

## Chemicals

## Chem Weekly: Helium supplies increasing, MDI pricing up, lithium inventories rise

Price Objective Change

## Global helium supplies to increase 50% in 5 years

Global helium demand is a 6bcf market with nearly half from US LNG-derived reserves that have been depleted, resulting in very tight supplies the last couple of years, leading to higher spot prices to ration demand and all the major gases suppliers other than Air Products had force majeure. Two new helium sources are underway, with the initial startup last fall of Russia's Amur complex near the Chinese border that will add 1bcf by 2026 and 2bcf by the end of the decade and a 4<sup>th</sup> project in Qatar that will add 1.7bcf by 2030 (see Exh 1). While spot prices increased sharply during the 2022/23 shortage, helium expert Phil Kornbluth attributes the reversal of pricing in the last 6 months to the Amur start-up, particularly in Asian countries that have not implemented US sanctions targeted at preventing use of US-manufactured helium containers (85% of global fleet). Other sources of disruption include shipping challenges through the Red Sea, price increases from Exxon, Gazprom selling to tier 2 gas companies, and the slowdown in electronics manufacturing. [Join our discussion with Phil Kornbluth on Wednesday March 20 at 10amET.](#)

## European MDI moves up

According to ICIS, European contract prices for MDI (polyurethane precursor) increased by €140/mt for polymeric (crude) product and €50 for monomeric (pure) product, as supply has tightened and feedstock inflation is overcoming continued soft demand. European prices for benzene (MDI raw material) are up ~50% since the start of the year largely on refinery turnarounds, including €214/mt in March. Net-net, however, we estimate that the crude MDI to benzene spread in Europe widened by ~€35/mt (~1.5c/lb). Additionally spot and forward benzene prices are easing in Europe, while ICIS also noted benzene costs should start deflating in the US as well.

## Lithium carbonate inventories in China increased in Feb

Shanghai Metals Market (SMM) reported lithium carbonate inventories at LCE converters and cathode/battery producers in China as of Feb 29, which were up 14% vs the end of January, and only 16% below the year-ago peak (see Exh 2). Most of the m/m increase was at converters, which do not appear to be slowing operating rates. In other lithium news, Lithium Americas received notice from the DOE for a loan up to \$2.26bn to build Nevada's Thacker Pass project. The mine's first phase is expected to produce 40ktpa of battery grade Li<sub>2</sub>CO<sub>3</sub>, and the project is expected to reach full capacity in 2028, producing 80ktpa. We also updated our SGML model, now expecting \$15mn 4Q23 EBITDA vs \$42mn prior, reflecting a material revenue adjustment headwind occurring when the Sigma's late September 22.5kt lithium shipment settled in 4Q likely at a much lower price than initially expected. Our 2024E EBITDA also decreases to \$0mn from \$5mn, off of lower 1Q pricing expectations. However, from a valuation perspective, these decreases in near-term earnings are offset by Sigma's resource expansion (extending mine life in Phase 1 through 3) as well as recent closing of \$90mn in trade finance credit lines (increasing our confidence that Phase 2 and 3 will be able to start producing in 2025). Our PO rises to \$29 from \$27, based solely on the NAV assessment.

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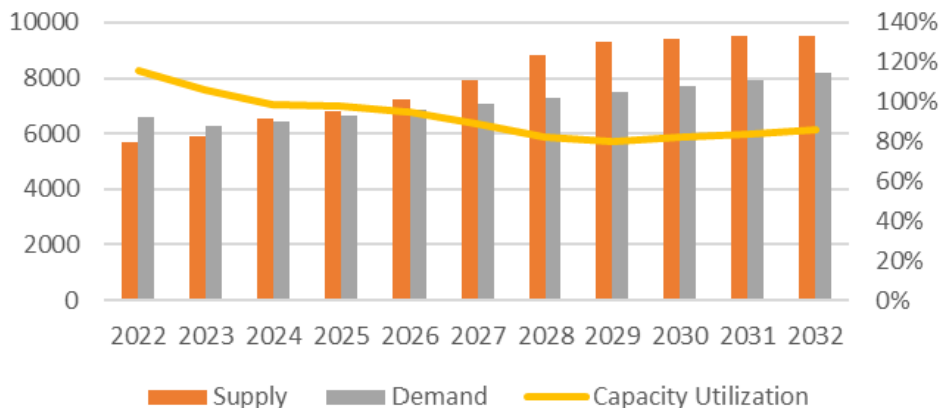
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## Abbreviations

MDI: methylene diphenyl diisocyanate  
Bcf: billion cubic feet

**Exhibit 1: Global Helium Supply and Demand**

Supplies are balanced now post the 2022-23 shortage, but could get long in coming years

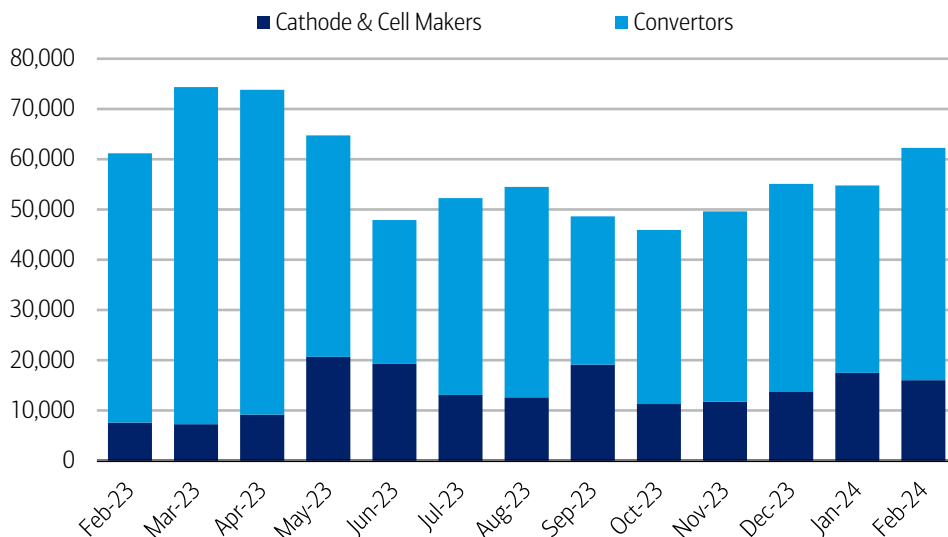


Source: Kornbluth Helium Consulting

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**Exhibit 2: Total China Inventory Lithium Carbonate (mt)**

Inventory growth at the converter level drove carbonate inventories +14% m/m increase vs Jan-24



Source: SMM

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**Petrochemical & Chlor-Alkali****Exhibit 3: Historical pricing overview for PE, PP, PVC, LNG, Isocyanates**

US ethane margins are currently higher than EU naphtha PE margins

	2018	2019	2020	2021	2022	2023	1Q22	2Q22	3Q22	4Q22	1Q23	2Q23	3Q23	4Q23
<b>Integrated PE Margins</b>														
US Ethane	34	28	25	58	34	29	42	38	26	28	30	30	25	29
EU Naphtha	31	28	29	49	45	29	36	55	56	34	28	35	23	30
China Naphtha	17	5	11	2	-17	-11	-22	-17	-14	-16	-12	-6	-11	-13
<b>Polyethylene Prices</b>														
HDPE Net Transaction (NA c/lb)	62	52	49	85	69	54	74	78	65	61	55	54	53	54
HDPE Discounted Contract (EU c/lb)	74	66	60	91	87	75	91	100	79	76	77	75	71	75
HDPE Spot (Asia c/lb)	58	44	40	50	47	42	51	50	45	42	43	42	42	41

**Exhibit 3: Historical pricing overview for PE, PP, PVC, LNG, Isocyanates**

US ethane margins are currently higher than EU naphtha PE margins

	2018	2019	2020	2021	2022	2023	1Q22	2Q22	3Q22	4Q22	1Q23	2Q23	3Q23	4Q23
<b>Ethylene Prices</b>														
Ethylene (US Gulf c/lb)	20	19	19	45	29	20	38	30	25	21	23	19	19	21
Ethylene (EU c/lb)	50	42	27	53	51	35	60	65	40	40	42	32	30	35
Ethylene (SE Asia c/lb)	53	39	33	47	49	41	54	55	44	43	44	40	37	42
<b>Ethylene Cash Costs</b>														
US Ethane (c/lb)	15	11	11	14	23	13	18	27	26	20	12	11	15	12
US Propane (c/lb)	23	13	13	23	32	19	39	34	32	25	20	18	20	16
US Naphtha (c/lb)	29	30	21	24	47	41	61	47	38	43	39	38	46	39
EU Naphtha (c/lb)	30	25	18	29	28	33	43	31	10	29	37	27	35	32
Asia Naphtha (c/lb)	35	33	21	40	53	43	64	55	46	47	45	37	43	46
US Butane (c/lb)	19	11	14	18	31	20	41	32	25	25	24	16	21	20
<b>Feedstock Dynamics</b>														
US Ethane (c/gal)	33	22	19	31	48	25	39	57	55	39	25	21	29	23
US Propane (c/gal)	88	55	46	105	112	71	131	126	109	81	81	69	68	67
US Butane (c/gal)	92	59	53	117	125	80	159	134	111	96	108	67	61	85
Brent Oil (\$/bbl)	72	64	44	71	99	82	97	112	99	89	83	78	85	84
<b>Isocyanates</b>														
US MDI (c/lb)	184	158	142	189	218	171	221	231	223	199	185	175	164	160
US TDI (c/lb)	165	152	211	269	232	263	240	223	227	238	272	270	260	251
EU MDI (Eur c/lb)	150	119	87	130	140	124	139	145	138	137	139	136	114	105
EU TDI (Eur c/lb)	90	106	151	148	92	136	89	79	84	116	173	153	114	106
China MDI (c/lb)	114	71	76	115	98	84	120	104	91	78	86	83	86	81
China TDI (c/lb)	88	104	187	184	83	101	90	84	76	83	114	102	96	90

Source: OPIs, Bloomberg, BofA Global Research

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**Exhibit 4: Historical pricing overview for PE, PP, PVC, LNG, Isocyanates**

US ethane margins are currently higher than EU naphtha PE margins

	12/7	12/14	12/21	12/28	1/4	1/11	1/18	1/25	2/1	2/8	2/15	2/22	2/29	3/7	3/14
<b>Integrated PE Margins</b>															
US Ethane	27	28	28	28	31	29	29	31	30	30	31	31	31	31	32
EU Naphtha	25	25	25	25	23	23	23	23	29	29	29	29	29	35	35
China Naphtha	-14	-14	-18	-17	-14	-11	-14	-15	-18	-11	-15	-13	-14	-15	-16
<b>Polyethylene Prices</b>															
HDPE Net Transaction (NA c/lb)	51	51	51	51	54	54	54	54	54	54	54	54	54	54	54
HDPE Discounted Contract (EU c/lb)	74	74	74	74	74	74	74	74	80	80	80	80	80	82	82
HDPE Spot (Asia c/lb)	40	40	40	40	40	41	41	41	41	41	41	41	41	42	42
<b>Ethylene Prices</b>															
Ethylene (US Gulf c/lb)	20	19	18	18	19	20	20	20	21	20	20	19	19	19	19
Ethylene (EU c/lb)	34	34	34	34	33	33	33	33	38	38	38	38	38	37	37
Ethylene (SE Asia c/lb)	43	41	41	41	41	40	40	41	43	43	43	43	49	49	49
<b>Ethylene Cash Costs</b>															
US Ethane (c/lb)	11	10	10	10	10	12	12	10	11	11	10	10	10	10	9
US Propane (c/lb)	19	17	16	18	18	19	23	27	27	29	27	25	22	18	15
US Naphtha (c/lb)	40	36	38	38	37	36	34	38	38	34	37	36	36	34	33
EU Naphtha (c/lb)	35	35	35	35	38	38	38	38	37	37	37	37	37	34	34
Asia Naphtha (c/lb)	46	46	51	50	47	42	44	42	44	40	45	43	42	44	47
US Butane (c/lb)	28	30	28	29	28	25	25	29	26	26	26	25	23	17	15
<b>Feedstock Dynamics</b>															
US Ethane (c/gal)	21	17	20	17	18	21	24	19	20	21	19	17	19	20	19
US Propane (c/gal)	71	69	64	66	70	70	82	86	86	92	92	92	86	86	79

**Exhibit 4: Historical pricing overview for PE, PP, PVC, LNG, Isocyanates**

US ethane margins are currently higher than EU naphtha PE margins

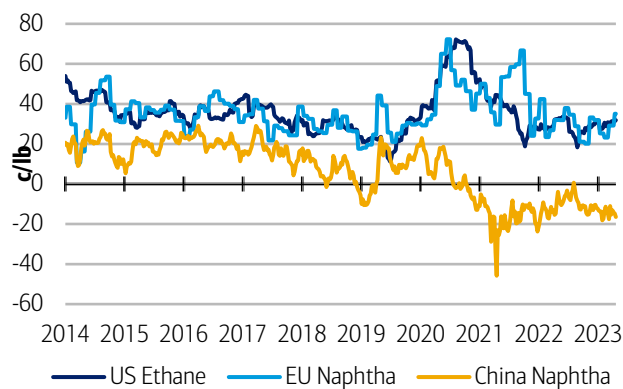
	12/7	12/14	12/21	12/28	1/4	1/11	1/18	1/25	2/1	2/8	2/15	2/22	2/29	3/7	3/14
US Butane (c/gal)	96	104	99	96	101	93	96	102	95	96	100	95	87	84	81
Brent Oil (\$/bbl)	79	76	77	79	77	79	78	79	84	77	82	83	82	84	82
<b>Isocyanates</b>															
US MDI (c/lb)	160	160	160	160	160	160	160	170	160	160	160	160	160	160	160
US TDI (c/lb)	249	249	249	249	249	244	244	244	244	244	244	244	244	244	244
EU MDI (Eur c/lb)	108	110	110	111	111	111	112	112	112	111	113	114	114	115	118
EU TDI (Eur c/lb)	108	104	106	106	105	106	104	105	104	103	103	104	104	105	105
China MDI (c/lb)	81	81	81	81	81	81	81	82	83	83	83	90	90	90	90
China TDI (c/lb)	87	87	87	87	87	87	87	87	87	90	90	90	92	94	94

Source: OPIS, Bloomberg, BofA Global Research

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**Exhibit 5: Global PE Margins based on feedstock mix**

Integrated margins remain negative for Chinese producers



Source: IHS, Bloomberg, BofA Global Research

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**Exhibit 6: US premium to global netbacks**

The US polyethylene price continues to have a premium to historic

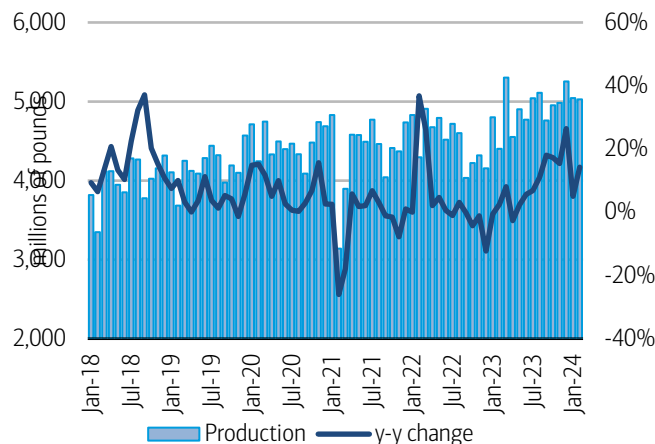


Source: OPIS, Bloomberg, BofA Global Research

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**Exhibit 7: US polyethylene production**

Production is accelerating with new capacity

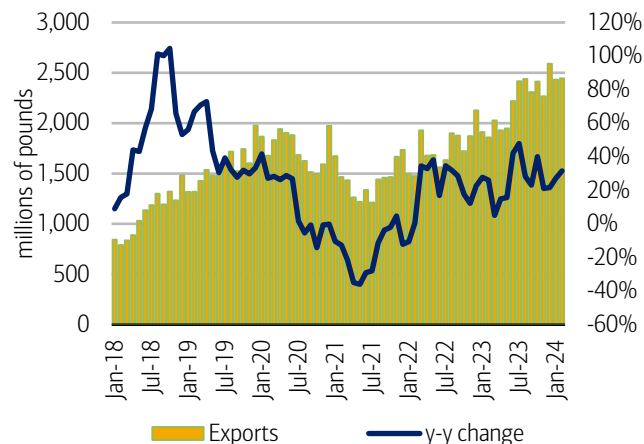


Source: American Chemistry Council, BofA Global Research

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**Exhibit 8: US polyethylene exports**

Exports have improved more recently

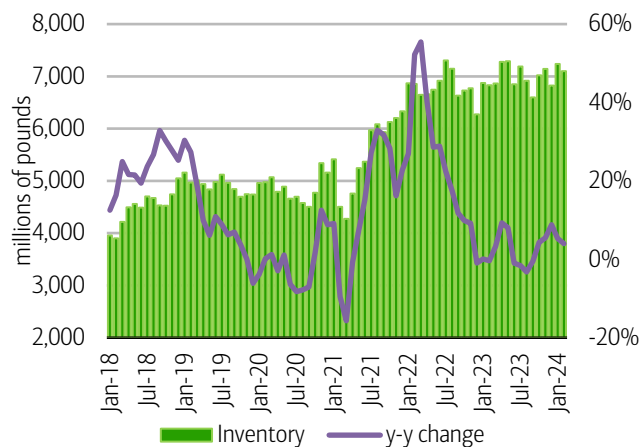


Source: American Chemistry Council, BofA Global Research

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**Exhibit 9: US polyethylene inventory**

Inventories remain elevated, returning to near peak levels

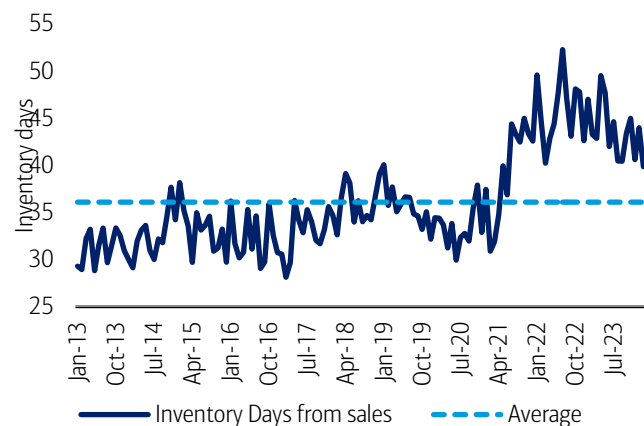


Source: American Chemistry Council, BofA Global Research

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**Exhibit 10: US polyethylene days of sales in inventory**

Days of sales in inventory are above normal

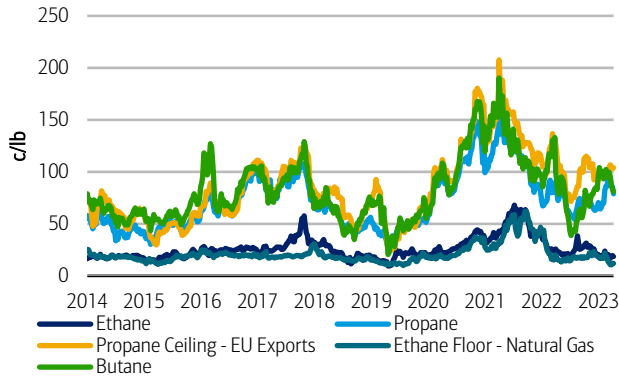


Source: American Chemistry Council, BofA Global Research

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**Exhibit 11: US NGL Dynamics (c/lb)**

US ethane is at the low end of the PE cost curve

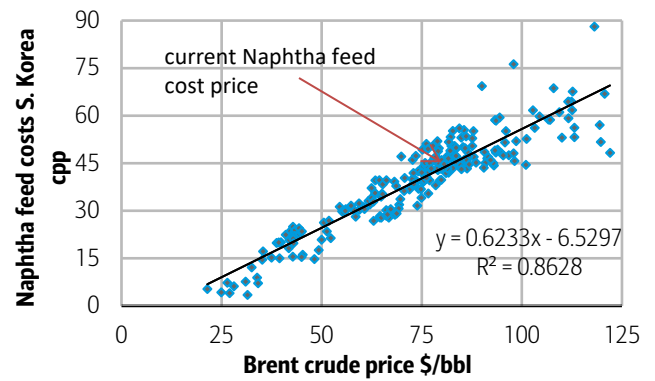


Source: OPIS, Bloomberg, BofA Global Research

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**Exhibit 12: Brent Oil vs Naphtha feed cost (S. Korea) price regression**

Naphtha feedstock cost closely follow changes in Brent crude

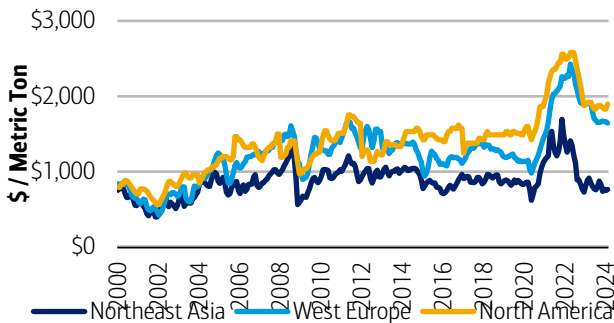


Source: OPIS, Bloomberg, BofA Global Research

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**Exhibit 13: PVC prices (\$/mt)**

PVC prices moving off of multi-decade highs

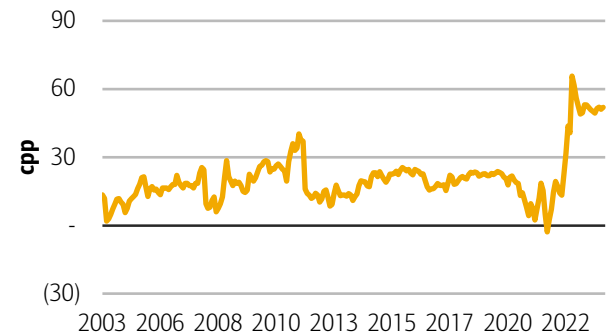


Source: OPIS, Bloomberg, BofA Global Research

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**Exhibit 14: US Contract PVC Premium over Spot**

Spot markets trade at a significant discount to contract



Source: OPIS, BofA Global Research Estimates

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**Exhibit 15: non-integrated PVC margin (80% contract 20% spot)**

PVC margins are moving off peak



Source: OPIS, Bloomberg, BofA Global Research Estimates

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**Exhibit 16: US ethylene dichloride price**

Prices have collapse with international PVC price

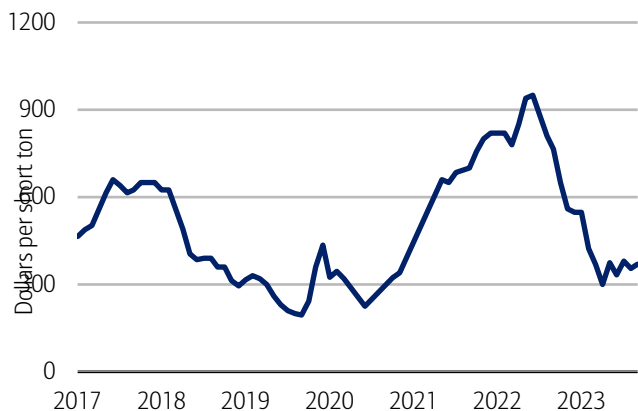


Source: Bloomberg, BofA Global Research

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**Exhibit 17: Caustic export price (\$/ short ton)**

At \$580/short ton caustic export prices have fallen off of highs

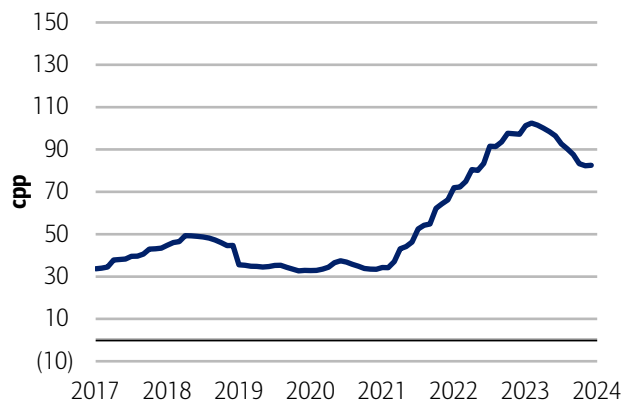


Source: Bloomberg

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**Exhibit 18: US ECU Cash Margins**

Cash margins remain high as cost deflation offset softer contract caustic

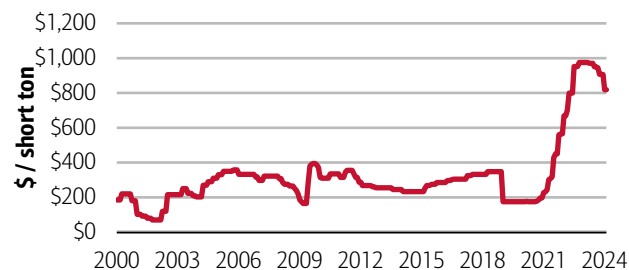


Source: Bloomberg, OPIS

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**Exhibit 19: US chlorine price**

Chlorine prices have moved higher on initiatives by Olin

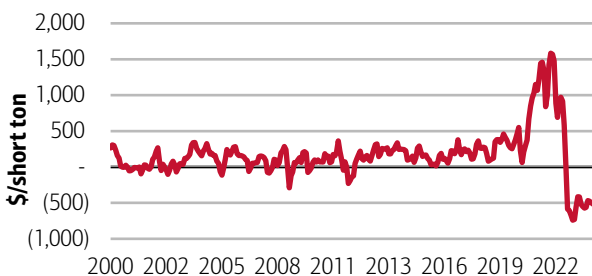


Source: OPIS

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**Exhibit 20: Implied chlorine premium in spot PVC vs. merchant price**

A negative value indicates an incentive to sell chlorine vs spot PVC

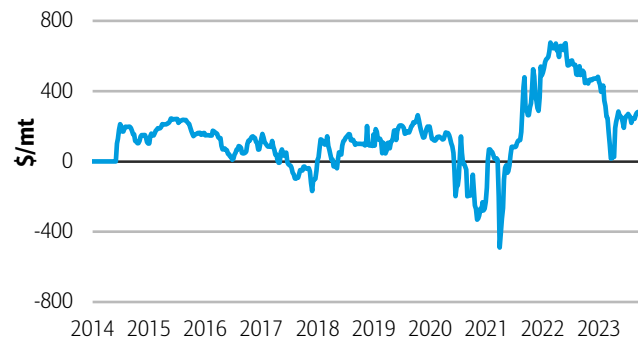


Source: OPIS, BofA Global Research

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**Exhibit 21: US acetic acid spread to China**

US acetic acid spread to china is near to zero

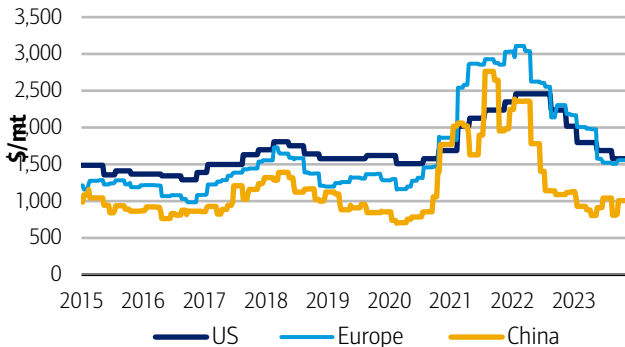


Source: Bloomberg, BofA Global Research

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**Exhibit 22: Global VAM contract prices**

US &amp; European VAM prices remain bid

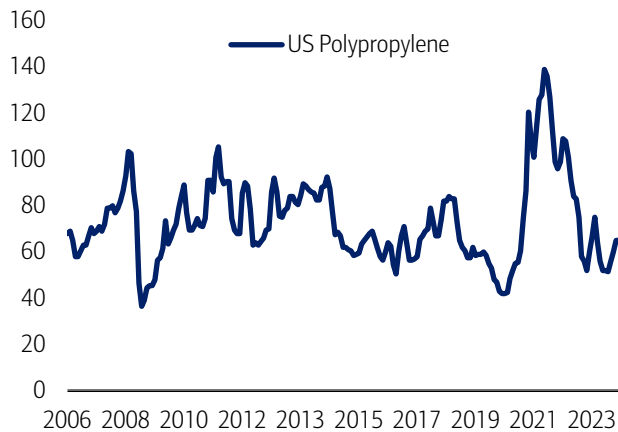


Source: Bloomberg

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**Exhibit 23: US Polypropylene price**

Polypropylene prices have retraced sharply

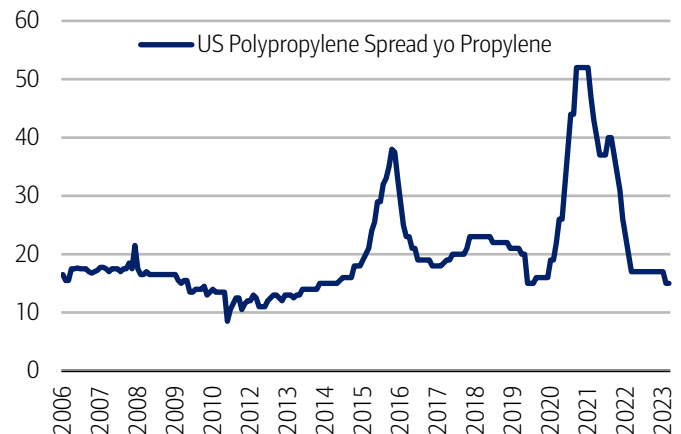


Source: OPIS

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**Exhibit 24: Polypropylene spread to propylene**

PP spread to monomer would seem to have more downside

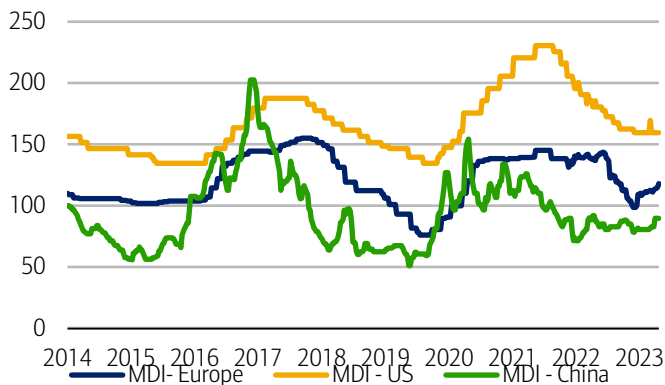


Source: OPIS and BofA Global Research

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**Exhibit 25: Global polymeric MDI price deck**

US remains at a healthy premium to global markets

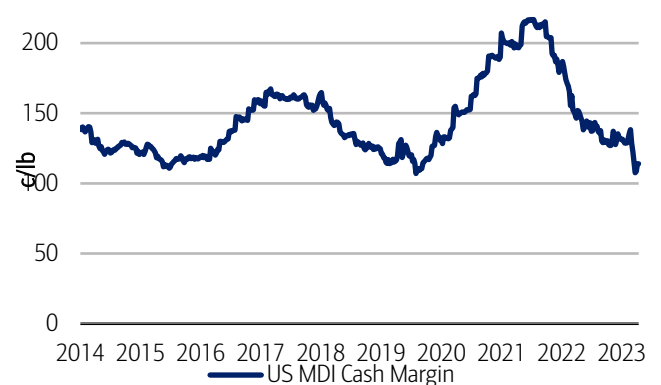


Source: ICIS

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**Exhibit 26: US Polymeric MDI spread over raw material costs**

US margins are off peak, but still at healthy levels



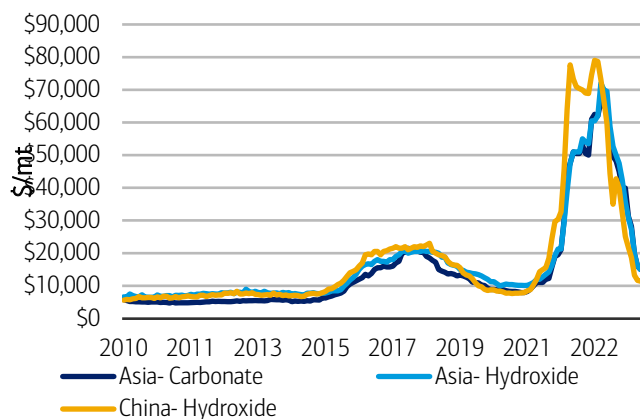
Source: ICIS, OPIS, BofA Global Research Estimates

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**Exhibit 27: China and Asia (non-China) Prices**

China prices continue to trade at a premium to other benchmarks



Source: Benchmark Minerals, BofA Global Research

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**Exhibit 28: Premium of lithium hydroxide over carbonate**

Hydroxide has historically carried a \$2,000/mt premium over carbonate



Source: Benchmark Minerals, BofA Global Research

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**Nitrogen****Exhibit 29: Nitrogen pricing overview**

Nitrogen prices have started to decrease materially

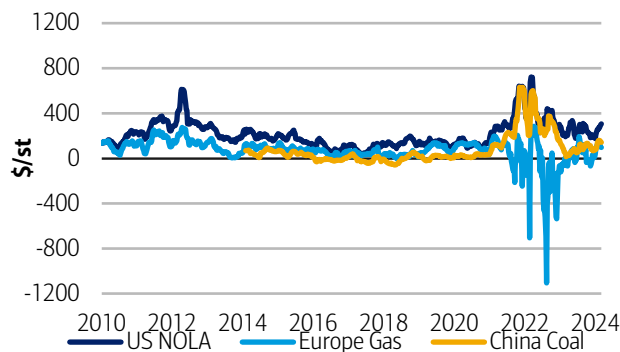
	2018	2019	2020	2021	2022	2023		1Q22	2Q22	3Q22	4Q22	1Q23	2Q23	3Q23	4Q23
Nitrogen Prices															
Urea granular (US NOLA \$/st)	259	244	228	492	601	354		678	613	591	522	342	368	374	334
Urea granular (US Midwest \$/st)	297	302	272	535	667	434		752	679	633	605	421	466	428	422
Urea granular (Mediterranean \$/st)	265	252	238	510	687	364		800	703	682	562	386	317	393	359
Urea granular (SE Asia \$/st)	267	255	240	503	629	352		728	687	570	533	366	325	369	350
Ammonia (US Midwest \$/st)	416	403	328	759	1276	630		1383	1394	1086	1241	834	466	517	703
UAN (US Midwest \$/st)	212	202	160	372	561	300		602	614	482	547	351	285	268	294
Feedstock Costs															
Natural Gas (US HH \$/mmbtu)	3.07	2.53	2.12	3.70	6.49	2.66		4.53	7.39	7.78	6.01	2.71	2.35	2.65	2.92
Natural Gas (UK ICE \$/mmbtu)	7.89	4.86	3.30	15.81	31.84	12.65		32.03	21.98	41.54	31.09	16.30	10.24	10.58	13.48
Anthracite coal (China \$/mt)	139	131	131	164	212	182		237	221	200	194	204	179	183	162
	12/7	12/14	12/21	12/28	1/4	1/11	1/18	1/25	2/1	2/8	2/15	2/22	2/29	3/7	3/14
Nitrogen Prices															
Urea granular (US NOLA \$/st)	319	302	300	300	304	302	318	345	351	348	358	353	375	388	394
Urea granular (US Midwest \$/st)	398	385	398	398	380	380	385	395	400	393	400	410	450	460	463
Urea granular (Mediterranean \$/st)	321	329	312	312	322	327	347	364	384	388	381	367	357	349	349
Urea granular (SE Asia \$/st)	329	311	316	316	316	316	325	363	375	384	384	384	370	370	366
Ammonia (US Midwest \$/st)	738	610	610	610	610	600	600	600	600	600	625	625	625	625	630
UAN (US Midwest \$/st)	287	287	287	287	275	275	268	268	268	268	268	268	297	312	312
Feedstock Costs															
Natural Gas (US HH \$/mmbtu)	2.58	2.49	2.61	2.51	2.89	3.31	2.52	2.71	2.08	1.85	1.61	1.60	1.84	1.81	1.73
Natural Gas (UK ICE \$/mmbtu)	13.94	12.18	10.47	10.84	10.27	11.07	10.19	8.87	8.81	9.03	8.39	7.63	7.15	8.13	8.46
Anthracite coal (China \$/mt)	159	157	157	156	155	154	151	146	143	140	139	139	142	142	142

Source: CRU, Bloomberg, BofA Global Research

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**Exhibit 30: Global Granular Urea Cash Margins (\$/st)**

European urea margins remain challenged

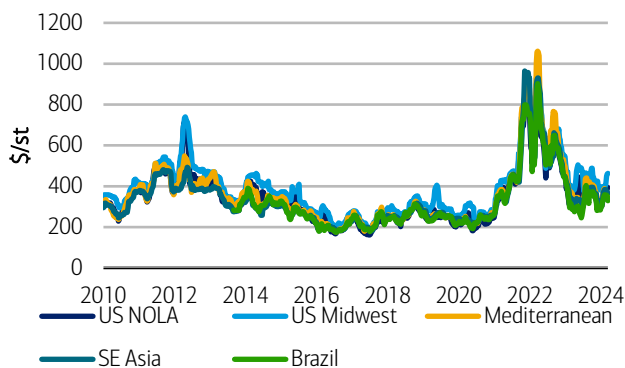


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 32: Global Granular Urea Prices (\$/st)**

Prices have come off their recent highs

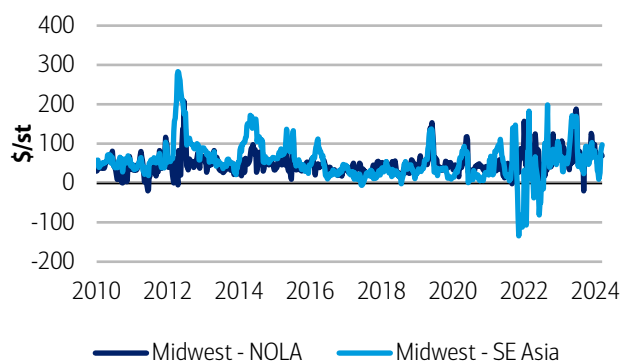


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 34: US Urea Price Differentials (\$/st)**

US Midwest urea prices are above NOLA import price

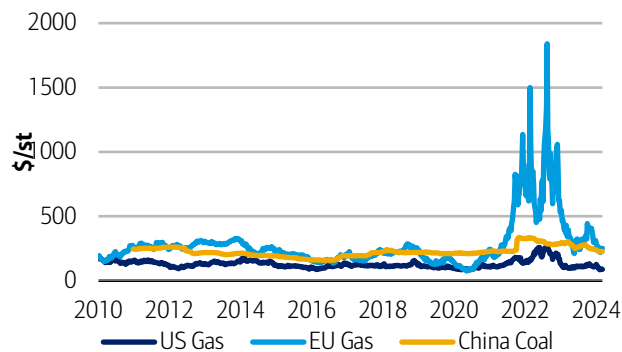


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 31: Global Granular Urea Cash Cost (\$/st)**

US gas costs at bottom of cost curve

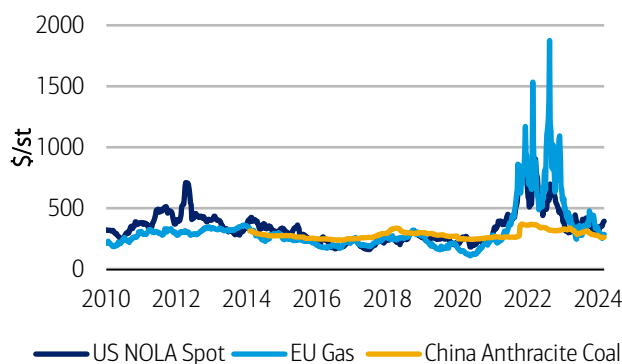


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 33: US NOLA Urea vs Delivered Costs (\$/st)**

Product costs have fallen off their peak, but still remain elevated vs 2019 (pre-covid)

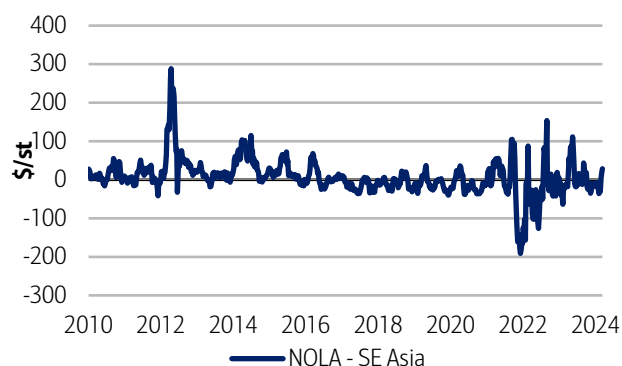


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 35: US NOLA - SE Asia Urea Price (\$/st)**

US NOLA urea price is below Asia prices

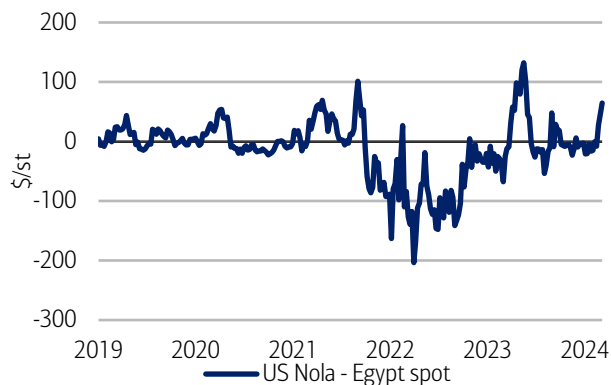


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 36: US NOLA – Egypt Urea Price (\$/st)**

US NOLA price is now above Egypt prices

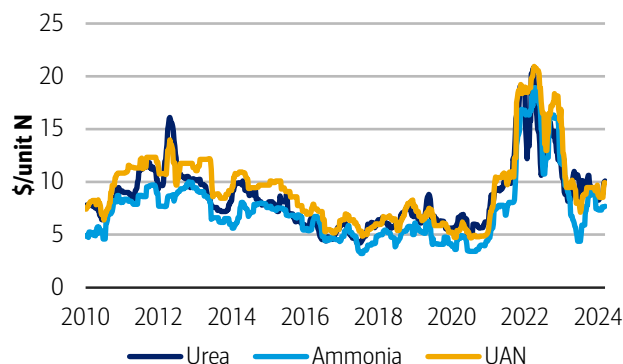


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 38: US Midwest Prices (\$/unit N)**

Midwest UAN prices have surpassed urea on a unit N basis

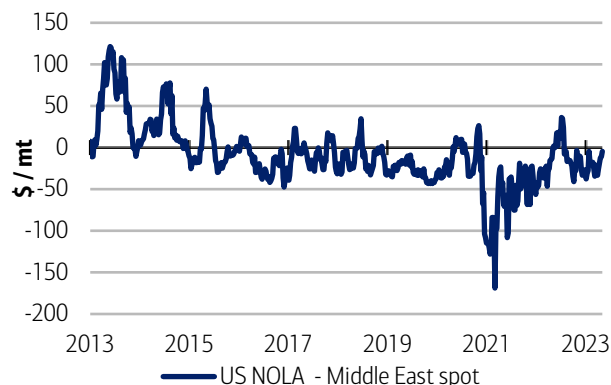


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 40: US NOLA implied vs. Middle East urea price spread**

US NOLA urea price is now comparable to Middle East levels

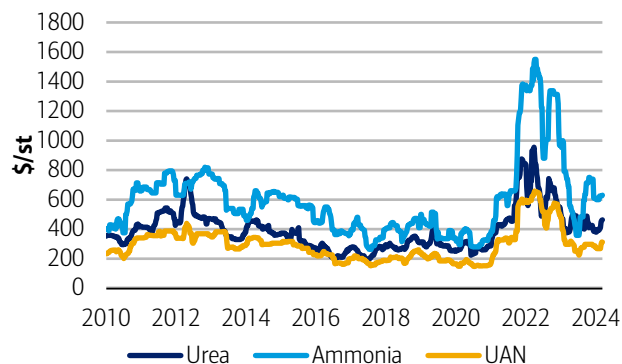


Source: CRU, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 37: US Midwest Prices (\$/st)**

All nitrogen fertilizer products have increased sharply

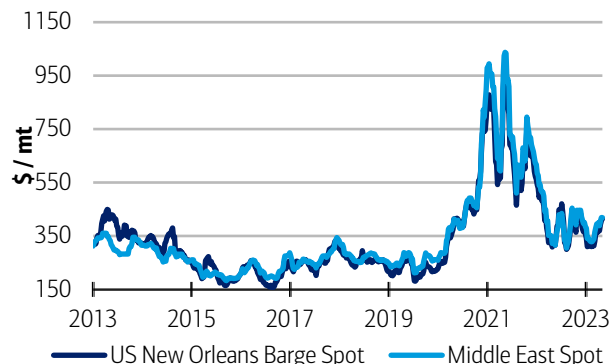


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 39: US NOLA implied vs. Middle East urea prices (\$/mt)**

Prices have both fallen off their- peak, but still remain elevated vs 2019 (pre-covid)

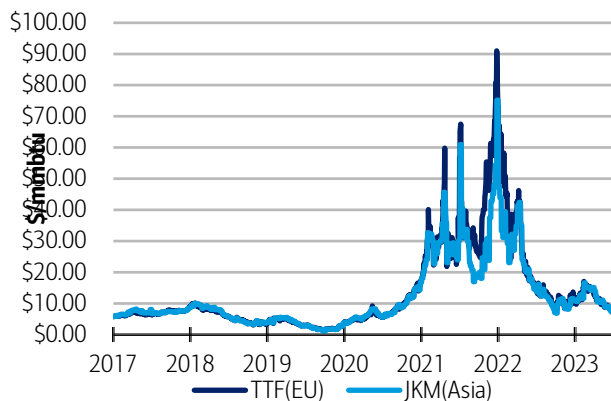


Source: CRU, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 41: EU vs. Asia NatGas Prices (\$/mmbtu)**

Asian nat gas prices are well below EU prices

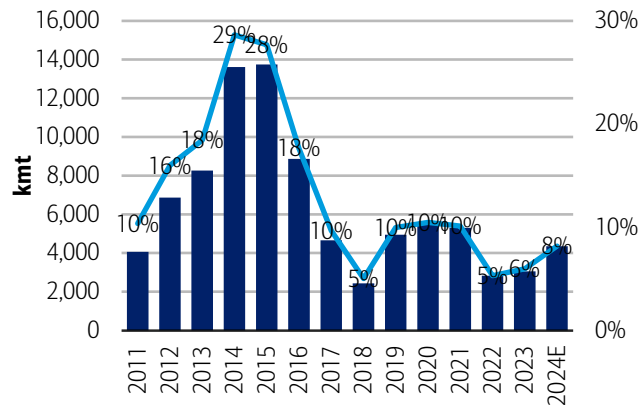


Source: Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 42: Chinese Urea Exports & % of World Total**

Chinese urea exports are well below prior peak levels

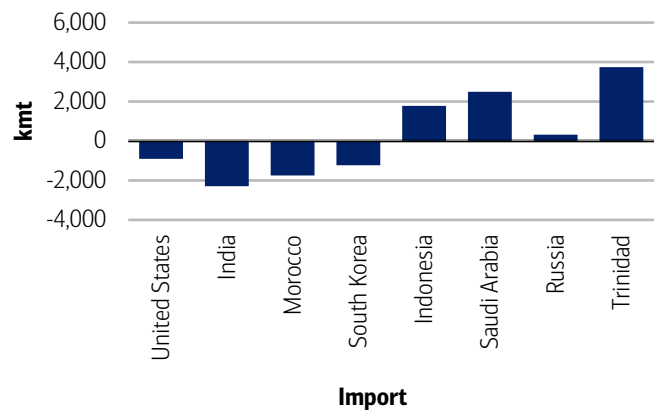


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 43: Global NH3 Trade Balance 2023**

Trinidad is the largest ammonia exporter

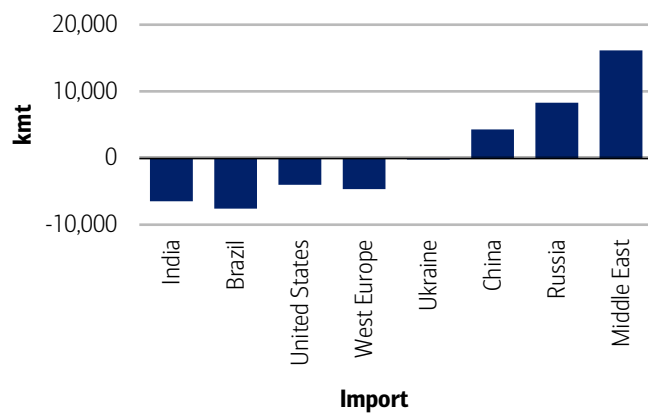


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 44: Global Urea Trade Balance 2023**

Middle East is the largest urea exporter

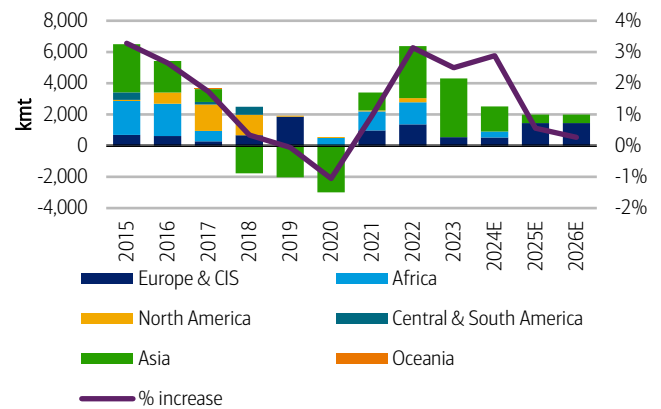


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 45: Global Urea Capacity additions by region**

Global urea capacity additions are set to decrease from the 2022 peak

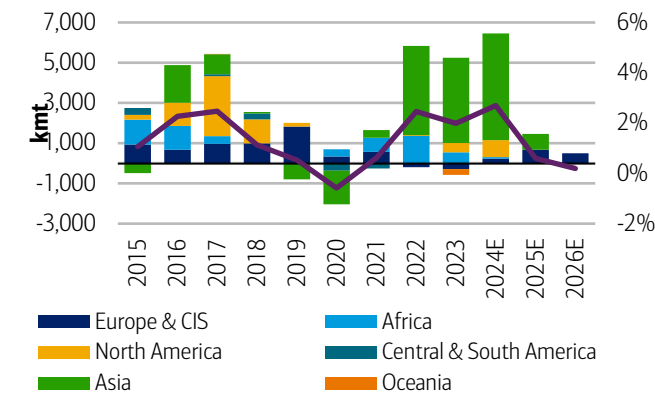


Source: BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 46: Global NH3 Capacity additions by region**

New global ammonia coming in 2022

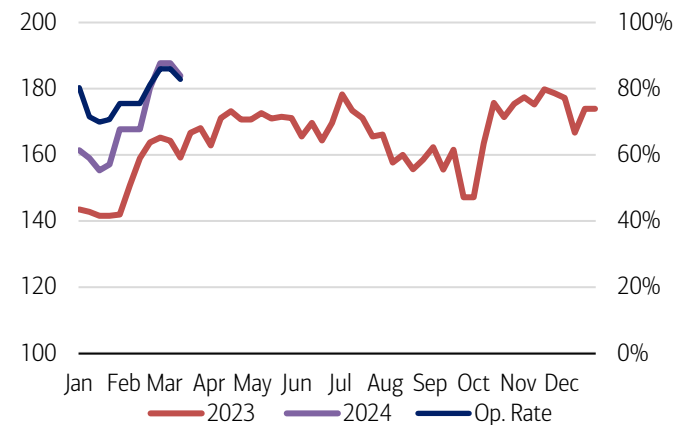


Source: CRU, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 47: Chinese Urea Daily Production (weekly kmt)**

China's urea production has dipped below year-ago levels



Source: CFMW, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 48: Chinese Urea Daily Production as a % of 5-yr max Daily production (weekly kmt)**

China's urea production is seasonally strong

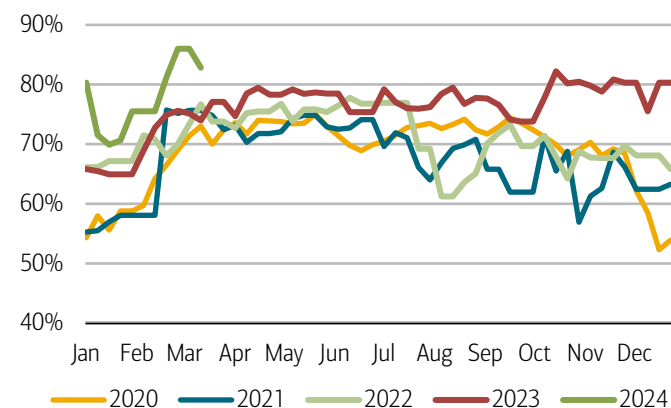


Source: CFMW, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 49: Chinese Urea Operating Rates**

Operating rates have collapsed recently

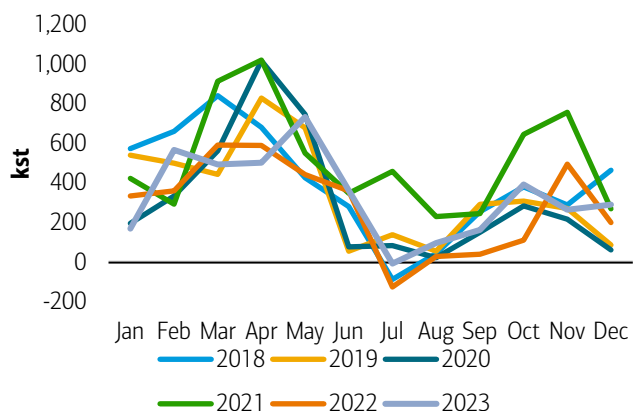


Source: CFMW, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 50: US Urea Net Imports (kst)**

Net imports running at low levels year-to-date

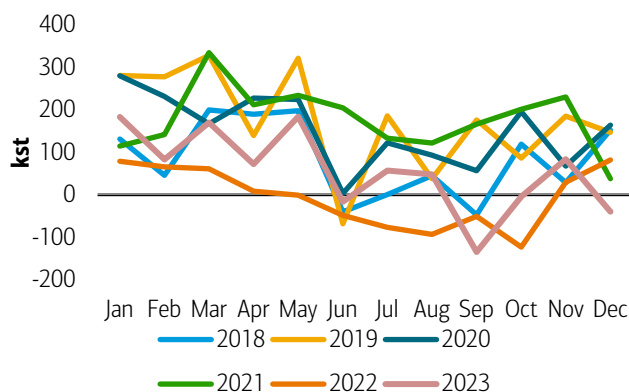


Source: TFI, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 51: US UAN net imports**

UAN net imports are down sharply

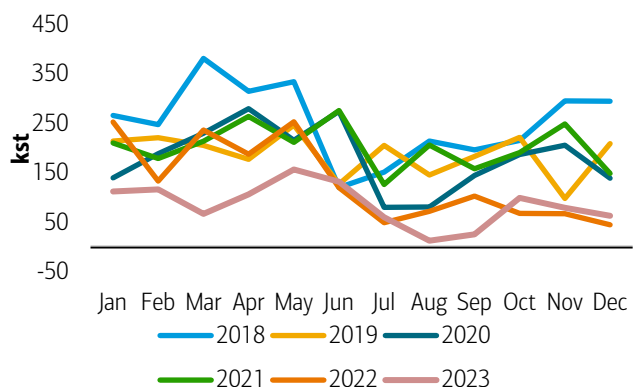


Source: TFI, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 52: US Ammonia net imports**

The US is a net importer of ammonia all year



Source: TFI, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Potash****Exhibit 53: Potash pricing overview**

Potash fertilizer prices have continued to rise

	2018	2019	2020	2021	2022	2023		1Q22	2Q22	3Q22	4Q22	1Q23	2Q23	3Q23	4Q23
Potash Prices															
Midwest Spot (\$/mt)	312	333	282	569	799	466		830	876	808	684	503	496	427	440
Brazil Spot (\$/mt)	321	329	239	539	850	391		877	1115	844	565	495	383	351	335
Southeast Asia Spot (\$/mt)	279	294	245	393	781	380		656	929	873	664	494	397	309	318
Vancouver Spot (\$/mt)	281	295	230	432	795	381		755	986	828	612	497	380	326	321
China Contract (\$/mt)	247	290	242	244	550	427		432	590	590	590	590	503	307	307
India Contract (\$/mt)	257	288	248	293	573	428		523	590	590	590	590	422	382	319
	12/7	12/14	12/21	12/28	1/4	1/11	1/18	1/25	2/1	2/8	2/15	2/22	2/29	3/7	3/14
Potash Prices															
Midwest Spot (\$/mt)	446	446	446	446	439	422	408	406	408	417	417	424	422	422	422
Brazil Spot (\$/mt)	325	315	315	315	315	308	295	295	295	283	283	285	290	300	305
Southeast Asia Spot (\$/mt)	320	320	320	320	320	320	315	315	310	308	308	308	303	303	303
Vancouver Spot (\$/mt)	286	284	287	287	287	288	283	283	278	277	277	276	268	265	265
China Contract (\$/mt)	307	307	307	307	307	307	307	307	307	307	307	307	307	307	307
India Contract (\$/mt)	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319

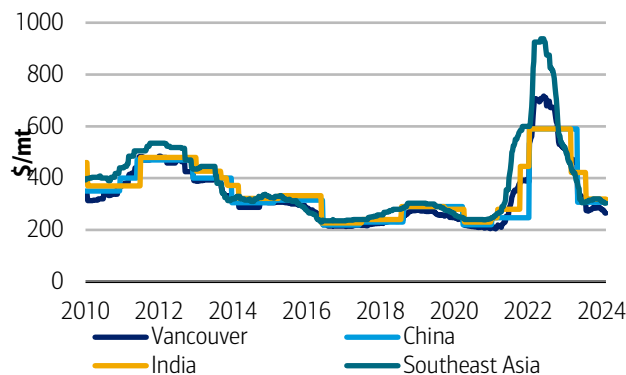
Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH



**Exhibit 54: Global Standard Potash Prices (\$/mt)**

Standard potash prices have fallen from their recent peaks but still remain elevated vs 2019 (pre-covid)

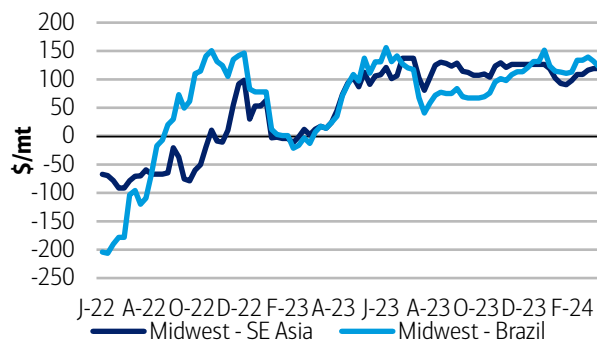


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 56: Potash Price Differentials (\$/mt)**

US Midwest potash prices trade at a discount to global ones

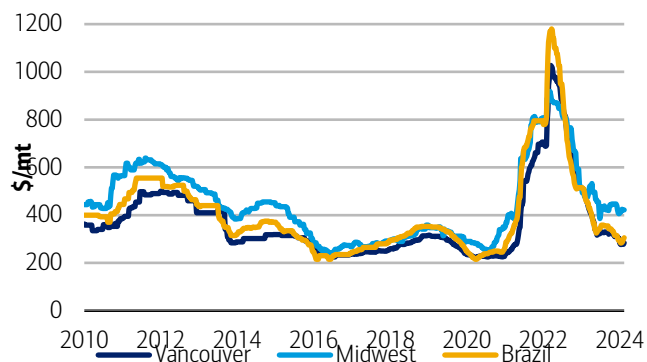


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 55: Global Granular Potash Prices (\$/mt)**

Granular potash prices are off their highs

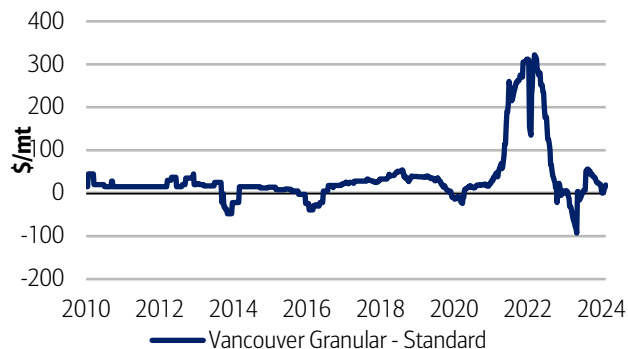


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 57: Granular Premium over Standard (\$/mt)**

The granular premium over standard has recently reversed

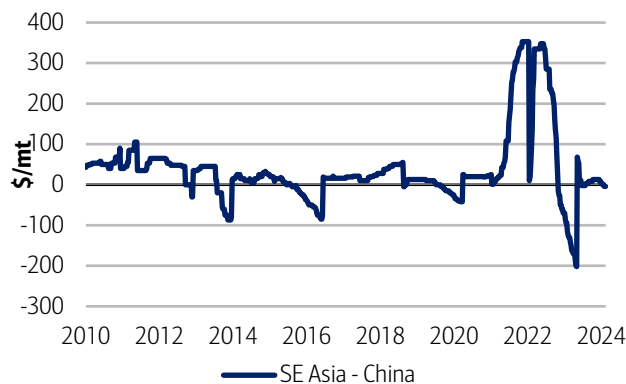


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 58: SE Asia Spot vs. China Contract (\$/mt)**

SE Asia spot potash market is well above the contract price

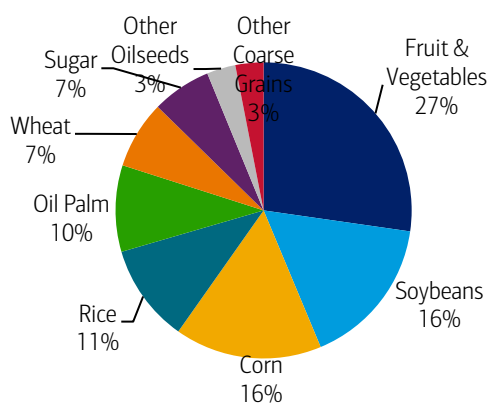


Source: CRU, Bloomberg, BofA Global Research

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**Exhibit 60: Global Potash Demand By Crop(2018)**

Potash is used on all crops

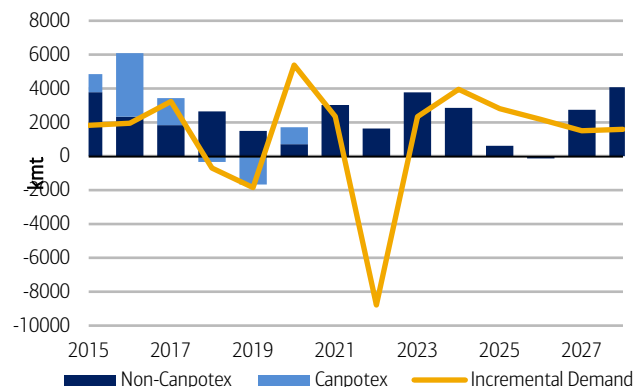


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 62: Global Capacity addition and demand growth**

Most capacity additions were expected to come from Russia



Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 59: US NOLA vs. Brazil potash price spread**

US NOLA urea price is now far below Brazil levels

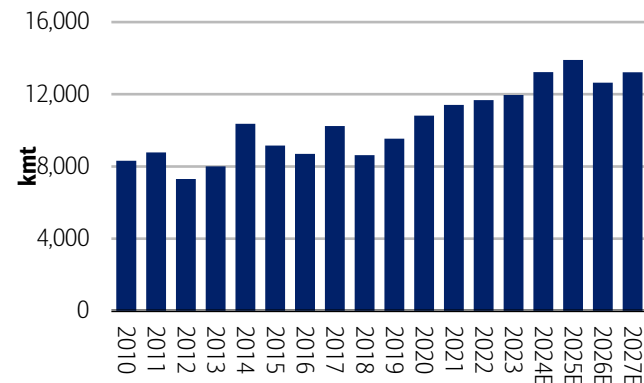


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 61: Russian Potash Exports (kmt)**

Russia remains a large potash exporter

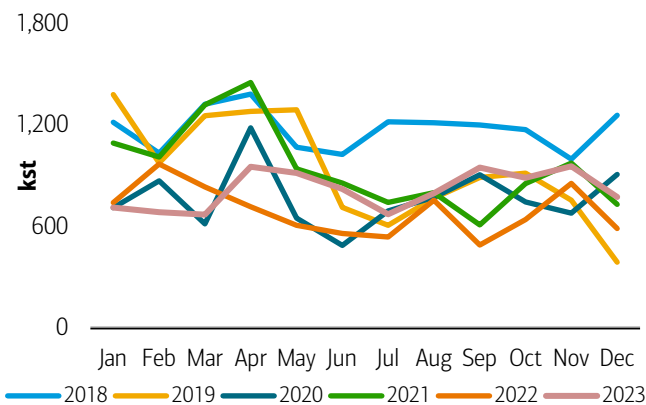


Source: CRU, Bloomberg, BofA Global Research

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**Exhibit 63: US MOP Net Imports**

The US normally imports roughly 1mnt of potash per month



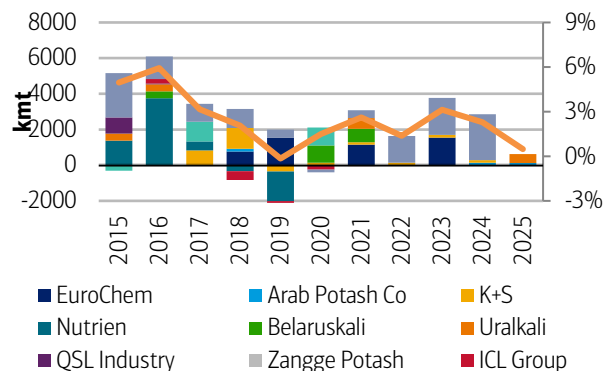
Source: TFI, Bloomberg, BofA Global Research

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**Exhibit 64: Net Potash Capacity Addition by Company**

Eurochem has significant Potash capacity to provide to the market

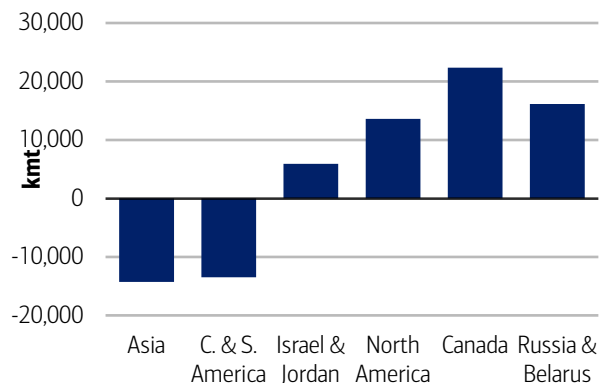


Source: CRU, BofA Global Research

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**Exhibit 65: Global Potash Trade Flows**

Canada &amp; FSU are key potash supply regions



Source: CRU, BofA Global Research

BofA GLOBAL RESEARCH

**Phosphate****Exhibit 66: Historical pricing data for phosphate fertilizer**

Phosphate pricing is four-fold higher than mid-2020 levels

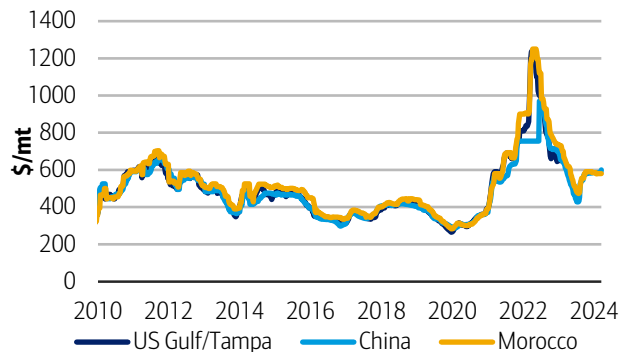
	2018	2019	2020	2021	2022	2023		1Q22	2Q22	3Q22	4Q22	1Q23	2Q23	3Q23	4Q23
Phosphate Prices															
DAP (US Midwest , \$/mt)	471	402	385	706	912	692		929	1000	889	830	740	743	622	664
DAP (US Gulf/Tampa, \$/mt)	419	344	324	644	894	560		950	1115	838	674	644	546	501	550
DAP - barge (New Orleans, \$/mt)	435	338	345	667	845	605		880	932	833	733	676	584	559	599
DAP (China, \$/mt)	435	338	345	667	845	605		880	932	833	733	676	584	559	599
DAP (Morocco, \$/mt)	412	348	323	595	779	557		755	805	846	709	636	503	507	583
MAP (US Gulf/Tampa, \$/mt)	429	361	324	656	964	589		979	1203	918	759	685	557	524	589
MAP - barge (New Orleans, \$/mt)	418	344	323	659	898	552		959	1114	845	674	641	525	497	546
MAP (Morocco, \$/mt)	444	340	356	706	869	633		907	967	869	731	638	568	643	682
MAP (Brazil, \$/mt)	427	361	327	679	964	574		1008	1195	935	720	668	553	514	562
Feedstock Costs															
Phosphate Rock (N. Africa, FOB, \$/mt)	94	95	90	137	277	255		213	286	320	290	300	285	215	220
Ammonia, (Tampa, CFR, \$/mt)	312	247	233	604	1160	514		1168	1272	1089	1110	744	369	343	598
Sulphur, (Tampa, FOB, \$/mt)	122	83	54	166	313	97		297	481	362	110	124	107	59	98
	12/7	12/14	12/21	12/28	1/4	1/11	1/18	1/25	2/1	2/8	2/15	2/22	2/29	3/7	3/14
Phosphate Prices															
DAP (US Midwest , \$/mt)	694	694	678	678	714	758	742	742	742	742	717	739	739	794	843
DAP (US Gulf/Tampa, \$/mt)	550	560	560	560	560	560	560	560	560	560	560	560	560	560	560
DAP - barge (New Orleans, \$/mt)	615	623	623	623	643	665	659	657	648	648	637	654	667	717	692
DAP (Morocco, \$/mt)	590	585	585	585	585	585	585	578	580	580	580	580	580	580	580
MAP (US Gulf/Tampa, \$/mt)	545	560	560	560	560	560	560	560	560	560	560	560	560	560	560
MAP - barge (New Orleans, \$/mt)	665	672	678	678	689	694	694	689	694	683	667	681	681	694	689
MAP (Morocco, \$/mt)	578	578	578	578	578	578	578	578	578	578	578	578	578	578	578
MAP (Brazil, \$/mt)	563	563	563	563	563	563	563	563	560	560	560	560	560	565	565
Feedstock Costs															
Phosphate Rock (N. Africa, FOB, \$/mt)	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
Ammonia, (Tampa, CFR, \$/mt)	625	625	525	525	525	525	525	445	445	445	445	445	445	445	445
Sulphur, (Tampa, FOB, \$/mt)	102	102	102	102	102	69	69	69	69	69	69	69	69	69	69

Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 67: Global DAP Prices**

DAP prices globally are up sharply

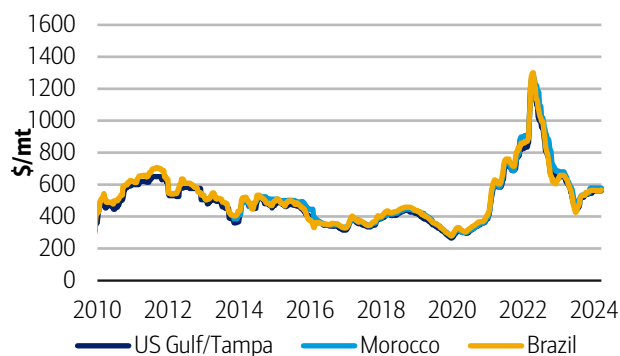


Source: CRU, Bloomberg, BofA Global Research

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**Exhibit 68: US MAP Prices (\$/mt)**

Morocco currently has the highest MAP prices

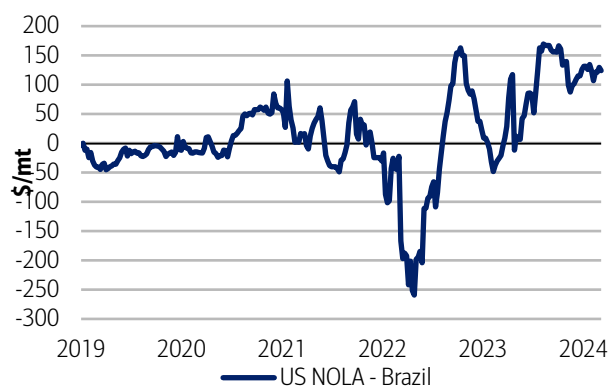


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 69: US NOLA vs Brazil phosphate price spread**

US NOLA phosphate prices is above Brazil levels

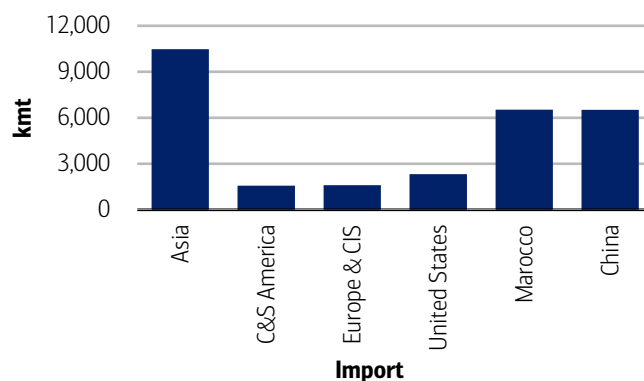


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 70: Global Phosphate Trade Flows 2023**

China is the largest phosphate importer

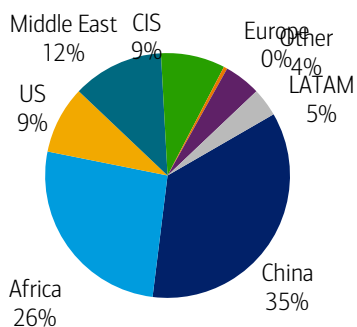


Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 71: Phosphate Rock Production by Region**

China is the largest phosphate rock supplier



Source: CRU, Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

## Price objective basis & risk

### **Sigma Lithium (SGML, C-1-9, \$12.95)**

Our \$29 PO is derived from our comprehensive net asset value (NAV) model, which is predicated on a three-stage buildout and a 9.8% WACC with no terminal value.

Downside risks to our forecast are lower lithium prices, higher operating costs, and failure to successfully commission the new assets.

Upside risks are further resource discovery, faster speed to commissioning new assets, higher lithium prices, and lower operating costs

## Analyst Certification

I, Steve Byrne, CFA, hereby certify that the views expressed in this research report accurately reflect my personal views about the subject securities and issuers. I also certify that no part of my compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

## Special Disclosures

BofA Securities is currently acting as strategic advisor to Sigma Lithium Corp in their review of strategic alternatives.

## US - Chemicals Coverage Cluster

Investment rating	Company	BofA Ticker	Bloomberg symbol	Analyst
<b>BUY</b>				
	Air Products	APD	APD US	Steve Byrne, CFA
	Axalta Coating Systems	AXTA	AXTA US	Steve Byrne, CFA
	Bunge Limited	BG	BG US	Salvator Tiano, CFA
	CF Industries	CF	CF US	Steve Byrne, CFA
	Dow Inc	DOW	DOW US	Steve Byrne, CFA
	Eastman Chemical Co	EMN	EMN US	Salvator Tiano, CFA
	Element Solutions Inc.	ESI	ESI US	Steve Byrne, CFA
	Green Plains	GPPE	GPPE US	Salvator Tiano, CFA
	Huntsman Corp	HUN	HUN US	Salvator Tiano, CFA
	Linde	LIN	LIN US	Steve Byrne, CFA
	Linde	LINGY	LIN GY	Steve Byrne, CFA
	Nutrien	NTR	NTR US	Steve Byrne, CFA
	Olin Corp	OLN	OLN US	Steve Byrne, CFA
	PPG Industries Inc.	PPG	PPG US	Steve Byrne, CFA
	Sigma Lithium	SGML	SGML US	Steve Byrne, CFA
	The Mosaic Company	MOS	MOS US	Steve Byrne, CFA
<b>NEUTRAL</b>				
	Archer-Daniels-Midland Company	ADM	ADM US	Salvator Tiano, CFA
	Corteva	CTVA	CTVA US	Steve Byrne, CFA
	Ecolab Inc	ECL	ECL US	Steve Byrne, CFA
	International Flavors & Fragrances	IFF	IFF US	Salvator Tiano, CFA
	LyondellBasell Industries	LYB	LYB US	Steve Byrne, CFA
	Origin Materials	ORGN	ORGN US	Steve Byrne, CFA
<b>UNDERPERFORM</b>				
	Celanese Corporation	CE	CE US	Salvator Tiano, CFA
	DuPont	DD	DD US	Steve Byrne, CFA
	FMC Corporation	FMC	FMC US	Steve Byrne, CFA
	RPM International Inc	RPM	RPM US	Steve Byrne, CFA
	Sherwin-Williams Company	SHW	SHW US	Steve Byrne, CFA
	Westlake Chemical Partners, LP	WLKP	WLKP US	Steve Byrne, CFA
	Westlake Corp	WLK	WLK US	Steve Byrne, CFA
<b>RVW</b>				
	Albemarle	ALB	ALB US	Steve Byrne, CFA

## Disclosures

## Important Disclosures

## Sigma Lithium (SGML) Price Chart



The Investment Opinion System is contained at the end of the report under the heading "Fundamental Equity Opinion Key". Dark grey shading indicates the security is restricted with the opinion suspended. Medium grey shading indicates the security is under review with the opinion withdrawn. Light grey shading indicates the security is not covered. Chart is current as of a date no more than one trading day prior to the date of the report.

**Equity Investment Rating Distribution: Chemicals Group (as of 31 Dec 2023)**

Coverage Universe	Count	Percent	Inv. Banking Relationships <sup>R1</sup>	Count	Percent
Buy	66	47.83%	Buy	33	50.00%
Hold	33	23.91%	Hold	16	48.48%
Sell	39	28.26%	Sell	20	51.28%

**Equity Investment Rating Distribution: Non-Ferrous Metals/Mining & Minerals Group (as of 31 Dec 2023)**

Coverage Universe	Count	Percent	Inv. Banking Relationships <sup>R1</sup>	Count	Percent
Buy	58	53.70%	Buy	26	44.83%
Hold	24	22.22%	Hold	10	41.67%
Sell	26	24.07%	Sell	13	50.00%

**Equity Investment Rating Distribution: Global Group (as of 31 Dec 2023)**

Coverage Universe	Count	Percent	Inv. Banking Relationships <sup>R1</sup>	Count	Percent
Buy	1895	53.62%	Buy	1083	57.15%
Hold	832	23.54%	Hold	454	54.57%
Sell	807	22.84%	Sell	383	47.46%

<sup>R1</sup> Issuers that were investment banking clients of BofA Securities or one of its affiliates within the past 12 months. For purposes of this Investment Rating Distribution, the coverage universe includes only stocks. A stock rated Neutral is included as a Hold, and a stock rated Underperform is included as a Sell.

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Investment rating	Total return expectation (within 12-month period of date of initial rating)	Ratings dispersion guidelines for coverage cluster <sup>R2</sup>
Buy	≥ 10%	≤ 70%
Neutral	≥ 0%	≤ 30%
Underperform	N/A	≥ 20%

<sup>R2</sup> Ratings dispersions may vary from time to time where BofA Global Research believes it better reflects the investment prospects of stocks in a Coverage Cluster.

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