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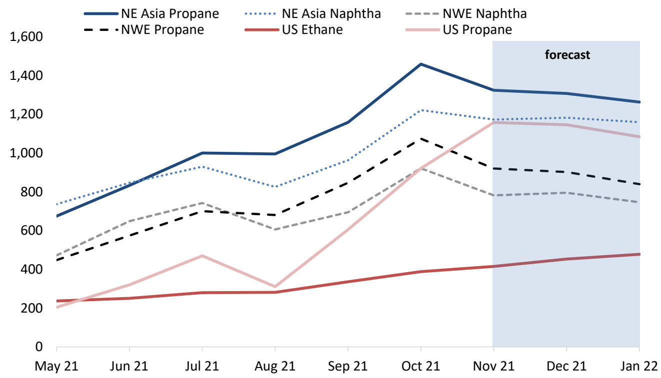
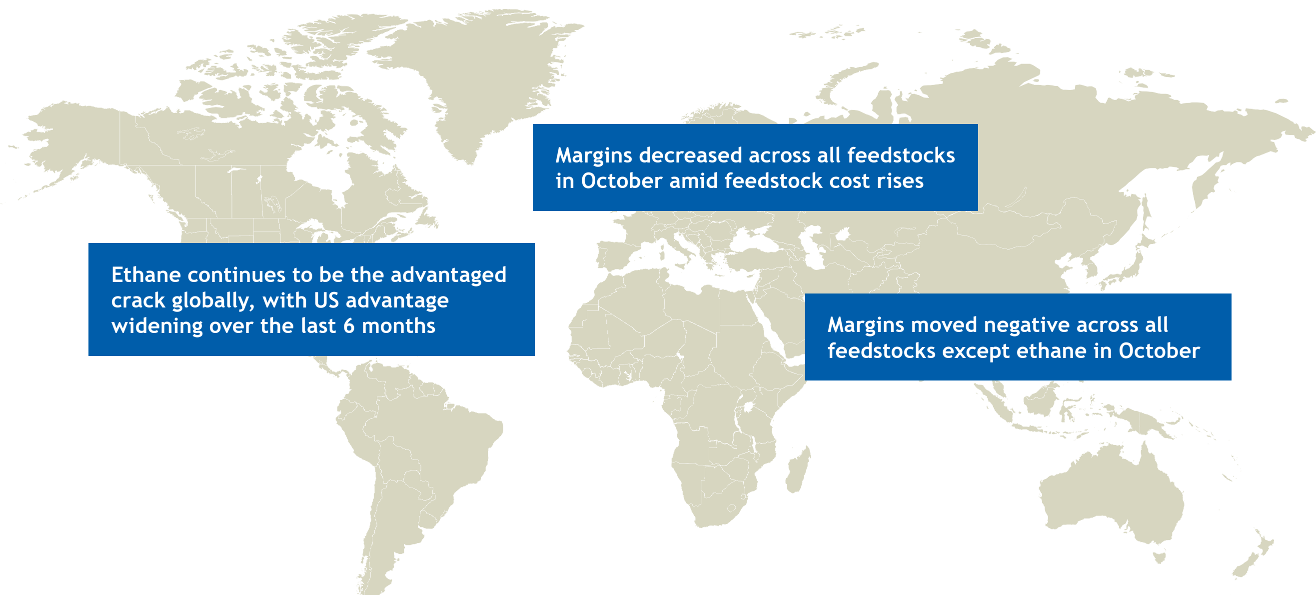
Argus Global Steam Cracker Economics

Highlights

- Soaring natural gas prices, coal shortages, and limited alternatives amid rising crude prices bring cracking energy input costs to the forefront of issues
- Inefficient older crackers and high energy cost sites could see costs over $100/t higher than the average cracker in this environment
- Higher oil-to-natural gas ratios are widening the US cost advantage, but at the same time exposure to TTF gas or LNG is disadvantaging many global crackers

Steam cracker cash cost **$/t**





Available on Argus Direct: Argus Global Steam Cracker Economics historical and forecast data

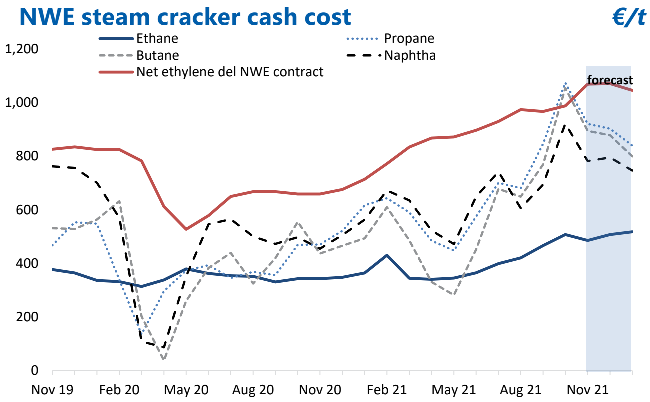
Petrochemicals

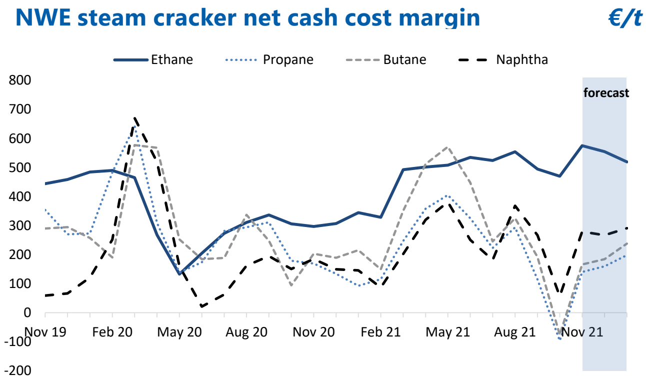
illuminating the markets

Europe

Key featured news

- Margins decreased across all feedstocks in October amid feedstock cost rises
- Ethane remained as the more attractive feedstock for a fifth consecutive month
- Ethane is expected to maintain a significant advantage over LPG and naphtha over the next three months





Market commentary

Margins decreased across all feedstocks in October amid feedstock cost increases. Imported ethane remained the more attractive feedstock choice for ethylene production from steam cracking in western Europe for a fifth consecutive month, despite margins decreasing by €25/t (5pc). This was largely driven by an 11pc increase in the cost of imported US ethane feedstock into Europe, which was partially offset by the October ethylene contract price settling up €25/t to €1,190/t compared to September. Naphtha margins decreased by €210/t (79pc) as the cost of northwest Europe naphtha feedstock increased by 14pc. Margins were partially supported by increases in contract prices for key co-products such as propylene (2pc) and pygas (5pc), which resulted in naphtha becoming the second-most attractive feedstock ahead of gasoil.

Gasoil margins decreased by €287/t (85pc), driven by feedstock cost increases. However, it should be noted that in reality, the decision to crack gasoil is likely to be taken in order to optimize across an integrated refinery/steam cracker complex. Both LPG feedstocks witnessed negative margins for the first time since December 2010 as the cost of LPG feedstocks increased by an average of 19pc across propane and butane. Propane margins fell by €211/t (184pc) compared to September as the cost of ARA large cargo feedstock increased by 17pc while butane margins fell by €268/t (140pc), driven by a 21pc rise in the cost of ARA coaster feedstock.

The November contract prices for propylene, butadiene and benzene were settled by the start of November while the ethylene settlement took an additional few days. Ethane is anticipated to remain as the more advantaged feedstock for ethylene cracking in western Europe over the next three months where it will maintain a significant cost advantage over LPG and naphtha.

Europe

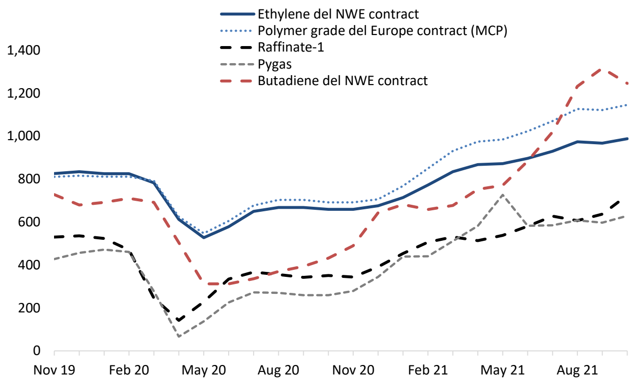
Northwest Europe ethylene steam cracker production costs and margins €/t

	Ethane					Propane					Butane					Naphtha					Gasoil				
	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin
Oct 21	-90	432	507	470	546	-664	984	1,074	-96	-6	-1,117	960	1,054	-77	18	-1,705	815	921	56	162	-2,332	806	927	51	172
Sep 21	-90	392	466	495	570	-654	758	846	115	203	-1,063	676	769	192	285	-1,629	590	694	267	371	-2,202	504	623	338	457
Aug 21	-88	345	420	554	629	-653	592	681	294	382	-1,039	556	649	325	418	-1,601	502	606	368	473	-2,131	354	473	502	621
Jul 21	-80	324	399	525	599	-610	612	700	223	311	-1,000	586	678	245	338	-1,533	638	742	182	285	-2,064	493	611	312	431
Jun 21	-74	292	365	535	608	-582	488	574	326	412	-952	361	452	448	539	-1,467	547	649	251	353	-1,960	518	634	266	382
May 21	-74	272	345	508	581	-563	362	448	405	491	-919	192	282	571	661	-1,499	371	472	381	482	-1,930	379	494	359	474

NWE feedstock price month-on-month change (Sep to Oct)

	Unit		Change
North Sea Dated Brent	$/bl	▲	+9.15
Ethane (US import)	USC/USG	▲	+4.48
Propane ARA large cargo	€/t	▲	+105.37
Butane ARA coaster	€/t	▲	+123.29
Naphtha 65 para NWE	€/t	▲	+79.99

NWE net product prices €/t



NWE product price (net) €/t

		Change
Ethylene del NWE contract	▲	+25.00
Propylene polymer grade del Europe contract (MCP)	▲	+25.00
Butadiene delivered NWE contract month	▼	-75.00
Raffinate-1	▲	+87.99
Pygas	▲	+31.34

NWE cash margin €/t

		Change
Ethane	▼	-24.55
Propane	▼	-211.11
Butane	▼	-268.48
Naphtha	▼	-210.31
Gasoil	▼	-287.37

Definitions

Argus Western Europe Steam Cracker Model is based on a fully flexible mixed-feed cracker located on the ARG pipeline with a nameplate capacity of 500,000 t/yr and fully-integrated downstream.

Net product prices based on monthly contract price; average discounts are based on market consultation.

Pygas modelled as equivalent to 35pc Benzene cif NWE contract/65pc Naphtha 65 para NWE minus $84/t

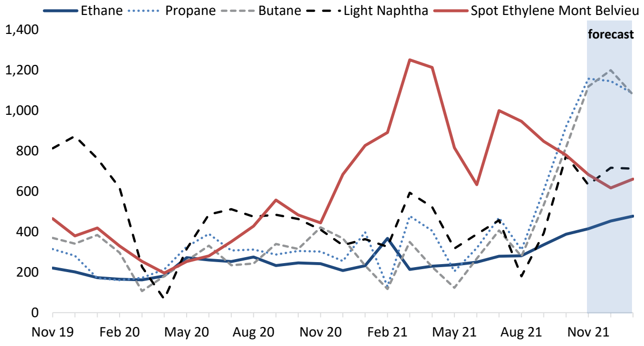
Raffinate-1 is taken as 1.1* Naphtha 65 para NWE

Americas

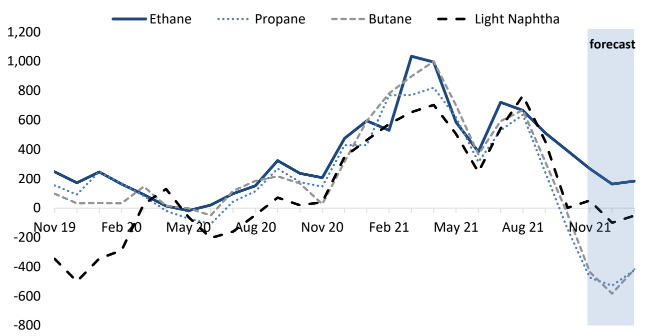
Key featured news

- Margins decreased across all feedstocks in October amid feedstock cost increases
- Ethane remained as the most attractive feedstock
- Ethane is expected to maintain a significant advantage over LPG and light naphtha over the next three months

US steam cracker cash cost *$/t*



US steam cracker net cash cost margin *$/t*



Market commentary

Margins decreased across all feedstocks in October as ethane prices rose and co-product prices in most categories decreased. Ethane remained the most attractive choice for ethylene production from steam cracking in the US in October. While the October ethylene spot price was down 3.11¢/lb (8.79pc) to 35.4¢/lb, ethane cash margins decreased substantially by $121/t (30.95pc) amid a sharp drop in key co-product prices. PGP pipeline Gulf coast propylene dropped 15.15¢/lb (22.46pc). Butadiene fob prices were down 7¢/lb to 90¢/lb (7.78pc) over the same period. Light naphtha remained the second most attractive feedstock choice despite cash margins falling markedly from September by $453/t to $2/t in October. Light naphtha cracking was supported especially in the beginning of the month by high propylene prices.

Contract prices for co-products were generally down across the board. Raffinate-1 prices firmed by $94.96/t (11.24 pc), however. Pygas-US prices declined by $2.90 (6.37pc). The ethane price has increased by 4.48¢/USG (10.3pc), while propane prices increased 15.34¢/USG in October to 144¢/USG (10.61pc). This context is amid a $9.79/bl increase (12.04pc) in Nymex WTI and a $86/t increase in light naphtha prices (11.24pc).

LPG margins also dropped substantially. Propane was the next hardest hit as average cash margins fell by $385/t to a negative cash margin of -$142/t amid a rise in Mt Belvieu propane feedstock. Meanwhile, average butane margins fell by $357/t from $316/t in September to a negative cash margin of -$41/t. Ethane is anticipated to remain the most advantaged feedstock for ethylene cracking in the US over LPG and naphtha over the next three months. This will result in an average cash margin for ethylene production from ethane in January 2022 of $184/t, representing the only positive cash margin across feedstocks in a high energy environment. The largest risk for US competitiveness is a colder than normal US winter, which would drive ethane prices higher than forecast.

Americas

US ethylene steam cracker production costs and margins $/t

	Ethane					Propane					Butane					Light Naphtha				
	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin
Oct 21	-126	320	388	391	459	-885	840	921	-142	-61	-1,279	735	820	-41	44	-1,279	682	777	2	97
Sep 21	-135	267	336	512	581	-1,022	524	605	243	324	-1,391	448	533	316	400	-1,391	298	393	455	551
Aug 21	-136	212	281	665	734	-1,099	230	311	636	717	-1,427	194	279	668	753	-1,427	85	180	767	862
Jul 21	-116	211	279	721	790	-919	388	470	531	612	-1,234	322	407	593	678	-1,234	362	457	543	638
Jun 21	-111	181	250	383	452	-927	239	320	314	395	-1,209	183	268	366	451	-1,209	293	389	245	340
May 21	-106	168	237	587	655	-871	123	204	619	700	-1,141	38	123	700	785	-1,141	222	318	506	601

US feedstock price month-on-month change (Sep to Oct)

	Unit		Change
WTI Cushing	$/bl	▲	+9.79
Ethane mt.B. Enterprise	USC/USG	▲	+4.48
Propane front month mt.B. Enterprise	USC/USG	▲	+4.46
Butane front month	USC/USG	▲	+15.34
Light Naphtha	$/t	▲	+86.33

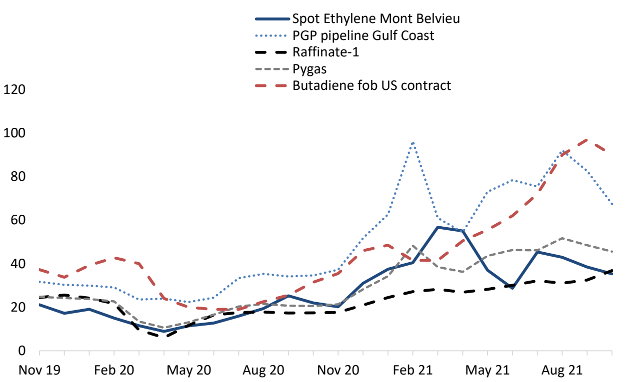
US product price

			Change
Ethylene spot	USC/lb	▼	-3.11
Propylene polymer grade spot	USC/lb	▼	-15.15
Butadiene fob US contract month	USC/lb	▼	-7.00
Raffinate-1 - US	USC/USG	▲	+94.96
Pygas - US	USC/USG	▼	-2.90

US cash margin $/t

		Change
Ethane	▼	-121.79
Propane	▼	-385.61
Butane	▼	-356.39
Light Naphtha	▼	-453.55

US product prices ¢/lb



Definitions

Argus US steam cracker model is based on a fully flexible mixed feed cracker of 700,000 t/yr located on the Texas grid, fully integrated downstream

Product prices are based on spot values

US Pygas = (0.35 x Benzene US Gulf coast USD/t) + (0.65 x Gasoline 87 conv USGC waterborne fob lowest RVP not 7.8 or 7.0) - 84 (the 84 is a discount)

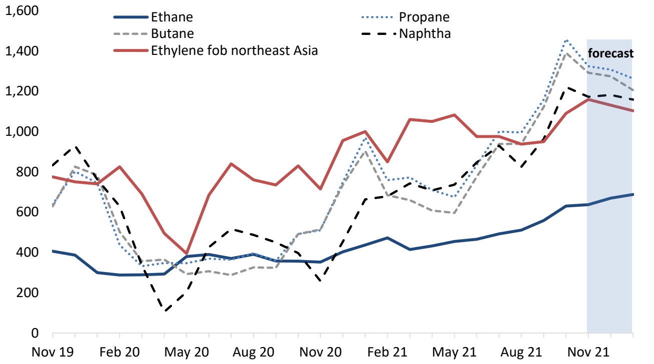
Raff 1 = 1.1 x Naphtha full-range USGC waterborne del

Asia-Pacific

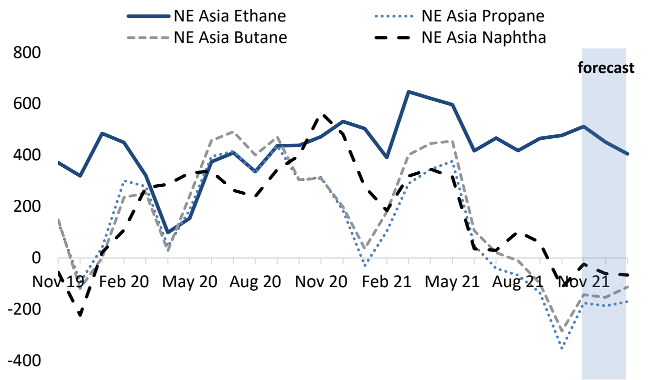
Key featured news

- Margins moved negative across all feedstocks except ethane in October
- Ethane is expected to maintain a significant advantage over LPG and naphtha over the next three months where margins are expected to remain negative

NEA steam cracker cash cost *$/t*



NEA steam cracker net cash cost margin *$/t*



Market commentary

With the exception of ethane, margins across all other feedstocks were negative in October amid feedstock cost increases. Ethane remained as the more attractive feedstock choice for ethylene production from steam cracking in north-east Asia as margins increased by $12/t (3pc). Despite the cost of imported US ethane feedstock into northeast Asia rising by 11pc, this was offset by an increase in the ethylene price, which was up 8pc compared to September. Naphtha margins moved negative in October, decreasing by $175/t (290pc). This was largely driven by the 12pc increase in naphtha feedstock costs, coupled with a decrease in product prices of certain key co-products such as butadiene (29pc), of which naphtha cracking produces relatively large quantities compared to ethane and LPG cracking.

Gasoil margins also moved negative in October, down by $371/t (156pc). As with naphtha, this was largely driven by a combination of rising feedstock costs and decreasing product prices for key co-products. LPG margins remained negative for the fourth consecutive month. Butane margins fell by $185/t (186pc) as the cost of Japan cargo feedstock increased by 12pc and propane margins decreased by $217/t (160pc) amid Japan cargo feedstock increases of 14pc.

Going forward, ethane is anticipated to remain as the more advantaged feedstock for ethylene cracking in northeast Asia over the next three months. It will maintain a significant cost advantage over LPG and naphtha, where margins are expected to remain negative out to January 2022.

Asia-Pacific

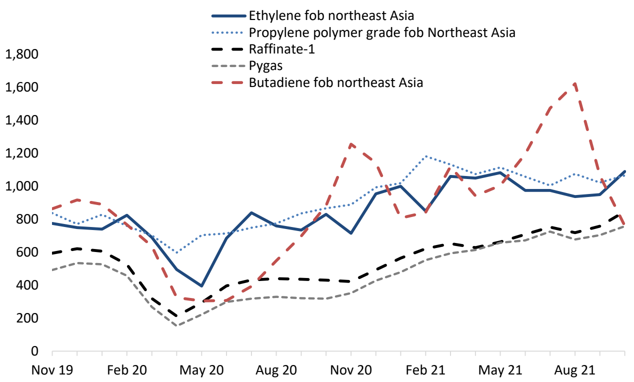
Northeast Asia ethylene steam cracker production costs and margins $/t

	Ethane					Propane					Butane					Naphtha					Gasoil				
	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin
Oct 21	-80	570	630	477	537	-616	1,387	1,459	-352	-280	-1,117	1,316	1,391	-284	-209	-1,753	1,137	1,221	-114	-30	-2,391	1,144	1,240	-133	-37
Sep 21	-87	498	558	465	525	-616	1,087	1,158	-135	-64	-1,083	1,048	1,123	-99	-25	-1,706	879	963	60	145	-2,327	689	786	238	334
Aug 21	-102	450	510	418	478	-669	924	995	-67	4	-1,113	864	939	-11	64	-1,758	741	825	103	187	-2,367	504	600	328	424
Jul 21	-95	432	493	467	527	-629	928	1,000	-41	31	-1,079	864	938	21	96	-1,726	845	930	30	114	-2,321	649	745	214	310
Jun 21	-87	405	465	417	477	-625	762	833	49	121	-1,051	701	776	106	181	-1,648	763	847	35	120	-2,214	693	789	93	189
May 21	-83	394	455	596	657	-634	603	675	377	448	-1,036	522	597	454	529	-1,617	652	736	315	399	-2,141	606	703	348	445

NE Asia feedstock price month-on-month change (Sep to Oct)

	Unit		Change
Dubai Crude	$/bl	▲	+8.89
Ethane (US import)	USC/USG	▲	+4.48
Propane Japan cargo	$/t	▲	+110.81
Butane Japan cargo	$/t	▲	+88.59
Naphtha Japan c+f	$/t	▲	+81.04

NEA product prices $/t



NE Asia product price $/t

		Change
Ethylene fob Northeast Asia	▲	+83.50
Propylene polymer grade fob Northeast Asia	▲	+43.25
Butadiene fob Northeast Asia	▼	-304.50
Raffinate-1	▲	+89.14
Pygas	▲	+53.95

NE Asia cash margin $/t

		Change
Ethane	▲	+11.72
Propane	▼	-216.84
Butane	▼	-184.53
Naphtha	▼	-174.57
Gasoil	▼	-371.20

Definitions

Argus Northeast Asia Steam Cracker Model is based on a fully flexible mixed-feed coastal Chinese cracker with a nameplate capacity of 600,000 t/yr and fully-integrated downstream.

Product prices based on spot values.

Pygas modelled as equivalent to 35pc Benzene fob South Korea/65pc Naphtha Japan c+f minus $70/t Raffinate-1 is taken as 1.1* Naphtha Japan c+f

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