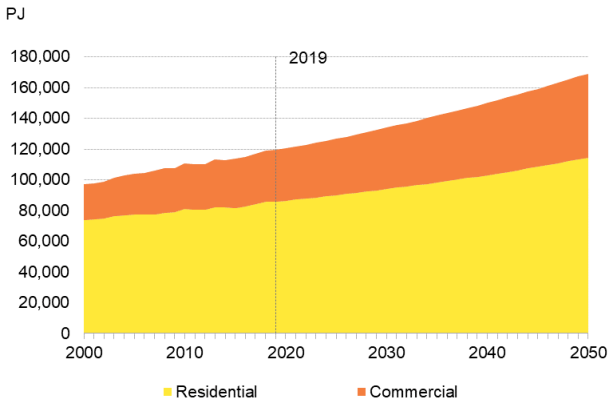


*Charts 17 – Sources: ODDO BHF Securities, BNEF, *PJ = Petajoule, equal to 1.0E+15 joules*

Energy consumption by transport sub-sector*



Energy consumption by building* sub-sector*



*Charts 17 – Sources: ODDO BHF Securities, BNEF, *PJ = Petajoule, equal to 1.0E+15 joules*

WHAT(EVER) IT TAKES TO GET THERE(?)

Hydrogen production costs vary depending on the implemented feedstock and production region, with natural gas (in the Middle East) remaining the low-cost production method for now (c. $ 1/kg). Costs of electrolysis as a mean to convert renewable energy to hydrogen is currently ~2x higher than its fossil fuel alternatives but is expected to reach parity by 2028-2030. In our base-case scenario, we forecast green hydrogen production costs will decrease by 44% until 2030 to $ 1.52 (base case), fueled by halving electrolyser costs and a sharp price degression of renewable energy costs of -43%, as a reflection of a combination of renewable energy prices and electrolyser efficiency. Accounting for sky-high CO2 prices, 'green' H2 is in many cases already a worthwhile alternative by now. We expect PEM electrolyser technology to be on the rise to reach large-scale capacity of >100MW. This view is supported by Air Liquide, planning for 2x 100MW electrolyser in the Normandy to be commissioned by 2025 (currently Linde is building 24MW in Leuna, Germany).

Electrolysers – 'Green' H2 to pave the way for energy transformation

We expect 'green' hydrogen to pave the way for energy transformation. To better assess its growth prospects, it is therefore important to understand that hydrogen is classified into three different groups/colours depending on the production process and associated CO2 emission intensity. **These are as follows:**

Paths of producing H2 and 'colour' classifications – Green H2 the key element for CO2 abatement

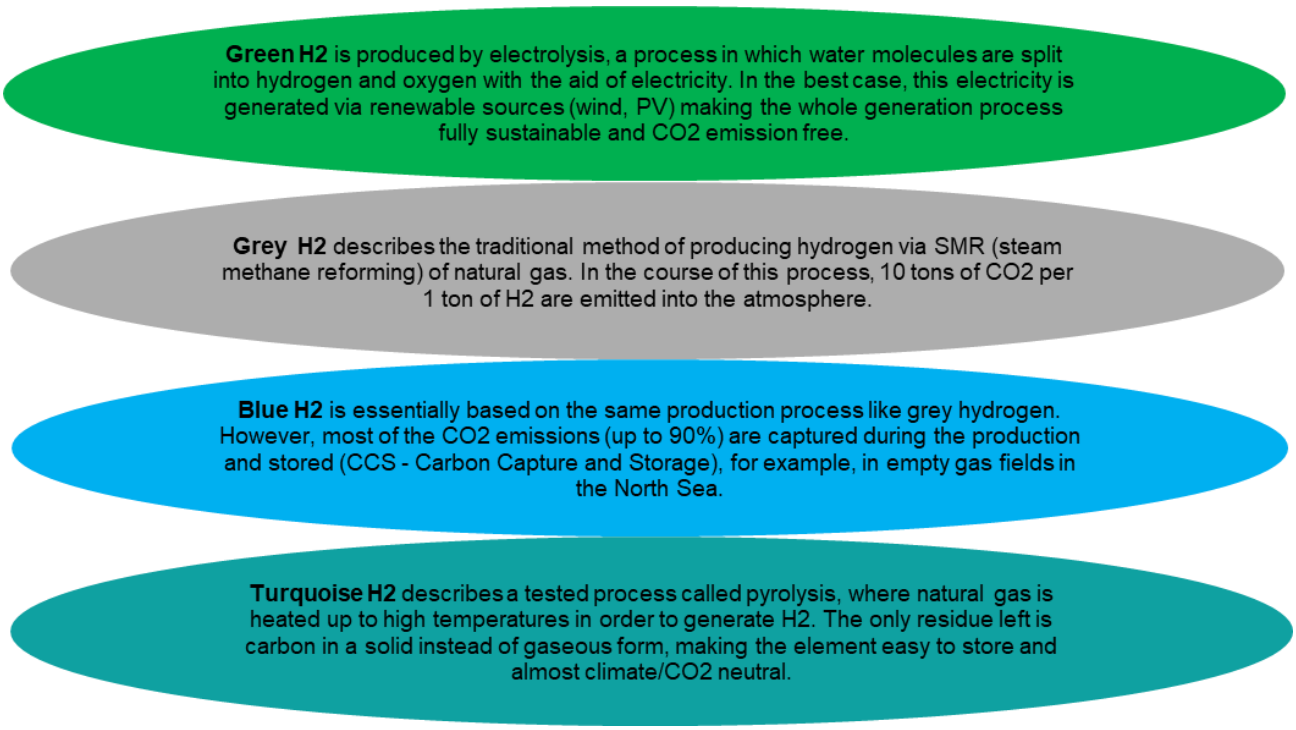


Chart 18– Sources: ODDO BHF Securities, H2 international, company data

Many commitments but 12 GW residual left so far in the EU

As we have learned so far, if 'green' hydrogen output is to be increased, electrolyser capacity must be ramped up. The EU aims to install 6GW of electrolyser capacity by 2024 and 40GW by 2030. According to our calculations and assumptions, 40GW electrolyser capacity equals around 6mt of 'green' hydrogen which is almost the same as the current feedstock demand for refinery, ammonia and methanol end-markets in the EU. This could also result in electrolyser capex demand of c.€ 21bn, of which Siemens Energy should be able to claim a fair share (> € 4bn) based on an expected market share of ~19%. In terms of actual installation commitments by 2030, 12.3GW electrolyser capacity has yet to be announced.

Proposed vs. already announced EU electrolysis capacity – 12GW still needed to achieve 40GW target by 2030

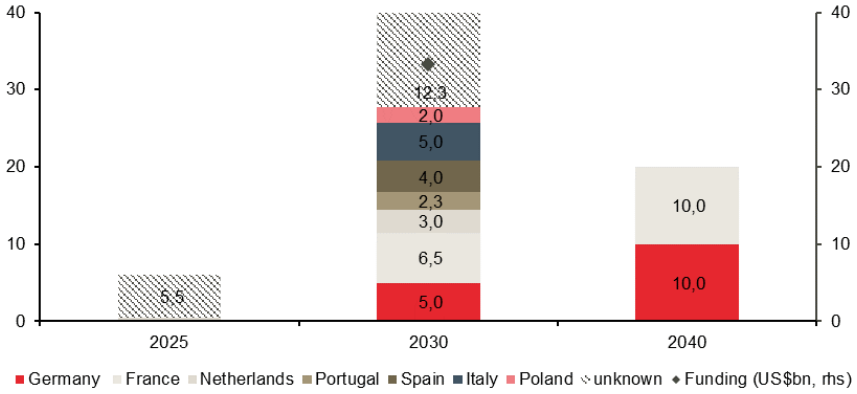
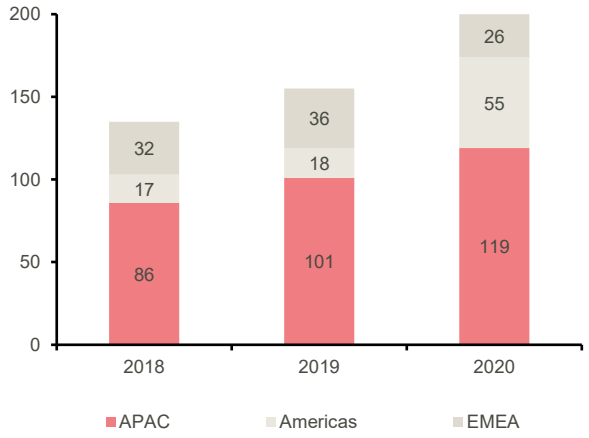


Chart 19 – Sources: ODDO BHF Securities, Hydrogen Europe, Germany's national hydrogen strategy, BNEF

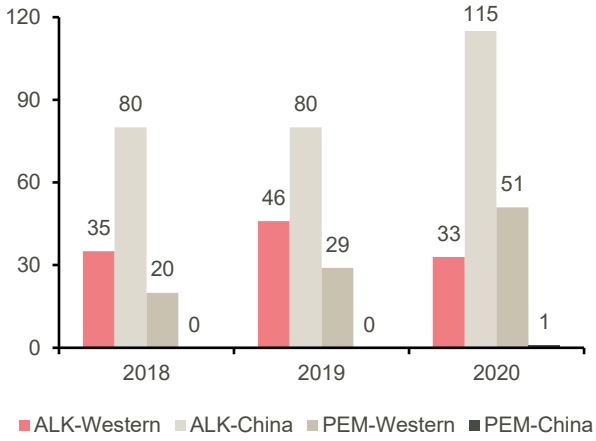
Alkaline = large-scale, PEM = (better) technical charactaristics

There are a number of key differentiations between alkaline and PEM (proton exchange membrane) electrolysers. The former technology is cost-efficient, mature and can be deployed for large-scale applications (>100MW). The latter (PEM) is more costly (due to the use of precious metals, e.g., platinum), rather small-scale (Air Liquide built a 20MW unit, Linde is aiming for a 24MW unit in Leuna, Germany), but has more promising technical properties in combination with renewables (quicker start-up/shut-down of the system in response to unreliable renewable energy supply). One potential pitfall of the hydrogen story could be technical obstacles to ramping up PEM technology to large-scale applications (uneven pressure within the stack, system efficiency). Nevertheless, alkaline technology is moving forward by further expanding its cost leadership due to new electrode coatings (HydrogenPro aims to lift efficiency by an additional 14%). Between 2018 and 2020, electrolyser shipments increased by 48% to $ 189m and equivalent to 200MW capacity, with the majority coming out of China. The Western world follows the more sophisticated PEM technology (~60%), while China has been focusing so far solely onlow-cost/large-scale alkaline electrolysers.

Electrolyser shipments - region (MW capacity)



Electrolyser shipments - type & origin (MW capacity)



Charts 20 – Sources: ODDO BHF Securities, BNEF

H2 production costs – NatGas dominates but 'green' H2 closes the gap

Hydrogen production costs vary depending on the implemented feedstock and production region, with natural gas (in the Middle East) remaining the low-cost production method for now (c. $ 1/kg). Costs of electrolysis as a means to convert renewable energy to hydrogen is currently ~2x higher than its fossil fuel alternatives. Hydrogen production costs are the lowest in the US ($ 1.0-1.5/kg) and highest in China ($ 1.8-2.4 /kg) as China has limited resources of natural gas (net importer). Thus, the Chinese focus is on coal gasification projects. In the summer of 2020, Air Liquide announced that it is to divest some activities located in Fujian, China, to Fujian Shenyuan New Materials; these include a coal gasification unit which is no longer aligned with the former's climate objectives. We expect 'green' hydrogen production to become a worthwhile alternative in less than a decade based on a forecast price degression of 44% to $ 1.52/kg ($ 0.82/kg incl. CO2 malus for SMR) until 2030. Adding the costs of carbon capture and storage (CCUS) technology (blue hydrogen), increases production costs by up to 50% (i.e., ~$ 0.5). However, this might become an attractive option and transition technology, assuming an average CO2 price of $ 70/ton by 2030 and corresponding additional costs of $ 0.7/kg for! hydrogen.

H2 production costs (via natural gas) in 2018 vs. ODDO green H2 price projection by 2030E ($/kg)

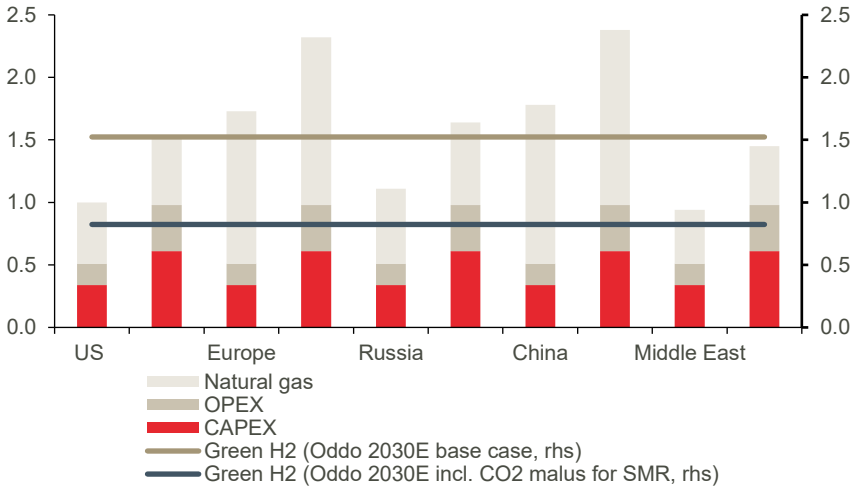


Chart 21 – Sources: ODDO BHF Securities, IEA

Value is generated along the whole H2 supply chain

According to our scenario calculations, total production costs of green hydrogen via electrolysis are around 1.5-2.0x the cost of SMR (conventional natural gas alternative) depending on geography. The key cost factors are feedstock prices of ~ $ 1.0/kg for SMR, and around US $ 2.4/kg renewable electricity costs for the operation of electrolysers. However, the current selling price at the pump fluctuates around levels of $10/kg. In conclusion, a large part of the hydrogen economy can be captured along the value chain, which encompasses industrial operations, compression, liquefaction, distribution and storage. Based on hydrogen figures from Air Liquide and Linde, the H2 production business of the two companies appears similar in size. Linde's stronger footprint in the US and its access to more favourable natural gas prices is reflected in calculated ASPs of ~$ 1,900 for Air Liquide and ~US $ 1,300 for Linde. Based on Air Liquide data, we calculate additional H2 infrastructure-related revenues of at least $ 671m for Air Liquide and $ 969m for Linde. Thus, both companies profit from surging hydrogen demand, irrespective of the production method (‘green’, ‘blue’, or ‘grey’), while Linde has greater exposure to the conventional SMR production method.

H2 activities of Air Liquide and Linde

Hydrogen activities	Air Liquide	Linde
Production H2 (m3)	14 000 000 000	20 500 000 000
Production H2 (t)	1 260 000	1 845 000
ASP H2 (US$/t)	1 857	1 192
H2 revenues (US$)	**2 340 000 000**	**2 200 000 000**
H2 services (e.g. liquefaction, distribution, US$/t)	1 462.5	994.5
H2 which is further processed (in % of total volume)	*35%*	*30%*
o/w H2 infrastructure revenues (US$)	**644 962 500**	**550 455 750**

Table 22 – Sources: ODDO BHF Securities, company data

Base case points to breakeven by 2028-30, CO2 pricing may accelerate shift

In our base-case scenario, we forecast green hydrogen production costs will decrease by 44% until 2030, fuelled by halving electrolyser costs and a sharp price degression of renewable energy costs of -43%, as a reflection of a combination of renewable energy prices and electrolyser efficiency. Incorporating flat CO2 prices of ~$70/t we see ‘green’ hydrogen to gain competitiveness in each of our scenarios.

Green hydrogen price degression scenarios by 2030

Component	Status-quo	Bear case	Base case	Bull case
OPEX				
Input costs - Renewable energy costs (US$/kWh)	0.046	0.032	0.030	0.027
Efficiency - kWh required to produce 1kg of H2	48.9	45.3	42.2	41.9
Power/electricity costs (US$/kg) of H2	**2.25**	**1.45**	**1.29**	**1.15**
CAPEX				
Electrolyser (50/50 PEM/Alkaline) capex (US$m/MW)	0.80	0.60	0.39	0.27
Capex over the useful life (US$/kg H2)	**0.48**	**0.36**	**0.24**	**0.16**
CAPEX + OPEX				
Production cost of 'green' hydrogen (US$/kg)	**2.73**	**1.81**	**1.52**	**1.31**
Grey' hydrogen via SMR (US$/kg)	1.73	1.70	1.66	1.63
Spread - 'Green'-electrolysis vs. SMR (US$/kg)	**1.00**	**0.12**	**-0.14**	**-0.31**
CO2 price (US$/t CO2)	70	70	85	100
CO2 avoidance by 'green' H2 vs. SMR (t)	10	10	10	10
CO2 cost saving per ton of 'green' H2 (US$)	**696**	**700**	**850**	**1000**
Spread - 'Green'-electrolysis vs. SMR (US$/kg) incl. CO2	**0.31**	**-0.58**	**-0.99**	**-1.31**
Liquefaction (US$/kg)	1.32	1.20	1.08	0.96
Transportation by tankers (US$/kg)	0.18	0.18	0.17	0.16
Other distribution/infrastructure costs (US$/kg)	3.50	3.15	2.84	2.55
Total (post distribution) costs (US$/kg LH2)	**7.73**	**6.34**	**5.61**	**4.98**

Table 23 – Sources: ODDO BHF Securities, BNEF, ITM Power, NEL ASA, Cummins, Linde, IRENA (LHS = liquefied hydrogen)

Technology determines cost degression potential

The table below ranks today's renewable hydrogen production technologies by their technology-readiness level (TRL). More developed technologies (TRL>7) such as alkaline/PEM electrolysers could profit from R&D (design & construction) as well as economies of scale (manufacturing processes) to improve performance and decreasing material and system costs. Less developed technologies (TRL 4-7), such as solid oxide electrolysis and biomass gasification with CCUS, could allow for efficiency enhancements and a broadening of the feedstock base. The least developed technologies (TRL<4), such as hydrogen produced via novel chemical/biological processes, will require R&D support and knowledge-sharing to bring them forward as they are a long way off entering the commercial stage.

Summary of main renewable hydrogen production technologies

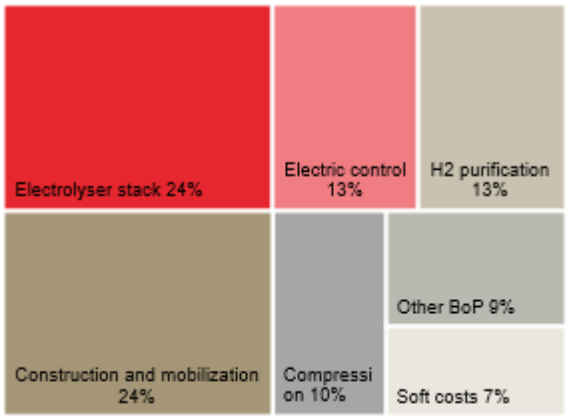
H2 production technologies	TRL (technology readiness level)	Feedstock	
Alkaline electrolysis	9	H_2O +	electricity
PEM electrolysis	7-8	H_2O +	electricity
Solide oxide electrolysis	3-5	H_2O +	electricity + heat
Biomass gasification	4	Biomass + heat	
Biological	1-3	Biomass + microbes (+ light)	
Photoelectrochemical	1-3	H_2O +	light
Thermochemical	1-3	H_2O +	heat

*Table 24 – Sources: IEA, H.Thomas, F.Armstrong, N.Brandon and B.David - The Royal Society (2017), Commerzbank Research, *beige coloured = technically available at industrial scale [reference asterisk missing in table]*

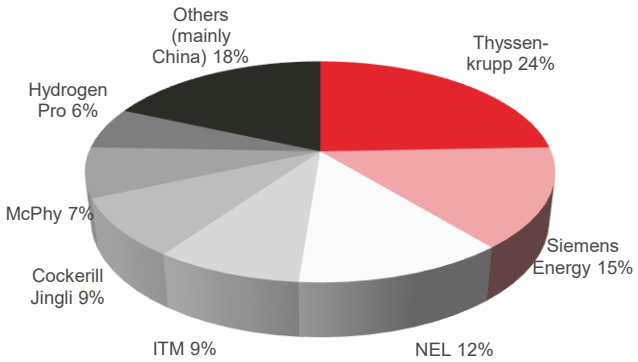
Thyssenkrupp #1; ~24% electrolyser market share

Based on data collected by BNEF, we expect Thyssenkrupp to have a #1 market position in the electrolyser market with ~1GW (alkaline), right behind Siemens energy with c. 600MW of PEM electrolyser capacity. With respect to electrolysis engineering, we assume Thyssenkrupp (Uhde Chlorine) to have roughly half the global market, where it competes with Japan's Asahi Kasei (25%), China's Bluestar Beijing Chemical Machinery (19%) and Britain's chemicals group Ineos (6%).
We expect the largest cost degression potential within the electrolyser to come from the stack (24% of total costs, PEM even 40%) and via standardised design & construction (24%) of the respective modules.

Capex split – 20MW alkaline electrolyser



Split of electrolyser capacity – TK leads with ~1GW



Charts 25 – Sources: ODDO BHF Securities, BNEF, company data

Price development of batteries should be a role model for electrolysers

Based on our cost calculation above, we have reconciled the single components of the forecast 51% electrolyser price degression between 2020 and 2030E. We expect the magnitude and pace of price degression of batteries to serve as a role model for electrolysers.

- The design and modular construction allow for optimisation and economies of scale similar to Teslas battery design improvements (from 1865 to 2170 to 4680 - first two-digits: diameter, last two-digits: length) and each development stage lifted (might lift) the energy density by 50%. We expect improvements in the design & construction and corresponding economies of scale to allow electrolyser prices drop by 36% over the next decade.

- Battery manufacturers reduced the use of cobalt within the cathode in favour of nickel via new compositions (from NCV 333 to 811 to 307). We expect a high share of alkaline electrolysers in combination with a reduced platinum content (or even substitution by Molybdänsulfid, etc.) in PEM to ensure cost control and show price degression potential of 9% by 2030.

- Bear in mind that our learning rate assumption of 19% is still conservative compared to the actual figures for the batteries (39%) and solar (35%) industry, and are likely to provide additional downside potential in respect to cost aspects, in our view.

Electrolyser cost degression components by 2030

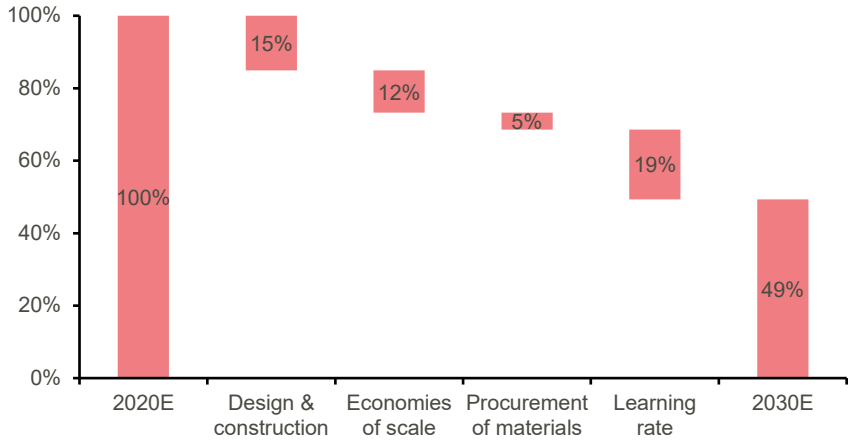


Chart 26 – Sources: ODDO BHF Securities, company data, IRENA, IEA

H2 DEEP DIVE – MARKET POTENTIAL

In our view, especially Europe is pushing the 'green' hydrogen agenda forward and emphasises the huge potential to decarbonise industrial sectors such as the steel industry. A prominent example for linked offshore wind and hydrogen production is H2North (initiated by Shell). Based on forecasts of the Hydrogen Council, energy transition bears the potential to trigger rising hydrogen demand from 10EJ (Exajoule) in 2020E to 78 EJ by 2050E, equivalent to 550m tons of H2 and 18% of global energy consumption. This compares to our in depth H2 demand projection of 54m tons in the EU by 2050, fueled by demand for industrial and transportation purposes. After comparing our modelled scenarios, we conclude that just the transformation alone is a real game-changer, implying ~€ 600bn revenues p.a. by 2050 and an additional 426mt H2 demand. However, note that the 'transforming' scenario would still imply that >70% of global energy demand comes from energy sources other than hydrogen.

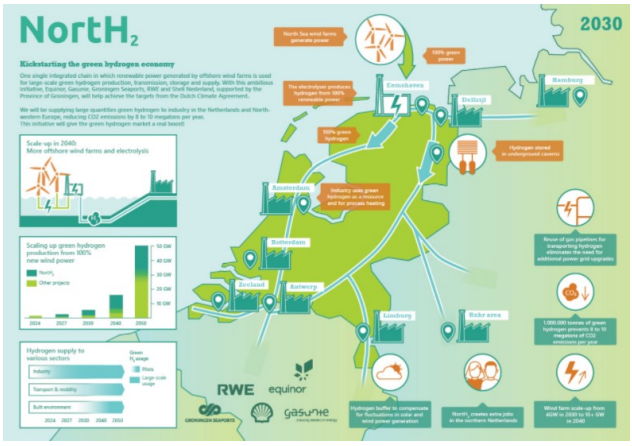
First large-scale projects already in ramp-up

Siemens Energy has recognised the 'green' hydrogen trend and has the capability to offer the entire value chain of 'green' hydrogen production. This ranges from wind energy generation (Siemens Gamesa), through to power-to-gas hydrogen production (Silyzer 300) and ultimately to industrial applications by serving energy, transportation and industrial end-markets. A prominent example for linked offshore wind and hydrogen production is H2North (initiated by Shell). This project aims to build 3-4GW wind capacity, targeting production of 800kt of 'green' hydrogen by 2040.

Siemens Energy and Thyssenkrupp have already initiated a number of prestigious projects, such as the large-scale coupled hydrogen and solar-PV complex in co-operation with the Dubai Electricity and Water Authority (DEWA) and the world's largest ($ 5bn, 650t per day) green H2 project initiated as a cooperation between Thyssenkrupp, Air Products, ACWA Power and NEOM. The facility aims to demonstrate the efficient linkage of hydrogen production and renewable energy generation, especially as this creates buffer capacities and allows conversion of chemical into physical energy when needed (to re-electrify fuel cell powered cars, etc.). Siemens has deployed its SILYZER 200 (PEM technology), including the SIMATIC PCS7 control system and SINAMICS DCM converters. Each unit requires 1.25 MWe of electric power to generate 20 kg/hr of H2, whereas the next generation SILYZER300 already achieves a production rate of 340 kg/hr of H2 per full module array. As a rule of thumb, a typical fuel cell electric vehicle requires c.1 kg of H2 per 100 km of range, equivalent to 39.4KWh. The facility was planned to provide hydrogen for mobility purposes at the Expo 2020 in Dubai.

Siemens - SILYZER 300 - PEM module array

NorthH2 – Backbone of the EU hydrogen economy

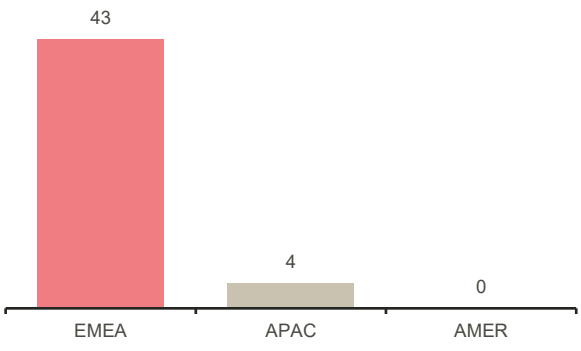


Charts 27 – Source: Siemens Energy

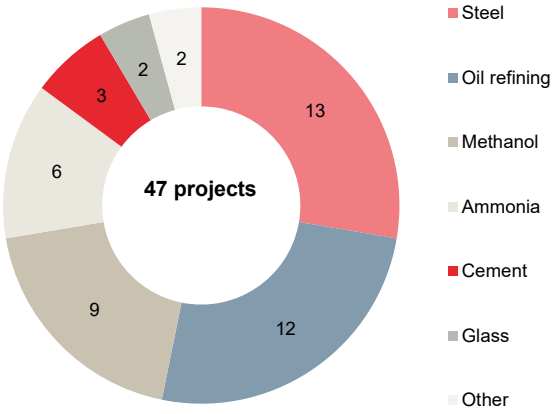
‘Green’ H2 pipeline skewed towards EMEA & steel

Europe is pushing the 'green' hydrogen agenda forward and emphasises the huge potential to decarbonise industrial sectors such as the steel industry. According to data collected by BNEF, 43 industrial ‘green’ hydrogen projects have already been announced and completed in EMEA, followed by APAC (4), while the Americas are lagging behind (none). In addition, the steel industry has recognised the potential of producing green steel in the EAF-DRI route and has alreadyaccomplished 13 projects.

Industrial ‘green’ H2 projects announced and completed by region



Industrial green H2 projects announced and completed by sector



Charts 28 – Sources: ODDO BHF Securities, BNEF

Hydrogen demand by 2050 in a +2°C scenario

According to the global Hydrogen Council, this market is set to grow at a 9.0% CAGR (2030-50E), as it plays an essential role in the targeted energy transition to combat climate change. Capex investments in renewable energy (upstream) and electrolysers (downstream) need to be executed now to lay the groundwork for elevated demand by mid-2020. The global community has committed to keeping a global temperature rise this century to below +2°C to address the structural challenge of climate change. Hydrogen will play a major role as a key element of the ongoing energy transition, and could trigger rising hydrogen demand from 10EJ (Exajoule) in 2020E to 78 EJ by 2050E, equivalent to 18% of global energy consumption. This 78EJ would translate into 546mt of hydrogen to be produced, with 'green' hydrogen gaining relative importance. In 2019, 86% of hydrogen was produced from fossil fuel sources (natural gas, coal), 11% as a by-product (chloralkali electrolysis, etc.) and just 3% from renewable sources via water electrolysis.

Potential development of hydrogen demand in a +2°C scenario (in EJ)

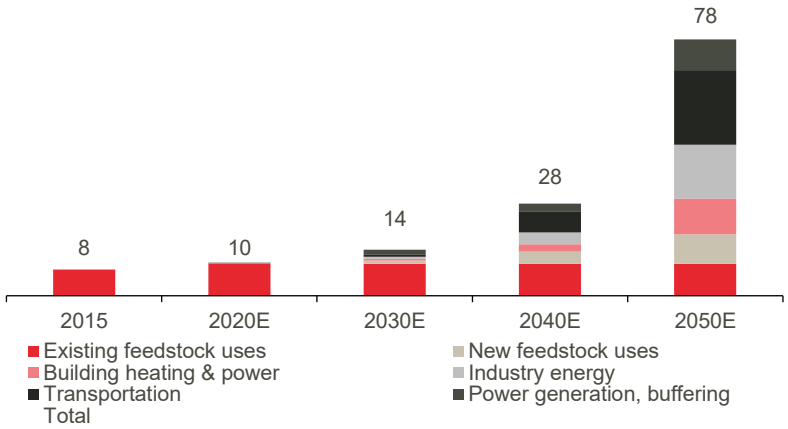


Chart 29 – Sources: ODDO BHF Securities, IEA, Hydrogen Council

H2 demand up >x3 in the 2050 blue-sky scenario

The Hydrogen Council has published a rather bullish hydrogen demand projection of 550mt for the year 2050. This is equivalent to an electrolysis capacity of ~830GW, if we assume that 30% of total demand is met by renewable sources. In a best-case wind scenario (100% penetration) this would imply 2,000GW wind capacity to be installed, however we would consider a 30% share to be more reasonable (i.e., c.700GW). These assumptions - together with IRENA's planned and transforming scenarios - are the foundation of our bullish hydrogen demand/wind installation scenarios. Apart from today's largest hydrogen end-markets, we expect the transportation and additional industrial end-markets, like steel production, to move towards hydrogen as a substitute for fossil-fuel based conventional energy sources.

Blue-sky electrolyser/wind installation scenario based on Hydrogen Council projections

Description	Amount	Calculation
Total demand by 2050 (EJ)	78	(A)
Hydrogen (t) per (EJ)	7 000 000	(B)
Hydrogen (t) equivalent to 78 (EJ)	546 000 000	(AxB)=(C)
thereof 'green' hydrogen	30%	(D)
'Green' hydrogen (t)	**163 800 000**	**(CxD)=(E)**
Exchange ratio - t/NM³	0.00009	(F)
Hydrogen Nm³	1 820 000 000 000	(E/F)=(G)
Hydrogen Nm³/h	207 762 557	(G/(24*365))=(H)
Power-to-Hydrogen (NM³/h/MW)	250	(I)
Required H2 electrolysis capacity (GW)	**831**	**(H/I/1,000)=(J)**
Level of efficiency of electrolysis (%)	83%	(K)
Required electricity demand (GW)	1 001	(J/K)=(L)
Wind-yield (%)	50%	(M)
Wind power capacity to be installed (GW)	**2 003**	**(L/M)=(N)**
Gas-yield (%)	98%	(O)
Gas power capacity to be installed (GW)	**1 022**	**(L/O)=(P)**

Table 30 – Sources: ODDO BHF Securities, IEA, Hydrogen Council, Hydrogen Europe

EU H2 demand could reach a level of 54mt in 2050

We have conducted a thorough analysis to gain a broader understanding of hydrogen demand development heading into 2030/2050. We deployed vehicle registration data, EU hydrogen guidelines, proprietary industry knowledge and energy conversion factors - including the Fischer-Tropsch reaction (synfuels) - to derive the best possible result. In addition, we have baked in a gradual electrolyser efficiency gain of 32% (production rate of H2 (t) per installed electrolyser capacity (GW)) between 2030 and 2050. We expect a wind penetration rate of one-third. These assumptions are also the underlying scenario of our DCF calculations later on. The most intuitive step is that the existing hydrogen demand for refining and ammonia applications is shifted from 'grey' to 'green'. A 100% (CBK 30%) penetration could be satisfied with the targeted 40GW electrolyser capacity in the EU by 2030. In addition, we expect the production of 'green' steel in the EAF-DRI route to also become a worthwhile and realistic opportunity and to potentially contribute up to 400kt of 'green' H2 demand by 2030, assuming a 25% penetration rate. In transportation markets we see a gradually rising fuel-cell penetration in trucks/LCVs/buses, and also cars to levels of 56% and 30%, respectively. In the aviation and maritime markets, synthetic fuels have the best chance to achieve a short-term decarbonisation, in our view, whereas fuel-cell deployment might remain a niche market by 2050.

European H2 demand breakdown by 2030/2050E

Sector	Penetration rate	Hydrogen (TWh)	Electrolysis capacity (GW)	Hydrogen (t)	Wind installations (GW)
Refining		170	19.7	2 942 690	15.9
Ammonia		142	16.4	2 456 555	13.3
Methanol		30	3.4	514 163	2.8
Other chemicals		3	0.4	57 129	0.3
Processing		14	1.7	247 560	1.3
H2 demand (existing feedstock)		**359**	**41.6**	**6 218 096**	**33.6**
Existing feedstock demand (2030)	30%	108	12.5	1 865 429	10.1
Power generation	1%	28	3.2	484 977	2.6
Transportation (mix LCV, trucks)	12%	114	13.1	1 966 406	10.6
Transportation (passenger cars)	4%	76	8.8	1 310 400	7.1
Heating and power for buildings	0%	29	3.4	504 725	2.7
Industry energy	0%	0	0.0	0	0.0
New industry feedstock (1st step - green DRI steel)	25%	23	2.7	397 333	2.1
European H2 demand (2030E)		**377**	**43.6**	**6 529 270**	**35.3**
EU supply (phase II - 2030)		**346**	**40.0**	**5 986 000**	**32.3**
Supply gap Europe (phase II)		-31	-3.6	-543 270	-2.9
Investments by 2030 (€bn)			**20.7**		**29.4**
Existing feedstock demand (2050)	85%	276	31.9	6 297 206	25.8
Power generation	12%	371	42.9	8 460 432	34.7
Transportation (road transport, aviation, maritime)	56%	402	46.5	9 171 090	37.6
Transportation (passenger cars)	30%	431	49.9	9 828 000	40.3
Heating and power for buildings	7%	387	44.8	8 832 695	36.2
Industry energy	6%	237	27.4	5 406 563	22.2
New industry feedstock (2nd step - plus synthetic chemicals)	6%	257	29.7	5 862 813	24.0
European H2 demand (2050E)		**2 361**	**273.3**	**53 858 797**	**220.8**

Table 31 – Sources: ODDO BHF Securities, European Hydrogen Council, IRENA, LMC, ACEA, NEL ASA, ITM Power, European Commission, European Steel Association, Hydrogen Roadmap Europe

H2 for existing feedstock demand (6.3mt | ~12% of total)

Existing hydrogen demand could be substituted by targeted 40GW electrolysis capacity to be installed in the EU by 2030. This should be the most convenient and intuitive step and is evident in current cluster formations (e.g., Westküste 100), where hydrogen electrolysers are built decentralised and linked with existing hydrogen consumers such as refineries and ammonia production units. In a first step by 2030, we expect a penetration rate of 30% (1.9mt H2), increasing to 85% in 2050 and corresponds with hydrogen demand of 6.3mt.

40GW EU electrolyser target allows 'grey' to be substituted by 'green' by 2030

Sector	Penetration rate	Hydrogen (TWh)	Electrolysis capacity (GW)	Hydrogen (t)	Wind installations (GW)
Refining		170	19.7	2 942 690	15.9
Ammonia		142	16.4	2 456 555	13.3
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Existing feedstock demand (2050)	**85%**	**276**	**31.9**	**6 297 206**	**25.8**

Table 32 – Sources: ODDO BHF Securities, Hydrogen Roadmap Europe, IRENA

Hydrogen demand from Transport (18.8mt, ~35% of total)

We have reconciled the hydrogen demand from Transport and split it into three parts. We expect road transportation H2 demand of 13.2mt H2 p.a., split into 3.4mt for trucks/LCV's, whereas 9.8mt is expected to be consumed by cars in 2050E. We forecast H2 demand for aviation and maritime end-markets to amount to 3.5mt and 2.3mt, respectively.

Road transportation (13.2mt)

For the truck/bus market we derive a registration numbers-weighted penetration rate of 39%, with heavy trucks at the top (70%) and LCVs at the bottom (35%). We assume an average life cycle of 12 years and H2 consumption in a range of 8.1-12.6 g/km H2, depending on the vehicle size. Based on these assumptions, we expect 3.8m fuel-cell equipped trucks and 14.5m LCVss (buses: 0.3m) to be on the street in 2050 which consume a total of 3.4mt H2 annually. The model parameters to approximate H2 demand from cars are as follows: 1) EU registered cars: 280m, 2) average range: 13,000km p.a., 3) average consumption: 0.9 g/km 4) penetration rate: 40%.

New registrations ramp-up of fuel cell powered trucks/buses 2038-2050e (m units)

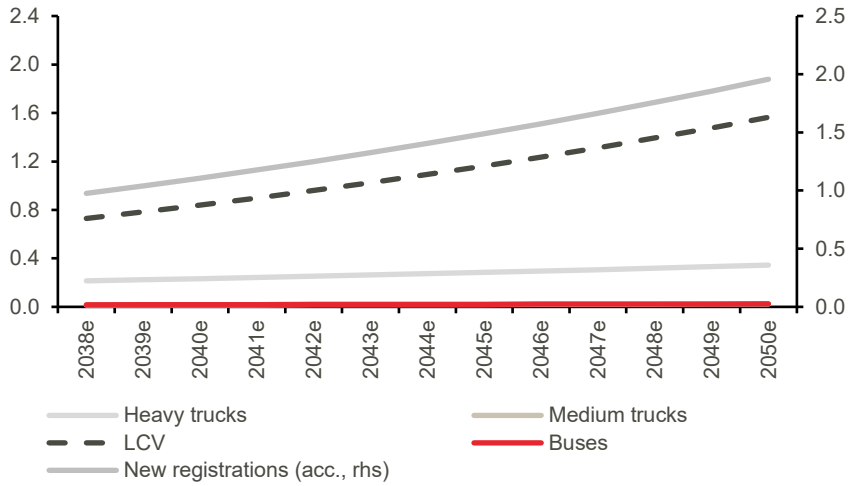
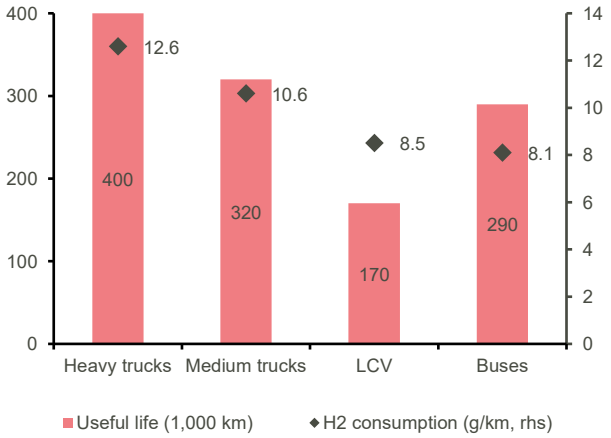
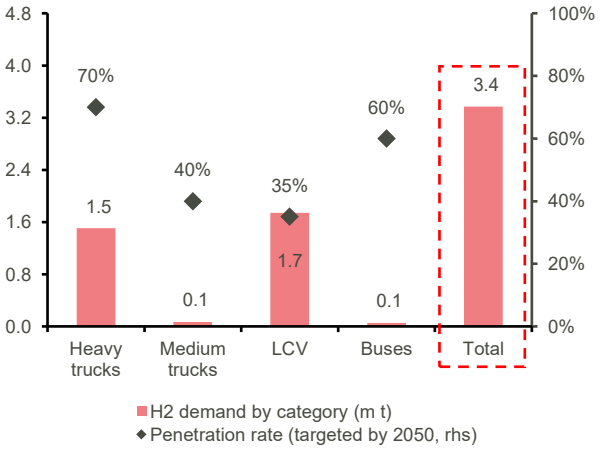


Chart 33 – Sources: ODDO BHF Securities, LMC

Model parameters – H2 consumption (g/km)/ useful life (km)



Truck market (incl. LCV) may consume 3.4m tons of H2 by 2050



Charts 34 – Sources: ODDO BHF Securities, LMC, FCH JU study, Roland Berger

Aviation (3.5mt) & Maritime (2.3mt)

We approximated the hydrogen demand from the aviation market by utilizing the Fischer-Tropsch reaction for synfuels. We do not rate fuel cell deployment in aircraft as a practical solution before 2050 (niche market). However, we consider synthetic fuels as a combination of 'green' hydrogen and existing CO2 (waste product in many industrial processes) could pave the way for CO2-neutral air transportation in the years to come. The total respective demand amounts to 3.5mt annually, assuming a 70% penetration rate. Utilizing the energy equivalent (btu/lb) of diesel and hydrogen as well as a fuel-cell efficiency of 80% and a 60% penetration rate, we arrive at demand from the maritime market of 2.3mt.

New industry feedstock (5.9mt | ~11% of total)

We forecast additional hydrogen demand from new feedstock applications, such as green steel and synthetic chemicals, of 5.9mt by 2050, of which we expect 1.5mt (95% penetration rate) to be used as a substitute for fossil fuels in DRI-EAF steel production. From a timing perspective, we believe green steel via the DRI-EAF route might already have become a reality by 2025, whereas the broad-based production and deployment of synthetic chemicals is unlikely before 2030.

Reliance on coal is still the norm but has huge substitution potential

The steel industry is a significant emitter of CO2, accounting for 7-9% of global CO2 emissions, according to the World Steel Association. Energy intensity of steel production has not shown any major efficiency enhancements since 2000, abandoning the hope of organic improvement but rather transferring the hope of better ESG scores to 'green' hydrogen incorporation. In 2017, the energy intensity of crude steel fell by 2.2% versus a CAGR 2010-16 of 0.7%, however this was primarily attributable to rising scrap-based production and some minor energy efficiency improvements, rather than from a transformative change towards low-carbon steel production methods. The reliance on coal is still omnipresent in the steel sector, accounting for 75% of energy demand. According to the IEA, the energy intensity of crude steel needs to decline by 1% p.a. in 2019-2030 to be compliant with the Sustainable Development Scenario.

Energy demand (EJ), energy intensity (GJ/t) in iron and steel production

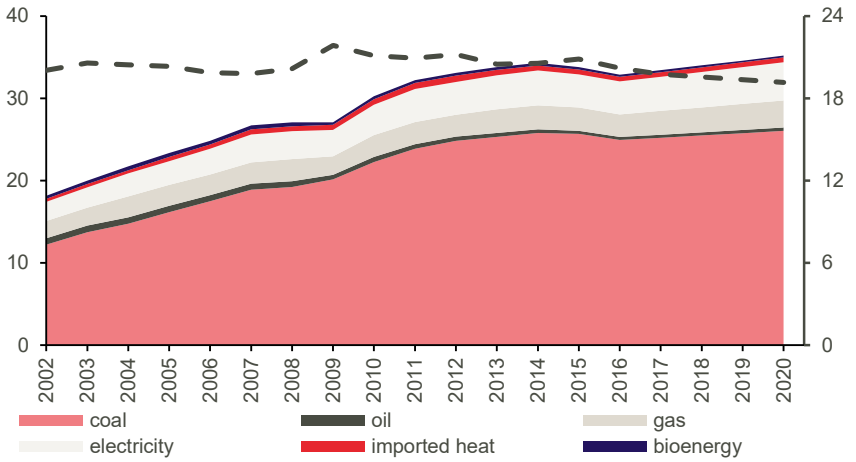


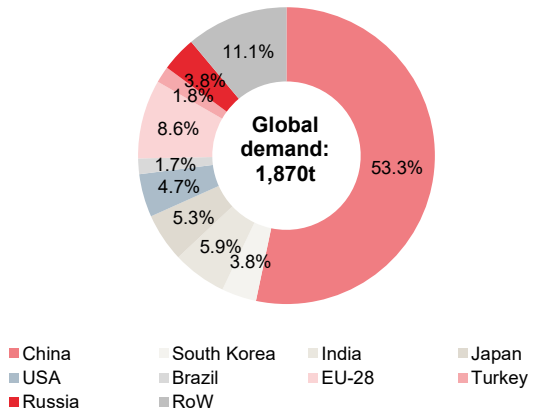
Chart 35 – Sources: ODDO BHF Securities, IEA

DRI-EAF route to become ‘green’ first!

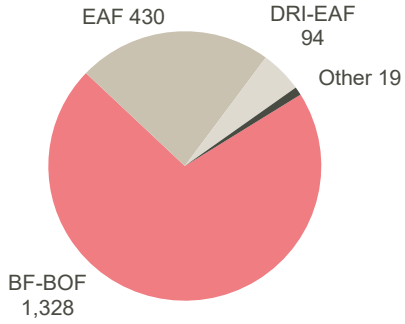
The vision of 'green' steel is expected to become a reality soon with the DRI-EAF steel production route having the best technical preconditions in a first stage. However, this method just accounts for 5% of global steel production. World crude steel production increased by 2.6% (CAGR 2012-19) to 1,870mt in 2019. China is by far the largest producer, and with 53.3% produces more than half of the global products. The EU lags far behind as the #2 production region with 8.6%.

Basic oxygen furnace (BOF) is the dominant steel production method in the steel industry with 71% share of total global crude steel production. In this process, direct CO2 emissions amount to c.1.6t of CO2/t of crude steel produced, hence the steel industry accounts for 8% of global carbon emissions. Nevertheless, it has been the most scalable and most cost-effective steel production route in most regions, most of the time, and can be used for the production of long and flat steel products. On average, 20-25% scrap is used in this process. The other relevant steel production method is the Electric Arc Furnace (EAF), with a 23% share of global crude steel production, mostly used for long products. In the EAF-steelmaking process, >90% of steel input is currently scrap (<10% DRI). We believe the share of direct-reduced iron can be gradually increased in existing EAFs, and more importantly believe that greenfield H2-DRI-EAF plants (e.g. in regions with close proximity to iron ore and/or cheap hydrogen supply) can crowd out existing BOFs and EAFs, if sufficient political incentives are set to compensate for the higher cost of H2-DRI-EAF steelmaking. According to IEA estimates, H2-DRI-EAF steelmaking costs are currently 40-100% higher than in a BOF.

Steel production by country (2020)



Methods of steel production (2020, million tons)



Charts 36 – Sources: ODDO BHF Securities, IEA, World Steel Association

WHAT COULD GO WRONG – THREAT OR MYTH?

The blue-sky scenario of hydrogen demand rising by more than 3x sounds impressive, but what about the potential bottlenecks which could undermine all the ambitions and never-ending growth prospects? In an initial step, by 2030 the existing natural gas network would be utilized for hydrogen distribution across Europe. However, the second stage by 2050 might either require an overhaul of the existing grid or the deployment of non-intuitive distribution methods such as the ammonia route. We expect the industry to move from industrial clusters to an emerging multiple-pathway hydrogen infrastructure.

Transport issues, if demand multiplies? No!

According to the general communication line of technicians and politicians, the existing natural gas grid in Europe might tolerate a 10% hydrogen blending quota. Based on data provided by the European Network of Transmission System Operators for Gas (ENTSOG), we derive potential annual natural gas capacity of 16,180TWh (10% = 1,618TWh). This compares to our 2030/2050 European hydrogen demand forecasts of 377TWh / 2,361TWh (49% above), respectively. Assuming that production and consumption will primarily take place in clusters (e.g., Westküste 100), this would reduce the hydrogen TWh amount to be fed into the gas grid to c.1,700TWh by 2050. This is once again in line with current capacity restrictions.

The European natural gas network 2019

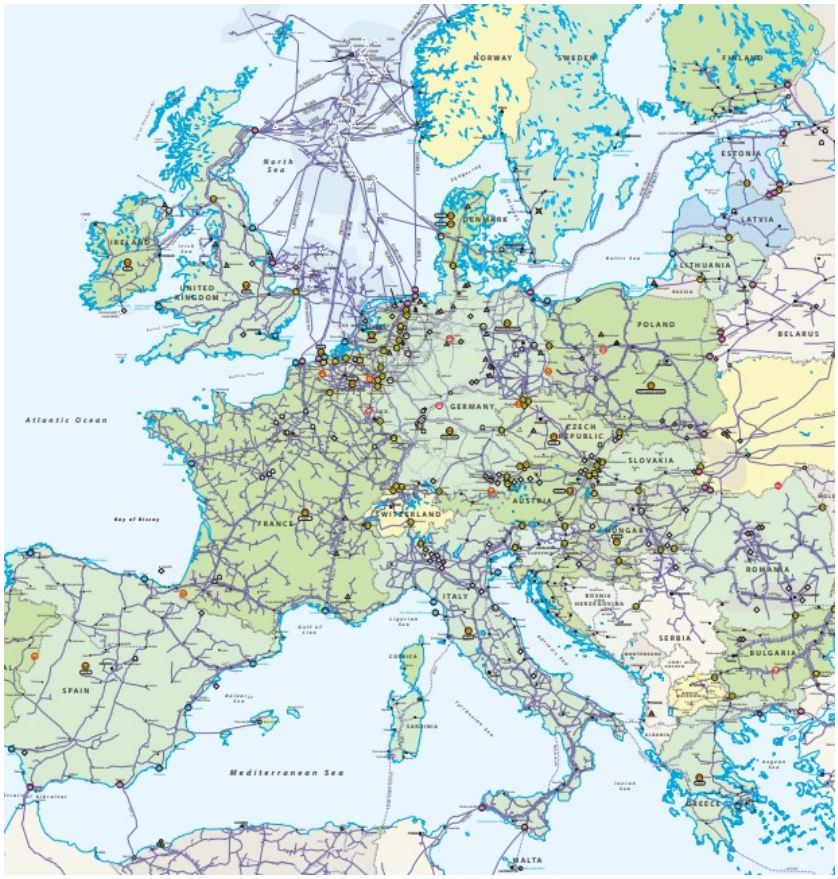


Chart 37 – Source: entsog

~€ 45bn investment to overhaul existing gas grid

In the next step, the upcoming large-scale hydrogen deployment will require a well-developed hydrogen transport infrastructure to properly connect hydrogen consumers (widespread) and producers (primarily coastal OF wind). According to a study released by ten European transmission system operators (TSOs), the establishment of a pan-European hydrogen pipeline network might require investments of € 27-€64bn (75% retrofitted, 25% new construction) and could stretch into all directions with a length of almost 23,000 km by 2040. The highest network density is expected to be found in the key areas of renewable energy production (i.e., North Sea/ OF wind and Spain/PV). The dotted lines describe possible additional routes to connect Europe with adjacent countries/continents to import either hydrogen or renewable energy.

Mature European hydrogen backbone by 2040

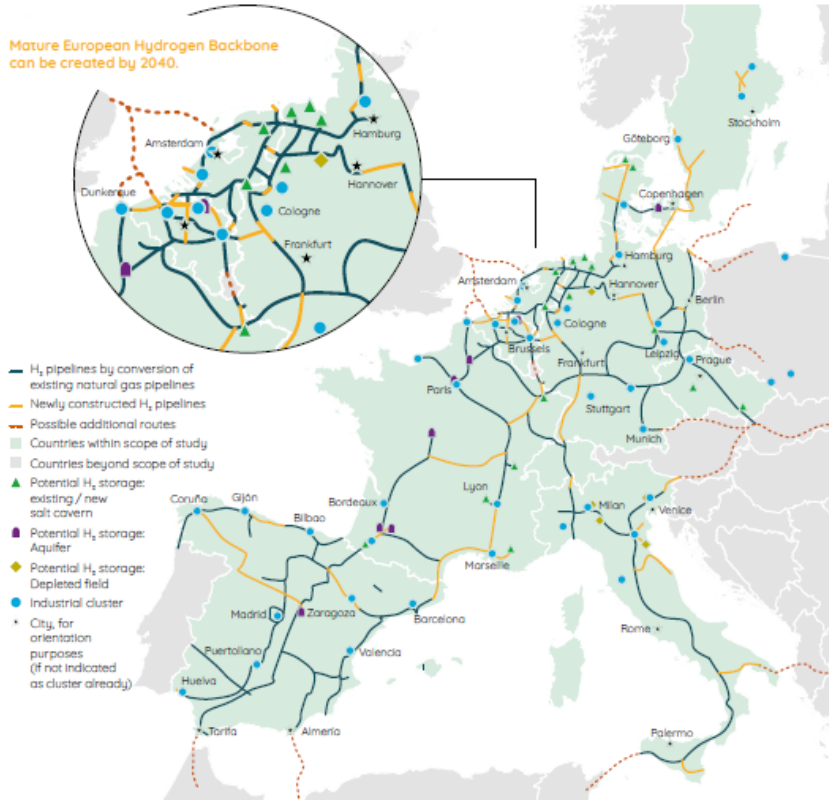


Chart 38 – Source: European hydrogen backbone study as of July 2020

Transportation comprises <5% of total H2 costs

The levelised cost of hydrogen (LCOH) transportation by primarily utilizing the existing gas grid (75% retrofitted) is estimated to be in a range of € 0.09-0.17/kg per 1,000 km. This allows the cost-efficient transportation over long distances within Europe and is still superior compared to other methods like tankers (c. € 0.14/kg), which would additionally require an energy intensive liquefaction beforehand.

Transportation costs of hydrogen via pipeline infrastructure/tankers

Levelised cost (€/kg/1000km)	Bull case	Base case	Bear case
100% new infrastructure	0.16	0.20	0.23
100% retrofitted network	0.07	0.11	0.15
Working assumption (75% retrofitted)	**0.09**	**0.13**	**0.17**
Transportation by tankers (excl. liquefaction)	0.13	0.14	0.15

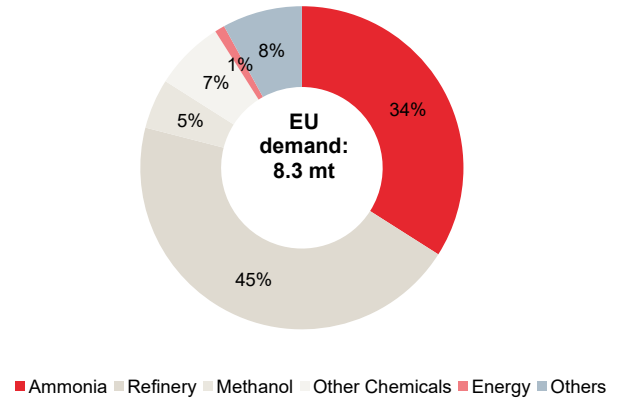
Table 39 – Sources: ODDO BHF Securities, European hydrogen backbone study, IDEALHY

2nd option - tap the existing ammonia network

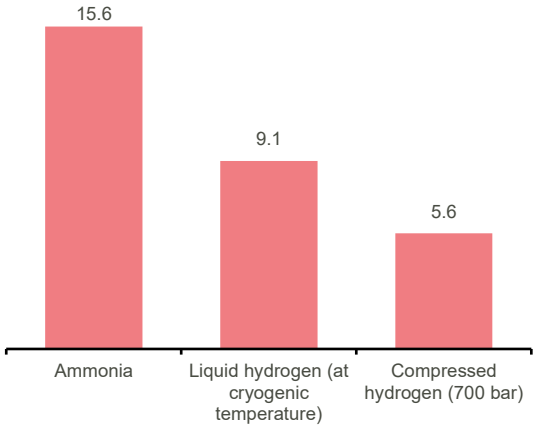
Energy distribution remains one of the key challenges of the hydrogen economy, especially as the boiling point of hydrogen (from gas to liquid) stands at -253 °C (at 1 bar). The transportation route via ammonia (chemical molecule encompassing hydrogen and nitrogen and precursor of fertilizers) could provide a worthwhile alternative. 1) an existing distribution network can be relied upon; and 2) ammonia has advantageous storage and transportation properties (boiling point: -33 °C, energy density: 15.6 MJ/L vs. 9.1 MJ/L for H2). These promising storage properties of ammonia over hydrogen are reflected in a lower cost per unit of stored energy. According to the scientific study 'Ammonia for Power' (Progress in Energy and Combustion Science), storage of ammonia over a half year would cost $ 0.54/kg/H2 compared to $ 14.95/kg/H_2 of pure hydrogen storage.

Air Products, ACWA Power and NEOM have already signed a $ 5bn agreement to build a large-scale green H2-based ammonia production facility at NEOM. The facility will have capacity of 1.2mt of ammonia p.a. which is equivalent to 43% of current EU ammonia demand. However, the trick lies in dissociating/reconverting the ammonia back into green hydrogen at the point of arrival.

EU H2 demand - ammonia already accounts for 1/3



Energy density (MJ/L) – ammonia with >1.7x content



Charts 40 – Sources: ODDO BHF Securities, Hydrogen Europe, Yara, Ammonia energy association

Water scarcity (low LCOH=dry solar-rich)? No!

Regions with an abundant source of water

The assumption that the water electrolysis process consumes vast amounts of water is just a myth. Our forecast EU hydrogen demand of 53.9mt in 2050 (should it materialise), would just need 0.03% of the EU's freshwater resources.

Technology and developments

Electrolysers use highly purified water, but this does not imply additional strain on freshwater systems. The water deployed in the large-scale water electrolysis process can be either freshwater, waste water (considered in Portugal's hydrogen strategy) or seawater, once it has been demineralised (via reverse osmosis plants). Further research and feasibility studies are ongoing to check whether adjacent desalination plants and modes of low-grade and saline surface water electrolysis are cost-efficient.

Water scarce regions

At first glance, the production of 'green' H2 in water-scarce regions like North Africa, seems to make a lot of sense from an LCOH perspective, but appears counterintuitive from a freshwater demand perspective. However, the supposed dilemma can be cost-efficiently resolved by implementing the aforementioned desalination plants to minimise uncontrolled water deprivation. Water desalination would increase 'green' H2 costs by €0.007/kg (i.e., 0.8 €/m³ water).

2050 EU hydrogen demand forecast of 53.9mt…would consume 0.03% of EU freshwater resources

Small scale	Large scale – Forcasted EU H2 demand in 2050
1kg of H2	Forecasted 53.9mt of H2 demand in the EU in 2050
~50 kWh electricity + ~ 9l of demineralised water	479m tons of demineralised water
1 kg of H2 is sufficient for…	% of EU (2017) freshwater resources needed for electrolysis of 53.9mt of H2 by 2050…
1) 15 kg of sponge iron for clean steel 2) 5.65 kg of ammonia based fertilizer 3) travel 100 km with FCEV 4) refine enough diesel for 40 km	0.0259%

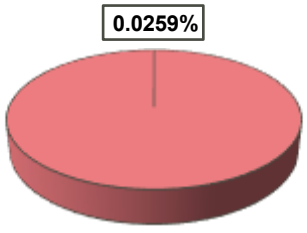


Chart 41 – Sources: ODDO BHF Securities, Hydrogen Europe

Insufficient electrolyser capacity? No!

At first glance, current electrolyser capacity falls short of projected demand in the EU by 2030. However, looking at 2021's expected new-build electrolyser installations of 334MW (CBK base case) the picture clearly changes based on an implied utilization rate of 8%. We expect new market entrants and capacity increases once the market picks up from mid-2020 onwards. We can imagine that rapid market growth might attract further Chinese manufacturers in particular to step in. As we have learned from SFC Energy, the stack construction can be perceived as an assembly business, thus allowing capacity to be ramped up quickly. Existing market players are scaling their systems by a modular design similar to wind turbine manufacturers. The only bottleneck remains manpower in terms of engineering and assembling capacity.

EU 2030 H2 demand (GW, rhs) exceeds current electrolyser capacity

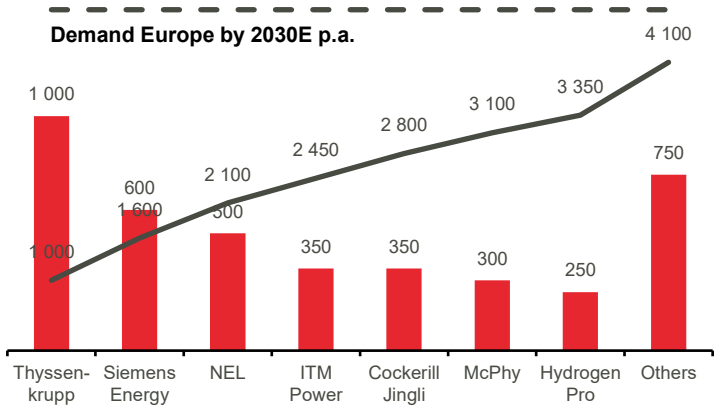


Chart 42 – Sources: ODDO BHF Securities, company data, BNEF

Renewables – Chicken-and-egg problem?

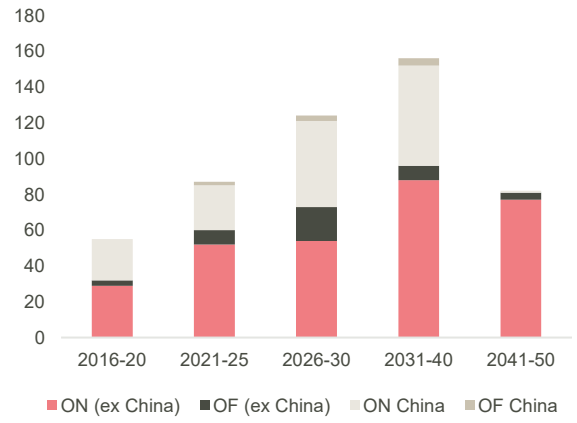
Based on projections of Bloomberg New Energy Finance, renewable energies (RE) are expected to command ~70% of total electricity generation by 2050, it is scarcely surprising that the expected ~12TW expansion in generation capacity is almost exclusively attributable to solar and wind. Following annual new installations of ~50-60GW p.a. for the wind sector between 2015 and 2019 (split onshore (ON)/ offshore (OF) ~90/10), when solar PV jumped from <60GW to ~120GW accompanied by huge capacity expansions to come on-stream by 2022. In 2020 we saw an acceleration of wind installations towards almost 70GW, which is expected to at least double through this decade (ON: 2x / OF: 4-5x) narrowing the gap to solar. Beyond 2030, we expect growth in wind capacities to be primarily dedicated to (floating)-offshore deployments, thanks to 'green' H2. Assuming the scenario handed out by the Hydrogen Council, this could trigger an additional ~25GW p.a. to reach the required level of ~700GW by 2050 and based on the assumption that wind would account for one third of the required capacity increase with the remainder related to solar. According to BNEF, achieving net-zero carbon emissions by 2050 will require as much as $173 trillion in investments in the energy transition.

Based on a continuing expected decline in PV/wind LCOE´s to levels of $30/MWh by 2030 and corresponding projected capacity installations to an installed base of >4,000GW for wind alone by 2050, we currently see limited risk that lagging installations harm 'green' H2 evolvement. However, pace of installations might be highly dependent on government commitments to ensure investment certainty for coupled electrolyser and renewable energy projects.

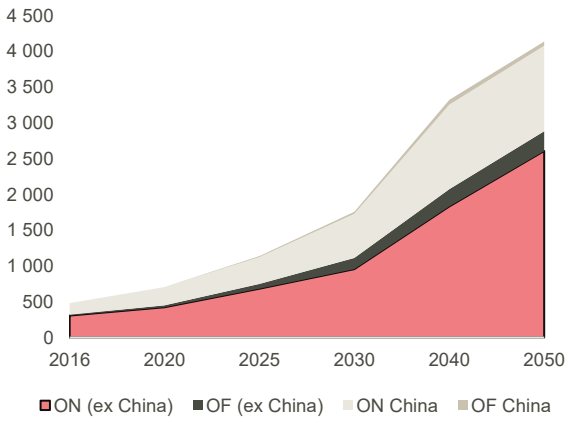
BNEF base case outlook for wind seems encouraging

BNEF predicts that global wind installations are going to increase rapidly from an annual rate of 50-60GW in 2016-20 to almost 90GW in in the period 2021-25 followed by an average of >120GW p.a. between 2026-2030. Peak levels of >150GW p.a. are expected to be reached in 2030-40. China, at the moment a comparatively modest contributor to accelerating installations, is forecasted to account for almost 40% of all new wind installations in the decades 2021-40. In the 2041-50 decade, China's share is forecasted to drop to about a quarter of total capacity additions in light of a lack of offshore projects and also onshore installation activity climbing down towards zero in BNEF's forecast scenario, which should however be seen in context with renewables accounting for 63% of total electricity generation by 2040 (wind / PV / hydro: 33% / 16% / 14%).

Average wind installations p.a. by period (GW)



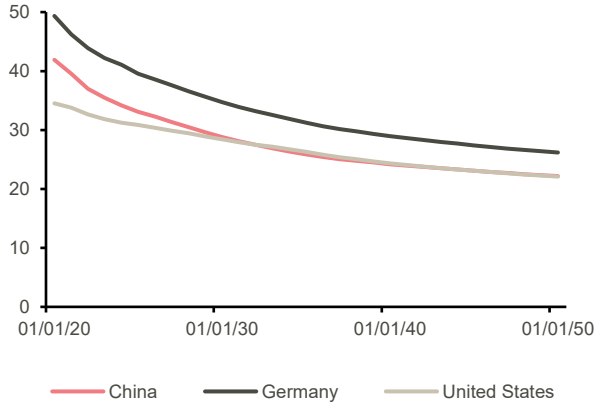
Cumulative wind capacity (GW)



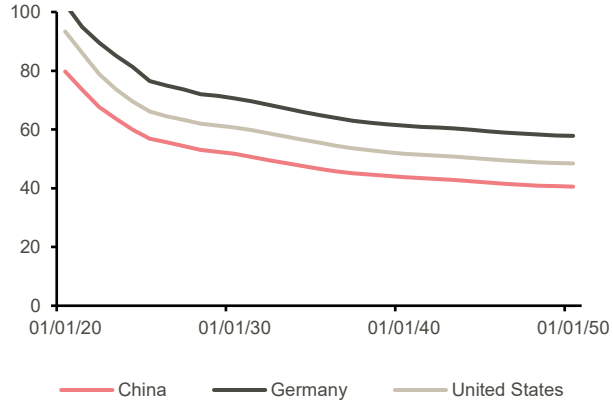
Charts 43 - Sources: ODDO Research, BNEF

The previously discussed strong volume growth and related scalability effects are expected to contribute to declining LCOE (levelised cost of electricity = fully loaded average generation costs of a wind/PV installation per megawatt hour over the entire life-time). For both, ON and OF wind BNEF guides for an average decline to the tune of 2% p.a. thanks to ~10% volume CAGR and the introduction of bigger turbines (lower logistic costs, development expenses, etc.) As a result, BNEF expects LCOEs of onshore wind to approach $30/MWh in the US and China by 2030 with Germany trailing some five years behind with respective costs ~15% above. By way of comparison, LCOEs for offshore are expected to decline at widely the same pace reaching just above $50/MWh in 2030 for China compared to ~$60/$70 in the US or Germany, respectively.

Wind onshore – LCOE by regions ($/MWh)

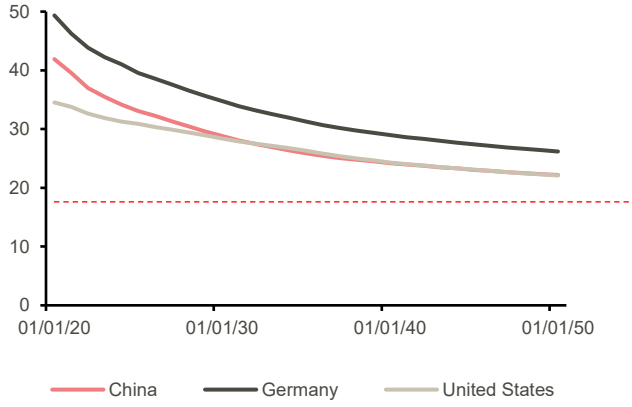


Wind offshore – LCOE by regions ($/MWh)

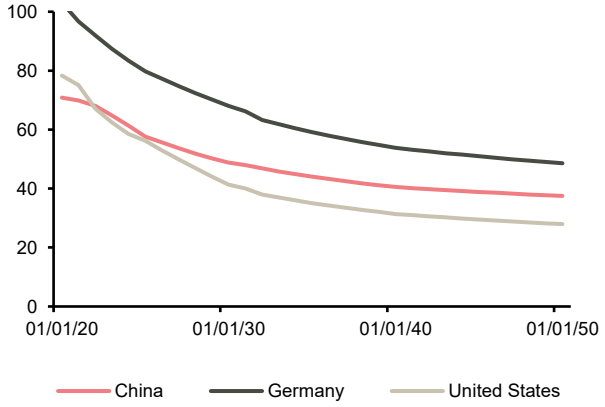


Charts 44 - Sources: ODDO Research, BNEF

Wind onshore & storage – LCOE ($/MWh)



PV non-tracking & storage – LCOE ($/MWh)



Charts 45 - Sources: ODDO Research, BNEF

Target price raised
Chemicals | France

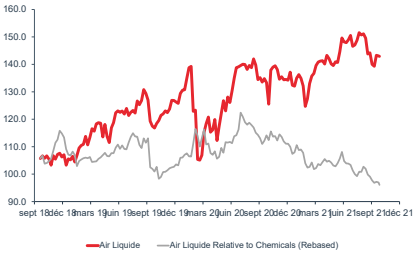
Air Liquide

Outperform ➔ | Target 197 € vs 190 €
Price (25/10/2021) : 142.92 € | Upside : 38 %

Revision	2011e	2012e
EPS	ns	ns

First mover in the 'green' H2 energy transition

Tuesday 26 October 2021



Share data	
AI FP | AIRP.PA	
Market Cap (€m)	67 402
Enterprise value (€m)	81 024
Extrema 12 months (€)	124.7 - 152.8
Free Float (%)	ns

Performance (%)	1m	3m	12m
Absolute	-0.9	-5.1	7.2
Perf. rel. Country Index	-2.8	-7.2	-17.7
Perf. rel. Chemicals	-2.1	-5.7	-14.0

P&L	12/21e	12/22e	12/23e
Sales (€m)	22 392	23 413	24 788
EBITDA (€m)	6 084	6 772	7 329
Current EBIT (€m)	3 965	4 585	5 067
Attr. net profit (€m)	2 638	3 117	3 491
Adjusted EPS (€)	5.71	6.40	6.82
Dividend (€)	2.95	3.15	3.35
P/E (x)	25.0	22.3	21.0
P/B (x)	3.4	3.3	3.2
Dividend Yield (%)	2.1	2.2	2.3
FCF yield (%)	2.8	3.4	3.6
EV/Sales (x)	3.62	3.71	3.47
EV/EBITDA (x)	13.3	12.8	11.7
EV/Current EBIT (x)	20.4	19.0	17.0
Gearing (%)	55	46	38
Net Debt/EBITDA (x)	1.8	1.5	1.3

Next Events

Air Liquide - key beneficiary of emerging 'green' H2 market

We consider Air Liquide to be a key beneficiary of the emerging 'green' H_2 market, representing 78% of modelled 11.6mt H_2 top-up by 2030. We forecast H_2 revenues to increase by a factor of 2.5x, to ~€ 5bn (company target: >3x by 2035), implying an adjusted EBIT increase of c.€ 600m (16% of the group) by 2030 in our planned scenario. Heading into 2022, we like the more cyclical portfolio based on 44% Industrial Merchant (IM) exposure, with forecasted vol/price growth of 3.7%/3.1% (H1 2021: 9%/2%). Both drivers are expected to lift comparable growth to 2.7% (CAGR 2020-23E) and fuel adjusted EBIT increase of 10.2% (CAGR 2020-23E) to € 5,067m, which brings us 8% ahead of consensus forecast of €4.7bn. We maintain our Outperform rating backed by outlined hydrogen guidance, encompassing 3GW electrolyser capacity to be installed by 2030. The properly filled 'green' hydrogen order pipeline, including the recently raised stake (now 100%) in the >200MW electrolyser capacity Air Liquide Normand'Hy project, is supplemented by initiatives like 'carbon capture-as-a-service', where CO_2 is captured via Air Liquide's proprietary technology and stored in decommissioned natural gas fields by oil & gas companies like Total Energies.

Strongly committed & well positioned along the 'green' H2 value chain

We expect the emerging 'green' H_2 market to represent 78% of modelled 11.6mt H_2 top-up by 2030. AI expedites manifold 'green' hydrogen projects, but we can imagine that especially the MoU with Siemens Energy and the evolving H2 ecosystem in the Normandy basin (France) may accelerate European 'green' H_2 market buildup and proton exchange membrane (PEM) electrolyser penetration. This strategic investment once again proves Air Liquide's long-term commitment and leading position in the field of 'green' H_2. In addition, we consider carbon capture-as-a-service to perfectly complement the positioning along the H_2 value chain.

We like the cyclical IM exposure (44%), push from strong order backlog

AI can bank on its strong investment decision pipeline of € 2.8bn and sequentially increased investment opportunities to € 3.3bn (up € 200m q/q). Comparable growth in gases & service should benefit from continuing strength in merchant markets, leading to an increase of 6.6% in 2021E vs -1.2% in 2020. We increase our EBIT estimates for 2022/23 by 4%/5% to €4.6bn and €5.1bn, respectively. The raised underlying growth rates for sales and EBIT are 6.6% and 10.2% (CAGR 2020-2023e). As a consequence, EBIT margin is expected to gradually increase by 190bps, to 20.4%, between 2020 to 2023e.

ROCE of 13.4% in 2023e looks compelling to us

We expect existing barriers to entry which grant a long-term return ahead of the cost of capital (ROCE >0) to remain in place based on substantial capex requirements and special contractual agreements. ROCE for AI and Linde is expected to sequentially increase to levels of ~13% and 9% in 2023. In the case of LIN, goodwill (31% of total assets) weighs on capital turnover. Given expected adjusted EBIT of € 5.1bn, 13.4% pre-tax ROCE and 3.6% OpFCF-yield (% of mcap) for AI in 2023 looks compelling to us.

H2 scenarios contribute € 13-€ 73/share - New TP at € 197

We forecast H_2 revenues to increase by a factor of 2.5x, to ~€ 5bn, implying an adjusted EBIT increase of c.€ 600m (16% of the group) by 2030 in our planned scenario. This is followed by an even more pronounced growth trajectory over 2030-2040, with further revenue potential of € 15bn. This is expected to translate into a NPV potential of € 13/share (€ 73/share in our bull case scenario), and assuming a 4% forward-looking H_2 market share. Based on the considered H2 potential we derive a new target price of €197. AI trades at a 12.9x EV/EBITDA on our 2022e, a 16% discount to peers.

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Valuation

Our typical valuation approach for Air Liquide and Linde is based on a 50/50 contribution from SotP and DCF. This would result in a target price of € 184. In respect to our H2 scenario analysis we opted for the more conservative approach and 'just' assigned a € 13/share (4% H2 market share) contribution arising from the NPV of surging H2 activities by 2050 (i.e. H2 revenues up 2-3x by 2030e). Both pillars together yield our new fair value of € 197 for Air Liquide.
Incorporating the bullish scenario would even bring up the target price by an additional € 60 to € 257. In conclusion, we raise our target price from € 190 to € 197, providing 37% upside to current trading and confirming AI as our top-pick in the field of 'green' H2 underscored by a tangible order pipeline. Air Liquide trades at 12.9x EV/EBITDA 23e, at a 17% discount to Linde.

Air Liquide – Valuation (SotP / DCF / H2 opportunity)

€ m	EV	€ / share	% of EV	EV 2021E	EBITDA 2021E	EV/EBITDA 2021e	EV 2022e	EBITDA 2022e	EV/EBITDA 2022e	EV 2023e	EBITDA 2023e	EV/EBITDA 2023e
Gases	99,476	210.0	99.9%	94,115	6,174	15.2x	103,180	6,740	15.3x	101,133	7,219	14.0x
Engineering & Construction	637	1.3	0.6%	657	48	13.7x	616	50	12.4x	637	55	11.5x
Global Markets & Technologies	2,908	6.1	2.9%	2,234	154	14.5x	2,917	210	13.9x	3,574	280	12.8x
Reconciliation	-3,425	-7.2	-3.4%	-4,222	-292	14.5x	-3,171	-229	13.9x	-2,882	-226	12.8x
GROUP	**99,596**	**210.3**	**100%**	**92,783**	**6,084**	**15.2x**	**103,542**	**6,772**	**15.3x**	**102,462**	**7,329**	**14.0x**
Net cash (debt)	-10,187	-21.5		-11,207			-10,190			-9,163		
Pension, similar obligations	-1,540	-3.3		-1,569			-1,540			-1,510		
Total debt, similar obligations	**-11,727**	-24.8		**-12,777**			**-11,731**			**-10,673**		
Buy-out of minorities	-642	-1.4		-552			-642			-732		
TOTAL SOTP	**87,227**	**184.2**		**79,455**			**91,169**			**91,057**		
Fair value SotP		**184.2**										
Fair value DCF		**184.5**										
Fair value (50/50 SotP/DCF)		**184.3**										
NPV - H2 opportunity (mid-scenario)		**13.0**										
Fair value (incl. H2 opportunity)		**197.3**										
Current equity value	**68,283**	**144.2**										
Upside (downside)		37%										
Number of shares outstanding (m)		473.7										

Sources: ODDO research, FactSet

Air Liquide - Peer Group Summary

x	Currency	Share Price (LC)	Market Cap. (€ m)	EV/EBITDA 21E	EV/EBITDA 22E	PE 21E	PE 22E	FCF Yield 21E	FCF Yield 22E	EV/EBIT 21E	EV/EBIT 22E
Linde plc	USD	310.68	137,780.64	17.5	16.5	29.86	27.20	2.9%	3.2%	25.1	23.2
Air Products and Chemicals, Inc.	USD	294.49	55,983.23	15.2	15.3	32.71	27.54	1.4%	1.1%	25.8	24.9
Nippon Sanso Holdings Corporation	JPY	2,715.00	8,837.24	10.7	10.3	18.67	17.12	6.0%	5.8%	19.9	18.6
Median Gases				**15.2**	**15.3**	**29.9**	**27.2**	**2.9%**	**3.2%**	**25.1**	**23.2**
GEA Group AG	EUR	40.51	7,311.74	11.8	10.8	24.89	21.66	3.6%	4.1%	17.6	15.3
ABB Ltd.	CHF	32.25	61,720.31	15.6	14.1	23.70	20.62	4.3%	4.5%	20.4	17.5
Engineering				**13.7**	**12.4**	**24.3**	**21.1**	**3.9%**	**4.3%**	**19.0**	**16.4**
Median				**15.2**	**15.3**	**29.9**	**27.2**	**2.9%**	**3.2%**	**25.1**	**23.2**
Air Liquide		**144.2**	**68,292**	**13.4**	**12.9**	**25.1**	**24.0**	**3.1%**	**3.3%**	**19.5**	**19.3**
relative to broad peer group				*-12%*	*-16%*	*-16%*	*-12%*	*5%*	*3%*	*-23%*	*-17%*
relative to Linde				*-23%*	*-22%*	*-16%*	*-12%*	*5%*	*3%*	*-23%*	*-17%*
Air Liquide @ PT		**197.0**	**93,311**	**16.7**	**17.0**	**34.3**	**32.8**	**2.2%**	**2.4%**	**25.5**	**25.4**
relative to broad peer group				*10%*	*11%*	*15%*	*21%*	*-23%*	*-25%*	*1%*	*10%*
relative to Linde				*-4%*	*3%*	*15%*	*21%*	*-23%*	*-25%*	*1%*	*10%*
Share prices as of		*22/10/21*									

Sources: ODDO research, FactSet

Air Liquide – DCF calculation

€ m	Forecasted Period			Fade Period							Annuity
	2022e	2023e	2024e	2025e	2026e	2027e	2028e	2029e	2030e	2031e	
Sales	**23,413**	**24,788**	**25,581**	**26,349**	**27,139**	**27,953**	**28,792**	**29,656**	**30,545**	**31,462**	
y/y	*4.6%*	*5.9%*	*3.2%*	*3.0%*	*3.0%*	*3.0%*	*3.0%*	*3.0%*	*3.0%*	*3.0%*	
EBIT	**4,595**	**5,077**	**5,270**	**5,454**	**5,645**	**5,842**	**6,046**	**6,257**	**6,476**	**6,701**	
EBIT margin	*19.6%*	*20.5%*	*20.6%*	*20.7%*	*20.8%*	*20.9%*	*21.0%*	*21.1%*	*21.2%*	*21.3%*	
Tax rate	*24.0%*	*24.0%*	*24.0%*	*24.0%*	*24.0%*	*24.0%*	*24.0%*	*24.0%*	*24.0%*	*24.0%*	
NOPAT	**3,492**	**3,859**	**4,005**	**4,145**	**4,290**	**4,440**	**4,595**	**4,756**	**4,921**	**5,093**	
Depreciation & Amortisation	2,174	2,253	2,275	2,298	2,321	2,344	2,367	2,391	2,415	2,439	
Capex	-2,933	-3,111	-3,142	-2,298	-2,321	-2,344	-2,367	-2,391	-2,415	-2,439	
Changes in working capital	91	138	139	0	0	0	0	0	0	0	
Free cash flow to the firm	**2,823**	**3,138**	**3,277**	**4,145**	**4,290**	**4,440**	**4,595**	**4,756**	**4,921**	**5,093**	**131,660**
Discounting factor	*98.8%*	*92.3%*	*86.3%*	*80.6%*	*75.4%*	*70.5%*	*65.9%*	*61.6%*	*57.5%*	*53.8%*	*53.8%*
PV of free cash flow	**2,788**	**2,896**	**2,827**	**3,343**	**3,234**	**3,128**	**3,026**	**2,928**	**2,832**	**2,739**	**70,812**
Enterprise Value	**100,554**										70%
+ Financial assets	161										
+ Gross cash	2,000										
- Gross debt	-13,207										
- Minority Interests	-552										
- Pension liabilities	-1,569										
Equity Value	**87,386**										
no. of of shares (in million)	474										
Value per share (€)	**184.5**										

Source: ODDO research

Financials

Air Liquide - Segment sales, adjusted EBITDA and adjusted EBIT

€ m	2018	2019	2020	2021e	2022e	2023e	CAGR 20-23e
Gases	**20,107**	**21,040**	**19,656**	**21,277**	**22,054**	**23,116**	**5.6%**
Europe	*7,111*	*7,172*	*6,826*	*7,543*	*7,694*	*8,001*	*5.4%*
APAC	*4,359*	*4,794*	*4,467*	*4,825*	*5,018*	*5,319*	*6.0%*
Americas	*7,982*	*8,461*	*7,799*	*8,267*	*8,681*	*9,115*	*5.3%*
Middle-East, Africa	*655*	*614*	*564*	*643*	*662*	*682*	*6.5%*
Engineering & Construction	430	328	250	363	381	400	16.9%
Global Markets & Technologies	474	552	579	753	979	1,272	30.0%
Total Sales	**21,011**	**21,920**	**20,485**	**22,392**	**23,413**	**24,788**	**6.6%**
Change y-y		*4.3%*	*-6.5%*	*9.3%*	*4.6%*	*5.9%*	
Gases	**5,359**	**6,058**	**6,036**	**6,174**	**6,740**	**7,219**	**6.2%**
Europe	*1,949*	*2,077*	*2,063*	*2,089*	*2,300*	*2,458*	*6.0%*
APAC	*1,193*	*1,387*	*1,406*	*1,476*	*1,571*	*1,705*	*6.6%*
Americas	*2,046*	*2,413*	*2,398*	*2,420*	*2,664*	*2,836*	*5.7%*
Middle-East, Africa	*171*	*182*	*168*	*189*	*206*	*220*	*9.4%*
Engineering & Construction	15	35	38	48	50	55	12.9%
Global Markets & Technologies	86	114	133	154	210	280	28.3%
Reconciliation	-245	-276	-278	-292	-229	-226	-6.7%
Adj. EBITDA	**5,215**	**5,932**	**5,928**	**6,084**	**6,772**	**7,329**	**7.3%**
Change y-y		*13.7%*	*-0.1%*	*2.6%*	*11.3%*	*8.2%*	
Gases	**3,679**	**4,028**	**4,016**	**4,179**	**4,700**	**5,131**	**8.5%**
Europe	*1,368*	*1,431*	*1,405*	*1,418*	*1,616*	*1,760*	*7.8%*
APAC	*837*	*951*	*985*	*1,047*	*1,129*	*1,250*	*8.2%*
Americas	*1,369*	*1,537*	*1,530*	*1,596*	*1,823*	*1,978*	*8.9%*
Middle-East, Africa	*105*	*110*	*95*	*119*	*132*	*143*	*14.9%*
Engineering & Construction	-4	9	13	22	23	28	30.1%
Global Markets & Technologies	50	67	78	94	132	178	31.5%
Reconciliation	-277	-311	-317	-330	-270	-270	-5.2%
Adj. EBIT	**3,449**	**3,794**	**3,790**	**3,965**	**4,585**	**5,067**	**10.2%**
Change y-y		*10.0%*	*-0.1%*	*4.6%*	*15.6%*	*10.5%*	

Sources: ODDO Research, company data

Air Liquide - Derivation of net profit

€ m	2018	2019	2020	2021e	2022e	2023e	CAGR 20-23e
Sales	**21,011**	**21,920**	**20,485**	**22,392**	**23,413**	**24,788**	**6.6%**
Change y-y		*4.3%*	*-6.5%*	*9.3%*	*4.6%*	*5.9%*	
Adj. EBITDA	**5,215**	**5,932**	**5,928**	**6,084**	**6,772**	**7,329**	**7.3%**
Margin (% of segm. sales)	*24.8%*	*27.1%*	*28.9%*	*27.2%*	*28.9%*	*29.6%*	
Depreciation, amortization	-1,766	-2,138	-2,138	-2,119	-2,187	-2,261	
EBIT (recurring)	**3,448**	**3,794**	**3,790**	**3,965**	**4,585**	**5,067**	**10.2%**
Margin	*16.4%*	*17.3%*	*18.5%*	*17.7%*	*19.6%*	*20.4%*	
Other non-recurring op. income	5	2	481	10	10	10	
Other non-recurring op. expenses	-166	-189	-621	0	0	0	
EBIT	**3,287**	**3,606**	**3,650**	**3,975**	**4,595**	**5,077**	**11.6%**
Net financial result	-349	-467	-444	-386	-375	-365	
Earnings before tax	**2,938**	**3,139**	**3,206**	**3,589**	**4,220**	**4,712**	
Income tax expense	-731	-802	-678	-861	-1,013	-1,131	
Effective tax rate	*24.9%*	*25.5%*	*21.2%*	*24.0%*	*24.0%*	*24.0%*	
Net income b. min.	**2,207**	**2,338**	**2,528**	**2,728**	**3,207**	**3,581**	**12.3%**
Margin	*10.5%*	*10.7%*	*12.3%*	*12.2%*	*13.7%*	*14.4%*	
Minority interests	-94	-96	-93	-90	-90	-90	
Discontinued operations	0	0	0	0	0	0	
Net income	**2,113**	**2,241**	**2,435**	**2,638**	**3,117**	**3,491**	**12.8%**
EPS (€ / share)	**4.49**	**4.76**	**5.16**	**5.57**	**6.26**	**6.69**	**9.0%**
Change y-y		*6.0%*	*8.4%*	*7.9%*	*12.4%*	*6.9%*	
DPS (€ / share)	2.40	2.70	2.75	2.95	3.15	3.35	6.8%
Pay-out (% of basic EPS)	*53%*	*57%*	*53%*	*53%*	*50%*	*50%*	

Sources : ODDO research, company data

Air Liquide - Cash Flow and debt projections

€ m	2018	2019	2020	2021e	2022e	2023e
Adj. EBITDA	5,215	5,932	5,928	6,084	6,772	7,329
Conversion factor	*79%*	*80%*	*82%*	*81%*	*80%*	*81%*
OCF before NWC change	**4,104**	**4,749**	**4,841**	**4,943**	**5,438**	**5,921**
Change in NWC	*613*	*-37*	*364*	*-240*	*-91*	*-138*
Operating Cash Flow	4,716	4,712	5,206	4,703	5,347	5,783
Net capex (excl. acquisitions)	-2,151	-2,052	-2,549	-2,811	-2,933	-3,111
% of segment sales	10%	9%	12%	13%	13%	13%
OpFCF	**2,565**	**2,660**	**2,657**	**1,892**	**2,414**	**2,671**
Net (acquisitions) disposals	-119	-532	594	0	0	0
Free Cash Flow	**2,446**	**2,127**	**3,251**	**1,892**	**2,414**	**2,671**
Dividend payment	-1,159	-1,163	-1,308	-1,303	-1,397	-1,644
Equity	18,207	19,324	19,005	20,430	22,239	24,177
Net financial (debt) cash	**-12,535**	**-13,705**	**-11,797**	**-11,207**	**-10,190**	**-9,163**
Pension provisions	-1,605	-1,729	-1,598	-1,569	-1,540	-1,510
Economic net (debt) * (A)	**-14,140**	**-15,433**	**-13,395**	**-12,777**	**-11,731**	**-10,673**
Adj. EBITDA (B)	5,215	5,932	5,928	6,084	6,772	7,329
Leverage factor (A / B)	**2.7x**	**2.6x**	**2.3x**	**2.1x**	**1.7x**	**1.5x**
… equivalent gearing	*78%*	*80%*	*70%*	*63%*	*53%*	*44%*
Net financial gearing	*69%*	*71%*	*62%*	*55%*	*46%*	*38%*
Equity ratio	***43.4%***	***44.3%***	***45.3%***	***47.1%***	***48.9%***	***50.6%***

Sources: ODDO Research, company data

Air Liquide - ODDO versus consensus forecast

€m	2020	2021e					2022e			2023e		
		ODDO	y/y	cons.	y/y	ODDO vs. c	ODDO	cons.	ODDO vs. c	ODDO	cons.	ODDO vs. c
Sales	20,485	**22,392**	9%	22,222	8%	1%	**23,413**	23,490	0%	**24,788**	24,679	0%
EBITDA	5,928	**6,084**	3%	6,225	5%	-2%	**6,772**	6,638	2%	**7,329**	7,012	5%
EBITDA-Margin	*28.9%*	*27.2%*		*28.0%*			***28.9%***	*28.3%*		***29.6%***	*28.4%*	
EBIT	3,790	**3,965**	5%	4,055	7%	-2%	**4,585**	4,399	4%	**5,067**	4,707	8%
EPS	5.16	**5.57**	8%	5.53	7%	1%	**6.26**	6.04	4%	**6.69**	6.53	2%
DPS	2.75	**2.95**	7%	2.95	7%	0%	**3.15**	3.13	1%	**3.35**	3.35	0%
Pay-out ratio	*53%*	*53%*		*53%*			*50%*	*52%*		*50%*	*51%*	
OpFCF	2,657	1,892	-29%	1,848	-30%	2%	2,414	2,221	9%	2,671	2,330	15%

Sources: ODDO Research, company data, FactSet

AI FP | AIRP.PA **Outperform** **Price 142.92EUR**
Chemicals | France **Upside 37.84%** **TP 197.00EUR**

PER SHARE DATA (€)	12/17	12/18	12/19	12/20	12/21e	12/22e	12/23e
Adjusted EPS	6.03	4.82	5.22	5.55	5.71	6.40	6.82
Reported EPS	**5.16**	**4.49**	**4.76**	**5.16**	**5.57**	**6.26**	**6.69**
Growth in adjusted EPS	-	-20.1%	8.3%	6.3%	2.9%	12.0%	6.6%
Net dividend per share	2.40	2.40	2.70	2.75	2.95	3.15	3.35
FCF to equity per share	5.97	5.45	5.64	5.63	3.99	4.85	5.12
Book value per share	38.27	37.79	40.05	39.32	41.97	43.39	44.93
Number of shares market cap (m)	428.40	429.42	473.11	473.66	473.66	521.84	521.84
Number of diluted shares (m)	426.41	470.56	471.21	471.60	473.66	497.75	521.84
VALUATION (€m)	**12/17**	**12/18**	**12/19**	**12/20**	**12/21e**	**12/22e**	**12/23e**
12m highest price (€)	115	115	131	143	153		
12m lowest price (€)	99.45	97.94	102	99.22	125		
(*) Reference price (€)	107	106	118	130	143	143	143
Capitalization	45 638	45 731	55 659	61 495	67 696	74 582	74 582
Restated Net debt	13 371	12 535	13 705	11 797	11 207	10 190	9 163
Minorities (fair value)	401	424	454	0.0	552	642	732
Financial fixed assets (fair value)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Provisions	1 736	1 605	1 729	1 598	1 569	1 540	1 510
Enterprise Value	**61 145**	**60 295**	**71 546**	**74 890**	**81 024**	**86 955**	**85 987**
P/E (x)	17.7	22.1	22.5	23.4	25.0	22.3	21.0
P/CF (x)	11.2	12.2	11.7	12.6	13.7	13.1	12.6
Net Yield	2.3%	2.3%	2.3%	2.1%	2.1%	2.2%	2.3%
FCF yield	5.6%	5.1%	4.8%	4.3%	2.8%	3.4%	3.6%
P/B incl. GW (x)	2.78	2.82	2.94	3.30	3.41	3.29	3.18
P/B excl. GW (x)	7.04	6.26	6.29	6.42	6.06	5.35	4.80
EV/Sales (x)	3.00	2.87	3.26	3.66	3.62	3.71	3.47
EV/EBITDA (x)	11.9	11.6	12.1	12.6	13.3	12.8	11.7
EV/Current EBIT (x)	**18.2**	**17.5**	**18.9**	**19.8**	**20.4**	**19.0**	**17.0**
(*) historical average price							
PROFIT AND LOSS (€m)	**12/17**	**12/18**	**12/19**	**12/20**	**12/21e**	**12/22e**	**12/23e**
Sales	20 349	21 011	21 920	20 485	22 392	23 413	24 788
EBITDA	5 142	5 215	5 932	5 928	6 084	6 772	7 329
Depreciations	-1 777.9	-1 766.3	-2 137.7	-2 137.9	-2 119.0	-2 186.9	-2 261.3
Current EBIT	**3 364**	**3 449**	**3 794**	**3 790**	**3 965**	**4 585**	**5 067**
Published EBIT	3 020	3 287	3 606	3 650	3 975	4 595	5 077
Net financial income	-484.2	-348.6	-467.0	-443.9	-386.3	-375.3	-364.9
Corporate Tax	-207.3	-730.7	-801.7	-678.2	-861.4	-1 012.7	-1 131.0
Net income of equity-accounted companies	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Profit/loss of discontinued activities (after tax)	-37.2	0.0	0.0	0.0	0.0	0.0	0.0
Minority interests	-92.0	-94.0	-96.1	-92.9	-90.0	-90.0	-90.0
Attributable net profit	2 200	2 113	2 241	2 435	2 638	3 117	3 491
Adjusted attributable net profit	**2 572**	**2 269**	**2 460**	**2 617**	**2 706**	**3 185**	**3 560**
BALANCE SHEET (€m)	**12/17**	**12/18**	**12/19**	**12/20**	**12/21e**	**12/22e**	**12/23e**
Goodwill	12 840	13 345	13 943	13 087	13 337	13 587	13 837
Other intangible assets	1 611	1 599	1 555	1 398	1 398	1 398	1 398
Tangible fixed assets	18 526	19 248	21 118	20 003	20 403	20 912	21 521
WCR	1 787	1 246	1 443	1 174	1 414	1 505	1 643
Financial assets	387	425	411	429	429	429	429
Ordinary shareholders equity	16 318	17 783	18 870	18 542	19 877	21 597	23 445
Minority interests	401	424	454	462	552	642	732
Shareholders equity	16 718	18 207	19 324	19 005	20 430	22 239	24 177
Non-current provisions	10 938	11 238	10 637	11 176	11 774	13 030	14 416
Net debt	**13 371**	**12 535**	**13 705**	**11 797**	**11 207**	**10 190**	**9 163**
CASH FLOW STATEMENT (€m)	**12/17**	**12/18**	**12/19**	**12/20**	**12/21e**	**12/22e**	**12/23e**
EBITDA	**5 141.7**	**5 214.8**	**5 931.5**	**5 928.2**	**6 084.3**	**6 771.7**	**7 328.6**
Change in WCR	188.3	612.9	-36.7	364.3	-240.3	-90.6	-138.0
Interests & taxes	-629.2	-1 034.1	-1 163.3	-1 031.0	-1 147.6	-1 288.0	-1 395.9
Others	-446.8	-77.2	-19.3	-55.8	6.8	-45.9	-12.2
Operating Cash flow	4 254.0	4 716.4	4 712.2	5 205.7	4 703.1	5 347.2	5 782.5
CAPEX	-1 709.6	-2 151.2	-2 052.4	-2 548.9	-2 810.9	-2 933.4	-3 111.4
Free cash-flow	**2 544.4**	**2 565.2**	**2 659.8**	**2 656.8**	**1 892.2**	**2 413.9**	**2 671.2**
Acquisitions / disposals	-136.1	-119.0	-532.4	594.3	0.0	0.0	0.0
Dividends	-1 031.2	-1 159.4	-1 163.0	-1 307.9	-1 302.6	-1 397.3	-1 643.8
Net capital increase	-88.5	74.8	-108.7	-6.2	0.0	0.0	0.0
Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change in net cash	1 288.6	1 361.6	855.7	1 937.0	589.7	1 016.6	1 027.4
GROWTH MARGINS PRODUCTIVITY	**12/17**	**12/18**	**12/19**	**12/20**	**12/21e**	**12/22e**	**12/23e**
Sales growth	7.6%	3.3%	4.3%	-6.5%	9.3%	4.6%	5.9%
Lfl sales growth	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Current EBIT growth	-	2.5%	10.0%	-0.1%	4.6%	15.6%	10.5%
Growth in adjusted EPS	-	-20.1%	8.3%	6.3%	2.9%	12.0%	6.6%
Net margin	12.6%	10.8%	11.2%	12.8%	12.1%	13.6%	14.4%
EBITDA margin	**25.3%**	**24.8%**	**27.1%**	**28.9%**	**27.2%**	**28.9%**	**29.6%**
Current EBIT margin	**16.5%**	**16.4%**	**17.3%**	**18.5%**	**17.7%**	**19.6%**	**20.4%**
CAPEX / Sales	-10.7%	-10.7%	-12.0%	-12.8%	-12.6%	-12.5%	-12.6%
WCR / Sales	8.8%	5.9%	6.6%	5.7%	6.3%	6.4%	6.6%
Tax Rate	8.2%	24.9%	25.5%	21.2%	24.0%	24.0%	24.0%
Normative tax rate	8.2%	24.9%	25.5%	21.2%	24.0%	24.0%	24.0%
Asset Turnover	-	0.6	0.6	0.6	0.6	0.6	0.7
ROCE post-tax (normative tax rate)	**-**	**7.4%**	**7.7%**	**8.1%**	**8.3%**	**9.4%**	**10.2%**
ROCE post-tax hors GW (normative tax rate)	-	11.8%	12.2%	12.8%	13.2%	14.8%	15.9%
ROE	17.0%	13.3%	13.4%	14.0%	14.1%	15.4%	15.8%
DEBT RATIOS	**12/17**	**12/18**	**12/19**	**12/20**	**12/21e**	**12/22e**	**12/23e**
Gearing	80%	69%	71%	62%	55%	46%	38%
Net Debt / Market Cap	0.29	0.27	0.25	0.19	0.17	0.14	0.12
Net debt / EBITDA	**2.60**	**2.40**	**2.31**	**1.99**	**1.84**	**1.50**	**1.25**
EBITDA / net financial charges	12.2	17.2	16.4	16.8	21.3	24.6	27.7

Sources: ODDO BHF Securities, SIX

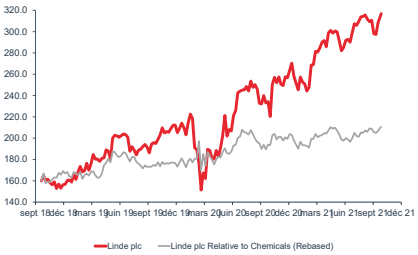
Linde plc

Outperform➔ | Target 366 $ vs 296 $ ↗
Price (25/10/2021) : 316.84 $ | Upside : 167

Revision	2021e	2022e
EPS	0.5%	2.2%

Winning from 'grey' to 'blue' in H2

Tuesday 26 October 2021



Share data	
LIN GY | LING.DE	
Market Cap ($m)	163 927
Enterprise value ($m)	176 935
Extrema 12 months ($)	216.9 - 316.8
Free Float (%)	ns

Performance (%)	1m	3m	12m
Absolute	2.0	6.0	35.2
Perf. rel. Country Index	0.1	3.6	3.8
Perf. rel. Chemicals	0.8	5.3	8.6

P&L	12/21e	12/22e	12/23e
Sales ($m)	30 817	32 472	34 133
EBITDA ($m)	10 488	11 074	11 552
Current EBIT ($m)	7 117	7 740	8 251
Attr. net profit ($m)	4 084	4 875	5 249
Adjusted EPS ($)	10.19	11.24	12.22
Dividend ($)	4.35	4.70	4.80
P/E (x)	31.1	28.2	25.9
P/B (x)	3.4	3.3	3.1
Dividend Yield (%)	1.4	1.5	1.5
FCF yield (%)	2.5	2.6	2.9
EV/Sales (x)	5.74	5.33	4.96
EV/EBITDA (x)	16.9	15.6	14.7
EV/Current EBIT (x)	24.9	22.4	20.5
Gearing (%)	24	23	21
Net Debt/EBITDA (x)	1.2	1.1	1.0

Next Events	
30/11/2021	Q3 Results

Margin expansion story continues

The margin expansion story continues while unprecedented H_2 top-line effects grant necessary operational leverage. In our view, Linde's share price only partly mirrors H_2-related appreciation potential of $ 27-154/share. The higher exposure to 'grey' ('blue' in future) H_2 production can be a blessing, as we expect this transition technology to last for longer (accounting for 64% in 2050). Healthcare and Electronics end-markets (~27% exposure) are expected to defend recent growth rates and to remain buoyant heading into 2022, with forecast comparable growth rates of 4-6%. We appreciate the strong profitability focus, resulting in an adjusted EBIT CAGR 2020-2023E of 12.5%, to $ 8,251m by 2023E, which brings us in-line with consensus. We forecast adjusted EPS of $ 10.19 in 2021, up 23.2% y/y, of which 4pp is attributable to ongoing share buybacks. Our new target price of $ 366 provides 17% upside potential is based on two pillars: 1/ operational excellence which would yield a fair value of $ 339 and 2/ a $ 27 top-up to capture the discounted NPV potential of our H_2 mid-case. Linde trades at 14.4x EV/EBITDA on 2023E, a 9% discount to the three-year historical trading area (15.9x). We maintain our Outperform rating.

H2 upside varies between $27-€153, 'blue' H2 better captured by LIN

We forecast H_2 group revenues to double, to $ 4bn, by 2030, with an adjusted EBIT contribution of $ 420m (ie, 7% of group total), considering our blue-sky scenario and backed by MoUs with China Power and SNAM. We expect 'blue' H_2 to last for longer as transition technology (64% of H_2 in 2050). LIN's strong 'conventional' H_2 position is confirmed by the number of operated SMR units (LIN: >60; AI: ~50) of H_2 sold (LIN: 21bn m^3; AI: c. 14bn m^3) and its strong engineering unit (refuelling stations LIN: 200; AI: c. 120). Thus, we see LIN having an 8% market share of H_2 ('green' + 'blue') NPV opportunity, implying share price appreciation potential of $ 27/$ 154 (blue sky/bull case).

No premature praise modelled in, FCF strength to continue

We forecast adjusted EBIT growth of 12.5% (CAGR 2020-2023e), bringing EBIT up to $ 8.3bn in 2023e, which puts us in line with current consensus of $ 8.3bn. Group margin looks set to improve by 290bps to 24.2% between 2020-2023e. FCF generation of $4.0bn in 2020 has more than doubled compared to 2018, in line with rising cash conversion to 80% in 2020. This yields an OpFCF-yield of 2.7% (% of mcap) at current price levels.

EPS accretion continuing with 23% growth in 2021e

Linde's recent history was characterised by immense shareholder reimbursement of merger-related divestiture income. Hence, share buybacks are an essential part of FCF allocation. Instead of debt reduction, LIN could additionally distribute $ 1.2bn over 2021-2023e to shareholders beyond dividends and the $ 5bn SBB programme executed until mid-2023. We expect that the newly announced CEO Sanjiv Lamba, who will take over in March 2022, will leverage on the superior margin level going forward. This leads to forecasted adjusted EBIT growth of 12.5% (CAGR 2020-2023e), triggering EPS growth of 13.9% (CAGR 20-23e) to a forecasted level of $ 12.22 in 2023e.

We assign $ 27/ share for evolving H2 potential – New TP at $ 366

Our target price is based on two pillars: 1/ operational excellence which would yield a fair value of $ 339 and 2/ a $ 27 top-up to capture the discounted NPV potential of our 'conservative' H_2 base case, providing 17% potential upside. Linde trades at a 14.4x EV/EBITDA for 2023e, a 9% discount to its three-year historical trading area (15.9x). Our SOTP/DCF derived TP rises to $ 366 and encompasses $ 27 from evolving H_2 activities.

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Valuation

We typically assess a 50/50 contribution from SoTP and DCF to derive a fair value for industrial gas companies. We have overhauled our model to account for strong margin management and EPS accretion heading into 2022. This laid the groundwork for our SOTP and DCF calculations (we apply a WACC of 5.8%) and we derive a fair value of $ 339 for Linde. The SOTP result for Linde is slightly deflated due to the inclusion of Air Liquide in the peer group (FactSet: LIN - 16.5x EV/EBITDA 2022e; AI 12.4x EV/EBITDA 2022e). Note that the result for AI is slightly inflated. After we have accounted for operational achievements, we put the NPV result of our H_2 scenario analysis (mid-case as well) of $ 27/share (8% H2 market share) on top to reflect the H_2 opportunity by 2050. Both pillars combined provide the foundation for our new target price of $ 366, implying 17% potential upside. Incorporating the bullish scenario would lift our target price significantly, by an additional $ 127, to $ 493. However, this scenario is mentioned for illustrative purposes only so far. Linde trades at a 14.4x EV/EBITDA on 2023e, 9% below its three-year historical trading area of 15.9x.

Linde - Valuation (SotP / DCF / H2 opportunity)

€ m	EV	$ / share	% of EV	EV 2021e	EBITDA 2021e	EV/EBITDA 2021e	EV 2022e	EBITDA 2022e	EV/EBITDA 2022e	EV 2023e	EBITDA 2023e	EV/EBITDA 2023e
Gases	136,402	269.9	99.6%	137,956	10,449	13.2x	136,514	11,027	12.4x	134,735	11,496	11.7x
Engineering	3,541	7.0	2.6%	3,758	274	13.7x	3,509	282	12.4x	3,355	291	11.5x
Other, reconciliation	-2,937	-5.8	-2.1%	-3,163	-235	13.5x	-2,916	-235	12.4x	-2,733	-235	11.6x
GROUP	**137,005**	**271.1**	**100.0%**	**138,551**	**10,488**	**13.2x**	**137,107**	**11,074**	**12.4x**	**135,356**	**11,552**	**11.7x**
Net cash (debt)	-11,786	-23.3		-12,151			-11,964			-11,242		
Pension, similar obligations	-1,566	-3.1		-2,198			-1,582			-918		
Total debt, similar obligations	**-13,352**	-26.4		**-14,349**			**-13,546**			**-12,161**		
Buy-out of minorities	-2,720	-5.4		-2,462			-2,713			-2,984		
TOTAL SOTP	**120,934**	**239.3**		**121,741**			**120,848**			**120,212**		
Fair value SotP ($)		**239.3**										
Fair value DCF ($)		**438.8**										
Fair value (50/50 SotP/DCF, $)		**339.1**										
NPV H2 opportunity (mid-scenario, $)		**27.2**										
Fair value (incl. H2 opportunity, $)		**366.3**										
Current equity value	**158,740**	**314.1**										
Upside (downside)		17%										
Number of shares outstanding (m)		505.4										

Sources: ODDO Research, FactSet

Linde – Peer group summary

x	Currency	Share Price (LC)	Market Cap. (€m)	EV/EBITDA 21e	EV/EBITDA 22e	PE 21e	PE 22e	FCF Yield 21e	FCF Yield 22e	EV/EBIT 21e	EV/EBIT 22e
Air Liquide SA	EUR	144.32	68,380.92	13.2	12.4	26.08	23.89	2.7%	3.2%	20.3	18.7
Air Products and Chemicals, Inc.	USD	294.49	55,983.23	15.2	15.3	32.71	27.54	1.4%	1.1%	25.8	24.9
Nippon Sanso Holdings Corporation	JPY	2,715.00	8,837.24	10.7	10.3	18.67	17.12	6.0%	5.8%	19.9	18.6
Gases (median)				**13.2**	**12.4**	**26.1**	**23.9**	**2.7%**	**3.2%**	**20.3**	**18.7**
GEA Group AG	EUR	40.51	7,311.74	11.8	10.8	24.89	21.66	3.6%	4.1%	17.6	15.3
ABB Ltd.	CHF	32.30	61,816.00	15.7	14.1	23.73	20.66	4.3%	4.5%	20.4	17.5
Engineering (median)				**13.7**	**12.4**	**24.3**	**21.2**	**3.9%**	**4.3%**	**19.0**	**16.4**
Peer group				**13.2**	**12.4**	**26.0**	**23.8**	**0.0**	**0.0**	**20.2**	**18.6**
Linde plc		314.2	158,765	16.7	15.5	30.8	27.9	2.5%	2.7%	24.7	22.2
relative to broad peer group				*27%*	*25%*	*19%*	*18%*	*-8%*	*-18%*	*22%*	*20%*
relative to Air Liquide				*27%*	*25%*	*18%*	*17%*	*-6%*	*-17%*	*22%*	*19%*
Linde plc @ PT		366	184,969	19.2	17.8	35.9	32.5	2.2%	2.3%	28.4	25.5
relative to broad peer group				*45%*	*44%*	*38%*	*37%*	*-21%*	*-30%*	*40%*	*37%*
relative to Air Liquide				*46%*	*44%*	*38%*	*36%*	*-19%*	*-29%*	*40%*	*37%*
Share prices as of		*24/10/2021*									

Sources: ODDO Research, FactSet

Linde - DCF calculation

$ m	Forecasted Period					Fade Period					Annuity
	2022e	2023e	2024e	2025e	2026e	2027e	2028e	2029e	2030e	2031e	
Sales	**32,472**	**34,133**	**35,225**	**36,282**	**37,371**	**38,492**	**39,646**	**40,836**	**42,061**	**43,323**	
y/y	*5.4%*	*5.1%*	*3.2%*	*3.0%*	*3.0%*	*3.0%*	*3.0%*	*3.0%*	*3.0%*	*3.0%*	
EBIT	**7,740**	**8,251**	**8,251**	**8,889**	**9,193**	**9,507**	**9,832**	**10,168**	**10,515**	**10,874**	
EBIT margin	*23.8%*	*24.2%*	*24.4%*	*24.5%*	*24.6%*	*24.7%*	*24.8%*	*24.9%*	*25.0%*	*25.1%*	
Tax rate	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*	
NOPAT	**5,805**	**6,188**	**6,188**	**6,667**	**6,895**	**7,131**	**7,374**	**7,626**	**7,886**	**8,156**	
Depreciation & Amortisation	3,334	3,301	3,334	3,367	3,401	3,435	3,469	3,504	3,539	3,574	
Capex	-3,910	-3,960	-4,000	-3,367	-3,401	-3,435	-3,469	-3,504	-3,539	-3,574	
Changes in working capital	149	149	151	0	0	0	0	0	0	0	
Free cash flow to the firm	**5,378**	**5,678**	**5,673**	**6,667**	**6,895**	**7,131**	**7,374**	**7,626**	**7,886**	**8,156**	**307,513**
Discounting factor	*99.0%*	*93.6%*	*88.5%*	*83.7%*	*79.2%*	*74.9%*	*70.8%*	*67.0%*	*63.4%*	*59.9%*	*59.9%*
PV of free cash flow	**5,322**	**5,315**	**5,022**	**5,582**	**5,460**	**5,341**	**5,224**	**5,109**	**4,997**	**4,888**	**184,293**
Enterprise Value	**236,553**										**78%**
+ Financial Assets	2,031										
+ Gross Cash	2,349										
- Gross Debt	-14,500										
- Minority Interests	-2,462										
- Pension Liabilities	-2,198										
Equity Value	**221,773**										
No. Of Of Shares (In Million)	505										
Value per share ($)	**438.8**										

Source: ODDO BHF

Financials

Linde - Segment sales and operating profit

$ m	2018 (p-f)	2019	2020	2021e	2022e	2023e	CAGR 20-23e
Gases	**23,480**	**23,411**	**22,595**	**26,090**	**27,534**	**29,057**	**8.7%**
Americas	10,539	10,989	10,459	12,206	12,816	13,457	8.8%
EMEA	6,991	6,643	6,449	7,771	8,237	8,732	10.6%
APAC	5,950	5,779	5,687	6,114	6,480	6,869	6.5%
Engineering	2,792	2,799	2,851	2,737	2,929	3,046	2.2%
Other activities	1,812	1,953	1,797	1,990	2,010	2,030	4.1%
Total Sales	**28,084**	**28,228**	**27,243**	**30,817**	**32,472**	**34,133**	**7.8%**
y-y		*0.5%*	*-3.5%*	*13.1%*	*5.4%*	*5.1%*	
Gases	**4,806**	**5,128**	**5,515**	**6,765**	**7,322**	**7,813**	**12.3%**
Americas	2,433	2,577	2,773	3,344	3,601	3,835	11.4%
EMEA	1,344	1,367	1,465	1,935	2,101	2,227	15.0%
APAC	1,029	1,184	1,277	1,486	1,620	1,752	11.1%
Engineering	285	390	435	452	498	518	6.0%
Other activities	-295	-246	-153	-100	-80	-80	-19.4%
Adj. EBIT	**4,796**	**5,272**	**5,797**	**7,117**	**7,740**	**8,251**	**12.5%**

Sources: ODDO Research, company data

Linde – Derivation of net profit

$ m	2018	2019	2020	2021e	2022e	2023e	CAGR 20-23e
Sales (p-f)	28,084	28,163	27,243	30,817	32,472	34,133	7.8%
Sales (as reported)	**14,836**	**28,228**	**27,243**	**30,817**	**32,472**	**34,133**	**7.8%**
y-y		*90.3%*	*-3.5%*	*13.1%*	*5.4%*	*5.1%*	
Adj. EBITDA	**7,603**	**8,178**	**8,645**	**10,488**	**11,074**	**11,552**	**10.1%**
Margin (% of segm. sales)	*27.1%*	*29.0%*	*31.7%*	*34.0%*	*34.1%*	*33.8%*	
Depreciation, amortization	-2,266	-2,887	-4,626	-3,371	-3,334	-3,301	
Adj. EBIT	**4,796**	**5,272**	**5,797**	**7,117**	**7,740**	**8,251**	**12.5%**
Margin (% of sales)	*32.3%*	*18.7%*	*21.3%*	*23.1%*	*23.8%*	*24.2%*	
Net financial result	3,096	158	62	-184	-197	-184	
Earnings before tax	**5,049**	**2,927**	**3,384**	**5,432**	**6,542**	**7,067**	
Income tax expense	-817	-769	-847	-1,358	-1,636	-1,767	
Effective tax rate	*16.2%*	*26.3%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*	
Net income b. min.	**4,288**	**2,272**	**2,622**	**4,194**	**5,027**	**5,420**	**27.4%**
Margin (% of sales)	*28.9%*	*8.0%*	*9.6%*	*13.6%*	*15.5%*	*15.9%*	
Minority interests	-24	-96	-125	-210	-251	-271	
Discontinued operations	117	109	4	100	100	100	
Net income	**4,381**	**2,285**	**2,501**	**4,084**	**4,875**	**5,249**	**28.0%**
Weighted # of shares (m)	330.4	541.1	526.7	511.4	500.3	490.9	
y-y		*63.8%*	*-2.7%*	*-2.9%*	*-2.2%*	*-1.9%*	
Adj. Net income	**2,477**	**4,021**	**4,357**	**5,209**	**5,625**	**5,999**	**11.3%**
Adj. EPS ($)	**7.50**	**7.43**	**8.27**	**10.19**	**11.24**	**12.22**	**13.9%**
y-y		*-0.9%*	*11.3%*	*23.2%*	*10.4%*	*8.7%*	
DPS ($)	3.30	3.50	3.86	4.35	4.70	4.80	7.5%
Pay-out (% of EPS)	*44%*	*47%*	*47%*	*43%*	*42%*	*39%*	

Sources: ODDO Research, company data

Linde - Cash Flow and debt projection

$ m	2018	2019	2020	2021e	2022e	2023e
Adj. EBITDA	7,603	8,178	8,645	10,488	11,074	11,552
Conversion factor	*46%*	*77%*	*84%*	*74%*	*74%*	*74%*
OCF before NWC change	**3,495**	**6,294**	**7,283**	**7,775**	**8,244**	**8,558**
Change in NWC	*159*	*-175*	*146*	*31*	*-149*	*-149*
Operating Cash Flow	**3,654**	**6,119**	**7,429**	**7,806**	**8,095**	**8,409**
Net capex (excl. acquisitions)	-1,883	-3,682	-3,400	-3,760	-3,910	-3,960
% of segment sales	*7%*	*13%*	*12%*	*12%*	*12%*	*12%*
OpFCF	**1,771**	**2,437**	**4,029**	**4,046**	**4,185**	**4,449**
Net (acquisitions) disposals	7,246	4,871	414	0	0	0
Free Cash Flow	**9,017**	**7,308**	**4,443**	**4,046**	**4,185**	**4,449**
Dividend payment	-1,166	-1,891	-2,028	-1,997	-2,198	-2,327
Share buyback	0	0	0	-1,800	-1,800	-1,400
Equity	57,080	51,522	49,569	50,066	51,194	52,987
Net financial (debt) cash	**-10,830**	**-11,256**	**-12,400**	**-12,151**	**-11,964**	**-11,242**
Pension provisions	-1,797	-2,305	-2,770	-2,198	-1,582	-918
Economic net (debt) * (A)	**-12,627**	**-13,561**	**-15,170**	**-14,349**	**-13,546**	**-12,161**
Adj. EBITDA (B)	7,603	8,178	8,645	10,488	11,074	11,552
Leverage factor (A / B)	**1.7x**	**1.7x**	**1.8x**	**1.4x**	**1.2x**	**1.1x**
… equivalent gearing	*22%*	*26%*	*31%*	*29%*	*26%*	*23%*
Net financial gearing	*19%*	*22%*	*25%*	*24%*	*23%*	*21%*
Equity ratio	***61.1%***	***59.5%***	***56.2%***	***57.0%***	***57.8%***	***58.6%***

Sources: ODDO Research, company data

Linde - ODDO BHF versus consensus forecast

$ m	2020	2021e					2022e			2023e		
		ODDO	y/y	cons.	y/y	ODDO vs. c.	ODDO	cons.	ODDO vs. c	ODDO	cons.	ODDO vs. c
Sales	27,243	**30,817**	13%	29,938	10%	3%	**32,472**	31,447	3%	**34,133**	32,988	3%
EBITDA	8,645	**10,488**	21%	10,163	18%	3%	**11,074**	10,812	2%	**11,552**	11,509	0%
EBITDA-Margin	31.7%	34.0%		33.9%			**34.1%**	34.4%		**33.8%**	34.9%	
EBIT	5,797	**7,117**	23%	7,066	22%	1%	**7,740**	7,686	1%	**8,251**	8,273	0%
EPS ($)	8.27	**10.19**	23%	10.40	26%	-2%	**11.24**	11.42	-2%	**12.22**	12.66	-3%
DPS ($)	3.86	**4.35**	13%	4.36	13%	0%	**4.70**	4.72	0%	**4.80**	4.72	2%
Pay-out ratio	47%	43%		42%			42%	41%		39%	37%	

Sources: ODDO Research, company data, FactSet

LIN GY | LING.DE **Outperform** **Price 316.84USD**
Chemicals | Germany **Upside 15.52%** **TP 366.00USD**

PER SHARE DATA ($)	12/18	12/19	12/20	12/21e	12/22e	12/23e
Adjusted EPS	7.50	7.43	8.27	10.19	11.24	12.22
Reported EPS	**12.11**	**4.22**	**4.75**	**7.99**	**9.75**	**10.69**
Growth in adjusted EPS	-	-0.9%	11.3%	23.2%	10.4%	8.7%
Net dividend per share	3.30	3.50	3.86	4.35	4.70	4.80
FCF to equity per share	5.36	4.50	7.65	7.91	8.37	9.06
Book value per share	156.16	90.69	89.83	93.09	96.91	101.86
Number of shares market cap (m)	547.24	534.38	517.38	505.38	495.18	486.58
Number of diluted shares (m)	330.40	541.09	526.74	511.38	500.28	490.88
VALUATION ($m)	**12/18**	**12/19**	**12/20**	**12/21e**	**12/22e**	**12/23e**
12m highest price ($)	169	213	264	317		
12m lowest price ($)	142	152	150	243		
(*) Reference price ($)	158	187	220	317	317	317
Capitalization	86 239	100 122	113 758	160 125	156 893	154 168
Restated Net debt	10 830	11 256	12 400	12 151	11 964	11 242
Minorities (fair value)	5 484	2 448	0.0	2 462	2 713	2 984
Financial fixed assets (fair value)	0.0	0.0	0.0	0.0	0.0	0.0
Provisions	1 797	2 305	2 770	2 198	1 582	918
Enterprise Value	**104 350**	**116 131**	**128 928**	**176 935**	**173 152**	**169 313**
P/E (x)	21.0	25.2	26.6	31.1	28.2	25.9
P/CF (x)	14.9	16.1	15.9	20.8	19.2	18.2
Net Yield	2.1%	1.9%	1.8%	1.4%	1.5%	1.5%
FCF yield	3.4%	2.4%	3.5%	2.5%	2.6%	2.9%
P/B incl. GW (x)	1.01	2.07	2.45	3.40	3.27	3.11
P/B excl. GW (x)	1.34	2.90	3.70	5.11	4.81	4.44
EV/Sales (x)	3.72	4.12	4.73	5.74	5.33	4.96
EV/EBITDA (x)	13.7	14.2	14.9	16.9	15.6	14.7
EV/Current EBIT (x)	**21.8**	**22.0**	**22.2**	**24.9**	**22.4**	**20.5**
(*) historical average price						
PROFIT AND LOSS ($m)	**12/18**	**12/19**	**12/20**	**12/21e**	**12/22e**	**12/23e**
Sales	28 084	28 163	27 243	30 817	32 472	34 133
EBITDA	7 603	8 178	8 645	10 488	11 074	11 552
Depreciations	-2 807.0	-2 906.0	-2 848.0	-3 371.1	-3 334.0	-3 300.6
Current EBIT	**4 796**	**5 272**	**5 797**	**7 117**	**7 740**	**8 251**
Published EBIT	4 867	2 933	3 322	5 617	6 740	7 251
Net financial income	-198.0	-6.0	62	-184.5	-197.3	-184.1
Corporate Tax	-817.0	-769.0	-847.0	-1 358.0	-1 635.6	-1 766.7
Net income of equity-accounted companies	56	114	85	120	120	120
Profit/loss of discontinued activities (after tax)	117	109	4.0	100	100	100
Minority interests	-24.0	-96.0	-125.0	-209.7	-251.3	-271.0
Attributable net profit	4 001	2 285	2 501	4 084	4 875	5 249
Adjusted attributable net profit	**2 477**	**4 021**	**4 357**	**5 209**	**5 625**	**5 999**
BALANCE SHEET ($m)	**12/18**	**12/19**	**12/20**	**12/21e**	**12/22e**	**12/23e**
Goodwill	26 874	27 019	28 201	28 201	28 201	28 201
Other intangible assets	16 223	16 137	16 184	16 944	17 854	18 814
Tangible fixed assets	29 717	29 064	28 711	28 340	28 006	27 705
WCR	2 729	2 753	2 801	2 770	2 918	3 068
Financial assets	9 375	4 331	4 301	4 301	4 301	4 301
Ordinary shareholders equity	51 596	49 074	47 317	47 604	48 481	50 003
Minority interests	5 484	2 448	2 252	2 462	2 713	2 984
Shareholders equity	57 080	51 522	49 569	50 066	51 194	52 987
Non-current provisions	25 476	23 834	26 260	25 690	25 429	26 158
Net debt	**10 830**	**11 256**	**12 400**	**12 151**	**11 964**	**11 242**
CASH FLOW STATEMENT ($m)	**12/18**	**12/19**	**12/20**	**12/21e**	**12/22e**	**12/23e**
EBITDA	**7 603.0**	**8 178.0**	**8 645.0**	**10 487.6**	**11 073.7**	**11 551.7**
Change in WCR	159.0	-175.0	146.0	31.3	-148.7	-149.3
Interests & taxes	-1 015.0	-775.0	-785.0	-1 542.5	-1 832.9	-1 950.9
Others	-3 093.0	-1 109.0	-577.0	-1 170.2	-996.8	-1 042.4
Operating Cash flow	3 654.0	6 119.0	7 429.0	7 806.2	8 095.3	8 409.1
CAPEX	-1 883.0	-3 682.0	-3 400.0	-3 760.0	-3 910.0	-3 960.0
Free cash-flow	**1 771.0**	**2 437.0**	**4 029.0**	**4 046.2**	**4 185.3**	**4 449.1**
Acquisitions / disposals	7 246.0	4 871.0	414.0	0.0	0.0	0.0
Dividends	-1 166.0	-1 891.0	-2 028.0	-1 997.1	-2 198.4	-2 327.4
Net capital increase	-522.0	-2 586.0	-2 410.0	-1 800.0	-1 800.0	-1 400.0
Others	0.0	0.0	0.0	0.0	0.0	0.0
Change in net cash	7 329.0	2 831.0	5.0	249.1	186.9	721.8
GROWTH MARGINS PRODUCTIVITY	**12/18**	**12/19**	**12/20**	**12/21e**	**12/22e**	**12/23e**
Sales growth	-	0.3%	-3.3%	13.1%	5.4%	5.1%
Lfl sales growth	**-**	**-**	**-**	**-**	**-**	**-**
Current EBIT growth	-	9.9%	10.0%	22.8%	8.8%	6.6%
Growth in adjusted EPS	-	-0.9%	11.3%	23.2%	10.4%	8.7%
Net margin	8.8%	14.3%	16.0%	16.9%	17.3%	17.6%
EBITDA margin	**27.1%**	**29.0%**	**31.7%**	**34.0%**	**34.1%**	**33.8%**
Current EBIT margin	**17.1%**	**18.7%**	**21.3%**	**23.1%**	**23.8%**	**24.2%**
CAPEX / Sales	-6.7%	-13.1%	-12.5%	-12.2%	-12.0%	-11.6%
WCR / Sales	9.7%	9.8%	10.3%	9.0%	9.0%	9.0%
Tax Rate	17.5%	26.3%	25.0%	25.0%	25.0%	25.0%
Normative tax rate	16.2%	26.3%	25.0%	25.0%	25.0%	25.0%
Asset Turnover	-	0.4	0.4	0.4	0.4	0.4
ROCE post-tax (normative tax rate)	**-**	**5.2%**	**5.8%**	**7.0%**	**7.6%**	**8.0%**
ROCE post-tax hors GW (normative tax rate)	-	8.0%	9.1%	11.1%	12.0%	12.6%
ROE	-	8.0%	9.0%	11.0%	11.7%	12.2%
DEBT RATIOS	**12/18**	**12/19**	**12/20**	**12/21e**	**12/22e**	**12/23e**
Gearing	19%	22%	25%	24%	23%	21%
Net Debt / Market Cap	0.13	0.11	0.11	0.08	0.08	0.07
Net debt / EBITDA	**1.42**	**1.38**	**1.43**	**1.16**	**1.08**	**0.97**
EBITDA / net financial charges	38.4	1 363.0	-139.4	56.9	56.1	62.7

Sources: ODDO BHF Securities, SIX

- **Valuation method**

  Our target prices are established on a 12-month timeframe and we use three valuation methods to determine them. First, the discounting of available cash flows using the discounting parameters set by the Group and indicated on ODDO BHF' website. Second, the sum-of-the-parts method based on the most pertinent financial aggregate depending on the sector of activity. Third, we also use the peer comparison method which facilitates an evaluation of the company relative to similar businesses, either because they operate in identical sectors (and are therefore in competition with one another) or because they benefit from comparable financial dynamics. A mixture of these valuation methods may be used in specific instances to more accurately reflect the specific characteristics of each company covered, thereby fine-tuning its evaluation.

- **Sensitivity of the result of the analysis/ risk classification:**

  The opinions expressed in the financial analysis are opinions as per a particular date, i.e. the date indicated in the financial analysis. The recommendation (cf. explanation of the recommendation systematic) can change owing to unforeseeable events which may, for instance, have repercussions on both the company and on the whole industry.

- **Our stock market recommendations**

  Our stock market recommendations reflect the RELATIVE performance expected for each stock on a 12-month timeframe.

  Outperform: performance expected to exceed that of the benchmark index, sectoral (large caps) or other (small and mid caps).

  Neutral: performance expected to be comparable to that of the benchmark index, sectoral (large caps) or other (small and mid caps).

  Underperform: performance expected to fall short of that of the benchmark index, sectoral (large caps) or other (small and mid caps).

- **The prices of the financial instruments used and mentioned in this document are the closing prices.**
- **All publications by ODDO BHF concerning the companies covered and mentioned in this document are available on the research site: www.securities.oddo-bhf.com**

Recommendation split

		Outperform	Neutral	Underperform
Our whole coverage	(604)	58%	32%	10%
Liquidity providers coverage	(89)	62%	34%	4%
Research service coverage	(40)	65%	30%	5%
Investment banking services	(42)	71%	19%	10%

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Recommendation history over the last 12 months for the company analysed in this report

Company	Date	Reco	Price	
Air Liquide	27/08/2021	-	150.72	Fabian Sémon
Linde plc	25/10/2021	-	273.07	Fabian Sémon

Target price history over the last 12 months for the company analysed in this report

Company	Date	Price Target	Price	Analyst
Air Liquide	25/10/2021	197.00 EUR	142.92	Fabian Sémon
	27/08/2021	190.00 EUR	150.72	Fabian Sémon
Linde plc	25/10/2021	315.44 USD	316.84	Fabian Sémon
	27/08/2021	251.68 USD	314.21	0

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