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Ammonia Outlook

Quarterly outlook for the international ammonia market prepared by Fertecon analysts

August 2022

Agribusiness | **Fertecon**

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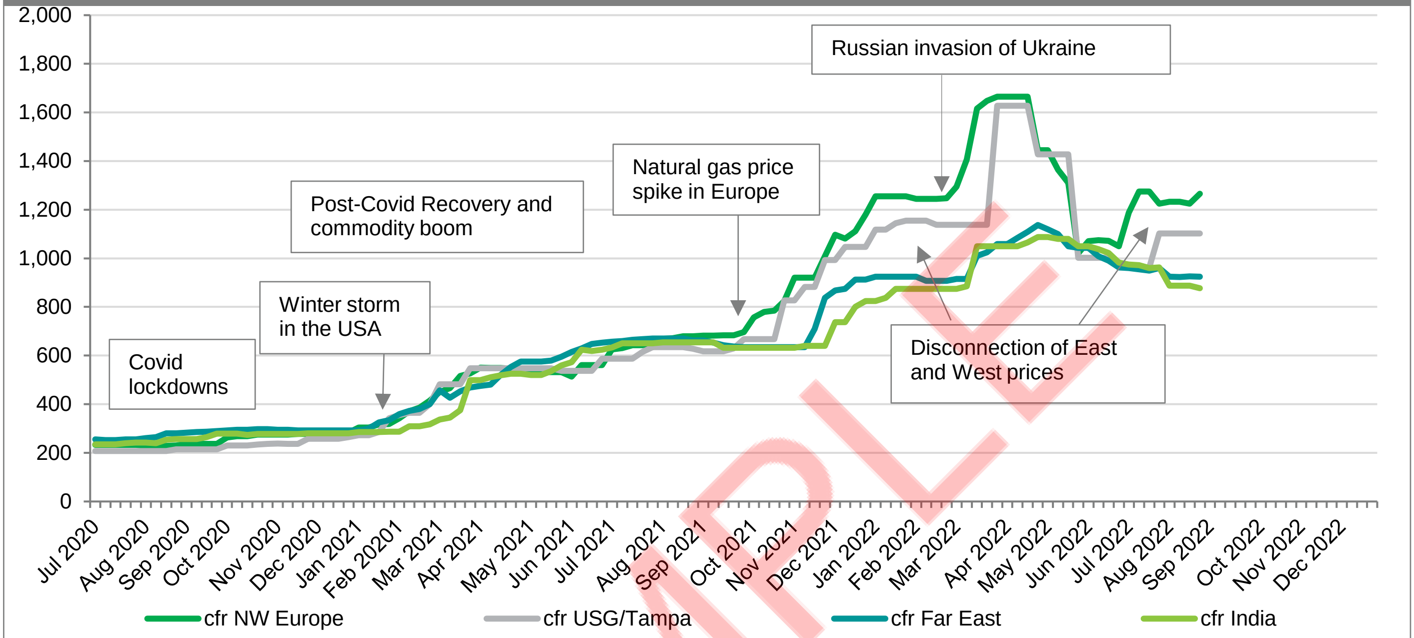

Source: IHS Markit

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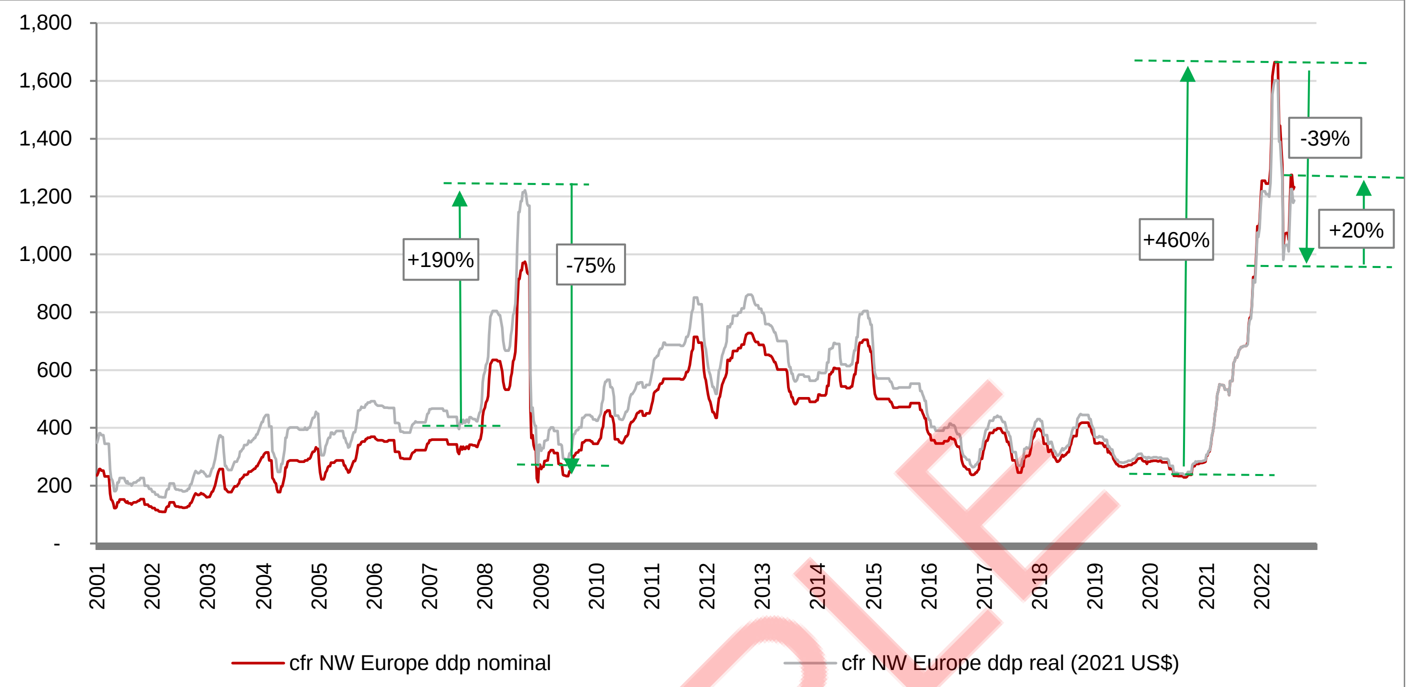
- The Covid-19 pandemic and lockdowns affected demand for ammonia in H1 2020 and this led to even lower levels of price in the spring of 2020 (<$200 for fob benchmarks).
- After two years of depressive apathy, prices were finally able to break out into explosive growth. Ammonia was not a unique product in this sense, as other commodities demonstrated very similar dynamics in the second half of 2020 and at the beginning of 2021.
- The rise in ammonia prices continued throughout 2021. During the year, there were moments when it seemed like the price increase was losing its strength and there was a prospect of a downward price correction, due to seasonal and other factors. However, unexpected events related to the weather and technical malfunctions affected the balance of supply and demand, and each time served to create further upward pressure on prices.
- In the fall of 2021, the world faced unprecedentedly high gas prices (see analysis in the November 2021 Ammonia Outlook). Gas prices in Europe have raised the cost of ammonia production above $1,000 per tonne. Many ammonia manufacturers in Europe have closed their plants.
- Contrary to expectations, despite high ammonia prices in Europe and generally west of Suez, there was no ammonia flow from east from Suez to the west (other than one ship from Saudi Arabia in December 2021). Prices in the east have decoupled from the west and have remained $200-300 per tonne lower. It turned out that there was simply no spot ammonia business in Asia that could be redirected to the west.
- The Russian invasion of Ukraine on February 24, 2022, has generated uncertainty. As a result of hostilities and sanctions imposed on Russia, the export of merchant ammonia from the Black and Baltic Seas, which accounts for approximately 23% of the world supply, has actually stopped.
- In 2022, ammonia prices are following urea prices and have begun another price hike. Record high gas costs in Europe have pushed ammonia prices up and slow demand in the east has pushed ammonia prices down. China (mainland) emerged as an exporter of small quantities of ammonia, at considerably lower value than in the West due to the large gap between the domestic and international prices.

Ammonia prices beat all records

Nominal and real cfr Northwest Europe ddp, 2001-2022, $/tonne



Source: IHS Markit

The dynamics of ammonia prices in 2021 - 2022 were unprecedented, as all records of the maximum level of ammonia prices were broken. In addition, there has never been such a rapid increase from an all-time low to an all-time high with a growth of 4.6 times in 16 months.

The fall in prices after the start of the correction in May 2022 was already 39% (over $600/t) in just 1 month. This is less than during the 2008 collapse (75%).

The reasons for the unprecedented rise in prices during the spring of 2022 have not waned: merchant ammonia supply decreased by more than 20% when exports from the Black and Baltic Seas were blocked. Similarly, gas prices in Europe were supported as supply from Russia reduced, which drove ammonia production costs to almost $1,500/t. Both oil and coal prices were under pressure with the fast growth of demand and lack of supply from Russia. Gas, oil and coal price forecasts, both in the short term and in the long term, have been revised upwards. The policy of weaning Europe off Russian resources will continue for several years, and so the shortage of natural gas will remain an issue on the continent for some time, certainly for the rest of 2022.

The price correction was caused by lack of demand due to high prices. Another reason for price correction is the seasonal decrease in demand for fertilizers due to the end of spring application.

In the spring of 2022, the direct use of ammonia in the US was weak due to high amounts of rainfall. As US participants said at the IFA conference, "we didn't have spring this year." There are stocks of ammonia that were not applied to the fields. This situation affects Tampa's pricing, which, in turn, has become a powerful indicator for overseas markets.

With the end of the fertilizer application season in the Northern Hemisphere, prices for urea began to decline, which pulled down quotes for ammonia. However, a new surge of European gas prices reversed this trend for urea prices. This was supported by healthy demand for fertilizers in India in line with the June monsoon period and Kharif sowing season, followed by a rise in ammonia prices. Despite weak demand, costs in Europe pulled up netbacks from ammonia supplies to the region, and it was just a matter of time before prices rose in other regions.

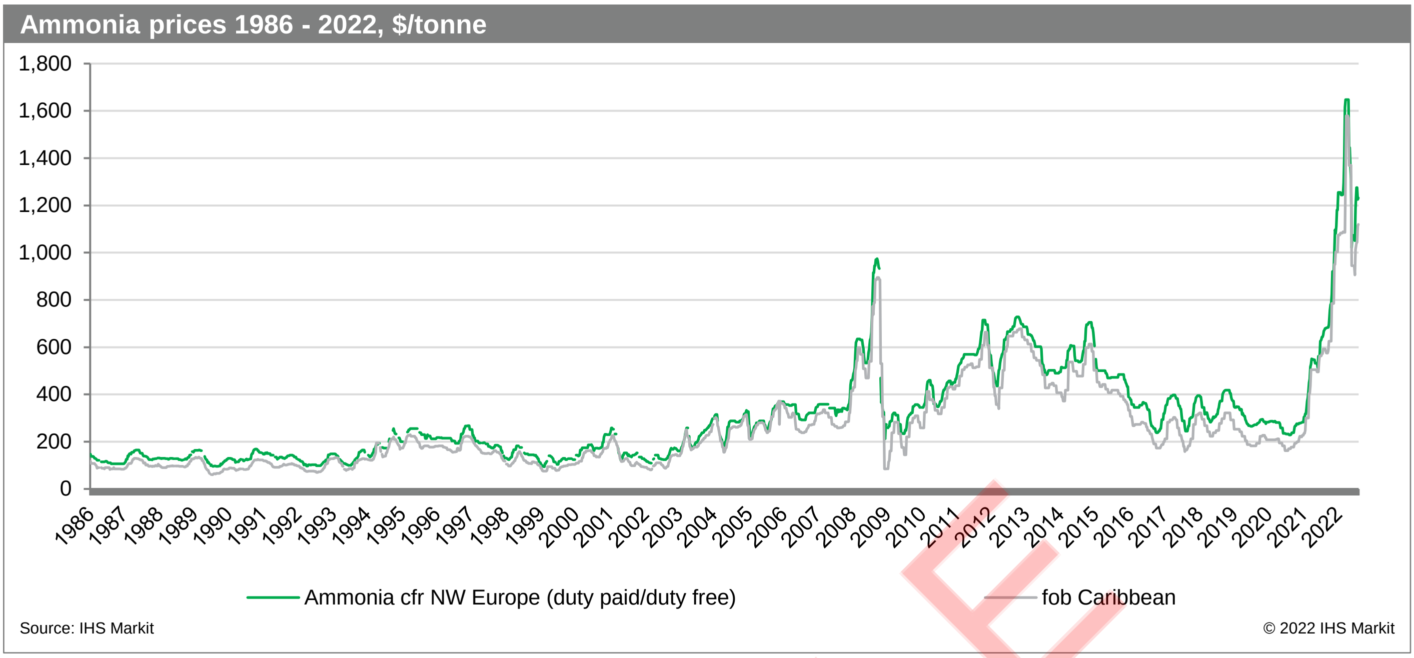
2
Ammonia Prices

Historic ammonia prices in 1986-2022

Average annual ammonia prices, nominal, $/tonne

	fob Black Sea	fob Caribbean	fob Middle East	fob SE Asia	fob Baltic	cfr NW Europe ddp	cfr Tampa/ USG	cfr Far East	cfr India
1986	-	91	87	-	-	116	-	-	-
1987	-	108	103	-	-	140	-	139	-
1988	-	99	91	-	-	130	129	132	-
1989	-	92	76	-	-	123	107	124	-
1990	-	97	88	-	-	136	118	154	-
1991	-	103	106	-	-	139	125	164	-
1992	-	87	86	-	-	112	110	120	116
1993	89	110	101	-	108	130	128	131	128
1994	146	167	158	-	152	185	190	196	190
1995	183	195	191	-	186	232	217	240	226
1996	178	183	175	-	183	222	207	214	208
1997	140	159	165	-	155	188	180	199	196
1998	110	117	125	-	121	148	137	158	153
1999	84	91	110	-	92	120	112	138	133
2000	139	148	158	-	137	181	171	200	188
2001	121	135	132	-	135	161	161	178	169
2002	100	109	112	-	114	138	136	142	137
2003	184	202	185	-	188	223	231	210	212
2004	229	251	258	-	240	274	281	284	285
2005	241	283	268	-	252	299	318	290	294
2006	245	283	268	-	254	330	322	317	305
2007	270	298	276	279	278	352	340	320	307
2008	553	553	506	514	563	610	600	553	518
2009	245	236	240	249	254	303	282	278	266
2010	359	370	348	352	362	412	412	416	378
2011	519	533	527	531	529	592	578	584	526
2012	545	563	552	563	561	620	609	644	570
2013	478	502	503	505	491	560	547	582	552
2014	498	503	504	531	508	591	548	565	536
2015	390	413	424	431	399	479	458	475	466
2016	237	239	274	270	248	316	280	329	311
2017	269	245	281	301	279	342	283	314	302
2018	288	278	310	317	292	354	314	361	343
2019	235	214	237	253	234	297	250	291	274
2020	204	195	221	230	203	263	236	277	258
2021	557	571	543	556	552	648	617	597	561
2022 8 m	1,030	1,161	967	1,045	1,134	1,312	1,192	992	976

Source: IHS Markit



In 2021, the dynamics of world ammonia prices changed, and after several years of passivity, prices jumped up. In June 2021, fob Black Sea prices exceeded $400 for the first time since 2014, and in August, cfr Far East prices exceeded $700. In the fall of 2021 prices have reached historical maximums at over $1,000 fob. As it stands the price dynamics of 2021 resemble those of 2008, when unprecedented growth fomented a free fall. We do not expect something of the same order in 2021 or 2022.

The reasons for the rise in prices in 2008 and 2021 are different. In 2008, the rise in prices was a manifestation of the financial bubble that preceded the crisis. In 2021, the world was recovering from the crisis of the pandemic, and experienced accelerating inflation. As the economy continues to recover, the world will need materials, including polymers, which require ammonia for their production.

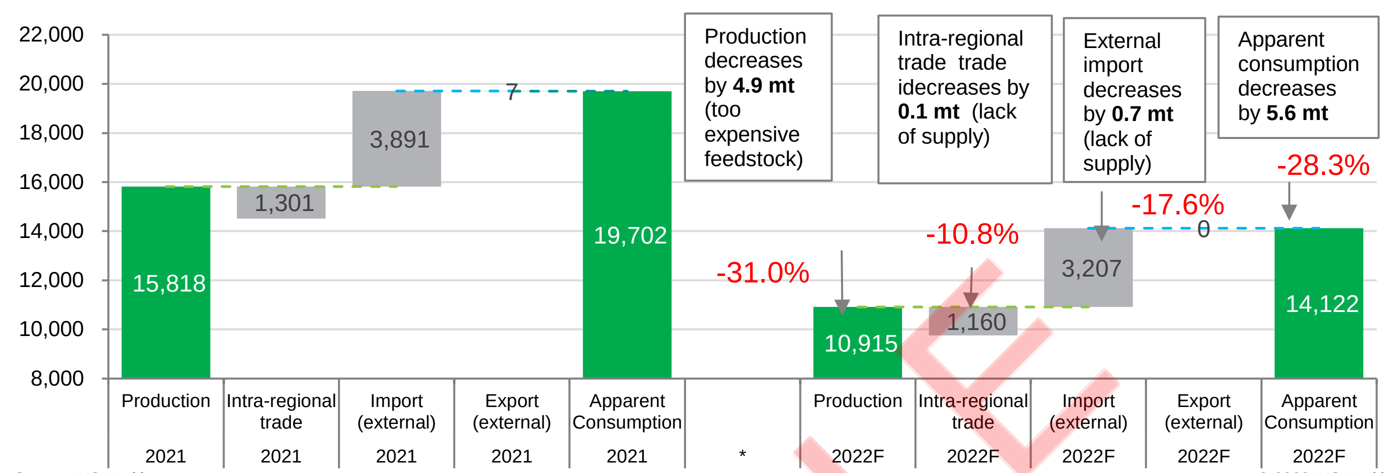
In addition to the boom in commodity prices, there are specific reasons for the rise in ammonia prices associated with supply and demand. The post-Covid global economic recovery coincided with the ammonia market cycle transitioning to its growth phase. After the commissioning of new capacities in 2016-2019, prices took a dive for 2 years, from 2020 onwards there has been almost no growth in capacities for merchant ammonia. Therefore, the utilization of export capacities is on the rise, which contributes to increasing prices.

An additional and important reason for the rise in ammonia prices is the concomitant spike in prices for raw materials - natural gas and coal. Record high gas price levels in Europe in the summer of 2021 pushed up the costs for marginal ammonia exporters in Europe. Many of which continue to operate thanks to high ammonia prices. However, were ammonia prices to fall, many would be forced to stop, which in turn will create the conditions for renewed price increases.

The question arises: how stable is the observed increase in ammonia prices? The main importers of ammonia are manufacturers of phosphate fertilizers and petrochemical products. For petrochemicals (caprolactam, acrylonitrile), ammonia is not the main feedstock, and although the rise in ammonia prices is important for this industry, it is not critical. However, hosphate producers are more sensitive to the cost of ammonia. Growth of fertilizer prices may not be sustainable for farmers and will certainly destroy some demand which may have long term consequences in lower yields next season and lower revenues/purchasing power of farmers in 2022 and 2023.

3
Special Focus: European Supply and Demand

Production, trade and apparent consumption of ammonia in Europe, '000 tonnes



Source: IHS Markit

Europe[2] was hit by the supply crisis triggered by Russia's aggression against Ukraine. The traditional trade ties that had formed over decades, upon which infrastructure and logistics had developed, disintegrated with the new geopolitical dynamics. As a result of the cessation of deliveries from Russia to three destinations - to the Baltic, to the Black Sea, and by rail to Finland and Lithuania - Europe lost 1.9 million tonnes of ammonia imports, which typically represents 10% of consumption and 50% of external imports. Europe can produce its own ammonia; however, the price of gas has increased significantly due to the reduction of supply from Russia on the back of the invasion. As gas is the main raw material for the production of ammonia, an increase to the price of gas has a direct impact onto the cost of production and selling price of ammonia. Thus, two opposing trends are affecting the European ammonia market:

1) a reduction in the supply of imported ammonia and an increase in the price of ammonia (as a result, a decrease in external imports and its replacement by means of domestic production), and

2) an unprecedented increase in the cost of ammonia production (resulting in reduced domestic production and a transition to external imports).

In fact, in 2022 we see that both domestic production (by 31%) and external imports (by 18%) are decreasing in Europe, while apparent consumption will decrease by 28% by the end of the year.

For many years, Europe has been developing a demand pattern for fertilizers and ammonia for industrial consumption, in which domestic production has played a major role. In 2021, European production accounted for 80% of the region's consumption despite the fact multiple producers had curtailed or halted production amid the high gas costs. External imports accounted for 20% of the apparent consumption. Ammonia suppliers from outside of the continent have costs substantially lower than in Europe and benefit from a good profit margin exporting to Europe. However, due to the size of the market in Europe and the support for domestic companies, the region has never completely abandoned domestic production in favour of imports. With the cessation of Russian supply, there is simply no other sources of low-cost ammonia left in the world to compensate for expensive production in Europe. This is an additional factor in the rise in ammonia prices worldwide.

In 2022 intraregional trade within Europe (in which captive deliveries within one company have a significant share), is expected to be slightly lower than in 2021. Although European companies redistributed trade flows, which compensated for the cessation of supplies to countries that were more dependent on external imports, such as Finland, Sweden, Norway, the total volume of trade goes down by 11%.

[2] Europe, including EU-27, UK, Norway, Switzerland, Iceland, Serbia, Bosnia and Herzegovina, Albania, Kosovo, North Macedonia, and Montenegro.

External Imports

External ammonia imports to Europe, 2021 - 2022, '000 tonnes

Origin of imports	2021	H1 2022	2022F	Difference 2022-2021	%
Russia	1,931	360	360	-1,571	-81%
Algeria	1,129	466	1,100	-29	-3%
Trinidad & Tobago	556	232	600	44	8%
Middle East	60	64	130	70	117%
Egypt	112	77	160	48	43%
Ukraine	43	2	2	-41	-95%
USA	50	67	170	120	240%
Indonesia	0	50	100	100	-
Others	11	31	80	69	622%
Total	3,891	1,299	2,702	-1,189	-31%

Notes: Fertecon estimates.

Source: IHS Markit

Historically, Russia (50% of external imports in 2021), Algeria (29%), and Trinidad and Tobago (14%) played the main role in providing Europe with external ammonia. Egypt (3%) also regularly supplied ammonia to Europe, diverting it from its main export destinations to India and Turkey. The remaining exporters (4%), including the Middle East, Indonesia, and the US supplied ammonia to Europe sporadically (1-2 ships per year). In late 2021, with gas prices already skyrocketing, small volumes from the US and Saudi Arabia reached European ports.

In Q1 2022, Russia supplied Europe with about 360,000 tonnes, after which the supplies stopped. After the owners of Russian exporting companies (EuroChem, Uralchem, and Akron) were included on the sanctioned list, Yara stopped importing by sea and rail. As a result, transit terminals in Estonia and Latvia, as well as EuroChem plants in Lithuania and Belgium were shut down. After the Antwerp plant received permission to resume operations, there was hope from Russian producers that the transit terminals would reopen in H2 2022, however, this did not take place. We do not expect for Russian ammonia supply to Europe in 2022 or 2023.

Algeria, the second largest supplier of ammonia to Europe, could not even partially compensate for the loss of supply from Russia. On the contrary, Algeria reduced its exports due to internal problems in 2022. For a long time, one of the lines of the Fertial plant in Arzew has not been working. The third supplier, Trinidad and Tobago, did not increase European supplies in H1 2022. The cessation of Russian exports hit not only Europe but also other markets, including Morocco, where ammonia is traditionally supplied from Trinidad and Russia. Yara, which has its own production facility in Trinidad from which it supplies ammonia from there to its plants in Europe, has a contract to supply ammonia to Tampa. In addition, other suppliers from Trinidad have contracts and not much surplus to spare. Therefore, we do not expect a significant increase in supplies from Trinidad to Europe in 2022, which will be no more than 8% compared to last year.

Egypt increased deliveries to Europe in H1 2022 by 40%. However, like Trinidad, Egypt has other markets “closer to home” which also affected by the absent Russian volumes including Turkey and Jordan.

Deliveries from the Middle East, including Saudi Arabia, Oman, and Qatar, have already exceeded those for the whole of last year in H1 2022 and will continue to grow, taking into account the growth of capacity in Saudi Arabia and Oman. By the end of the year, the Middle East can supply 130,000 t which is 5% of the European market.

Indonesia did not supply ammonia last year but has already exported 50,000 t in H1 of 2022 (from total of about 1 million tonnes of 6-month exports from Indonesia), and further supplies from the country are expected in H2 2022.

Imports from the United States have increased significantly. In H1 2022, 67,000 t came from the US, more than in the whole of 2021. From the end of 2021 and in H1 2022, deliveries from the USA were mainly carried out to meet the internal needs of companies: Yara from its JV with BASF in Freeport, TX to its plants in Europe, and OCI from OCI Beaumont, TX to its terminal in Rotterdam. By the end of the year, the US can provide more than 6% of Europe's required imports.

Supplies from other sources will increase somewhat. These include Libya, which, after Yara’s sale of its stake in Lifeco, refocused on the supply of ammonia to Turkey. Lifeco's total export capacity is estimated at 160,000 t. In H1 2022, Libya shipped only 13,300 tonnes to Portugal, Greece, and Bulgaria, and for the whole of 2021, only 10,500 tonnes to Bulgaria. In addition, in H1 2022 there was ammonia supplied from Mexico (18,000 t to France and Spain), and in 2H 2022 more imports are expected from unusual sources, attracted by the high price of ammonia in Europe, such as Mexico, Argentina, and Brazil.

4
Update of Low-Carbon Ammonia Developments

Policy Update

Europe

- **CBAM**

On 22 June 2022, the European Parliament (EP) adopted the package of carbon legislation, with a significant majority of votes. The package includes the revision of the European Union (EU) Emission Trading System (EU ETS) and the new Carbon Border Adjustment Mechanism (CBAM). CBAM is part of the "Fit for 55 in 2030 package", which is the EU's plan to reduce greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels in line with the European Climate Law. Parliament agreed on the need for a CBAM to reduce global carbon emissions by incentivizing non-EU countries to reduce their emissions and to prevent the risk of carbon leakage, i.e. production being moved to outside the EU to countries with laxer climate policies.

In addition to the products proposed by the Commission (iron and steel, refineries, cement, organic basic chemicals and fertilizers), Parliament wants CBAM to also cover organic chemicals, plastics, hydrogen and ammonia.

The CBAM would apply from 1 January 2023 with a transitional period until the end of 2026 and Parliament believes it must be fully implemented for the above listed sectors of the EU Emissions Trading System (ETS) by 2032 - three years earlier than proposed by the Commission. Until 2032, exporters should receive free allocations - 100% in the period 2023-2026, 93% in 2027, 84% in 2028, 69% in 2029, 50% in 2030 and 25% in 2031. To avoid double protection, any free allowances granted to EU industries in the ETS, to address the risk of carbon leakage in the absence of fair competition, should be fully phased out by 2032 when CBAM kicks in fully for the protected industries. This accelerated schedule for reducing free allowance is factored into the carbon cost projection for ammonia production in Europe and imports to the EU from other countries in our data file.

- **REPowerEU**

The European Commission on Wednesday 18 May published its plan setting out how the European Union can eliminate its dependency on Russian fossil fuels. The plan covers four main areas: energy efficiency and savings; energy supply diversification; clean-energy transition acceleration; investment and reform. If approved, this plan should see Europe end its reliance on Russian energy by 2027, while also accelerating its green transformation. REPowerEU emphasizes the acceleration of green technologies, from solar photovoltaic to wind, and heat pumps to green hydrogen – and proposes to increase the EU's headline 2030 target for renewables from 40% to 45%. The plan rightly focuses on faster permitting, with slow processes today represent a major obstacle to the deployment of wind and solar energy.

The document set a target of 10 million tonnes of domestic renewable hydrogen production and 10 million tonnes of imports by 2030, to replace natural gas, coal and oil in hard-to-decarbonize industries and transport sectors. To accelerate the hydrogen market increased sub-targets for specific sectors would need to be agreed by the co-legislators. The Commission is also publishing two Delegated Acts on the definition and production of renewable hydrogen to ensure that production leads to net decarbonization. To accelerate hydrogen projects, additional funding of €200 million is set aside for research, and the Commission commits to complete the assessment of the first Important Projects of Common European Interest by the summer.

Regarding the hydrogen strategy, the plan implies:

- Target 10 million tonnes of renewable hydrogen production in the EU and the same quantity of imports by 2030.
- Align the sub-targets for renewable fuels of non-biological origin (RFNBOs) under the RED for industry and transport with the REPowerEU ambition (75% for industry and 5% for transport).
- Double the number of hydrogen valleys through Hydrogen Joint Undertaking.

- Proposal of two Delegated Acts on (i) the definition of renewable hydrogen production as well as (ii) defining a methodology for calculating greenhouse gas emissions of different production methods. Both are open for public consultation until June 17, 2022.
- Regular reports on uptake of renewable hydrogen in key sectors starting in 2025.
- Mapping hydrogen infrastructure needs by March 2023.
- Scale-up of electrolyzer manufacturing, details outlined in the 'Electrolyser Declaration'.

Some experts criticize the document, in particular, believing that the plan counts on unrealistic levels of hydrogen. Deploying the production of 10 million tonnes of green hydrogen (equivalent to 50 million tonnes of green ammonia) over the remaining 8 years until 2030 really seems like an overestimated expectation.

USA

- **The Inflation Reduction Act (IRA).**

The act passed by the 117th United States Congress and signed into law by President Joe Biden on August 16, 2022, creates incentives for "green" hydrogen production. The aim is to make the zero-emissions fuel immediately cost-competitive with traditional fuels. The IRA will provide a $3 per kilogram "production tax credit" for hydrogen produced with an electrolyzer powered by clean energy, essentially eliminating the cost gap with the "gray" hydrogen produced through conventional steam methane reforming (SMR). Recalculated per green ammonia, the tax credit will amount to $600 per tonne, which would substantially support green ammonia competitiveness and will certainly push the development of green-ammonia projects in the USA. If green hydrogen producers can utilize renewable energy tax credits it is fair to assume that green hydrogen/ammonia will become cheaper to produce than grey for the foreseeable future.

The Q45 tax incentive for carbon sequestration has already attracted huge attention to the development of blue ammonia projects in the US. The United States leads the world in terms of the number of projects and the declared total capacity. The IRA could have a similar effect on green ammonia. The act may attract investment from around the world in the development of green ammonia production in the United States.

The risks of the initiative are connected with the domestic political struggle. The US Senate voted 51:50 in favor of the Act, while all 50 Republicans in the US Senate opposed the IRA. After the November 2022 elections, the Republicans can regain power in the US Congress and could potentially revise the initiative. Experts also draw attention to the fact that the Act does not put limits to budget spendings and there is a risk of spending billions of dollars more than expected. For example, producing 1 million tonnes of green ammonia would cost taxpayers $600 million per year, 10 million tonnes capacity would, accordingly, cost $6 bn/year.

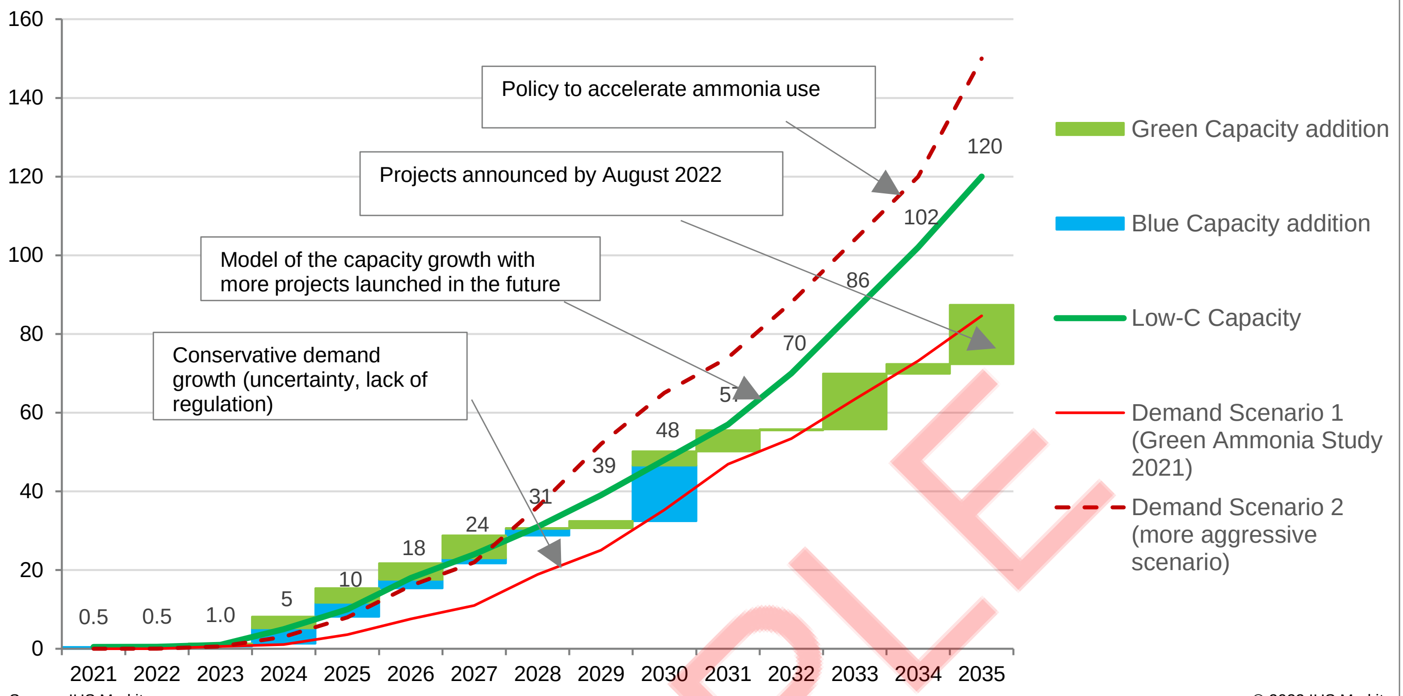
South Korea

The government is pushing for a 40% reduction in carbon emissions compared to 2018 by 2030 and achieving carbon neutrality by 2050.

Accordingly, the power generation sector is expected to require 11 million tonnes of ammonia per year after 2030 and 13.5 million tonnes of hydrogen per year after 2050. More than 80% of these must be procured overseas.

Green and blue ammonia supply and demand projections

Low-Carbon Ammonia Supply-Demand Forecasts



Source: IHS Markit

There are two scenarios for future clean ammonia supply-demand, both are quite probable at this stage:

1. Lack of low-carbon capacity to cover strong demand with consequent shortages and high premiums for low-carbon ammonia.

2. Excess of low-carbon capacity over slow demand with a lack of policy support and regulation, leading to lower prices and the use of low-carbon ammonia for conventional merchant ammonia uses.

On the supply side:

- By June 2022, there have been a sufficient number of green and blue ammonia projects announced across the globe to produce ~30 million tonnes of low-carbon ammonia by 2028.
- By June 2022, several massive-scale projects have been announced (4, 10, and 20 million tonnes per year capacity) and are scheduled for the first half of the 2030-s.
- There will also be a period from 2028-to 2031when capacity additions slow down. This gap can be covered by projects which may be announced in the next 5 years.

Assuming that more projects will start in the future, our model forecasts total probable low-carbon ammonia capacity at ~48 million tonnes by 2030 and 120 million tonnes by 2035.

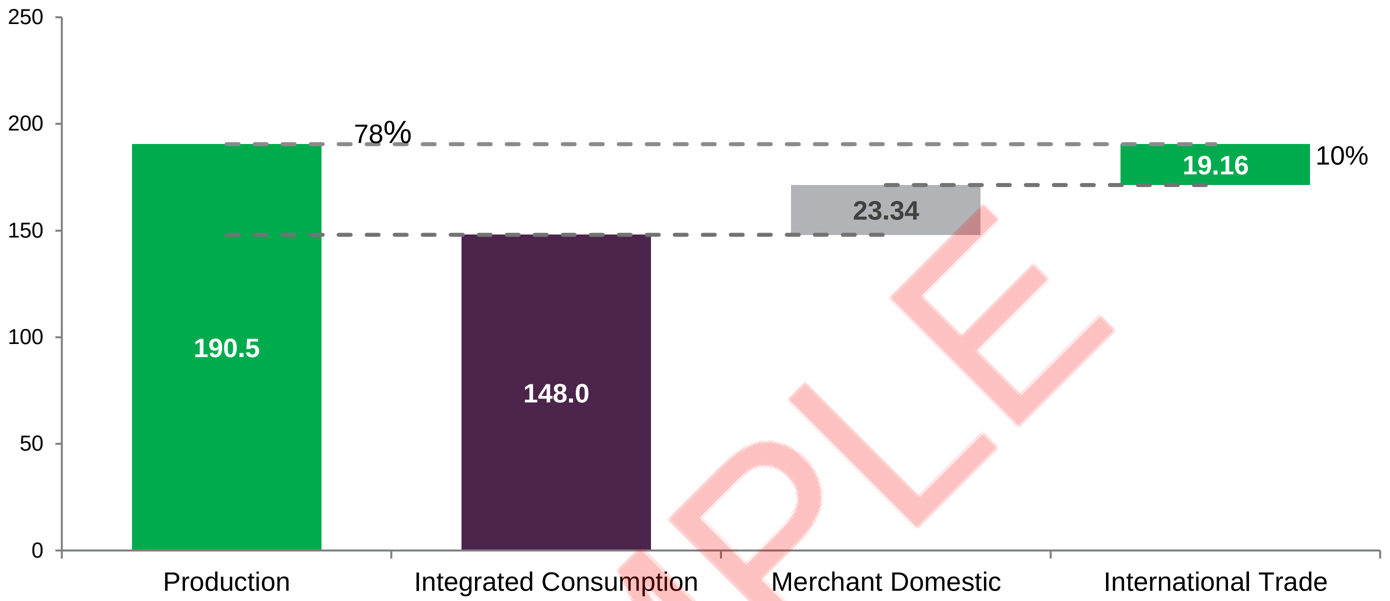
On the demand side:

- Taking a conservative approach to forecasting low carbon ammonia, the demand of low-carbon ammonia for bunkering, power/H2, and fertilizers may reach 35 million tonnes by 2030 and 85 million tonnes in 2035.
- With more dedicated policy to develop low-carbon ammonia application for energy (such as REPowerEU in Europe which set a plan to use ~20 million tonnes of ammonia for energy generation in EU by 2030), the demand may achieve 65 million tonnes by 2030 and150 million tonnes by 2035.

4
Supply-Demand Analysis

Market balance fundamentals

Global Ammonia Production and Merchant Markets in 2021



Source: IHS Markit

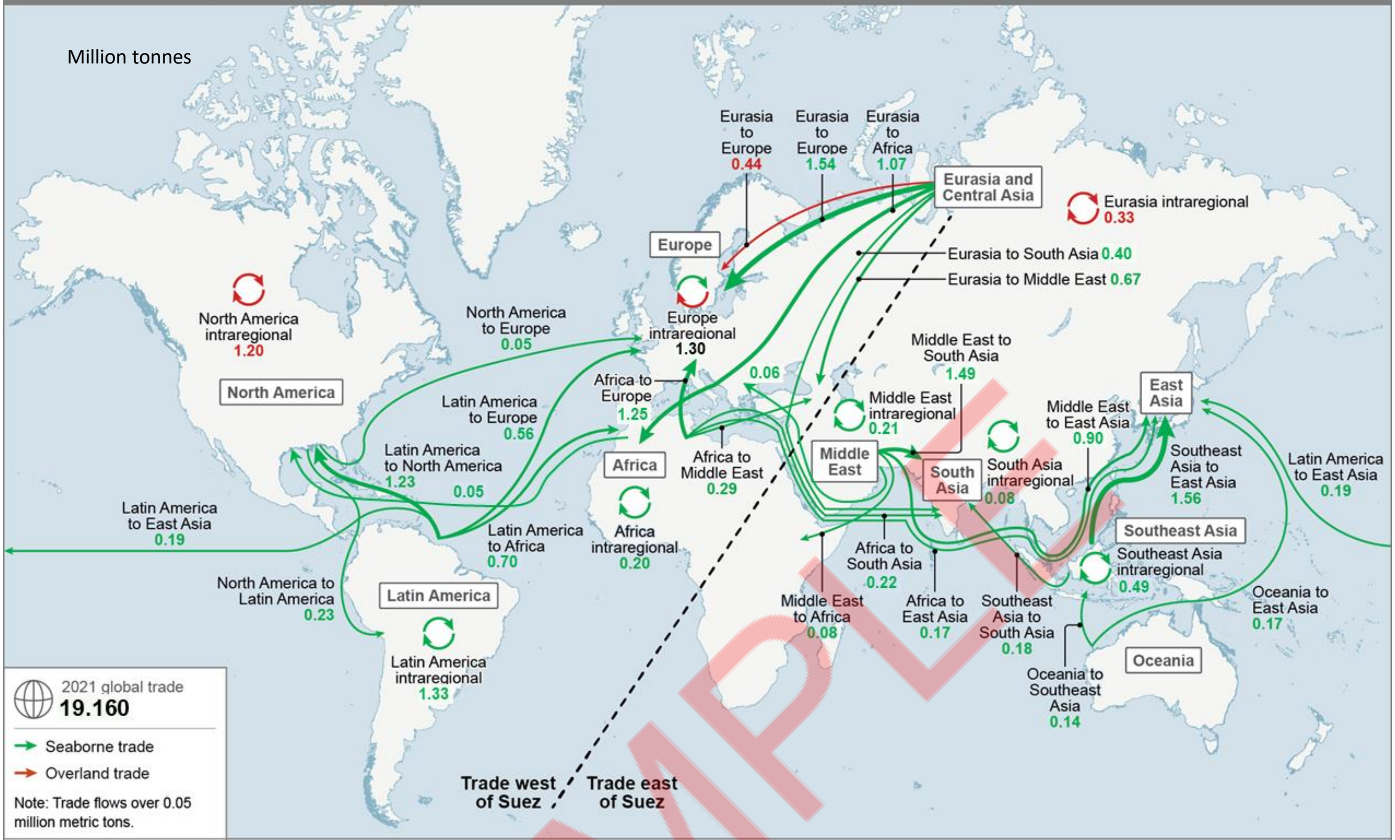
- The ammonia market includes international trade in merchant ammonia, the volume of which in 2021 amounted to 19.16 million tonnes, or 10.0% of global ammonia production.
- Most of the world's ammonia production - estimated at 78 % of total output, does not go beyond the boundaries of the plant at which it is produced and is processed there into downstream products.
- Most of the approximately 148 million tonnes of ammonia in integrated plants are processed into urea – 104.0 million tonnes or 75%: with 26.0 million tonnes or 19% into nitrates.
- There are integrated plants where ammonia is used to produce ammoniated phosphates and NPK in the same or a nearby production site, although the majority of MAP/DAP/NPK producers buy merchant ammonia.
- Most non-fertilizer users of ammonia acquire ammonia as their feedstock from the market. Ammonia usually is not the most important nor expensive feedstock for petrochemicals and does not play a major part in costs. The exception is caprolactam: about 40% of caprolactam producers have integrated ammonia plants, for example, Advansix (former Honeywell), Fibrant (former DSM), BASF, Azoty Tarnow, Azoty Pulawy, Grodno Azot, Kuybyshev Azot, Kemerovo Azot, Schekino Azot and some others.
- Merchant ammonia accounts for 22% of all ammonia produced in the world. This is ammonia which is transferred to other plants and consumed for various purposes there. The ammonia that is supplied from one plant to another within the framework of one company also falls into this volume. For example, Yara supplies many of its divisions in different countries with ammonia from its own production base from its plants in other countries, as does EuroChem and some other companies.
- Of the total merchant ammonia market of 42.2 million tonnes (2021), 45% goes to the international market, and 55% is traded within domestic markets. The largest domestic ammonia markets are in China (~12 Mt), USA (~7 Mt), Russia (~1.0 Mt), Germany (~0.5 Mt), Australia (0.48 Mt) and Indonesia (0.26 mt).

Ammonia export capacity

Country	Companies, plants	2010	2015	2020	2021	2022	2023	2024	2025
Canada	**CF Industries**: Medicine Hat, Courtright	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
USA	CF Industries: Donaldsonville, **Yara-BASF** Freeport, **OCI** Beaumont, **Coast Gulf Ammonia** (project)	-	-	0.5	0.5	0.5	0.5	1.3	1.7
Trinidad	**Nutrien, Yara/Tringen, CNCL, Nitrogen 2000, PLNL**	5.1	5.1	4.8	4.8	4.8	4.8	4.8	4.8
Venezuela	**Pequiven**	1.0	1.0	0.7	0.7	0.7	0.7	0.7	0.7
Russia	**TogliattiAzot, Rossosh, Eurochem** Kingisepp, **Uralchem, Acron, Kuybyshev Azot**	3.8	3.8	5.4	5.2	4.6	3.9	3.7	4.0
Ukraine	**OPZ, Ostchem**	2.2	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Saudi Arabia	**Ma'aden, Sabic**	1.2	1.2	2.0	2.0	2.5	3.1	3.2	3.2
Qatar	**Qafco**	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Iran	**Pardis Petrochem., Razi Petrochem**.	0.6	0.6	0.9	0.9	0.9	0.9	0.9	0.9
Oman	**Sohar**, **Omifco**, **OQ** Salalah (project)	0.2	0.2	0.2	0.2	0.4	0.5	0.5	0.5
UAE	**Fertiglobe** Al Ruwais	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Bahrain	**GPIC** Sitrah	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Algeria	**Fertial**: Arzew, Annaba, Fertiglobe **Sorfert** - Arzew	0.7	1.5	1.6	1.6	1.6	1.6	1.6	1.6
Egypt	**Fertiglobe** - Ebic, **Abu Qir**	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Libya	**Lifeco**	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Malaysia	**Petronas** - Kerteh, Sipitang	0.4	0.4	0.6	0.6	0.6	0.6	0.6	0.6
Indonesia	Kaltim, Parna Raya, PAU	1.0	1.2	1.8	1.8	1.8	1.8	1.8	1.8
Australia	**Yara** Pilbara	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
W Europe	**Yara** - Hull, Bruensbuttel, Sluiskil; **Borealis** - Rouen	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
E Europe	Azoty - Police; Bulgaria **Neochim**, others	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Turkey	**Igsas**, **Gemlik**	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Bangladesh	**BCIC** Chitagong	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Brazil	**Petrobras** Camacari (in rent to Unigel)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Others	Argentina, Bulgaria, Hungary,	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Export Capacity		**21.4**	**22.1**	**25.7**	**25.7**	**25.9**	**25.8**	**26.6**	**27.3**

World trade flows in 2021

Ammonia trade, 2021 (million metric tons)



Source: Data taken from IHS Markit Fertecon content: 2005468

Regional ammonia trade matrix in 2021, '000 tonnes

2021 total ammonia trade — Exporters — 000't NH_3

Importers ↓	Europe	Eurasia	Africa	Middle East	Central Asia	South Asia	East Asia	Southeast Asia	Oceania	North America	Latin America	Total
Europe	1,301	1,974	1,251	60	-	-	0	-	-	50	556	5,191
Eurasia	-	330	-	0	0	-	-	-	-	-	-	331
Africa	0	1,068	195	76	-	-	-	23	16	37	699	2,115
Middle East	7	672	287	209	-	-	0	-	-	-	-	1,175
Central Asia	-	49	-	-	0	-	-	-	-	-	-	49
South Asia	-	418	223	1,490	-	81	-	178	18	0	26	2,434
East Asia	-	38	168	901	-	24	0	1,562	168	-	185	3,046
Southeast Asia	-	-	4	23	-	-	2	485	136	3	-	652
Oceania	-	-	-	-	-	12	-	27	-	-	-	39
North America	0	25	69	-	-	-	7	-	-	1,199	1,233	2,533
Latin America	-	6	32	-	-	-	-	-	-	230	1,326	1,594
Total	**1,308**	**4,580**	**2,230**	**2,759**	**1**	**116**	**9**	**2,276**	**338**	**1,520**	**4,024**	**19,160**

Source: IHS Markit

Differences in 2021 regional ammonia trade matrix to 2020, '000 tonnes

Total trade, 2021 - 2020 differences — Exporters

Importers ↓	Europe	Eurasia	Africa	Middle East	Central Asia	South Asia	East Asia	Southeast Asia	Oceania	North America	Latin America	Total
Europe	-326	-177	657	60	-	-	0	-	-	49	84	347
Eurasia	-0	33	-	0	0	-	-	-	-	-	-	34
Africa	-21	12	70	42	-	-0	-	23	16	-63	-162	-84
Middle East	6	-108	-101	38	-	-	0	-	-	-0	-92	-257
Central Asia	-	0	-	-	0	-	-	-	-	-	-	0
South Asia	-0	130	31	-246	-	55	-	34	18	0	-26	-3
East Asia	-0	15	119	-346	-	-14	-0	63	11	-99	162	-89
Southeast Asia	-0	-	4	-19	-	-0	2	12	77	3	-	79
Oceania	-0	-	-	-49	-	12	-	4	-0	-	-	-33
North America	-1	25	69	-	-	-	-1	-	-0	189	-121	161
Latin America	-20	6	8	-	-	-	-	-19	-	-74	202	103
Total	-363	-64	857	-520	1	53	1	118	122	6	46	257

Source: IHS Markit

Differences in 2021 regional ammonia trade matrix to 2019, '000 tonnes

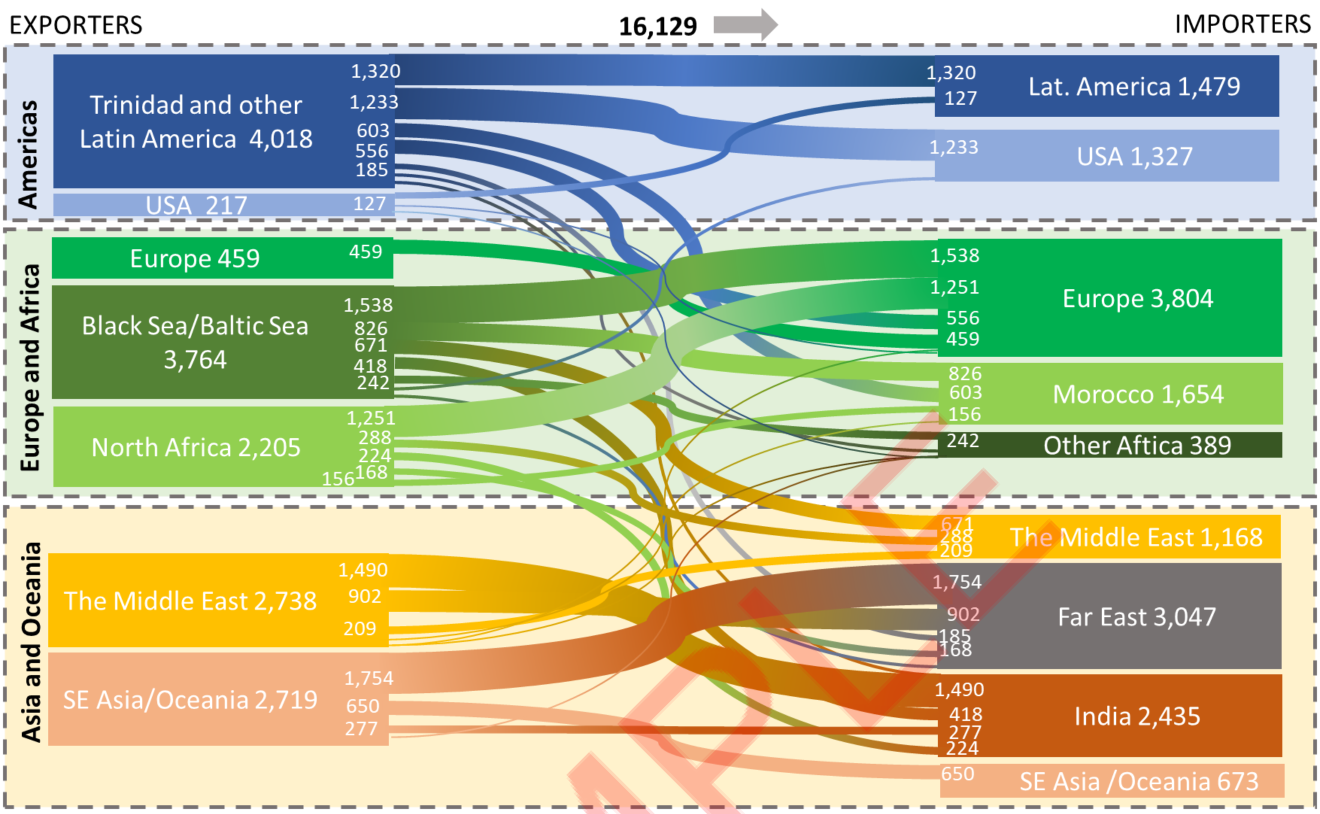
Total trade, 2021 - 2020 differences — Exporters

Importers ↓	Europe	Eurasia	Africa	Middle East	Central Asia	South Asia	East Asia	Southeast Asia	Oceania	North America	Latin America	Total
Europe	-272	-140	205	39	-	-	0	-	-	34	5	-129
Eurasia	-0	-203	-	0	0	-	-	-	-	-	-	-203
Africa	0	-42	167	63	-	-	-	23	16	-18	-15	195
Middle East	7	70	-120	74	-	-	0	-	-	-0	-106	-75
Central Asia	-	5	-	-	-9	-	-	-	-	-	-	-4
South Asia	-	178	-117	-218	-	59	-	-196	18	0	26	-250
East Asia	-	38	62	-323	-	13	-0	193	-38	-38	-182	-275
Southeast Asia	-	-	4	18	-	-	2	-31	37	3	-	33
Oceania	-	-	-	-	-	12	-	-34	-0	-	-	-23
North America	-1	25	69	-	-	-	-1	-	-	257	-277	72
Latin America	-0	6	10	-	-	-	-	-	-	-81	145	80
Total	-266	-62	281	-347	-9	84	1	-45	32	157	-404	-577

Main differences in 2021 trade flow respect to 2019 and 2020 trade flow matrices:

- Total recovery in trade by 0.26 million tonnes respect to 2020, including more imports to Europe, North America, Southeast Asia and Latin America, but still considerable reduction relative to 2019 level (-0.6 million tonnes),
- Fall of imports to South Asia (India), East Asia (China, mainland) and Middle East (Turkey). Imports to Africa (Morocco) have grown in 2021 relative to 2019 but reduced to the 2020 level. Decrease in exports from the Middle East (Saudi Arabia) to all destinations due to technical reasons, and from Europe (reduction in intra-reginal trade in Europe).
- Increase in exports from Africa (Algeria, Egypt, Libya). After a low-export 2019 and 2020, the Algerian producers recovered production and exported more. Slight recovery in exports from Latin America in 2021: Trinidad increased output after having worked at a reduced capacity in 2020. Both Brazil and Mexico resembled production and exports. Venezuela did not export in 2020.Still, the continent exported less in 2021 than in 2019.
- Eurasia has slightly reduced exports. After strong growth of exports to Turkey in 2020, the demand in Turkey reduced due to high prices in 2021. Ukraine resumed ammonia production in 2020 and reduced imports from Russia, at the same time exporting more from the Black Sea.

Seaborne ammonia trade flows, 2021, '000 tonnes



EXPORTERS

Trinidad and other Latin America	USA	Europe	Black Sea/Baltic Sea	North Africa	The Middle East	SE Asia/Oceania
Trinidad and Tobago Brazil, Argentina	USA	EU-27, UK	Russia, Ukraine	Algeria, Egypt, Libya	Saudi Arabia, Qatar, Iran, Oman, Bahrain, UAE, Turkey	Indonesia, Malaysia, Australia, Bangladesh

IMPORTERS:

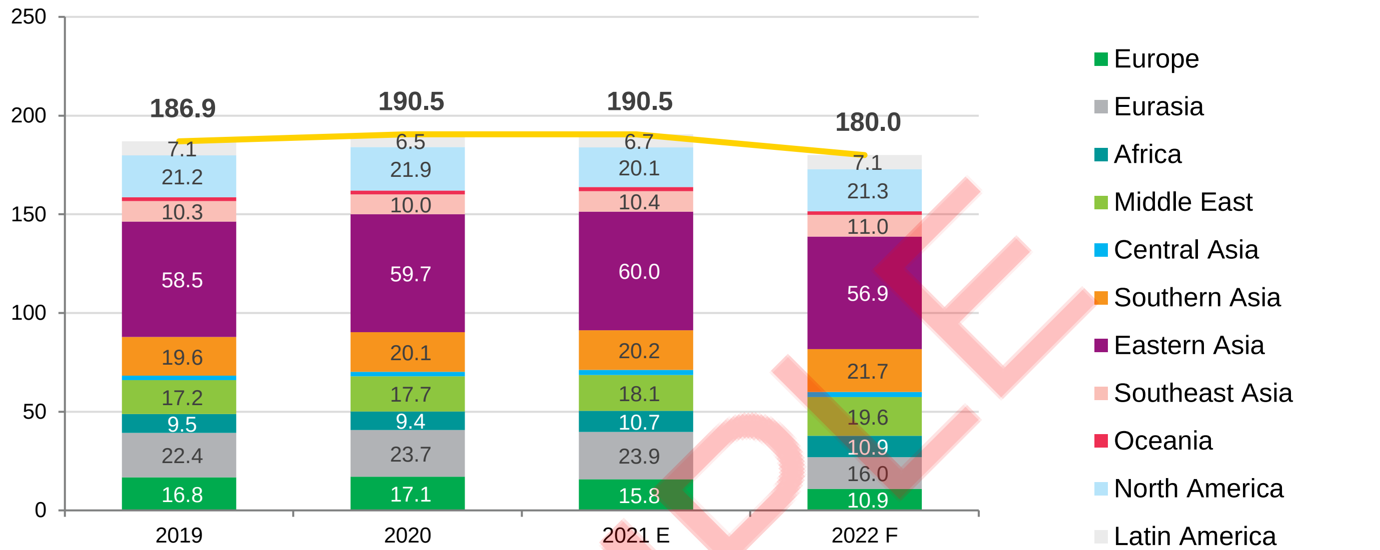
Latin America	USA	Europe	Morocco	Other Africa	The Middle East	Far East	India	SE Asia/Oceania
Brazil, Mexico, Chile, Colombia Guatemala, Cuba	USA	EU-27, Norway, Serbia Switzerland	Morocco	South Africa, Tunisia Senegal, Madagascar	Turkey, Jordan, Israel	S. Korea, China mainland, Taiwan, Japan	India	Thailand, Australia, Vietnam, Philippines Indonesia, Singapore

Source: IHS Markit

4
Outlook for Supply

Production Update

Global ammonia production, 2019 - 2022, million tonnes



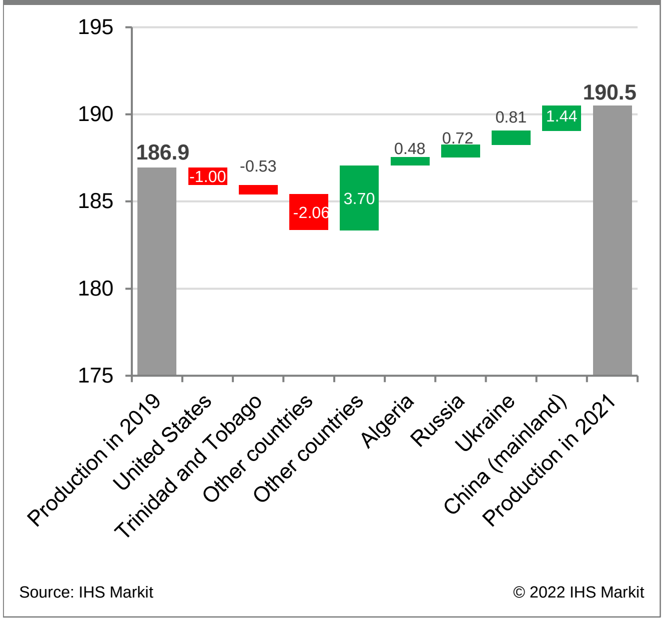
Source: IHS Markit

Top 20 ammonia producing countries, '000t

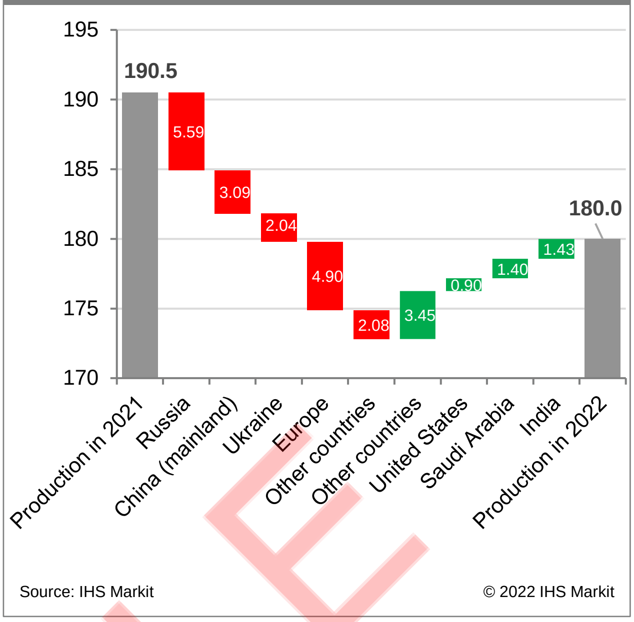
Rank (2021)	Country	2019	2020	2021	2022 F	Difference 2021/2019	Difference 2021/2020	Difference 2022/2021
1	China (mainland)	57,647	58,844	59,092*	*56,000*	1,445	248	-3,092
2	Russia	19,128	19,512	19,846**	*14,259*	718	334	-5,587
3	United States	16,475	17,056	15,472**	*16,375*	-1,003	-1,584	903
4	India	14,860	14,794	15,037***	*16,471*	177	243	1,434
5	Indonesia	7,464	7,175	*7,326*	*7,552*	-138	152	226
6	Egypt	5,069	5,139	*5,122*	*5,219*	53	-17	97
7	Saudi Arabia	4,879	5,262	*5,063*	*6,468*	184	-199	1,404
8	Trinidad and Tobago	5,444	5,066	4,930****	*4,917*	-527	-131	4
9	Canada	4,707	4,887	4,613**	*4,971*	-94	-274	358
10	Iran	4,291	4,337	*4,397*	*4,525*	105	59	128
11	Pakistan	4,008	4,242	*4,219*	*4,329*	211	-23	110
12	Qatar	3,771	3,786	*3,871*	*3,862*	100	85	-9
13	Algeria	2,944	2,838	*3,419*	*3,145*	475	581	-274
14	Germany	2,938	2,838	*2,856*	*1,940*	-83	18	-916
15	Ukraine	1,827	2,795	2,634**	*594*	807	-161	-2,040
16	Poland	2,450	2,646	*2,544*	*1,900*	94	-103	-644
17	Netherlands	2,688	2,526	*2,504*	*1,900*	-184	-21	-604
18	Oman	2,080	2,104	*2,177*	*2,314*	97	73	137
19	Australia	1,835	1,916	*1,834*	*1,736*	-0	-82	-99
20	Malaysia	1,455	1,587	*1,694*	*1,627*	239	107	-67
	Other countries	20,988	21,154	*21,871*	*21,682*	883	717	-189
	Total	**186,944**	**190,483**	***190,505***	***183,285***	**3,561**	**22**	**-7,220**

Sources: *- CNFIA, **-IFA, ***- IFA, FAI, ****- MEEI, *italics – Fertecon estimates*

Production changes in 2021 to 2019, million t



Ammonia production: changes in 2022 to 2021



According to our estimates, global production in 2021 remained at the level of 2020. The increase in production in early 2021 due to the recovery of the global economy after the pandemic was offset by a decrease in operational rates at the end of 2021 due to rising gas prices in some regions. In 2022, we expect a significant decrease in production - by 7 million tonnes compared to 2021.

Not surprisingly, Russia and Ukraine are leading the way in reducing ammonia production in 2022 with reference to 2021. Also, a significant decline in production is observed in China - according to our estimates, by more than 3 million tonnes. The main reason is the decrease in demand.

6
Outlook for Costs

Assumed cash costs of production of 1 tonne of ammonia, $/t, 2021 (estimates and model)	Saudi Arabia	Russia	USA	Trinidad	Indonesia	Europe
Assumed price for natural gas, 2021	$1.25	$1.60	$5.00	$4.40	$6.00	$15.70
Natural gas cost	43.75	54.40	170.00	162.80	204.00	502.4
Electricity	0.26	1.1	0.9	0.9	1.3	1.4
Cooling water	5	4.8	5.5	5.5	8.1	8
Catalysts/chemicals	4.9	4.9	4.9	4.9	4.9	4.9
Operating Labour	1.4	0.8	2.3	1.7	0.3	4.3
Maintenance	17.2	19.0	40.0	19.5	19.9	13.0
Plant overhead	10	3.2	5.5	6.9	10.3	7.5
Carbon costs	-	-	-	-	-	11
Total Cash Costs	**82.51**	**88.2**	**229.1**	**202.2**	**248.8**	**552.5**

Source: IHS Markit Fertecon

Natural gas costs (all export capacities are currently running on natural gas) are the main item in the cost structure of ammonia producers. Depending on the price of gas, the share of expenses on it ranges from 53% (Saudi Arabia) to 87% (Western Europe) of cash costs. In the largest exporters - Russia and Trinidad, natural gas accounts for 62% and 76% of cash costs, respectively, and in the USA - 64%. It is the significant differences in gas prices in different countries and regions that determine the competitiveness of certain ammonia producers and dictate the shape of the cost curve.

Other costs vary from country to country but differ significantly less than gas costs. According to our estimates, in 2021 other cash costs ranged from $34/ts in Russia to $45/t in Indonesia. Other costs include other energy (electricity from the grid, steam, additional gas as fuel), water, including purified process water for steam generation and water for cooling, as well as catalysts and other consumables, including chemicals. In addition, there are labor and repair costs as well as overheads.

Staff costs are not a defining expense item. For example, in the United States, a 24-hour ammonia plant operation with a capacity of 750,000 t per year requires 27 people, including 2 managers, 5 shift managers and 20 operators, with a payroll of $1.8 million per year, or $ 2.3 per ton of ammonia produced, or 1.4% of cash costs. In countries with lower salaries, personnel costs can be significantly lower than in Europe or the United States, but this difference is often neutralized by the large number of employees hired.

Oil Price Analysis and Outlook

Crude oil prices rose during much of 2021, with Brent crude oil spot prices averaging $71/bbl for the year compared with $42/bbl in 2020. Rising prices reflected growth in global oil demand that outpaced near-term growth in oil production, resulting in falling global oil inventories.

In Q2 2022, Brent crude oil prices averaged $115/bbl, a $14/bbl increase from the previous quarter and a $46/bbl increase from Q2 2021. For Q3 2022, we now project the Dated Brent price to average $136/bbl.

S&P Global's Oil Analysis Team has reduced its second-half 2022 world oil demand outlook by 1.1 MMb/d, and its 2023 demand growth estimate is cut from 3.0 MMb/d to 2.6 MMb/d. These cuts reflect the intertwined impact of high oil prices and decelerating economic growth. The team has revised up its projections for the average price of Dated Brent in the second half of 2022 and full year 2023 to $135/bbl and $109/bbl, respectively.

Brent crude oil price outlook
$/bbl fob

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035
Nominal	52.4	43.7	54.2	71.0	64.2	41.6	70.6	121.4	109.3	88.5	88.0	97.9	107.8
Real 2021$	59.3	48.9	59.6	76.2	67.7	43.3	70.6	113.5	98.7	78.2	76.1	75.6	74.3

Source: IHS Markit

Feedstock Price Outlook

Natural Gas Global Overview

In most regions, natural gas comprises by far the largest part of the production cost of urea. However, the structure of gas markets varies considerably by region, and within the regions for individual countries. In some regions where there is an active trading hub, pricing is determined by market competition, but in many others, different mechanisms apply. Of particular significance to the European industry has been the supply of gas under formula-based contracts which linked the gas supply price to the prices of liquid fuels, and which dominated producers' cost structures in the early 2000's. Since then, however, the development of an active spot market for gas in the region has allowed most producers to move away from these legacy pricing structures. In some regions/countries, gas prices are under government control, and can be regulated either at a level which covers cost of supply, or at levels above or below this to either generate revenue or to provide subsidies to the population or to industry.

Some urea producers purchase gas at the prevailing wholesale price in their country, but others buy gas under contract directly from gas suppliers, while hedging is also widely used in some regions to manage feedstock costs. Many producers will use a combination of these purchasing strategies as a means of diversifying risk. In the production cost estimates which follow, we reflect where known the actual prices paid by producers rather than the wholesale gas costs in the relevant country, though it should be noted that these arrangements are often considered commercially sensitive and not widely publicised.

Longer term, there is the potential for the development of unconventional gas in Europe and in other world regions. However, while unconventional gas resources globally are now estimated to be as large as conventional resources, their production outlook is less certain. The United States has seen a very rapid development of shale gas resources, partly owing to the large number of independent rig companies which have been able to deploy quickly, and partly due to a planning system which has facilitated the process. Elsewhere, however, the use of hydraulic fracturing or "fracking", the technique that uses chemicals and high-pressure water to allow gas to flow from shale and other tight gas deposits, has raised environmental concerns with issues arising over water use, contamination, and disposal, though adhering to best practices in production can largely mitigate these environmental risks. Production costs for unconventional gas in Europe are likely to be higher than in the US, both because of tighter environmental restrictions and due to differences in the geology of the rock formations which are likely to make recovery more difficult technically.

Thus, in most regions, these concerns, combined with a more limited availability of the necessary equipment and expertise, will lead to a slower development of unconventional gas production than has been seen in the United States, particularly in more densely populated areas. Furthermore, the fall in gas prices has dramatically reduced the economic viability of many projects. In Europe this is despite a political will to diversify away from a dependence on Russian gas in many Central/East European countries. Poland has abandoned its attempts to develop a shale gas industry, at least for the present, with geological difficulties, as well as environmental concerns and a powerful coal lobby acting as further disincentives, while Shell cited geopolitical risk in abandoning similar attempts in Ukraine. Elsewhere in the world, several countries are developing their shale industry, including Canada, China, the largest potential world shale gas source, and Argentina and these developments are expected to have an impact on world gas markets over the coming years.

Forecast Summary

Natural gas price forecasts
$/MMBtu

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035
W Europe TTF	6.4	4.5	5.7	7.9	4.4	3.1	15.8	49.6	54.3	33.7	28.5	17.0	13.3
W Europe Contract	6.8	4.5	5.6	6.8	7.2	5.8	6.2	10.0	12.6	10.5	9.9	10.9	11.9
BAFA	6.7	4.9	5.6	6.6	5.3	4.1	9.0	39.9	48.1	31.1	27.1	13.5	12.0
Spain, LNG Imported	6.6	4.9	5.7	6.6	5.7	4.2	9.4	19.9	26.7	21.6	20.8	12.6	10.0
US Henry Hub	2.6	2.5	3.0	3.1	2.5	2.0	3.8	6.0	4.9	3.5	4.2	4.0	4.4

BAFA – IHS Markit Energy's proxy for a pipeline contract gas price in Northwest Europe.
Source: IHS Markit

Questions? **Speak to a Sales Rep**