

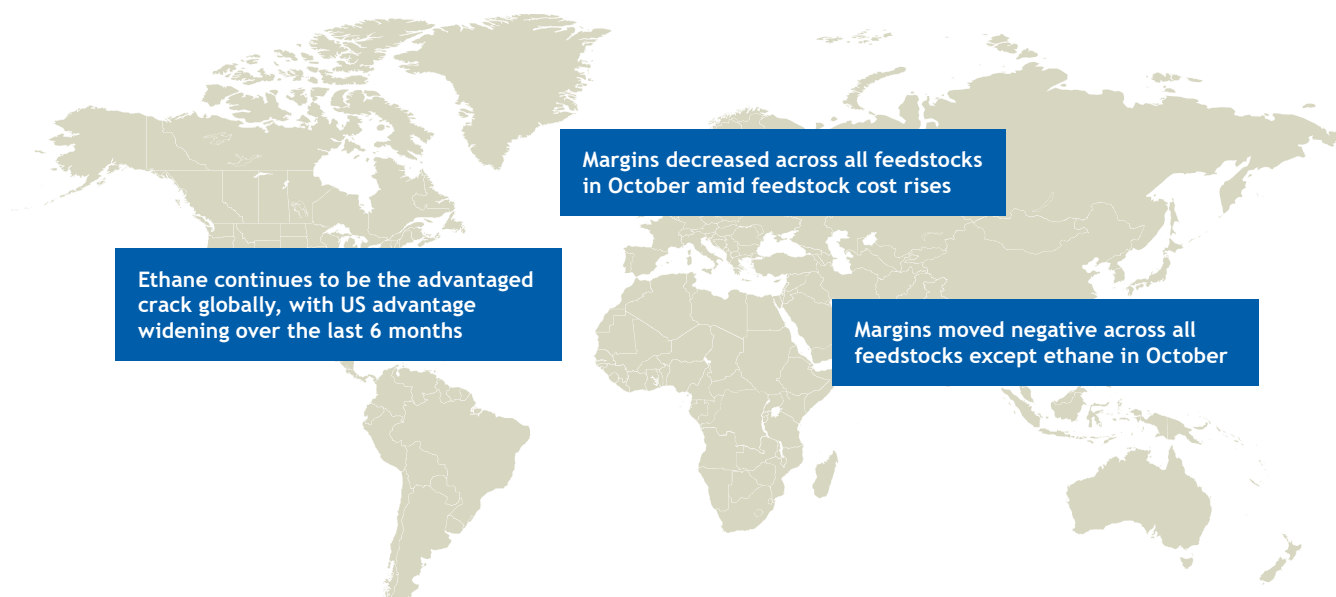
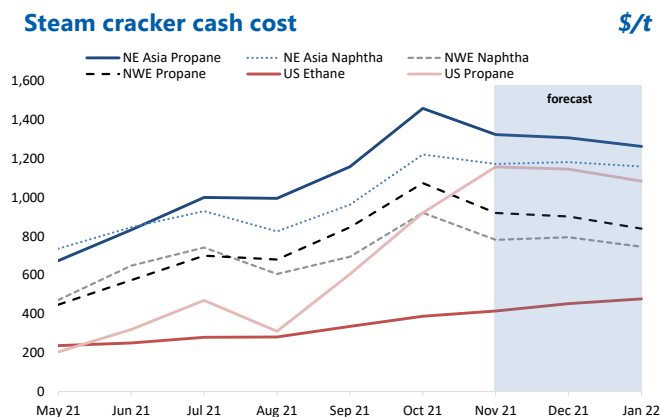
Argus Global Steam Cracker Economics



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

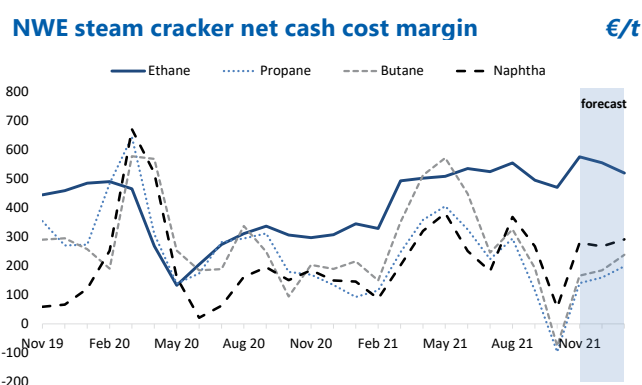
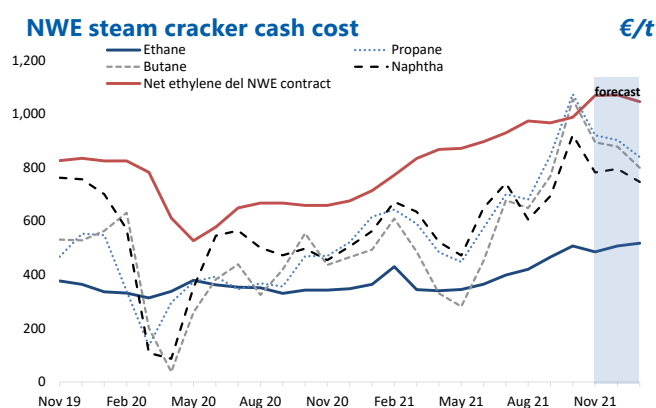


Available on Argus Direct: Argus Global Steam Cracker Economics historical and forecast data

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

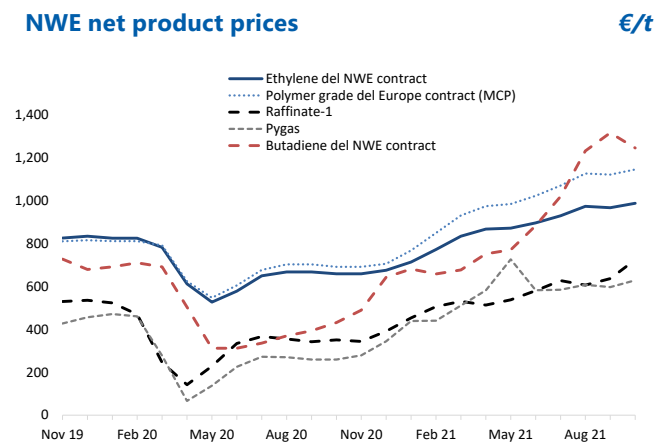
Northwest Europe ethylene steam cracker production costs and margins																							€/t		
	Ethane					Propane					Butane					Naphtha					Gasoil				
	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product 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)	US\$/USG	▲	+4.48
Propane ARA large cargo	€/t	▲	+105.37
Butane ARA coaster	€/t	▲	+123.29
Naphtha 65 para NWE	€/t	▲	+79.99

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

NWE net product prices



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.

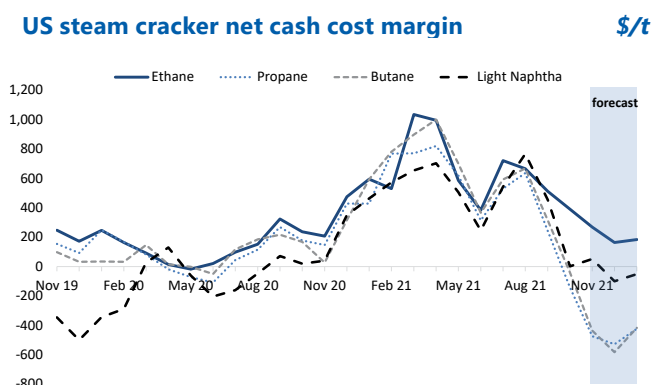
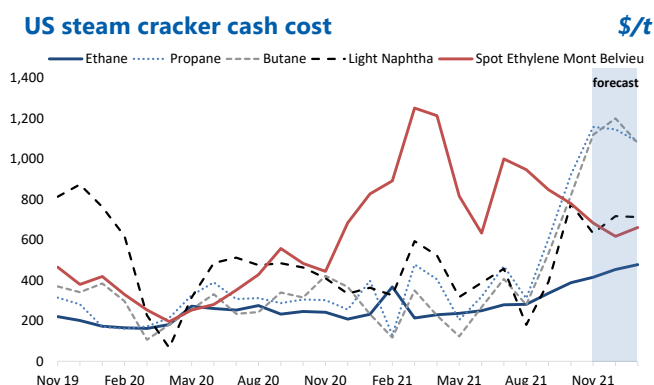
Pygas modelled as equivalent to 35pc Benzene cif NWE contract/65pc Naphtha 65 para NWE minus \$84/t

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



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 pro-

pane 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

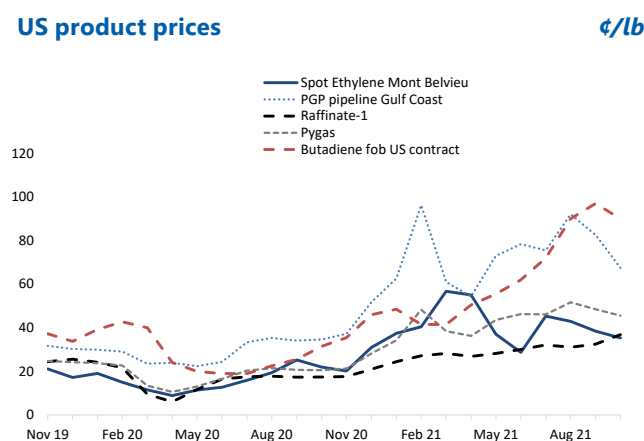
	Ethane					Propane					Butane					Light Naphtha					\$/t
	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash cost	Cash margin	Variable margin	Co-product credit	Variable cost	Cash 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	

	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

	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

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

US product prices



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

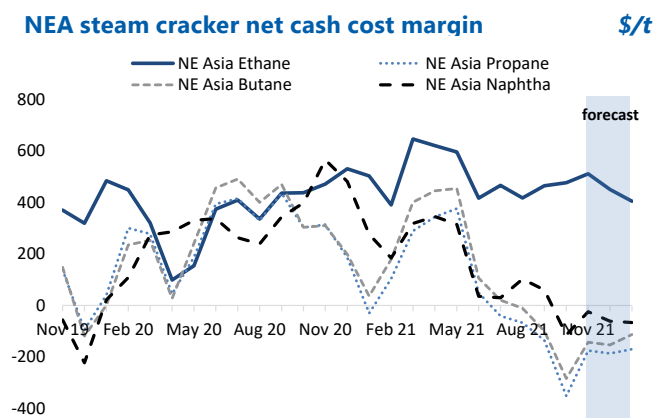
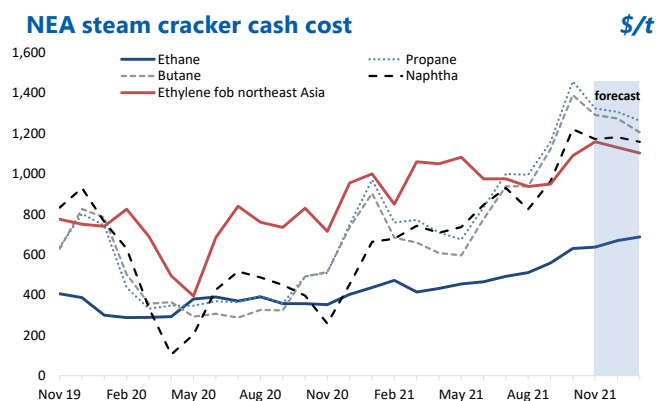
US Pygas = (0.35 x Benzene US Gulf coast USD/t) + (0.65 x Gasoline 87 conv USGC waterborne fob lowest RVP not 7.8 or 7.0) - 84 (the 84 is a discount)

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



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

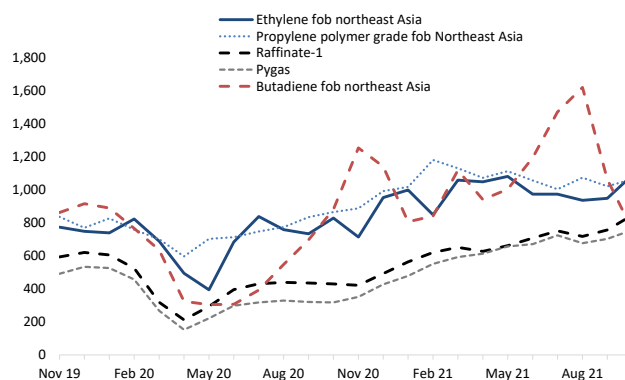
NE Asia feedstock price month-on-month change (Sep to Oct)			
	Unit		Change
Dubai Crude	\$/bl	▲	+8.89
Ethane (US import)	US\$/USG	▲	+4.48
Propane Japan cargo	\$/t	▲	+110.81
Butane Japan cargo	\$/t	▲	+88.59
Naphtha Japan c+f	\$/t	▲	+81.04

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	

NEA product prices

\$/t



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

Argus International LPG Forward Curves



The Argus International LPG Forward Curves service is a powerful, independent market valuation tool used to support investment and trading decisions in LPG markets across Europe, Americas and Asia.

Key features

- Daily assessments providing a rolling 36-month view of monthly forward prices
- Time-stamped using the appropriate market's daily settlement time — Singapore, London and New York
- Independent and transparent market-appropriate methodology
- Delivery options — your choice of data feeds, our third-party partners, FTP, API, Argus Direct, Excel Add-in or email

For more information:
www.argusmedia.com/forward-curves

Argus Global Polyethylene and Polypropylene



Argus Global Polyethylene and Polypropylene is a weekly pricing service with global resin prices and detailed commentary on key polymer grades.

Key features

- Detailed feedstock information on crude, naphtha, propane, ethane, ethylene and propylene
- Cracker and propane margins analysis
- Global pricing and fundamental information by country and region
- Coverage of Dalian futures market
- Production and outage news • New plant data
- Buy-side information, including FMCG and packaging news
- Polymer freight assessments

For more information, visit our webpage:

www.argusmedia.com/argus-global-polyethylene
www.argusmedia.com/argus-global-polypropylene

Set up a trial: Petrochemicals-m@argusmedia.com

Argus Global Steam Cracker Economics is published by Argus Media group

Registered office
Lacon House, 84 Theobald's Road,
London, WC1X 8NL
Tel: +44 20 7780 4200

ISSN: 2754-0219

Copyright notice
Copyright © 2021 Argus Media group
All rights reserved
All intellectual property rights in this publication and the information published herein are the exclusive property of Argus and/or its licensors (including exchanges) and may only be used under licence from Argus. Without limiting the foregoing, by accessing this publication you agree that you will not copy or reproduce or use any part of its contents (including, but not limited to, single prices or any other individual items of data) in any form or for any purpose whatsoever except under valid licence from Argus. Further, your access to and use of data from exchanges may be subject to additional fees and/or execution of a separate agreement, whether directly with the exchanges or through Argus.

Trademark notice
ARGUS, the ARGUS logo, ARGUS MEDIA, INTEGER, ARGUS GLOBAL STEAM CRACKER ECONOMICS, other ARGUS publication titles and ARGUS index names are trademarks of Argus Media Limited. Visit www.argusmedia.com/Ft/trademarks for more information.

Disclaimer
The data and other information published herein (the "Data") are provided on an "as is" basis. Argus and its licensors (including exchanges) make no warranties, express or implied, as to the accuracy, adequacy, timeliness, or completeness of the Data or fitness for any particular purpose. Argus and its licensors (including exchanges) shall not be liable for any loss, claims or damage arising from any party's reliance on the Data and disclaim any and all liability related to or arising out of use of the Data to the full extent permissible by law.

All personal contact information is held and used in accordance with Argus Media's Privacy Policy <https://www.argusmedia.com/en/privacy-policy>

Publisher
Adrian Binks

Chief operating officer
Matthew Burkley

Global compliance officer
Jeffrey Amos

Chief commercial officer
Jo Loudiadis

President, Expansion Sectors
Christopher Flook

SVP Consulting services
Lloyd Thomas

Senior Analyst
Jimmy Levine
Tel: +1 713 400 7857
ethylene@argusmedia.com

Customer support and sales:
support@argusmedia.com
sales@argusmedia.com

London, Tel: +44 20 7780 4200
Beijing, Tel: +86 10 6598 2000
Dubai, Tel: +971 4434 5112
Hamburg, Tel: +49 48 22 378 22-0
Houston, Tel: +1 713 968 0000
Kyiv, Tel: +38 (044) 298 18 08
Moscow, Tel: +7 495 933 7571
Mumbai, Tel: +91 22 4174 9900
New York, Tel: +1 646 376 6130
Paris, Tel: +33 1 53 05 57 58
San Francisco, Tel: +1 415 829 4591
Sao Paulo, Tel: +55 11 3235 2700
Shanghai, Tel: +86 21 6377 0159
Singapore, Tel: +65 6496 9966
Tokyo, Tel: +81 3 3561 1805
Washington, DC, Tel: +1 202 775 0240