LNG DAILY

Volume 18 / Issue 220 / November 9, 2021

JKM remains supported above $30; Dec-Jan contango widens further

JKM ™	AAOVQ00	30.559	-1.305 ▼
Cumulative monthly average (Dec)	AAOVS00	32.063	
Previous month average (Nov)	AAOVS03	33.254	
CNL WTW JKTC	ACNLF00	0.851	

KEY DRIVERS / MARKET HIGHLIGHTS

- APAC Physical MOC: Shell sells to Trafigura for Jan. 5-7 delivery at $32.30/MMBtu
- APAC Physical MOC: 3 entities report 2 bids, 2 offers
- APAC Derivative MOC: 6 entities report 18 trades, 7 bids, 9 offers
- UK LNG storage sees net withdrawals in Dragon
- Atlantic MOC: BP bids into Turkey for Nov. 27 cargo

SHIPPING MARKET HIGHLIGHTS

- Day rates remain at $260,000/day in the Pacific
- NLNG ship heard fixed by Russia's Yamal LNG

NEWS HEADLINES

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SHIPPING RATES, NOV 9

		$/day		Ballast rate
Asia Pacific day rate	AARXT00	260,000	AAXTN00	100%
Atlantic day rate	AASYC00	195,000	AAXTM00	100%
TCR Australia-Japan	ATCRA00	260,000.00		
TCR USG-NWE	ATCRB00	195,000.00		
TCR USG-Japan	ATCRC00	195,000.00		

DAILY CUMULATIVE AVERAGES AND MONTHLY AVERAGES

Nov 9 ($/MMBtu)		Cumulative monthly average			Previous month average	
JKM	AAOVS00	32.063	Dec	AAOVS03	33.254	Nov
DES West India	AALIC00	29.972	Dec	AAWIC03	31.934	Nov
DES Mediterranean	AADCU00	27.723	Dec	AASWC03	29.207	Nov
DES Northwest Europe	AASDF00	27.780	Dec	AASDE03	29.202	Nov
FOB GCM Loading Month	LGCSM00	24.900	Dec	LGCSM31	27.329	Nov
JKM Yen	AAOVT00	3650.503	Dec	AAOVT03	3707.118	Nov
JKM Yuan	LJCWM00	205.261	Dec	LJCWM03	189.189	Nov

PLATTS DAILY LNG MARKERS ($/MMBtu)

Nov 9			Change
DES Japan/Korea Marker (JKM)			
JKM (Dec)	AAOVQ00	30.559	-1.305 ▼
H1 Dec	AAPSU00	30.058	-1.517 ▼
H2 Dec	AAPSV00	31.059	-1.093 ▼
H1 Jan	AAPSW00	31.861	-0.872 ▼
H2 Jan	AAPXA00	31.950	-0.825 ▼
JKM (Dec) Japanese Yen	AAOVR00	3452.250	-165.270 ▼
JKM (Dec) Chinese Yuan (CNY/mt)	LJCMS00	10154.621	-442.925 ▼
DES Japan/Korea (JKM) derivatives Singapore close*			
Balmo-ND	LJKMB00	30.248	-1.561 ▼
Dec	LJKMO00	31.700	-0.375 ▼
Jan	LJKMO01	31.990	-0.410 ▼
Feb	LJKMO02	30.275	-0.150 ▼
DES Japan/Korea (JKM) derivatives London close*			
Dec	JKLMO00	29.776	-2.224 ▼
Jan	JKLMO01	30.066	-2.418 ▼
Feb	JKLMO02	29.150	-1.609 ▼
DES Mediterranean Marker (MED)			
MED (Dec)	AASXY00	24.374	-2.451 ▼
H1 Dec	AASXZ00	24.274	-2.451 ▼
H2 Dec	AASYA00	24.474	-2.451 ▼
H1 Jan	AASYB00	24.505	-2.456 ▼
DES Northwest Europe Marker (NWE)			
NWE (Dec)	AASXU00	24.374	-2.451 ▼
H1 Dec	AASXV00	24.274	-2.451 ▼
H2 Dec	AASXW00	24.474	-2.451 ▼
H1 Jan	AASXX00	24.555	-2.406 ▼
Middle East Marker (MEM)			
MEM (Dec)	LMEMA00	27.952	-1.711 ▼
H1 Dec	LMEMB00	27.630	-1.745 ▼
H2 Dec	LMEMC00	28.273	-1.677 ▼
H1 Jan	LMEMD00	28.961	-1.564 ▼
H2 Jan	LMEME00	29.102	-1.473 ▼
DES West India Marker (WIM)			
WIM (Dec)	AARXS00	27.952	-1.711 ▼
H2 Nov	LMEAA00	27.525	-1.750 ▼
H1 Dec	LMEAB00	27.630	-1.745 ▼
H2 Dec	LMEAC00	28.273	-1.677 ▼
H1 Jan	LMEAD00	28.961	-1.564 ▼
H2 Jan	LMEAE00	29.102	-1.473 ▼
DES West India Marker (WIM) derivatives Singapore close*			
Dec	AWIMB00	29.650	-0.350 ▼
Jan	AWIMM01	30.440	-0.335 ▼
Feb	AWIMM02	28.875	-0.150 ▼
FOB Gulf Coast Marker (GCM)			
GCM	LGCSM01	22.000	-2.500 ▼

*For full forward curve, see page 4

LNG NETBACK PRICES ($/MMBtu)

Nov 9			Change
FOB Australia	AARXR00	28.150	-1.270 ▼
FOB Middle East	AARXQ00	27.100	-1.700 ▼
DES Brazil Netforward	LEBMH01	24.700	-2.440 ▼
FOB Singapore	AARXU00	28.629	-1.385 ▼
FOB Murmansk	AARXV00	23.424	-2.421 ▼

PLATTS LNG ASIA JKM RATIONALE & EXCLUSIONS

The S&P Global Platts JKM for December was assessed at $30.559/MMBtu on Nov. 9.
Platts assessed the first half of December at $30.058/MMBtu and the second half of December at $31.059/MMBtu, with a wider intra-month contango structure of $1.001/MMBtu on Nov. 8, compared to a contango of 57.7 cents/MMBtu on Nov. 8.
The value for Dec. 14 was assessed at $30.445/MMBtu, above Trafigura's bid for a Jan. 5-7 DES JKTC cargo at TTF Jan plus $4.55/MMBtu, with a GHV of 1,030-1,130 Btu/cu ft, which was normalized 13 cents lower on lower total sulfur limit and larger cargo size, and later discharge port nomination within the same country, equating to a fixed price of $30.435/MMBtu.
The value for Jan. 6 was assessed at $31.915/MMBtu, in which Shell sold to Trafigura's bid for a Jan. 5-7 DES JKTC cargo at $32.30/MMBtu, with GHV of 1,037-1,125 Btu/cu ft, which was normalized 38.5 cents lower on narrower GHV range, smaller volume and later discharge port nomination within the same country, equating to a fixed price of $31.915/MMBtu
Vitol placed a bid for a Dec. 27-31 DES JKTC cargo at TTF Dec full-month average plus $3.60/MMBtu, with GHV of 1,000-1,110 Btu/cu ft, which was normalized 10 cents lower on lower maximum GHV limit compared with the Platts standard of 1,030-1,130 Btu/cu ft, and equated to a fixed price of $29.14/MMBtu.
During the derivatives MOC process, Dare's remaining bid outstanding stood at $31.50/MMBtu, while PetroChina placed the most competitive offer at $31.75/MMBtu. There were also 17 trades of 25 lots each traded at $31.70/MMBtu with Unipec as the seller. Platts assessed December JKM Singapore close at $31.70/MMBtu, on the repeated trades.
For the January JKM derivatives MOC process, BP placed the most competitive bid at $31.70/MMBtu while PetroChina offered at $32.0 at 4:30 Singapore time. At 4:23:05 PM Singapore time, Onyx bought from PetroChina 25 lots of Jan derivatives contract at $32.0/MMBtu. Platts assessed January JKM Singapore close at $31.99/MMBtu on Nov. 9, below PetroChina's offer outstanding.
Platts valued TTF December full month average at 4:30 pm Singapore time at $25.999/MMBtu, based on a minus 4.5 euro cent/MWh differential between the December balance of month and January TTF spread.
Platts valued ICE TTF January at 4:30 pm Singapore time at $26.015/MMBtu, based on a $5.975/MMBtu differential between JKM Jan and TTF Jan.
This rationale applies to symbol(s) <AAOVQ00>
Exclusions: none

PLATTS LNG ASIA WIM RATIONALE & EXCLUSIONS

The S&P Global Platts WIM for December was assessed at $27.952/MMBtu on Nov. 9.
Platts assessed first-half and second-half December at $27.63/MMBtu and $28.273/MMBtu, respectively, with a wider intra-month contango structure of 64.3 cents/MMBtu, compared to 57.5 cents/MMBtu on Nov. 8.
The value for Dec. 27-28 was assessed at $28.455/MMBtu, below Uniper's offer for a Dec. 27-28 DES India cargo at TTF Dec full-month average plus $2.15/MMBtu, with a GHV of 1,025-1,130 Btu/cu ft and 3.4 TBtu quantity. The offer was normalized 30 cents higher on the exclusion of Dubai and Kuwait on discharge port, two-day delivery window, larger volume, and earlier nomination of the alternate discharge port, equating to a fixed price of $28.465/MMBtu.
Platts assessed the December JKM/WIM a wider spread of $2.607/MMBtu on Nov. 9, compared to a spread of $2.201/MMBtu on Nov. 8.
This rationale applies to symbol(s) <AARXS00>.
Exclusions: none

PLATTS LNG US FOB GULF COAST DAILY RATIONALE & EXCLUSIONS

The FOB Gulf Coast Marker (GCM) was assessed at $22/MMBtu Nov. 9.
The assessment was for FOB USGC cargoes loading 30 to 60 days forward. The market was assessed based on higher shipping rates for deliveries through the Atlantic and Pacific, reflecting continued lengthy maximum wait times at the Panama Canal for unreserved LNG tankers, and weakening price movements in the major destination markets by close.
This rationale applies to symbol(s) <LGCSM01>
Exclusions: None

PLATTS LNG EUROPEAN ASSESSMENT RATIONALE & EXCLUSIONS

The Northwest Europe Marker (NWE) for December was assessed Nov. 9 at $24.374/MMBtu
H1 NWE for December was assessed at $24.274/MMBtu
H2 NWE for December was assessed at $24.474/MMBtu
The NWE prices were assessed lower day on day, reflecting falling flat prices for December TTF. The TTF December contract fell from an intraday high of Eur78.095/MWh to Eur71.100/MWh at market close. Market participants reported bids for NWE H2 December at a flat price to TTF. However, sources said that a wide bid/offer spread was present in the market. NBP/TTF premiums rose by 23 cents/MMBtu day on day, to 65 cents/MMBtu at 4:30 pm London time on Nov. 9. UK LNG storage saw net withdrawals in Dragon, South Hook and Isle of Grain terminals, according to data from the National Grid. Russian gas flows via the Mallnow gas compressor increased on Nov. 9. Flows nominated on Nov. 10 are comparable to flows seen before nominations went to zero on Oct. 29.
The Mediterranean Marker (MED) for December was assessed at $24.374/MMBtu
H1 MED for December was assessed at $24.274/MMBtu
H2 MED for December was assessed at $24.474/MMBtu
The MED price was assessed lower day on day. MED prices were assessed flat to NWE, with comparable premiums into both UK and Spanish gas hubs. Spanish gas inventories remain well-stocked, with tanks currently 81% full, 8 percentage points above the European average.
The assessments were based on pricing information from market sources for cargoes delivering within the region for December delivery.
This rationale applies to symbol(s) <AASXU00, AASXY00>
Exclusions: None

MARKET COMMENTARIES

JKM remains supported above $30; Dec-Jan contango widens further

Asia-Pacific spot LNG prices slid amid tepid end-user demand in the region, while December-January contango widened further as buying interest arose for January.

The S&P Global Platts JKM for December was assessed at $30.559/MMBtu on Nov. 9.

Platts assessed the first half of December at $30.058/MMBtu and the second half of December at $31.059/MMBtu, with a wider intra-month contango structure of $1.001/MMBtu on Nov. 8, compared to a contango of 57.7 cents/MMBtu on Nov. 8.

During the Market on Close process Nov. 9, Shell sold to Trafigura at $32.30/MMBtu for a Jan. 5-7 DES JKTC cargo, with GHV of 1,037-1,125 Btu/cu ft and 3.3 TBtu at 4:24:25 pm SGT.

Vitol bid for Dec. 27-31 DES JKTC at the average of TTF December plus $3.60/MMBtu, Trafigura bid for Dec. 13-15 DES JKTC at the average of TTF January plus $4.55/MMBtu.

REPORTED ATLANTIC BIDS, OFFERS AND TRADES ($/MMBtu)

Date	Seller	Loading	Buyer	Basis	Loading window	Offer/Bid	Notes
Best bids/offers							
Nov 09		Marmara, Turkey	BP	DES	Nov. 27	ICE Dec TTF flat bid	MOC

REPORTED APAC BIDS, OFFERS AND TRADES ($/MMBtu)

Date	Buyer	Destination	Seller	Source	Basis	Delivery period	Bid/Offer	Notes
Best bids/offers								
Nov 09	Trafigura	JKTC			DES	Dec 13-15	Jan TTF+4.55 bid	MOC
Nov 09	Vitol	JKTC			DES	Dec 27-31	Dec TTF+3.6 bid	MOC
Nov 09		India	Uniper		DES	Dec 27-28	Jan TTF+2.15 offer	MOC
Nov 09		JKTC	Uniper		DES	Jan 1-3	Jan JKM+0.13 offer	MOC
Nov 09	Onyx		PetroChina			Jan JKM derivatives	32 traded offer	MOC, 25 lots
Nov 09	Onyx		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	Dare		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	BP		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	Dare		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	Trafigura		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	BP		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	Onyx		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	BP		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	BP		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	BP		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	Trafigura		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	Trafigura		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	Trafigura		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	Dare		Unipec			Dec JKM derivatives	31.7 traded bid	MOC, 25 lots
Nov 09	Trafigura		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	Trafigura		Unipec			Dec JKM derivatives	31.7 traded offer	MOC, 25 lots
Nov 09	Onyx		Unipec			Dec JKM derivatives	31.65 traded bid	MOC, 25 lots
Last 5 trades		**APAC**						
Nov 09	Trafigura	JKTC	Shell		DES	Jan 5-7	32.30	MOC
Oct 26	PTT	Thailand		Qatar	DES	Nov 27-29, Dec 3-5	low-33	Tender
Oct 26	Shell, Total		EGAS	Egypt	FOB	Nov 14-15, Nov 24-25	28.25, 28.70	Tender
Oct 22	Vitol	JKTC	PetroChina		DES	Dec 6-8	Dec TTF plus 3.05 traded offer	MOC
Oct 21	Vitol	JKTC	PetroChina		DES	Dec 7-11	Dec TTF plus 3.45 traded bid	MOC
Oct 21	PetroChina	JKC	Shell		DES	Dec 10-12	Dec TTF plus 3.00 traded offer	MOC

On the offer, Uniper offered Jan. 1-3 DES JKTC at the average of JKM January plus 13 cents/MMBtu, and a DES India cargo at the average of TTF January plus $2.15/MMBtu.

On the derivatives MOC, there were 17 trades of 25 lots each for December JKM derivatives at $31.70/MMBtu with Unipec as the seller.

Platts assessed December JKM Singapore close at $31.70/MMBtu, on the repeated trades.

Onyx also bought 25 lots of January JKM derivatives at $32/MMBtu from PetroChina at 4:23:05 pm.

Platts assessed January JKM Singapore close at $31.99/MMBtu on Nov. 9, below PetroChina's outstanding offer at $32/MMBtu.

Spot LNG prices remained supported at above $30/MMBtu on Nov. 9 as the supply balance remained tight on the back of ongoing supply concerns in Indonesia, Malaysia, and Freeport in the US.

Sources further pointed out that the Panama Canal congestion was presenting as the main hurdle to inter-basin trades lately, limiting cargo flows from the US.

"The US-Asia arb looks closed to me, mainly due to congestion at Panama Canal," a Singapore-based trader said.

"I don't think there are many fundamental reasons for LNG prices to fall rapidly. Bintulu issues won't improve, and Panama congestion is quite significant," a Japanese power utility said.

There was also market talk of ongoing production issues at Indonesia's Tangguh train 2, reportedly dating back to September when the problem first arose. Further details and the impact on cargo deliveries could be not obtained at the time of reporting.

Some sources also noted that they were expecting Freeport to resume operations only by mid-November.

In addition, the December-January JKM contango widened further as additional demand for January arose while demand in December was relatively softer.

The December-January contango widened by 45.7 cents/MMBtu on Nov. 9 from Nov. 8 to $1.348/MMBtu.

In China, the ex-terminal truck LNG prices continued to fall on Nov. 8 to close to mid-7,000 Yuan/mt, according to domestic sources, equivalent to $19-20/MMBtu.

"Trucked LNG prices in China fell again after it stopped snowing yesterday, not much impact overall as spot prices are too high anyway, [the buyers] still can't pass cost downstream," a Singapore-based source said.

ASIA/MIDDLE EAST ($/MMBtu), NOV 9*

DES Japan/Korea Marker (JKM)		
JKM (Dec)	AAOVQ00	30.559
JKM (H1 Dec)	AAPSU00	30.058
JKM (H2 Dec)	AAPSV00	31.059
JKM (H1 Jan)	AAPSW00	31.861
JKM (H2 Jan)	AAPXA00	31.950
Asian Dated Brent (16:30 Singapore)	ADBAA00	14.51
JKM vs Henry Hub futures	AAPRZ00	25.183
JKM vs NBP futures	AAPSA00	3.839
JKM vs TTF	LNTFJ00	6.392
JKM vs Asian Dated Brent (16:30 Singapore)	AAPSB00	16.053
JKM vs MED (16:30 London)	ALNGB00	6.185
JKM vs NWE (16:30 London)	ALNGA00	6.185

DES Japan/Korea (JKM) derivatives Singapore close		
Balmo-ND	LJKMB00	30.248
Dec	LJKMO00	31.700
Jan	LJKMO01	31.990
Feb	LJKMO02	30.275
Mar	LJKMO03	25.600
Q1 2022	LJKQR01	29.288
Q2 2022	LJKQR02	16.400
Summer 2022	LJKSN01	15.700
Winter 2022	LJKSN02	16.125
2022	LJKYR01	19.350
2023	LJKYR02	12.200
2024	LJKYR03	9.350

DES Japan/Korea (JKM) derivatives London close		
Dec	JKLMO00	29.776
Jan	JKLMO01	30.066
Feb	JKLMO02	29.150
Mar	JKLMO03	24.077
Q1 2022	JKLQR01	27.764
Q2 2022	JKLQR02	14.876
Summer 2022	JKLSN01	14.722
Winter 2022	JKLSN02	15.072
2022	JKLYR01	17.800
2023	JKLYR02	10.650
2024	JKLYR03	9.260

DES West India Marker (WIM)		
WIM (Dec)	AARXS00	27.952

DES West India Marker (WIM) derivatives Singapore close		
Dec	AWIMB00	29.650
Jan	AWIMM01	30.440
Feb	AWIMM02	28.875
Mar	AWIMM03	24.325
Q1 2022	AWIMQ01	27.880
Q2 2022	AWIMQ02	15.100
Summer 2022	AWISN01	14.450
Winter 2022	AWISN02	14.775
2022	AWIMY01	18.000
2023	AWIMY02	10.950
2024	AWIMY03	8.075

Carbon Neutral LNG		
CNL WTW JKTC Differential (ex-Australia)	ACNLF00	0.851
CNL WTT JKTC Differential (ex-Australia)	ACNLB00	0.188
CNL DES JKTC Differential (ex-Australia)	ACNLG00	0.181
CNL Combustion JKTC	ACNLJ00	0.663

FOB Middle East		
FOB Middle East	AARXQ00	27.100

FOB Australia (netback)		
JKM (Dec)	AAOVQ00	30.559
(-) Freight	AAUSA00	2.41
FOB Australia	AARXR00	28.15

Key gas price benchmarks			
Japan Customs Cleared LNG (Aug)	LAKPN00	10.15	Final
Japan Customs Cleared LNG (Sep)	LAKPM00	10.78	Estimated

Platts Dutch TTF		
Dec	GTFWM10	24.167
Jan	GTFWM20	24.192

Competing fuel prices			
Japan Customs Cleared crude oil (Aug) ($/b)	AAKOP00	73.78	Final
Japan Customs Cleared crude oil (Sep) ($/b)	AAKOM00	73.81	Estimated
HSFO 3.5% sulfur 180 CST FOB Singapore	LUAXZ00	11.63	
NEAT Coal Index	JKTCB00	6.099	
Minas crude oil	LCABO00	13.699	
Naphtha CFR Japan	LNPHJ00	16.814	

EUROPE ($/MMBtu), NOV 9

		$/MMBtu		Eur/MWh		Eur/MMBtu
DES Mediterranean Marker (MED)						
MED (Dec)	AASXY00	24.374	LNMTA00	71.783	LNMXA00	21.054
MED (H1 Dec)	AASXZ00	24.274				
MED (H2 Dec)	AASYA00	24.474				
MED (H1 Jan)	AASYB00	24.505				
Dated Brent (16:30 London)	ADBAB00	14.58				
MED vs Henry Hub futures	AASYF00	19.413				
MED vs TTF	LNTFS00	0.207				
MED vs NBP futures	AASYH00	-0.379				
MED vs Dated Brent (16:30 London)	AASYJ00	9.794				
MED vs NWE	ALNSA00	0.000				
MED vs JKM	AASYM00	-6.185				
DES Northwest Europe Marker (NWE)						
NWE (Dec)	AASXU00	24.374	LNNTA00	71.783	LNNXA00	21.054
NWE (H1 Dec)	AASXV00	24.274				
NWE (H2 Dec)	AASXW00	24.474				
NWE (H1 Jan)	AASXX00	24.555				
Dated Brent (16:30 London)	ADBAB00	14.58				
NWE vs Henry Hub futures	AASYE00	19.413				
NWE vs TTF	LNTFN00	0.207				
NWE vs NBP futures	AASYG00	-0.379				
NWE vs Dated Brent (16:30 London)	AASYI00	9.794				
NWE vs MED	AASYK00	0.000				
NWE vs JKM	AASYL00	-6.185				
NWE as a % of NBP	AASYD00	98.47				
Competing fuel prices						
Northwest Europe fuel oil	LAEGR00	13.07				
CIF ARA 15-60 day thermal coal	CSAAB00	6.76				

NORTH AMERICA ($/MMBtu), NOV 9

FOB Gulf Coast Marker (GCM)		
GCM	LGCSM01	22.000
Dated Brent (16:30 London)	ADBAB00	14.58
GCM vs JKM	LGMJM01	-8.559
GCM vs Henry Hub futures	LGMHM01	17.021
GCM vs TTF	LNTFG00	-2.167
GCM vs NWE	LGEUR00	-2.374
GCM vs MED	LGMET00	-2.374
GCM vs NBP futures	LGMNM01	-2.753
GCM vs Dated Brent (16:30 London)	LGMDB00	7.420
GCM vs USGC HSFO	LGMFO00	11.050
Competing fuel prices		
US Gulf Coast high sulfur fuel oil	LUAXJ00	11.06
New York Harbor 1%S fuel oil	LUAXD00	13.04

*Japan Customs Cleared value shows latest available CIF price published by the Ministry of Finance, converted to US dollars per MMBtu. All other values reflect Platts most recent one-month forward assessments for each product in each region, converted to US dollars per MMBtu. JKM Marker, SWE LNG and NWE LNG average the assessments of the two half-months comprising the first full month of forward delivery. Asian LNG assessments assessed at Singapore market close 0830 GMT, European LNG assessment assessed at London market close 1630 UK time. NYMEX Henry Hub futures and ICE NBP futures values taken at Singapore market close and London market close. ICE NBP futures converted from Pence/Therm to $/MMBtu. Asian Dated Brent crude oil assessed at Asian market close 0830 GMT and converted from $/barrel to $/MMBtu. Detailed assessment methodology is found on www.platts.com.

RECENT TENDERS AND STRIPS

Tender/ strip November 09	Issuer/location	Tender type	(Loading) or delivery period	Slots/ cargoes	Opening	Closing date	Validity	Notes	Results
Tender	Angola LNG - Angola LNG	Sell	16-Nov-21 - 15-Dec-21	1 DES		10-Nov-21		furthest delivery to Arun	
Tender	Sonatrach - Algeria	Sell	(01-Nov-21 - 15-Nov-21)	3 FOB					
Tender	APLNG - Australia Pacific LNG	Sell	(28-Dec-21 - 28-Dec-21)	1 DES or FOB	08-Nov-21				
Tender	Adnoc - ADNOC Das Island	Sell	(07-Apr-22 - 23-Sep-22)	6 FOB		09-Nov-21		loading dates: April 7-13, May 15-21, June 12-18, July 20-26, Aug 20-26, Sep 17-23 Brent-linked basis	
Tender	BOTAS - Turkey	Buy	01-Dec-21 - 28-Feb-22	9 DES		04-Nov-21		9 cargo tender, closing Nov.4	
Tender	EGAT - Map Ta Phut	Buy	10-Dec-21 - 18-Dec-21	1 DES		03-Nov-21		One cargo buy tender for Dec. 10-12 or Dec. 16-18 delivery	
Tender	Pakistan LNG - Port Qasim	Buy	19-Nov-21 - 27-Nov-21	2 DES	02-Nov-21	05-Nov-21	05-Nov-21	Two cargo buy tender for Nov. 19-20 and Nov. 26-27 delivery. Closes on Nov. 5, 1200 hours PST. Validity until 2300 hours PST.	
Tender	Oman LNG - Oman LNG	Sell	(01-Dec-21 - 03-Dec-21)	1 DES or FOB		21-Oct-21		Closing 1pm Oman time	heard awarded to Gunvor around $30/MMBtu FOB
Tender	Ichthys LNG - Ichthys LNG	Sell	(13-Nov-21 - 17-Nov-21)	1 DES or FOB	25-Oct-21	27-Oct-21	27-Oct-21	FOB or DES cargo, 13-17 November loading. The tender closes on Oct. 27, noon Tokyo time. Validity until 7 PM Tokyo time (7 hour validity).	heard awarded at approximately $31/MMBtu FOB
Tender	Darwin LNG - Darwin	Sell	(01-Dec-21 - 03-Dec-21)	1 DES or FOB		28-Oct-21		Dec 1-3 load or Dec 14-17 DES JKTC	heard awarded at approximately $31/MMBtu FOB
Tender	Petronet - Dahej	Buy	16-Nov-21 - 30-Nov-21	1 DES	21-Oct-21	27-Oct-21	28-Oct-21	Seller to nominate delivery window for H2 Nov, fixed price only, DES Dahej or Kochi, 3.2 Tbtu	heard not awarded
Tender	Egas - Egypt	Sell	(13-Nov-21 - 25-Nov-21)	2 DES or FOB		26-Oct-21	26-Oct-21		Heard awarded approximately $28s/MMBtu
Tender	PTT - Map Ta Phut	Buy	27-Nov-21 - 05-Dec-21	2 DES	25-Oct-21	26-Oct-21	26-Oct-21	Seeking two cargoes for Nov. 27-29 delivery and Dec. 3-5 delivery. Closes on 4 PM Thailand time on Oct. 26, and has a 3 hour validity until 7 PM Thailand time.	Heard awarded around $33-$34/MMBtu
Tender	IEASA - Escobar	Buy	19-Nov-21 - 19-Dec-21			26-Oct-21		Two cargo buy tender for Nov. 19 & Dec. 19 delivery	
Tender	Novatek - Yamal	Sell	05-Dec-21 - 31-Mar-22	3 DES		21-Oct-21		Dec. 5-23, Jan. 3-21, and March 25-31 delivery	Heard partially awarded
Tender	Sakhalin Energy - Sakhalin	Sell	(01-Dec-21 - 01-Dec-21)	1 DES or FOB		21-Oct-21	22-Oct-21		heard awarded at approximately $34/MMBtu
Tender	Angola LNG - Angola LNG	Sell	05-Nov-21 - 19-Nov-21	1 DES		25-Oct-21	26-Oct-21	Furthest to India, onboard Seri Balqis	
Tender	BOTAS - Turkey	Buy	01-Nov-21 - 31-Mar-22	19 DES		18-Oct-21		DW: Nov.1-7, Nov.8-14, Nov.15-21, Nov.22-28, Nov.29-Dec.5, Dec.6-12, Dec.13-19, Dec.20-26, Dec.27-Jan.2, Jan.3-9, Jan.10-16, Jan.17-23, Jan.24-30, Jan.31-Feb.6, Feb.7-13, Feb.14-20, Feb.21-27, Feb.28-Mar.6, Mar.7-13	Heard partially awarded at TTF+$0.40/MMBtu to +$0.70/MMBtu
Tender	Darwin LNG - Darwin	Sell	20-Nov-21 - 27-Nov-21	1 DES	12-Oct-21	14-Oct-21	14-Oct-21	Nov 14-16 loading or Nov 20-27 DES	heard awarded to a trader at high $36 or approximately $37/MMBtu FOB to BP
Tender	APLNG - Australia Pacific LNG	Sell	(25-Nov-21 - 27-Nov-21)	1 DES	11-Oct-21	12-Oct-21			Heard awarded to Gunvor

Meanwhile, in Japan, the Day-Ahead 24-hour spot electricity price in Japan remained buoyed at Yen 18.83/kWh on Nov. 9, according to the Japan Electric Power Exchange, equivalent to about $24.28/MMBtu.

Nevertheless, interest for spot cargoes was lackluster as "even if JEPX is at Yen 50/kwh, and hypothetically, if someone buys LNG cargo, it takes 2-3 weeks to convert this LNG cargo and sell it on JEPX. Usually, prices don't remain this high for weeks, so that is the conundrum," the same Japanese power utility said.

On tenders, ADNOC's strip tender closed on Nov. 9 at 5 pm Singapore time offering six cargoes for 2022 for April 7-13, May 15-21, June 12-18, July 20-26, Aug. 20-26, and Sept. 17-23. However, the results were not available at the time of reporting. — *Shermaine Ang*

European LNG prices fall on increased Russian gas pipeline flows

Increased pipeline gas flows from Russia via Germany and warmer expected weather across the continent pushed European LNG prices lower Nov. 9.

Shipping remained expensive, particularly via the Panama Canal. That reduced netbacks for cargoes delivered from the US Gulf Coast.

S&P Global Platts assessed DES Northwest Europe for December at $24.374/MMBtu Nov. 9, down $2.451/MMBtu from the previous day. The first half of December was assessed at $24.274/MMBtu and the second half was assessed at $24.474/MMBtu, maintaining the intramonth contango of 20 cents/MMBtu seen Nov. 8.

Dutch TTF December futures fell from an intraday high of Eur 78.095/MWh to Eur 71.100/MWh at market close.

"We don't even consider Panama for Asia flow anymore," an Atlantic-based LNG trader said. "This will keep shipping rates high during all winter."

NBP/TTF premiums rose by 23 cents/MMBtu day on day to 65 cents/MMBtu at 4:30 pm London time Nov 9.

UK LNG storage saw net withdrawals in Dragon, South Hook and Isle of Grain terminals, according to data from utility National Grid.

Russian gas flows via the Mallnow gas compressor that serves West Germany, meanwhile, increased Nov. 9. Flows nominated for Nov. 10 were comparable with flows seen before flows went to zero Oct. 29.

During the European trade, there was a high volume of spread trades for JKM/TFU (TTF in $/MMBtu) for February and March, with the February spread gaining 25 cents/MMBtu and March gaining 20 cents/MMBtu through to London close.

In the Atlantic MOC, BP bid into Turkey for a Nov. 27 cargo at a flat price to TTF. The bid could allude to greater trading activity in the Eastern Mediterranean region, with Turkey's Botas having awarded two cargoes in its recent nine cargo tender, which closed Nov. 4, according to market sources.

The LNG shipping market showed neither an uptrend nor a downturn Nov. 9, keeping day rates high.

In the Pacific, day rates were at $260,000/day. They remained at $195,000/day in the Atlantic. A Nigeria LNG ship was heard fixed by Yamal LNG in Russia for a period of 45 days for mid-January loading with delivery in Zeebrugge, Belgium, and redelivery in the East Asia JKTC region, with the rate not reported. The requirement by Australia's Woodside for an early January loading ex US Gulf was heard still not covered.

The maximum wait time at the Panama Canal for unreserved LNG transits was 18 days northbound and 18 days southbound Nov. 9, according to the Panama Canal Authority. — *Harry Weber, Zack Smith, Piers De Wilde*

SOUTH AMERICA ($/MMBtu), NOV 9

DES Brazil Netforward		
DES Brazil (Dec)	LEBMH01	24.700
DES Brazil vs NWE Fuel Oil Derivative	LAARM01	11.630
DES Brazil vs DES MED LNG	LASWM01	0.326
DES Brazil vs Dated Brent	LADBM01	10.120
DES Brazil vs Henry Hub (16:30 London)	LAHHM01	19.739
DES Brazil vs JKM (16:30 London)	LAJKM01	-5.859
DES Brazil vs NBP (16:30 London)	LABPM01	-0.053

NORTH AMERICAN FEEDGAS ($/MMBtu), NOV 8

Daily average US LNG feedgas cost	ALNFG00	5.175
30-day moving average US LNG feedgas cost	ALNUS00	5.365
Daily average USGC LNG feedgas cost	ALNFH00	5.199
30-day moving average USGC LNG feedgas cost	ALNUG00	5.402

Export facility		Estimated feedgas cost
Sabine Pass	ALNFA00	5.241
Corpus Christi	ALNFB00	5.163
Cove Point	ALNFC00	4.945
Cameron	ALNFD00	5.318
Freeport	ALNFE00	4.961
Elba Island	ALNFF00	5.417

Facility feedgas costs represent a calculation derived from S&P Global Platts' North American gas spot price indices at the hub(s) from which feedgas would be procured most economically for the export facility. The average summary costs are an average of the relevant export facilities' feedgas costs weighted by Platts Analytics' daily estimated volume delivered to each facility.

US CARGO CANCELLATIONS, NOV 9

Dec-21	0
Nov-21	0
Oct-21	0
Sep-21	0
Aug-21	0
Jul-21	0
Jun-21	0
May-21	0
Apr-21	0
Mar-21	0
Feb-21	5
Jan-21	2

The figures are collected from market sources.

NATURAL GAS FUTURES ($/MMBtu), NOV 9

NYMEX HH Singapore close	(Dec)	AAPSD00	5.376
NYMEX HH Singapore close	(Jan)	AAPSE00	5.448
ICE NBP Singapore close	(Dec)	AAPSF00	26.718
ICE NBP Singapore close	(Jan)	AAPSG00	27.159
NYMEX HH London close	(Dec 21)	AASYN00	4.961
NYMEX HH London close	(Jan 22)	AASYO00	5.052
ICE NBP London close	(Dec 21)	AASYR00	24.753
ICE NBP London close	(Jan 22)	AASYS00	25.256
NYMEX HH US close	(Dec 21)	NMNG001	4.979
NYMEX HH US close	(Jan 22)	NMNG002	5.070

MARINE FUEL LNG BUNKER, NOV 9

	$/MMBtu		$/mt (Oil)		$/mt (LNG)	
Singapore	LNBSG00	30.059	LNBSM00	1161.570	LNBSF00	1563.068
	Eur/MWh		**$/mt (Oil)**		**$/mt (LNG)**	
Rotterdam	LNBRT00	70.225	LNBRM00	920.473	LNBRF00	1239.940

MMBtu to $/mt (oil) factor: 38.643; MWh to $/mt (oil) factor: 11.322; MMBtu to $/mt (LNG) factor: 52.000.

NEWS

Gazprom begins implementing plan for gas injection into five European storage sites

- **Routes, volumes determined for November injections**
- **Gazprom completed domestic storage program on Nov 8**
- **Company's European stocks currently at low level**

Russia's state-controlled Gazprom said Nov. 9 it had started to implement a plan for gas injection this month into five of its European storage facilities.

In a brief statement, Gazprom also said it had decided on how much gas to put into its storage sites this month and how the gas would reach the facilities.

"Gazprom approved and began implementing the plan for gas injection into five European underground gas storage facilities for November," it said.

"The volumes and routes of gas transportation have been determined."

European gas prices have remained high through October and November, in part due to lower-than-expected imports from Russia and low levels of EU storage, especially in Gazprom-owned sites such as Rehden in Germany and Haidach in Austria.

S&P Global Platts assessed the benchmark TTF day-ahead price at a record high of Eur116.10/MWh ($134/MWh) on Oct. 5, with price volatility continuing through October and into November.

The TTF day-ahead price was assessed at Eur77.43/MWh on Nov. 8, up 480% from a year ago.

On Oct. 27, Russian President Vladimir Putin asked Gazprom to start refilling its gas storage sites in Germany and Austria as soon as it had completed injecting gas into domestic gas storage sites.

Gazprom said at the time that domestic storage injections would continue until Nov. 8.

European stocks

Gazprom's own stocks in Europe have fallen to very low levels, which has brought down overall gas storage levels in Europe more generally and added to winter supply concerns.

Gazprom has capacity in a number of sites in Europe, notably Rehden and Katharina in Germany, and Haidach in Austria. Rehden

(continued on page 9)

PLATTS WIM RLNG DAILY PRICES, NOV 9

		$/MMBtu	Rupee/MMBtu
Ex-Terminal			
Dahej	RLEDA00	29.70	RLEIA002200.37
Hazira	RLEDB00	29.85	RLEIB002211.67
Dabhol	RLEDC00	29.79	RLEIC002206.92
Mundra	RLEDE00	29.82	RLEEI002209.64
Kochi	RLEDD00	30.32	RLEDI002246.83
Average	RLEDF00	29.90	RLEIF002215.09
Location			
Ahmedabad	RLDDJ00	30.20	RLDIJ002237.50
Morbi	RLDDK00	30.32	RLDIK002246.77
Panvel	RLDDL00	30.45	RLDIL002256.30
Dabhol	RLDDC00	30.45	RLDIC002256.30
Vijaipur	RLDDM00	30.38	RLDIM002251.20
Kota	RLDDN00	30.38	RLDIN002251.20
Chhainsa	RLDDO00	30.45	RLDIO002255.97
Jagdishpur	RLDDP00	30.45	RLDIP002255.97
New Delhi	RLDDQ00	30.45	RLDIQ002255.97
Koottanad	RLDDR00	30.97	RLDIR002294.74
Kakinada	RLDDS00	31.06	RLDIS002301.44
Average	RLDDT00	30.51	RLDIT002260.31

Prices are net-forward calculations derived from the Platts WIM and exclude VAT and CST sales taxes. Delivered prices represent the cost of delivery from the nearest connected LNG terminal via pipeline.

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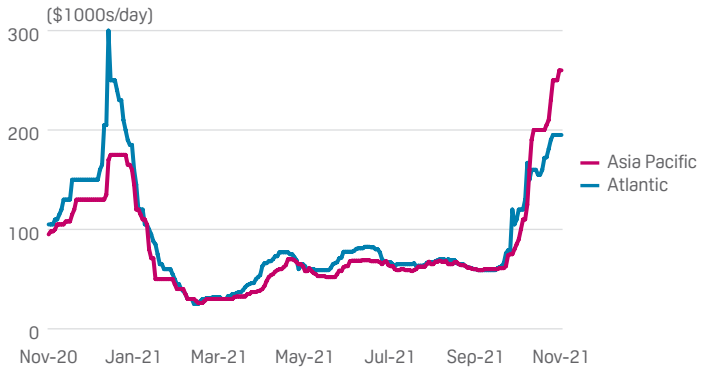
SHIPPING PRICES

SHIPPING RATES, NOV 9

		$/day
Asia Pacific day rate	AARXT00	260,000
Atlantic day rate	AASYC00	195,000
TCR Australia-Japan	ATCRA00	260,000.00
TCR USG-NWE	ATCRB00	195,000.00
TCR USG-Japan	ATCRC00	195,000.00
		$/MMBtu
PLF1 Middle East-Japan/Korea	AAUUA00	3.83
PLF2 Middle East-NWE	AAUTE00	4.02
PLF3 Trinidad-NWE	AAUUC00	1.83

SHIPPING RATES



Source: S&P Global Platts

SHIPPING CALCULATOR, NOV 9

	Australia-Japan/Korea	Middle East-India
Ship size (mt)	72980.77	72980.77
Trip length (days)	9	3
Carrier day rate ($/day)	260000	260000
Day rate cost ($/MMBtu)	1.50	0.63
Boil-off cost	0.62	0.20
Supplementary boil-off cost ($/MMBtu)	0.20	0.06
Cost of voyage* ($/MMBtu)	2.41	0.94

*Includes port cost.

FREIGHT ROUTE COSTS, NOV 9 ($/MMBtu)

Asian discharge ports

		Japan/Korea		South China/Taiwan		West India
Middle East	AAUUA00	3.83	AAUSH00	3.34	AAUSP00	0.94
Australia (Dampier)	AAUSA00	2.41	AAUSI00	1.94	AAUSQ00	2.31
Australia (Gladstone)	ACABA00	2.42	ACABB00	2.66	ACABC00	3.72
Bontang	AOJKA00	1.67	AOCTA00	1.21	AOWIA00	2.28
Bintulu	ABJKA00	1.70	ABCTA00	1.01	ABWIA00	2.08
Singapore	ASJKA00	1.90	ASCTA00	1.21	ASWIA00	1.60
Tangguh	ATJKA00	1.65	ATCTA00	1.42	ATWIA00	2.73
Trinidad via Suez	AAUSB00	7.39	AAUSJ00	6.93	AAUSR00	4.74
Trinidad via Panama	AAUXB00	5.12	AAUZB00	6.23		
Trinidad*	AAUZC00	5.12	AAUZD00	6.23		
Nigeria	AAUSC00	5.81	AAUSK00	5.15	AAUSS00	3.71
Algeria	AAUSD00	5.40	AAUSL00	4.96	AAUST00	2.95
Belgium	AAUSE00	6.27	AAUSM00	5.61	AAUSU00	3.53
Peru	AAUSF00	5.35	AAUSN00	6.12	AAUSV00	6.66
Russia	AAUSG00	0.97	AAUSO00	1.43	AAUSW00	3.68
Spain	ACAAA00	5.64	ACAAB00	4.99	ACAAC00	3.17
Norway	ACAAH00	7.20	ACAAI00	6.29	ACAAJ00	4.37
USGC*	LAUVA00	5.38	LAUVB00	6.49	LAUVC00	5.19
USGC via Panama	LAUVI00	5.38	LAUVL00	6.49		
USGC via Suez	LAUVJ00	8.12	LAUVM00	7.20	LAUVO00	5.19
USGC via Cape	LAUVK00	8.36	LAUVN00	7.65	LAUVP00	6.45

EMEA discharge ports

		South West Europe		North West Europe		Kuwait/UAE
Middle East	AAUSX00	3.38	AAUTE00	4.02	LMEMM00	0.51
Australia (Dampier)	AAUSY00	5.23	AAUTF00	5.91	LMEMN00	2.79
Australia (Gladstone)	ACABD00	6.68	ACABE00	7.38	ACABI00	4.22
Trinidad	AAUSZ00	1.86	AAUUC00	1.83	LMEMP00	4.34
Nigeria	AAUTA00	2.09	AAUTG00	2.24	LMEMQ00	3.97
Algeria	AAUTB00	0.46	AAUTH00	0.96	LMEMR00	2.57
Belgium	AAUTC00	0.80			LMEMS00	3.35
Peru	AAUTD00	5.47	AAUTI00	5.67	LMEMT00	7.19
Russia	AAUUB00	6.63	AAUTJ00	7.09	LMEMU00	5.14
Spain			ACAAD00	0.80	LMEMV00	2.79
Norway	ACAAK00	1.36	ACAAL00	0.79	LMEMW00	3.97
Murmansk			AARXW00	0.95		
USGC*	LAUVD00	2.45	LAUVE00	2.42	LMEMX00	5.00
USGC via Suez					LMEMY00	5.00
USGC via Cape					LMEMZ00	6.25

Americas discharge ports

		US Atlantic Coast		Argentina		Brazil
Middle East	AAUTK00	4.73	AAUTS00	4.90	ACAAP00	5.65
Australia (Dampier)	AAUTL00	5.95	AAUTT00	4.93	ACAAQ00	5.91
Australia (Gladstone)	ACABF00	5.76	ACABH00	4.24	ACABG00	5.21
Trinidad	AAUTM00	0.99	AAUTU00	2.16	ACAAR00	1.47
Nigeria	AAUTN00	2.42	AAUTV00	2.39	ACAAS00	2.06
Algeria	AAUTO00	1.61	AAUTW00	2.74	ACAAT00	2.41
Belgium	AAUTP00	1.45	AAUTX00	3.11	ACAAU00	2.77
Peru	AAUTQ00	4.92	AAUTY00	2.21	ACAAV00	3.36
Russia	AAUTR00	7.44	AAUTZ00	6.32	ACAAW00	8.87
Spain	ACAAE00	1.33	ACAAF00	2.77	ACAAG00	2.25
Norway	ACAAM00	1.62	ACAAN00	3.71	ACAAO00	3.55
USGC*			LAUVG00	3.32	LAUVH00	2.60

*Most economic.

All values calculated based on prevailing spot market values during the day for LNG, bunker fuel and ship chartering. No route cost is calculated for Zeebrugge to NW Europe, or Spain to SW Europe. Other routes appear blank on days when a public holiday in one or another location means underlying values are not published. Detailed assessment methodology, including assumed route times and underlying values, is found on www.platts.com.

was just 9.6% full as of Nov. 7, according to Gas Infrastructure Europe data, while Haidach was just 2% full.

Asked about the storage levels at Gazprom's sites in Germany and Austria, Gazprom CEO Alexei Miller said on Oct. 27 that the volume was "insignificant — literally very, very small."

As well as Rehden, Katharina and Haidach, Gazprom also has access to working gas capacities at Jemgum and Etzel in Germany, Bergermeer in the Netherlands, Banatski Dvor in Serbia, and Damborice in the Czech Republic.

It was not immediately clear which five European sites will be targeted by Gazprom.

However, Putin's remarks were specifically for sites in Germany and Austria, which implies the sites to be restocked will be Rehden, Katharina, Haidach, Jemgum, and Etzel.

Gazprom has been criticized for allowing its gas stocks in its European sites to sit close to empty, which has brought down overall gas storage levels in Europe generally.

According to data from Gas Infrastructure Europe, the EU's gas storage sites were just 75% full as of Nov. 7.

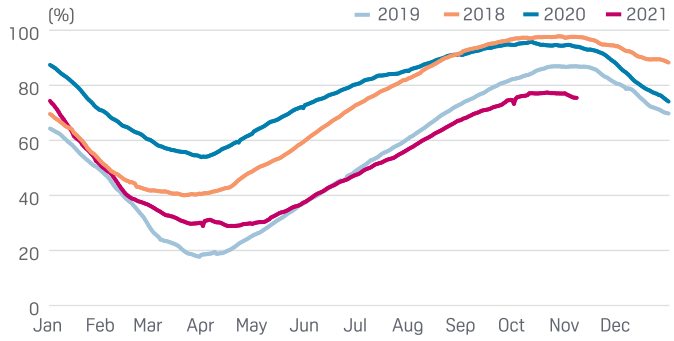
Market reassurance

S&P Global Platts Analytics believes a restocking by Gazprom would likely bring some relief to European gas markets, but would not be enough to boost stocks back to last year's levels.

"Any refilling through November will help reassure the market ahead of the peak demand season, but is unlikely to significantly reduce the year-on-year deficit that has accumulated over 2021," it said Nov. 9.

The current 75% level of stock filledness compares with 94% at the same time last year.

EU GAS STORAGE LEVELS BEGIN TO DECLINE, NOW 75% FULL



Source: GIE

Platts Analytics also believes Russian gas flows into northwest Europe will rise through November.

"We currently forecast 125 million cu m/d on average to go to northwest Europe in November, but so far these flows have averaged just 111 million cu m/d," it said.

However, it said, even at 125 million cu m/d, Russian flows would still be almost 80 million cu m/d below the five-year average. — *Stuart Elliott*

Morocco begins talks on new gas supply options after GME pipeline halt: report

- **Two Moroccan gas-fired power stations idled on Algeria spat**
- **Morocco in process of tendering for LNG import terminal**
- **Long-term focus is 'proactive' development of renewables**

Morocco has started talks with regional and international players on establishing new gas supply options following the suspension of deliveries from neighboring Algeria on Nov. 1, Morocco's energy transition minister Leila Benali said Nov. 8.

Speaking to the Moroccan parliament, Benali — who took office last month — also said while the two gas-fired power stations that took Algerian gas via the GME pipeline were currently idled, Morocco was able to meet power demand.

Moroccan gas demand has traditionally been pegged at around 1 Bcm/year, with most of the gas consumed by the two gas-fired power stations at Tahaddart and Ain Beni Mathar supplied with gas from Algeria via GME.

The country also has limited domestic production that is supplied to local industrial customers including carmakers and paper mills.

Cited by Morocco's official state news agency MAP, Benali said consultations had begun with market players to put in place a "sustainable and effective" system for the management of gas supply into the country.

But, she said, the end of Algerian supply had not impacted on the country's energy security.

"In recent days, supply has been able to satisfy the demand for energy even though the two power stations were not in service," Benali said.

Power supply was secured through the country's "established" national capacity, she said, as well as a fall in electricity demand due to the pandemic.

Algeria halt

Supply of Algerian gas via Morocco to Spain in the GME pipeline ended Nov. 1 after the long-term transit deal between the two countries was not renewed ahead of its expiry on Oct. 31.

Relations between Algiers and Rabat have worsened significantly in recent months, with Algerian President Abdelmadjid Tebboune on Oct. 31 ordering state-owned Sonatrach to break all commercial relations with Morocco's state utility ONEE.

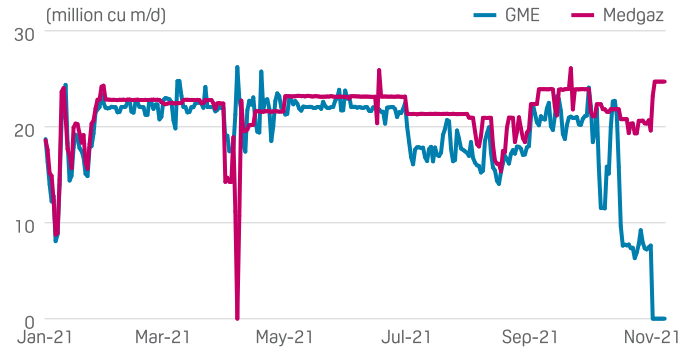
The standoff came as global gas prices hit record highs in October due to winter supply concerns.

S&P Global Platts assessed the benchmark TTF day-ahead price at a record high of Eur116.10/MWh Oct. 5, with price volatility continuing through October and into November.

The TTF day-ahead price was assessed at Eur77.43/MWh Nov. 8, up by 480% from a year ago.

Morocco used to receive gas as part-payment for transiting Algerian gas to Spain.

MEDGAZ STEADY AT 25 MILLION CU M/D AFTER GME HALT



Source: S&P Global Platts Analytics

LNG imports

It has relied on gas for around 10% of its power generation needs and Rabat is reportedly interested in reversing the GME line so that it can import gas from Spain.

Regasified LNG supply could potentially enter the pipeline via the Huelva LNG import terminal, close to the entry point of the GME line, sources have told S&P Global Platts.

Morocco is also in the process of evaluating bids from parties interested in providing the North African country with a floating LNG import facility.

Morocco launched the tender for the supply of an FSRU in March, with a deadline of end-May.

It then asked bidders for more information, specifically on the financing structure envisaged for the project and the conditions of gas supply, with a deadline of the end of October.

The ministry had also included the option of an alternative site for the facility after the original deadline closed.

Morocco has been talking about an LNG import facility for a number of years, but progress has been relatively slow.

However, the country is now looking to accelerate the process under its energy strategy that is focused on the "proactive development" of renewable energy in tandem with the strengthening of gas in the energy mix, the ministry said last month.

Gas, it said, would be a "vector" for decarbonizing the industrial sector and compensating for intermittent renewable energy generation.

The initial scope of the FSRU project in Morocco is for an annual requirement of 1.1 Bcm by 2025 rising to 1.7 Bcm in 2030 and 3 Bcm in 2040. — *Stuart Elliott*

S Korea sees rise in marine gasoil demand amid high LNG prices

- **LNG ships switch to LSMGO from LNG**
- **S Korea's LSMGO premium to Singapore 10 ppm gasoil gains**

South Korea has been seeing strong demand of low sulfur marine gasoil with maximum 0.1% sulfur, or LSMGO, from LNG ships since late October amid high LNG prices, industry sources said Nov. 9.

LNG ships typically uses boil-off gas as bunker fuel while the ships also burn LSMGO, or low sulfur fuel oil, depending on their facilities, the sources said.

As LNG prices are much higher than LSMGO, the ships are trying to reduce use of boil-off gas and buy LSMGO instead, according to the sources.

The Platts JKM — LNG benchmark for Asia — was assessed at $31.864/MMBtu Nov. 8, S&P Global Platts data showed, which is equivalent to $1,315/mt. South Korea's delivered LSMGO was assessed at $741.25/mt Nov. 8.

"We got asked if we could supply 3,000 mt of low sulfur marine gasoil at a South Korean port. If we accept it, we have to cancel other customers' orders," said a bunker trader.

"There was a 5,000-mt LSMGO inquiry. I heard a refiner is working on it," said another bunker trader.

The typical size of LSMGO for one delivery is 50-100 mt while the industry sometimes saw even 300 mt deliveries before LNG prices got higher than LSMGO, industry sources said.

Limited supply in Asia

"The LSMGO supply is limited. When we receive a huge order, we cannot supply," said the trader.

"The problem is South Korean refiners don't have sufficient supply. Hyundai Oilbank has low stocks. Only SK Energy and S-Oil could supply," a second bunker trader said.

As a result of strong demand, "[supply of] marine gasoil 0.1% sulfur is super tight," said a refining source in South Korea.

The South Korea's LSMGO premium to Singapore 10 ppm gasoil cargo rose to $27.69/mt Nov. 8, the highest since Sept. 27, when the premium was at $28.08/mt, Platts data showed.

A similar situation is currently on in Singapore. The rise in LSMGO demand in Singapore has yet to keep pace with the supply overhang, market sources said.

There have been inquiries for large parcels of LSMGO bunker in Singapore, which has supported demand for the past two months, traders said.

"LNG carriers have reduced their consumption of boil off gas originating from the LNG cargoes stored onboard, as there are better gains selling the grade as cargoes than to consume as bunkers," a Singapore-based bunker supplier said.

The bunker supplier also said that the LNG carriers opted for the relatively cheaper LSMGO bunker as a result.

LSMGO bunker sales rose 14.4% month on month to 331,700 mt in September, up from the 277,200 mt and 281,500 mt sold in June and July, respectively, latest preliminary data by the Maritime and Port Authority of Singapore showed. — *Atsuko Kawasaki, Nicholson Lim*

Winter fuel oil requests from some Japan utilities have doubled: Idemitsu

- **Power supply stretched to critical levels last winter**
- **Idemitsu sees no additional coal supply requests yet**
- **Raising refinery runs from 73% to above 80%**

Idemitsu Kosan, Japan's second-largest refiner, has already received winter fuel oil supply requests from a couple of power utilities at double the peak volumes seen last winter when the country's power

supply was stretched to critical levels during extreme cold spells, CEO Shunichi Kito said Nov. 9.

"Amid power shortage concerns this winter, power utilities are considering early procurements," Kito told an earnings press conference. "We have also received supply [requests] from a couple of power utilities at roughly double the level of last January-February, which we are considering fulfilling firmly."

Petroleum Association of Japan President Tsutomu Sugimori said Oct. 27 that Japanese refiners were unsure whether they would be able to meet all the requests they were receiving for oil supply from local power utilities this winter.

Last January, Japanese refiners boosted fuel oil supplies to power generators following an emergency request from the Federation of Electric Power Companies of Japan.

Japan experienced a power supply shortage last winter as demand surged during extreme cold spells in January, with local power utilities forced to restrict gas-fired power generation due to low LNG stocks. That was exacerbated by glitches at coal-fired power plants, low hydropower generation due to droughts, fluctuations in solar power output due to weather conditions, reduced oil-fired power generation capacity, and low nuclear power output.

Kito noted Idemitsu received abrupt inquiries for additional supplies of coal and fuel oil for power generation at the time but the company was only able to "supply to the best of its ability."

"At the beginning of this year, when power [supply] tightened extremely, a very challenging moment arrived all of sudden," Kito said, noting also there had been logistical challenges for refiners to ship fuel oil cargoes to power utilities due to a lack of coastal vessels.

"Following such events, power utilities are preparing early in this fiscal year, and we are also securing vessels as part of early preparations to avoid great confusion and maintain stable supply," Kito said. "However, we cannot predict the degree of power [supply] tightness. We believe we need to carefully respond to the situations."

Idemitsu, which produces coal in Queensland and New South Wales in Australia and Indonesia, has not so far received any additional supply requests from Japanese power utilities for coal, a company spokesperson said Nov. 9.

According to Ministry of Economy, Trade and Industry data, last January total fuel oil sales to the domestic market surged 43% on the year to 179,585 b/d. There was also a shipment of 751,109 barrels of crude oil for power generation, nearly double the 429,323 barrels in December 2020 and after no crude shipments for power generation in January 2020.

In February, fuel oil sales dropped 20.2% month on month and 4.3% year on year to 143,370 b/d as oil demand for power retreated with the replenishment of LNG stocks by mid-February, according to METI data. Crude shipments for power burn slid to 112,613 barrels in February.

Raising runs

Operationally, Idemitsu plans to raise its refinery run rates to over 80% in the second half of fiscal year 2021-22 (April-March), Yoshitaka Onuma, general manager of Idemitsu's finance and accounting department, said. This would bring its average run rate for the fiscal year up to about 80%. Rates in the first half of the fiscal year ending March 31 averaged 73% because of heavy refinery maintenance programs.

Idemitsu said it now expects gasoline demand to rise 2.1% year on year in FY 2021-22 but 7.8% below the pre-pandemic level in FY 2019-20.

FY 2021-22 jet fuel demand is seen surging 32% year on year but 28.4% below FY 2019-20.

Idemitsu also revised higher its FY 2021-22 income forecast due mainly to higher Dubai crude prices and Australian spot coal prices. It now expects an average Dubai crude price of $72.10/barrel and an Australian coal spot price of $135.50/mt for the fiscal year, up from its May 11 forecast of $60/b and $80/mt. — *Takeo Kumagai*

PetroChina expects tight global natural gas supply to ease in 2022

- **Global gas supply to exceed demand in 2022**
- **Sees 50% of incremental global demand from Asia by 2035**
- **China's natural gas demand expected to peak in 2040**

The tight supply situation of natural gas in the global markets is expected to ease to a certain extent in 2022 as production growth is forecast to outpace demand, said Luo Yizhou, vice president of PetroChina International Co. Ltd, a subsidiary of state-owned PetroChina.

"With the normalization of COVID-19 pandemic prevention and control measures, the continuous recovery of the world economy, and the stabilization of international oil prices, global natural gas demand is estimated to grow to around 4.070 trillion cu m in 2022, up 2.3% year on year," Luo said at the 10th China International Oil and Gas Trade Congress in Shanghai Nov. 8.

"On the other hand, global natural gas production is expected to be 4.12 trillion cu m in 2022, up 4% year on year," he said, expecting the tight gas supply to ease based on that scenario.

The tight supply has pushed up global gas prices in 2021, with the benchmark JKM, TTF and NBP all rising to historical highs in the September-October period.

"Supply has not been able to keep up with the rebound in demand post pandemic," said Chris Midgley, global head of analytics with S&P Global Platts, at the conference. This was the main reason that caused the tight natural gas supply situation this year, Midgley said.

Global demand for natural gas is expected to grow steadily in the next few decades due to accelerated actions against climate change.

"About 50% of the incremental global natural gas demand will come from Asia by 2035, with China and India as the main engines to boost the development of the LNG market," Luo said.

"Natural gas will play a very important role in the energy transition. We expect the global natural gas demand to grow to around 6.1 trillion cu m in 2050 while China's natural gas consumption will be around 670 billion cu m in the same year," he said, and adding that China's natural gas demand is expected to peak in 2040.

Energy transition

PetroChina targets reaching peak carbon by 2025, and the company is scheduled to have a changeover to renewable energy by 2035 and a near-zero emissions and green transformation by 2050, according to Luo.

"In addition to the existing LNG long term contracts, PetroChina will purchase spot natural gas and the overseas equity in a bid to diversify the natural gas resources," Luo said.

"And the company also plans to construct LNG terminals and natural gas power plants globally, as well as building LNG resource pools to improve the natural gas allocation and supply ability," Luo added.

PetroChina also would adapt to the energy transition trend, shifting from a traditional oil and gas trader to a trading company of oil, gas and renewable energy.

China's peak carbon and carbon-neutrality targets of 2030 and 2060, respectively, have promoted the development of new trading categories, such as carbon emissions trading. PetroChina will monitor the progress of domestic carbon futures, and participate in their trading to help its subsidiaries lower the cost of compliance, Luo added. — *Staff*

Mozambique security improving, but TotalEnergies seeks more stability to restart LNG project

- **Force majeure was declared in April after attacks**
- **Mozambique LNG targeting 13.1 million mt/year**
- **Full production delayed to at least 2026**

France's TotalEnergies said the security situation in Mozambique was "improving" as it weighs a restart of construction at its two-train Mozambique LNG project in the southeast African country.

"We are looking at the situation and, so far, the steps taken by the Mozambican government are going in the right direction," Henri-Max Ndong Nzue, the company's senior vice president of Africa, told S&P Global Platts Nov. 9 on the sidelines of the Africa Oil Week conference.

In April, TotalEnergies declared force majeure on the Mozambique LNG project and removed all of its staff from the site, after Islamist militants attacked the nearby town of Palma in late March, killing dozens.

The situation has pushed back the start of first production to at least 2025 from 2024, with full production of 13.1 million mt/year projected in 2026.

In February, TotalEnergies CEO Patrick Pouyanne said the Mozambique LNG project was 21% complete as of the end of 2020.

Since the Palma attack, military forces have secured the province in the north of the country, not only for the LNG project, Nzue said.

"Things are improving by what we can see on the ground. The African forces are doing quite a good job," he said. "So things are improving. But what is key is to have security in a sustained manner, and that is very important."

Mozambique's more than three-year-old insurgency has imperiled the country's ambitions to join the ranks of the world's biggest LNG exporters, impacting not just Mozambique LNG but also ExxonMobil's planned 15.2 million mt/year Rovuma LNG project.

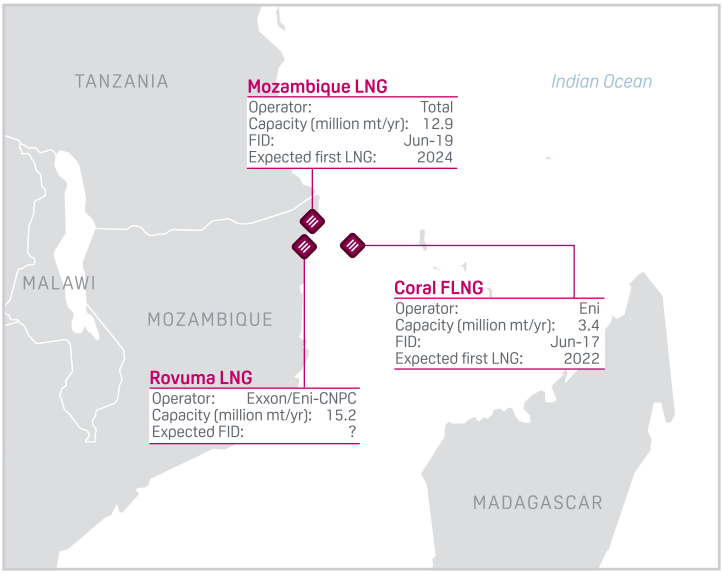
TotalEnergies operates Mozambique LNG with a 26.5% stake, having taken over the project in September 2019 as part of its deal with Occidental to buy assets the US company had acquired with its purchase of Anadarko.

Mozambique LNG has already secured long-term offtake agreements amounting to more than 11 million mt/year with the likes of Shell, France's EDF, China's CNOOC, a partnership of the UK's Centrica and Japan's Tokyo Gas, and a joint venture between Japan's JERA and Taiwan's CPC Corp .

Its partners are Mitsui (20%), ENH (15%), ONGC Videsh (10%), Beas Rovuma Energy (10%), BPRL (10%), and PTTEP (8.5%).

The initial two-train project could be expanded, with a potential capacity of as much as 43 million mt/year, according to the project's website. — *Claudia Carpenter*

MOZAMBIQUE'S LNG PROJECTS



Source: S&P Global Platts

Spain's Q3 LNG re-exports highest for quarter in seven years: CORES

- **Re-exports equivalent to 17% imports**
- **High volume sent to Asia Pacific, Americas**
- **First export cargo on record to Netherlands**

Spain re-exported 8.5 TWh (5.8 million cubic meters) of liquefied natural gas during the third quarter of 2021, the highest Q3 volume since 2014, according to strategic reserve corporation CORES Nov. 8.

The re-exported volume was equivalent to 17% of LNG imports during the period and around 9% of combined Q3 gas and LNG imports, the data showed.

In natural gas terms, the export volume would be equivalent to 3.5 billion cubic meters.

By destination 4.1 TWh of re-exports went to the Asia Pacific region, with 1.1 TWh sent to China and 2.0 TWh to India in August, followed by 938 GWh to Pakistan in September.

In the Atlantic market, one cargo for 920 GWh was sent to Puerto Rico in July (following a similar sized one in June) and one shipment for 977 GWh went to the US in August.

The US is usually one of Spain's largest suppliers, providing 22% of Spain's LNG volume in the first nine months of 2021 and 25% of its 2020 volume.

In other regions, Spain exported 953 GWh to Kuwait in July while within Europe it sent a 941 GWh cargo to the Netherlands in September - a first cargo in records going back to 2010 to carry LNG on that route.

By export terminal, Barcelona reloaded 2.1 TWh, Huelva 2.9 TWh and Sagunto 1.2 TWh in July and August with data not yet available for September.

S&P Global Platts assessed the price of LNG (Japan/Korea DES spot cargo) at $31.86/MMBtu Nov. 8, up from $6.85/MMBtu a year earlier. — *Gianluca Baratti*

US LNG WEEKLY: GCM rises slightly on week after high tanker rates fuel swings

- **Feedgas falls, then rebounds, amid Freeport outage**
- **Longer route to Asia via Cape of Good Hope eyed**

Shifting production levels at home, shipping rates at sea and activity in destination markets spurred back and forth movement during the week of Nov. 2-9 for the export value for LNG cargoes loading on the US Gulf Coast 30-60 days forward.

Reflecting the continued bullishness in the latest market fundamentals, commercial activity among US exporters and developers surged during the week.

The Platts-assessed Gulf Coast Marker ended the week at $22/MMBtu on Nov. 9, up 25 cents/MMBtu from $21.75/MMBtu on Nov. 2. The GCM reached as high as $25/MMBtu on Nov. 3, after falling below $20/MMBtu during the previous week for the first time in a month and a half.

Total US feedgas demand was down sharply toward the beginning of the week at about 10 Bcf/d on Nov. 3, largely due to an outage at Freeport LNG involving a pre-treatment train, before rebounding at the end of the week to around 11.1 Bcf/d on Nov. 9 as repairs at the Texas facility continued, Platts Analytics data showed. The operator expects full production to resume around Nov. 20. Ongoing commissioning of a sixth train at Cheniere Energy's Sabine Pass in Louisiana was supportive of overall US flows.

Maximum waiting times at the Panama Canal for unreserved LNG tankers rose sharply during the week, topping out at 18 days northbound and 18 days southbound as of Nov. 9, according to the Panama Canal Authority.

As a result of the added congestion, more LNG volumes from the US Gulf Coast headed to Far East were expected to travel eastward around the Cape of Good Hope, rather than the shorter distance through the Panama Canal, an Atlantic-based LNG trader said. For Mediterranean cargoes, the Suez Canal was being viewed as the best bet in the near-term, the trader said.

Through the volatility, term deal-making for US LNG supplies saw a notable uptick.

Offtake commitments that China's Sinopec and its trading arm, Unipec, have made to buy LNG from Venture Global LNG have been increased to at least 7.5 million mt/year, according to statements the two companies issued Nov. 4. When the purchases take effect, Venture Global would overtake Cheniere as the biggest US supplier of LNG to Chinese counterparties on a term basis.

On Nov. 5, Cheniere said China's Sinochem had agreed to buy as much as 1.8 million mt/year of LNG from the US exporter under a long-term deal. That followed Cheniere's announcement Oct. 11 that a subsidiary of China's ENN Natural Gas had signed a 13-year deal to buy 900,000 mt/year of LNG, starting in July 2022, from the US exporter. Cheniere previously signed two long-term contracts with PetroChina for a combined 1.2 million mt/year of LNG. Only a small portion is in effect, with shipments on the balance starting in 2023.

Elsewhere, during a presentation to an LNG conference in Louisiana on Nov. 3, a Tokyo Gas executive said the Japanese utility was considering linking new LNG term contracts to European and US gas hubs as it further diversifies its global supply.

The utility is interested in short- and medium-term supply deals, in addition to the long-term contracts for LNG volumes it currently has with producers in six countries, including the US, Atsunori Takeuchi, senior general manager of LNG optimization and trading, said in a video address to the World LNG & Gas Series Americas Summit & Exhibition in Lake Charles. — *Harry Weber*

HYDROGEN

China's hydrogen fuel price to be competitive against petroleum by 2030: Sinopec Marketing

- **Renewables-based hydrogen fuel cost estimated to reach around $4.69/kg in 2025**
- **Current hydrogen fuel costs range from $6-$11/kg, produced mainly from fossil fuels**
- **Sinopec Yanshan launches PEM hydrogen production station**

China's hydrogen-powered Fuel Cell Electric Vehicles (FCEVs) are expected to be cost-competitive in 2030 compared with conventional vehicles powered by gasoline or gasoil, in terms of both the purchasing price and the fuel cost, Jiang Ning, chief specialist with Sinopec Marketing, said at the 10th China International Oil and Gas Trade Congress Nov. 8.

"By 2025, when green hydrogen [renewables-based hydrogen] cost is expected to be lower than Yuan 30/kg [approx. $4.69/kg] and gasoil price [would be] around Yuan 6.7/Lite [74 cents/Liter before taxes], hydrogen-powered trucks' fuel cost will be competitive against gasoil-fueled ones," Jiang said, sharing the results from the company's recent study.

He added that hydrogen fuel costs below Yuan 34/kg (approx. $5.32/kg) imply fuel cost competitiveness against petroleum by 2030, when FCEVs' purchasing prices are almost flat to petroleum-fueled vehicles amid improvements to technology.

The current hydrogen fuel costs range around Yuan 40-70/kg (approx. $6-11/kg), which is still significantly higher compared with diesel and petroleum costs, Jiang said, adding that the current hydrogen supplies are mainly produced from fossil fuels.

In late September, Sinopec-listed Shanghai Petrochemical launched a hydrogen supply center in Shanghai, offering hydrogen at around Yuan 40/kg. A senior official with Shanghai Petrochemical said in late March that the price was almost equivalent to using gasoline in

a car covering a distance of 100 km when the price of crude is about $65/b. however, due to higher cost of FCEVs and weak hydrogen refueling service network, the center can only target to supply public transport vehicles, the senior official said.

S&P Global Platts valued Japanese hydrogen SMR without CCS, include capital expenditure, at $5.72/kg Nov. 8, and Japanese hydrogen PEM electrolysis at $8.19/kg.

FCEVs, powered by hydrogen, have significantly improved energy efficiency than conventional internal combustion engines or ICE vehicles powered by diesel and petroleum, and produce no exhaust emissions except for water vapors. FCEV plays a crucial role in decarbonizing China's transportation sector, which accounts for 7.5% of the nation's CO2 emissions, only behind China's power & heat sector (42%) and industrial sector (23%), official data showed.

Sinopec is the world's top refiner by capacity, while its subsidiary Sinopec Marketing holds the biggest domestic transportation fuel sale network with over 30,716 of retail stations.

These provide leading infrastructure to the company to become China's top hydrogen supplier.

Sinopec's CO2 emission

According to Jiang, the oil giant's annual carbon emission is about 150 million mt, while Sinopec Marketing's CO2 emission was about 2.2 million mt in 2020. Sinopec aims to meet net zero emissions by 2025, with about 40-70 million mt of CO2 emissions by that point in time, Jiang said.

Carbon emissions from fuels sold by Sinopec Marketing is currently over 500 million mt, accounting for 50% of China's CO2 emissions in the transportation sector.

"Building hydrogen service stations to supply clean energy is one of Sinopec's efforts to reduce carbon emissions," Jiang said.

Sinopec targeted to build 1,000 hydrogen refiling stations during the 14th five-year plan period [2021-2025] with the overall refilling service capacity to reach 200,000 mt/year, Platts reported earlier.

By end September, Sinopec had already equipped 31 stations with hydrogen refilling capacities, and established over 600 solar power projects, Jiang said, adding that the company targets to have 7,000 solar power plants by 2025.

Electricity is the main energy source for Sinopec Marketing, making it necessary to develop wind power and solar power to adjust the company's energy consumption mix for cutting emissions.

Sinopec Marketing expects 10,000–30,000 retail outlets with hydrogen refilling services would be required to meet demand in 2030 when registered FCEVs amount to 30 million units, Jiang said.

The company estimated that 30,000 integrated retail stations that are able to supply electricity and offer hydrogen refilling in addition to petroleum and gas will help to reduce more than 500 million mt of CO2 emissions from gasoline, gasoil, accounting for over 40% of carbon emissions from the transportation sector, Jiang said.

Green hydrogen

Jiang also said that four green hydrogen production projects were in the pipeline — the 20,000 mt/year solar-based hydrogen production in Kuqa, Xinjiang, 10,000 mt/year of wind and solar-based hydrogen production in Ordos, Inner Mongolia, 100,000 mt/year of renewables-based hydrogen production in Ulanqab, Inner Mongolia, and 10,000 mt/year of offshore wind based hydrogen production in Zhangzhou, Fujian.

Sinopec announced Nov. 4 that it had launched and put into use a new proton exchange membrane (PEM) hydrogen production demonstration station in its affiliated Yanshan Petrochemical, which fully adopted domestic technology.

Yanshan Petrochemical has a 2,000 cu m/hour hydrogen purifying unit which was launched in March 2020 and the production amounted to 130 mt as of mid October.

The plant targets to supply hydrogen to Beijing and the neighboring Heibei province, including four Sinopec's retail stations that will cater to the upcoming Winter Olympic Games.

In additional to Yanshan, six Sinopec plants, including Gaoqiao, Shanghai and Guangzhou, have installed hydrogen purifying units for producing hydrogen fuel instead of the typical hydrogen used for removing sulfur in the refining industry.

Yanshan and Guangzhou's hydrogen fuel production will reach 200 mt each this year, Jiang said, adding that Sinopec plans to install five to eight more hydrogen purifying units to produce hydrogen fuel.

Sinopec plans to invest $4.6 billion in hydrogen through 2021-2025, aiming to boost green hydrogen production capacity to 500,000 mt/year by 2025. Platts reported earlier.

With 5.98 million b/d of primary refining capacity, Sinopec's hydrogen production capacity from its refining processes was 3.9 million mt/year, accounting for 11% of China's hydrogen output, the company said earlier this year. — *Staff, Analyst Ivy Yin*

ITM Power to build second UK electrolyzer factory as it eyes rapid hydrogen market expansion

- **1.5 GW/year facility adds to existing 1 GW capacity**
- **Eyes 5 GW/year electrolyzer production by 2024**

Electrolyzer manufacturer ITM Power is to build a second UK factory to make renewable hydrogen production equipment as it prepares for rapid market expansion.

ITM Power has signed a heads of terms agreement to acquire a site in Sheffield, north England, for the 1.5 GW/year facility, it said in a statement Nov. 9.

"The planning and construction of our second, 1.5 GW capacity, factory marks the next step on delivering our strategic plan to create a blueprint for an automated PEM electrolyzer manufacturing facility to be rolled out internationally," ITM Power CEO Graham Cooley said in the statement.

Calculated production cost assessments for renewable hydrogen, produced by electrolysis of water, have been pushed sharply higher in recent weeks by soaring feedstock power prices, based on spot power prices.

S&P Global Platts assessed the cost of hydrogen production via proton exchange membrane electrolysis in the UK at GBP13.23/kg ($17.98/kg) on Nov. 8 (including capex, based on month-ahead power prices), up from below GBP5/kg when the assessment launched in April.

But production costs are expected to fall dramatically this decade, and are already significantly lower when taking into account renewable power purchase agreements.

Cooley told Platts in October that the recent spike in gas prices in Europe meant renewable hydrogen production costs were already below those for conventional fossil fuel-derived hydrogen production, when based on the latest most competitive PPAs.

"The cost of green hydrogen is now lower than the cost of grey hydrogen in most places around the world, because of the increase in the cost of natural gas," Cooley said in an interview Oct. 21. "If you link an electrolyzer to a PPA with a wind farm, [the power price] doesn't fluctuate at all, for the whole of the duration of the PPA."

UK solar PPA offers in Q2 2021 were GBP46.59/MWh, while wind PPA offers were GBP48.09/MWh, according to the Zeigo platform. By contrast, Platts assessed day-ahead baseload UK power prices at GBP168.15/MWh Nov. 8, up from GBP68.00/MWh at the start of the year.

Electrolyzer production expansion

ITM Power raised additional funds at the start of October to finance its production capacity expansion.

The significant scaling up would "take advantage of the forecast exponential demand growth in the global green hydrogen electrolyzer market," ITM Power said at the time.

The new factory will complement the company's existing 1 GW/year plant at Bessemer Park, also in Sheffield.

"We are also focused on increasing utilization and throughput at our Bessemer Park Gigafactory as we prepare for the next step change in capacity," Cooley added in the statement.

ITM Power said the new factory would provide the template for a first international facility, expected to have a production capacity of 2.5 GW/year, bringing ITM's total output capacity to 5 GW/year by the end of 2024.

The new UK plant will have an enlarged power supply that will allow testing of multiple modules of next-generation products at the same time, the statement said.

The site for the new facility is about 2 miles from the existing factory, and is part of the University of Sheffield's innovation district, ITM Power said. The new factory is expected to cost around GBP50 million to GBP55 million ($68 million to $75 million).

"The land has outline planning consent and a full design brief agreed with the City Council," it said. "The acquisition is subject to the grant of full planning permission for the new factory." — *James Burgess*

Norsk Hydro and Shell to explore green hydrogen projects

- **Hydrogen to help decarbonize own operations**
- **Supply hydrogen to customers in range of industries**
- **Produce and supply renewable hydrogen in Europe**

Norway-based aluminum producer Norsk Hydro said Nov. 9 its hydrogen company Hydro Havrand has agreed with Royal Dutch Shell unit Shell New Energies to explore the potential of producing hydrogen from renewable electricity.

Hydro said that with green hydrogen it could further reduce the footprint of its low-carbon aluminum, as aluminum production is highly energy-intensive, while adding that it could use the hydrogen to help decarbonize its own as well as and Shell's own operations, and to supply customers in heavy industries, the maritime sector and road transport.

Under the memorandum of understanding, both companies will jointly produce and supply hydrogen produced from renewable electricity in hubs centered around Hydro and Shell's own business, the company said.

Both companies have started initial work under the agreement and will look to identify opportunities to produce and supply renewable hydrogen to Hydro, Shell and the broader market from locations in Europe, with the intention to expand into additional regions and locations over time, Hydro said.

Replacing natural gas for heating purposes in aluminum production with renewable hydrogen will contribute toward Hydro's global commitment to reduce its greenhouse gas emissions by 30% by 2030, it said.

"Hydro Havrand can leverage a broad set of competencies within Hydro, and through its total offering help other industrial players succeed with their energy transitions," said Hydro Executive Vice President for Energy Arvid Moss said in a statement.

Shell's Executive Vice President for Renewables & Energy Solutions, Elisabeth Brinton, said: "Hydrogen will play a key role in decarbonizing hard-to-electrify sectors, which is vital for accelerating progress toward a net-zero emissions future."

"By leveraging each other's strengths and capabilities, Hydro Havrand and Shell can work toward a shared goal of establishing integrated hydrogen value chains and ultimately a strong global market for hydrogen," Brinton said. — *Filip Warwick*

SUBSCRIBER NOTES

Platts proposes new daily carbon neutral hydrogen assessments

S&P Global Platts is proposing to launch its first suite of carbon-neutral hydrogen assessments, effective Dec. 9, 2021.

Building on its industry-leading price valuations for hydrogen, Platts would launch new carbon-neutral hydrogen price assessments that incorporate the cost of carbon capture, renewable energy certificates and where appropriate the cost of offsetting carbon emissions generated during production.

Carbon offset costs would be accounted for using Platts CNC nature-based carbon credits, as measured in $/mtCO2e in certain markets. Platts would complement these backstop calculated prices with available source data including bids, offers and reported trades as these become available. Other factors that will be considered include market information on power-purchase agreements and hydrogen offtake agreements. In the absence of spot market activity, Platts would consider carbon neutral hydrogen production costs as a baseline against which market prices would be assessed.

Platts would start publishing daily assessments in six locations, which have the potential to become hydrogen hubs as global markets emerge: California and US Gulf Coast in the Americas, the Netherlands and Saudi Arabia in Europe and the Middle East, and Japan and Australia in Asia-Pacific.

Assessments would be measured in $/kg, $/MMBtu, Eur/kg, Eur/MMBtu, Yen/kg, Yen/MMBtu, A$/kg, A$/MMBtu.

The prices would be published on Platts Dimensions Pro and under the Market Data Category: HY.

The following symbols would be created:

-Australia Carbon Neutral Hydrogen A$/kg
-Australia Carbon Neutral Hydrogen A$/kg MAvg
-Australia Carbon Neutral Hydrogen A$/MMBtu
-Australia Carbon Neutral Hydrogen A$/kg MAvg
-Australia Carbon Neutral Hydrogen $/kg
-Australia Carbon Neutral Hydrogen $/kg MAvg
-Australia Carbon Neutral Hydrogen $/MMBtu
-Australia Carbon Neutral Hydrogen $/MMBtu MAvg
-California Carbon Neutral Hydrogen $/kg
-California Carbon Neutral Hydrogen $/kg MAvg
-California Carbon Neutral Hydrogen $/MMBtu
-California Carbon Neutral Hydrogen $/MMBtu MAvg
-Far East Asia Carbon Neutral Hydrogen Yen/kg
-Far East Asia Carbon Neutral Hydrogen Yen/kg MAvg
-Far East Asia Carbon Neutral Hydrogen Yen/MMBtu
-Far East Asia Carbon Neutral Hydrogen Yen/MMBtu MAvg
-Far East Asia Carbon Neutral Hydrogen $/kg
-Far East Asia Carbon Neutral Hydrogen $/kg MAvg
-Far East Asia Carbon Neutral Hydrogen $/MMBtu
-Far East Asia Carbon Neutral Hydrogen $/MMBtu MAvg
-Middle East Carbon Neutral Hydrogen $/kg
-Middle East Carbon Neutral Hydrogen $/kg MAvg
-Middle East Carbon Neutral Hydrogen $/MMBtu
-Middle East Carbon Neutral Hydrogen $/MMBtu MAvg
-NW Europe Carbon Neutral Hydrogen Eur/kg
-NW Europe Carbon Neutral Hydrogen Eur/kg MAvg
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-NW Europe Carbon Neutral Hydrogen Eur/MMBtu MAvg
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-USGC Carbon Neutral Hydrogen $/kg
-USGC Carbon Neutral Hydrogen $/kg MAvg
-USGC Carbon Neutral Hydrogen $/MMBtu
-USGC Carbon Neutral Hydrogen $/MMBtu MAvg

Please send all questions and comments to hydrogenassessments@spglobal.com and pricegroup@spglobal.com by Nov. 11, 2021. For written comments, please provide a clear indication if comments are not intended for publication by Platts for public viewing. Platts will consider all comments received and will make comments not marked as confidential available upon request.

Vercer Capital Markets Trading Limited changes entity name to Dare Global Limited

Vercer Capital Markets Trading Limited has advised Platts that it would like to change its participating entity name in the Platts Market on Close assessment processes for:

Americas Fuel Oil - Paper
Asia Naphtha-Paper
Asia Mogas-Paper
Asia Jet Fuel-Paper
Asia Gasoil-Paper
Asia Fuel Oil-Paper
Asia APAC LNG - Paper
EMEA Naphtha-Paper
EMEA Mogas-Paper
EMEA Jet Fuel-Paper
EMEA Gasoil/Diesel- Paper
EMEA Fuel Oil - Paper
EMEA Crude BFOE CFDs- Paper

This follows the Vercer Capital Markets Trading Limited name change to Dare Global Limited.

Platts has reviewed Dare Global Limited and will consider information from Dare Global Limited in the Americas, Asia and EMEA assessment processes for the abovementioned markets, subject at all times to adherence with Platts editorial standards.

Platts will publish all relevant information from Dare Global Limited accordingly.

Platts welcomes all relevant feedback regarding MOC participation. Platts considers bids, offers and transactions by all credible and creditworthy parties in its assessment processes. For comments and feedback, please contact: Platts editors at oilgroup@spglobal.com and PriceGroup@spglobal.com.

Platts launches Atlantic LNG physical eWindow

S&P Global Platts has launched the Platts Editorial Window, or eWindow, communication tool for its Atlantic LNG physical Market on Close (MOC) assessment process for its DES Northwest Europe (NWE), DES Mediterranean (MED) and FOB Gulf Coast Marker (GCM) price assessments on Sept. 24, 2021.

Participants in the Platts MOC process are now able to submit bids, offers and expressions of interest to trade for publication directly through the eWindow communication tool or through an editor, who would then publish the information using the software.

The instruments that are launched for the Platts Atlantic LNG are from the third to the fifth half-month forward (H+3 to H+5) in dollars per MMBtu for the DES NWE and DES MED assessments, and 30-60 days forward for FOB GCM.

Market participants can state their specific bid or offer delivery windows — for example, 3-day or 5-day delivery or loading windows — within these instruments.

The instruments will allow for a variety of different delivery or loading locations to be used in bids and offers, such as: DES UK, DES Spain, etc.

For delivery locations that are not listed individually, market participants can select "DES in TQC" and input the details directly the DES basis of the bid or offer in the Terms, Quality & Comments (TQC) box.

The instruments will allow for a volume range to be expressed for bids and offers, up to 0.3 TBtu.

If the bid or offer is in a volume range, then the instrument called Platts Atlantic LNG (Qty Range) would be selected. The instruments will also allow for a variety of pricing basis.

Market participants can also input directly other terms related to their bids or offers in the TQC box.

The eWindow instruments will generate a different format for headlines of bids, offers and trades published on Platts LNG Alert and via other Platts services. For example, a headline that currently appears as:

Atlantic LNG MOC: COMPANY Offers Oct TTF ICE Front Month Average +0.15 $/MMBTU DES Pricing 24-30 September. 2 Day Delivery Window: 11-12 October. Base Discharge Port: Buyer to advise during CN process. No later than 20 days prior to the 2 Day Arrival Period, Buyer can nominate substitute Discharge Port in Mugardos, Rotterdam, Dragon, Isle of Grain, South Hook, Montoir, Dunkirk, Zeebrugge, Bilbao, Huelva, Barcelona, Sagunto, FOS. GHV: 1000 to 1120 Btu/SCF. Contract Quantity 3.65 Tbtu +/-5%. Base ship: will be nominated upon completion of deal. No later than 15 days prior to the 1 Day Arrival Period, Seller may nominate an Alternate LNG Ship subject to SSCS and terminal acceptance. Base Load Port: Freeport. Seller's option to nominate an Alternative Load Port no later than 15 days prior to the 2 day Arrival Period. Laytime 36 hours., will be published as:

Platts Atlantic LNG DES NWE+MED H3-H5, COMPANY offers Oct11-Oct12 100% TTF Full Month Oct $0.15 for 3.65 Pricing 24-30 September. Base Discharge Port: buyer to provide at trade confirmation. No later than 20 days prior to the 2 Day Arrival Period, Buyer can nominate substitute Discharge Port in Mugardos, Rotterdam, Dragon, Isle of Grain, South Hook, Montoir, Dunkirk, Zeebrugge, Bilbao, Huelva, Barcelona, Sagunto, FOS. GHV: 1000 to 1120 Btu/SCF. Base ship: will be nominated upon completion of deal. No later than 15 days prior to the 1 Day Arrival Period, Seller may nominate an Alternate LNG Ship subject to SSCS and terminal acceptance. Base Load Port: Freeport. Seller's option to nominate an Alternative Load Port no later than 15 days prior to the 2 day Arrival Period. Laytime 36 hours.

TIMING: All bids and offers will still have to be submitted by 16.00.00.000 London time. Following any trade, market participants will have 60 seconds to rebid or re-offer. No price changes are allowed from 16:28:00:000 to the close of the MOC process at 16.30.00.999. A rebid or re-offer, following a trade, in last 120 seconds prior to the close of the MOC will trigger a 120-second extension from 16.30.01.000 to 16.32.00.999, in order to adequately test that rebid or re-offer.

INCREMENTABILITY: Bids and offers can be improved by a maximum of $0.05/MMBtu and a minimum of $0.01/MMBtu every 120 seconds. As per Platts editorial guidelines, buyers or sellers can withdraw bids/offers at any time when communicating through eWindow, provided no prior interest to transact has been expressed by any potential counterparty. All bids and offers are firm from the moment they are submitted into eWindow to the moment they are traded, the MOC process closes or the bid/offer is withdrawn from the system by the trader or a Platts editor. Market participants can still send bids and offers directly to an LNG editor for publication via eWindow. In markets where Platts eWindow is in operation, the eWindow clock will be used to determine the correct sequence of events when a bid or offer is amended, withdrawn, or traded by an interested counterparty. Bids or offers submitted by phone, or any other medium, such as instant messaging software, shall be measured at the time the bid, offer or trade indication is actually transmitted through the eWindow system via the editor.

Guidelines for the publication of bids and offers in the MOC process are published in the LNG Timing and Increment Guidelines available here: https://www.spglobal.com/platts/en/our-methodology/methodology-specifications/lng/lng-timing-and-increment-guidelines.

Full information relevant to these assessments can be found in the Global LNG specifications guide available here: https://www.spglobal.com/platts/en/our-methodology/methodology-specifications/lng/liquefied-natural-gas-lng-assessments-and-netbacks-methodology.

Platts expects credit relationships that prevail inside its assessment environment to fully reflect relationships in the markets as a whole. eWindow provides direct entry and management of credit filters which should mirror those normally applied in the marketplaces.

Where Platts editors publish bids and offers on behalf of a company that submits data to an editor, counterparty credit settings are set to "open" for regular participants in the assessment process unless companies have notified Platts in advance of any restrictions.

If a counterparty submitting information through an editor has not already notified Platts of any counterparty credit restrictions, they should notify Platts at least one hour prior to the start of the MOC process if any counterparty credit filters need to be modified.

Please send all feedback, comments and questions to lngeditorialteam@spglobal.com and pricegroup@spglobal.com.

For written comments, please provide a clear indication if comments are not intended for publication by Platts for public viewing.

Platts will consider all comments received and will make comments not marked as confidential available upon request.

Platts proposes to change timing and increment guidelines for Asia LNG MOC

S&P Global Platts is proposing to change the timing and increment guidelines for its Asia LNG Market on Close assessment process.

Platts proposes to allow a maximum price move of 5 cents/MMBtu per 60 seconds for bids and offers submitted through the eWindow communication tool and through a Platts editor for the Asia LNG physical MOC process, and a maximum price move of 5 cents/MMBtu per 30 seconds for bids and offers submitted through the eWindow communication tool and 5 cents/MMBtu per 60 seconds for bids and offers through the Platts editor for the Asia LNG derivatives MOC process from Jan. 17, 2022.

Platts is also proposing to change the final state for the Asia LNG physical MOC process to 16:29:00 Singapore time for eWindow or manual MOC environment, and Asia LNG derivatives to 16:29:30 Singapore time for eWindow MOC environment and 16.29.00 Singapore time for manual MOC environment.

Time allowed for participants to repeat a bid or offer for Asia LNG physical will remain unchanged from the current guideline of maximum 60 seconds following a trade, while the maximum time allowed for participants to repeat a bid or offer for Asia LNG derivatives following a trade will be shortened to 30 seconds, from 60 seconds currently.

An extension of the MOC process will be triggered by a rebid or re-offer following a trade between 16:29:00 and 16:30:00 Singapore time for Asia LNG physical, and between 16:29:30 and 16:30:00 Singapore time for Asia LNG derivatives.

The extension period will last for one minute until 16:31:00 Singapore time for both Asia LNG physical and derivatives in order to adequately test that bid or offer.

The proposed changes will apply to bids and offers submitted by market participants for the Platts JKM, WIM and MEM assessments directly through the Platts Editorial Window, or eWindow, communication tool and through a Platts editor who would then publish bids and offers using the software.

Under Platts existing timing and increment guidelines, bids and offers for Asia LNG physical submitted directly through the eWindow tool and through a Platts editor can improve by up to 5 cents/MMBtu per 120 seconds, with final state at 16:28:00 Singapore time.

Bids and offers for Asia LNG derivatives submitted directly through the eWindow communication tool can improve by a maximum of 5 cents/MMBtu every 60 seconds, and by a maximum of 5 cents/MMBtu every two minutes in the manual MOC process, with final state at 16:29:00 Singapore time.

The increments have been amended to a maximum of 10 cents/MMBtu every 30 seconds for Asia LNG derivatives since Oct. 12, and to a maximum of 5 cents/MMBtu every 60 seconds for Asia LNG physical since Oct. 8 until further notice, to reflect the current volatility in the market due to European gas market price movements (https://www.spglobal.com/platts/en/our-methodology/subscriber-notes/101221-platts-asia-lng-derivatives-market-on-close-incrementability-changes).

Platts has established clearly defined timing guidelines and standards of incrementability that apply when publishing bids and offers in the MOC process, in order to ensure an orderly and transparent price assessment process.

Guidelines for the publication of bids and offers in the MOC process are available in the Platts LNG Timing and Increment Guide, available here: https://www.spglobal.com/platts/en/our-methodology/methodology-specifications/lng/lng-timing-and-increment-guidelines.

Please send all comments, feedback and questions to LNGeditorialteam@spglobal.com and pricegroup@spglobal.com by Dec. 1.

For written comments, please provide a clear indication if comments are not intended for publication by Platts for public viewing.

Platts will consider all comments received and will make comments not marked as confidential available upon request.

HYDROGEN & CARBON

NORTH AMERICA HYDROGEN ASSESSMENTS, NOVEMBER 8*

	Excluding Capex		Including Capex	
Production Pathway	$/kg	Change	$/kg	Change
Alberta (C$/kg)				
SMR w/o CCS	0.8695	+0.0695	1.5911	+0.0694
Alkaline Electrolysis	5.2364	+1.8912	6.4280	+1.8908
PEM Electrolysis	6.0488	+2.1846	8.1839	+2.1841
Appalachia				
SMR w/o CCS	0.7334	-0.0327	1.3287	-0.0327
Alkaline Electrolysis	3.3305	-1.5440	4.2099	-1.5440
PEM Electrolysis	3.8473	-1.7835	5.4228	-1.7836
Gulf Coast				
SMR w/o CCS	0.8056	-0.0088	1.3096	-0.0089
Alkaline Electrolysis	2.2197	-0.4430	3.0521	-0.4429
PEM Electrolysis	2.5640	-0.5118	4.0554	-0.5118
Midcontinent				
SMR w/o CCS	0.7439	-0.0212	1.2752	-0.0212
Alkaline Electrolysis	1.7336	-1.3295	2.5875	-1.3294
PEM Electrolysis	2.0026	-1.5357	3.5324	-1.5357
Northeast				
SMR w/o CCS	0.7572	-0.0293	1.3918	-0.0294
Alkaline Electrolysis	2.9553	-0.1486	3.8599	-0.1486
PEM Electrolysis	3.4138	-0.1717	5.0346	-0.1717
Northern California				
SMR w/o CCS	0.9878	+0.0223	1.7181	+0.0223
Alkaline Electrolysis	3.1682	+0.0549	4.1544	+0.0548
PEM Electrolysis	3.6597	+0.0633	5.4268	+0.0634
Northwest				
SMR w/o CCS	0.8019	-0.0238	1.3844	-0.0239
Alkaline Electrolysis	2.3505	-0.4491	3.2466	-0.4491
PEM Electrolysis	2.7152	-0.5187	4.3208	-0.5187
Rockies				
SMR w/o CCS	0.7921	-0.0098	1.3503	-0.0097
Alkaline Electrolysis	3.1344	-0.2321	4.0009	-0.2322
PEM Electrolysis	3.6207	-0.2682	5.1733	-0.2682
Southeast				
SMR w/o CCS	0.8431	+0.0038	1.3628	+0.0038
Alkaline Electrolysis	2.9475	+0.0702	3.8021	+0.0701
PEM Electrolysis	3.4048	+0.0811	4.9361	+0.0811
Southern California				
SMR w/o CCS	1.0895	+0.1086	1.7903	+0.1086
Alkaline Electrolysis	3.0375	+0.0131	4.0034	+0.0131
PEM Electrolysis	3.5088	+0.0151	5.2394	+0.0151
Upper Midwest				
SMR w/o CCS	0.8100	-0.0002	1.3785	-0.0001
Alkaline Electrolysis	3.5230	-0.2057	4.4294	-0.2056
PEM Electrolysis	4.0696	-0.2376	5.6936	-0.2375

*Assessed previous day

JAPAN HYDROGEN ASSESSMENTS, NOVEMBER 9

	Excluding Capex		Including Capex	
Production Pathway	Yen/kg	Change	Yen/kg	Change
SMR w/o CCS	540.1551	-23.1684	625.5684	-23.5918
Alkaline Electrolysis	946.7051	+141.7769	1087.7568	+141.0777
PEM Electrolysis	1093.6024	+163.7768	1346.3252	+162.5240

ASSESSMENT RATIONALE

The S&P Global Platts hydrogen prices are daily valuations that incorporate the cost of variable natural gas, electricity, and carbon inputs, where applicable. A second set of valuations include fixed assumptions for capital and operating expenses. The Platts hydrogen prices are not based on observed or reported market transactions. Details on the Platts hydrogen methodology can be found at: https://www.spglobal.com/platts/en/our-methodology/methodology-specifications/energy-transition/hydrogen-methodology.

VOLUNTARY CARBON CREDITS, NOVEMBER 9

	$/mtCO2e	Change	Eur/mtCO2e	Change
Platts CEC	8.050	+0.150	6.952	+0.125

Note: The Platts CEC assessment reflects the value of CORSIA-eligible credits in the voluntary carbon market, and is not a component of Platts hydrogen assessments.

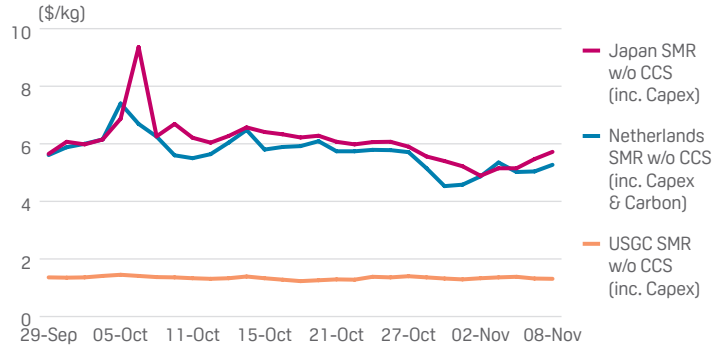
UK HYDROGEN ASSESSMENTS, NOVEMBER 9

Production Pathway	GBP/kg	Change	GBP/KWh	Change
ATR w CCS	3.7735	-0.3055	0.1132	-0.0092
ATR w CCS (inc. Capex & Carbon)	4.0927	-0.3055	0.1228	-0.0092
Alkaline Electrolysis	9.9355	-0.5659	0.2981	-0.0170
Alkaline Electrolysis (inc. Capex)	10.5509	-0.5645	0.3166	-0.0169
PEM Electrolysis	11.4746	-0.6536	0.3443	-0.0196
PEM Electrolysis (inc. Capex)	12.5771	-0.6512	0.3774	-0.0195

NETHERLANDS HYDROGEN ASSESSMENTS, NOVEMBER 9

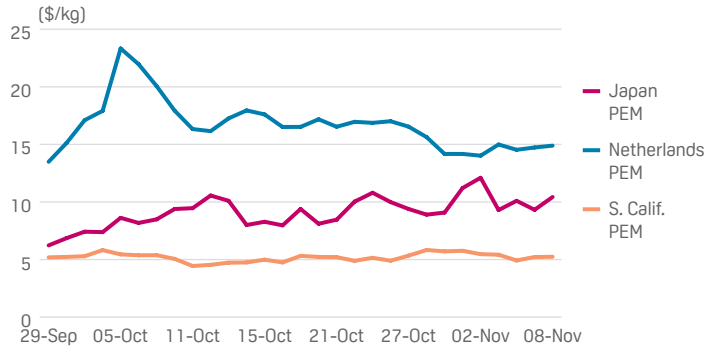
Production Pathway	Eur/kg	Change	Eur/KWh	Change
SMR w/o CCS	3.2615	-0.3135	0.0979	-0.0094
SMR w/o CCS (inc. Capex)	3.6969	-0.3130	0.1109	-0.0094
SMR w/o CCS (inc. Carbon)	3.7980	-0.3153	0.1140	-0.0094
SMR w/o CCS (inc. Capex & Carbon)	4.2334	-0.3148	0.1270	-0.0095
SMR w CCS	4.0949	-0.3761	0.1229	-0.0112
SMR w CCS (inc. Capex)	4.7999	-0.3754	0.1440	-0.0113
SMR w CCS (inc. Carbon)	4.1486	-0.3762	0.1245	-0.0113
SMR w CCS (inc. Capex & Carbon)	4.8535	-0.3756	0.1456	-0.0113
Alkaline Electrolysis	9.4362	-0.5711	0.2831	-0.0171
Alkaline Electrolysis (inc. Capex)	10.1553	-0.5703	0.3047	-0.0171
PEM Electrolysis	10.8977	-0.6597	0.3270	-0.0198
PEM Electrolysis (inc. Capex)	12.1859	-0.6584	0.3656	-0.0198

SMR w/o CCS COST COMPARISONS



Source: S&P Global Platts

PEM ELECTROLYSIS COST COMPARISONS



Source: S&P Global Platts