



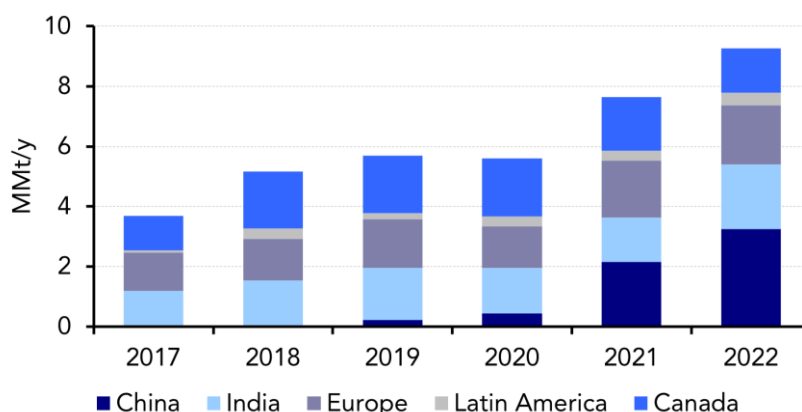
LPG in Worlds Market

More International Crackers Looking to US for Ethane

US ethane exports surged 21% in 2022 to 447,000 b/d (about 9.27 MMt/y), according to the US Energy Information Administration (EIA). Exports should increase another 10% in the next two years to 490,000 b/d in 2024, on more ethane-based cracking capacity additions, expansions in US export terminal capacity and increased gas plant production of natural gas liquids.

The first US ethane export was sent to Canada via pipeline in 2014. Ethane exports ramped up in 2016 following the startup of first waterborne terminal and increasing interests from international petrochemical producers. Ethane exports have grown more than two and a half times in the past five years as ethylene producers from Europe, Latin America, Canada, India and China increased ethane-based cracking capacity to utilize the cheaper feedstock.

US Ethane Exports



China

The growth in Chinese imports of the feedstock is the most impressive. The country has the world's highest demand for ethylene and often sees the highest ethylene price as a result. Ethylene production capacity has increased significantly in the past three years including crackers that utilize imported ethane.

China became the top ethane importer in 2021 with 2.15 MMt/y of imports from the US, up from just 440,000 t in 2020, following the startup of Zhejiang Satellite Petrochemical's ethane cracker in Lianyungang, China, and Energy Transfer's (ETP) Orbit ethane export terminal in Nederland, Texas, along the US Gulf Coast in 1Q 2021.

Currently Zhejiang Satellite, Wanhua Chemical and SP Chemical are operating ethane-based crackers in China that rely on imported ethane. Meanwhile, some other Chinese ethane crackers source it from domestic gas processing plants.

Chinese imports of US ethane jumped another 51% in 2022 to 3.25 MMt after Zhejiang Satellite started its second ethane cracker and existing crackers ramped production of ethylene. More ethane-based crackers are under construction which will continue to increase imports in the region.

Sanjiang Chemical is expected to commission its 1-MMt/y mixed-feed cracker in Jiaxing, China soon, which can process naphtha, LPG or ethane as feedstock.

Sinopec is also building a 1.2-MMt/y ethane-based cracker and 12 derivative units in Tianjin, China, which is expected to start in late 2023. UK-based chemical company Ineos late last year agreed to acquire a 50% share in the chemical project.

Wanhua expects its planned 1.2-MMt/y No. 2 mixed-feed cracker (ethane and naphtha) and derivative plants in Yantai, China should start up in 3Q 2024.

Europe

In Northwest Europe Ineos is building a 1.45-MMt/y ethane-based cracker in Antwerp, Belgium, known as Project ONE which is expected to start in 2026. The plant will rely on US imports.

US ethane exports to the region increased 4% in 2022 to about 2 MMt even as the petrochemical sector faced many challenges like high energy costs, low demand and poor margins. The cost advantage of ethane to produce ethylene incentivized optimizing ethane-based crackers while reducing run rates for crackers that process naphtha.

India

Recently India's state-owned gas company GAIL entered into an agreement with Shell Plc's Indian subsidiary to import ethane. GAIL's plan to import ethane is mainly for its mixed-feed cracker in Uttar Pradesh. GAIL is also planning to build another unit in Maharashtra.

The company also invited expression of interest (EOI) from shipowners and operators to time charter a Very Large Ethane Carrier (VLEC) for 20 years starting in mid-2026.

This indicates the state-owned company is following the path of private sector Reliance Industries which has been importing ethane from the US since 2017 after it converted its crackers to process the lighter feedstock instead of naphtha.

Indian imports of ethane from the US reached an all-time-high in 2022 to 2.15 MMt/y, after posting a 45% y-o-y increase, according to the EIA.

Latin America

US ethane exports to Latin America increased 31% in 2022 to 420,000 t driven by the 37% increase in imports by Mexico. Brazilian petrochemical company Braskem SA which has an ethane cracker in the country increased ethane imports from the US to supplant shortfalls from Pemex supplies.

Pemex had an agreement to supply 66,000 b/d (1.37 MMt/y) ethane to Braskem's cracker in Veracruz, Mexico, which was renegotiated down to 30,000 b/d due to falling natural gas and NGL production in Mexico.

Meanwhile, Pemex's ethane supply commitment will be further reduced in 2025 which will give Braskem more flexibility to source the ethane from the US or Pemex, depending on supply availability.

To increase import capacity, Braskem has started the construction of a new 80,000 b/d ethane import terminal for \$400 million in July 2022. The terminal is expected to be finished by late-2024.

Renewed Interest in VLECs

The sharp increase in ethane cracking in China and India boosted demand for ethane carriers, not surprisingly for better economics.

Additionally, Enterprise Co-CEO Jim Teague in an earnings call last year said that high LNG prices likely incentivized some Asian industrial plants to burn ethane instead of LNG.

Shiptracking data shows ethane being discharged at some Japanese ports. The country does not have ethane crackers.

Meanwhile, several smaller size ethylene carriers were seen carrying ethane from the US to China amid tight vessel availability.

With growing demand and the upcoming addition of new ethane crackers in China and Northwest Europe, there is renewed interest in the VLEC segment with more than 10 newbuild orders placed in 2022, in addition to several entering the fleet since January 2022.

[For additional details on VLEC orderbook and deliveries subscribe to **LPG in World Markets**]

US Terminal Expansion

Currently, Enterprise Products has a 5-MMt/y ethane export terminal at Morgan's Point with docks along the Houston Ship Channel in the USGC.

ETP operates two ethane export terminals – the 3.6 MMt/y Orbit Ethane Export Terminal along the Sabine-Neches waterway in Nederland, Texas, and a 1.5-MMt/y terminal at Marcus Hook, Pennsylvania.

To meet rising demand US terminal operators are also adding terminal capacity.

In a recent analyst call Enterprise confirmed it is converting another 120,000 b/d existing ethane refrigeration train at Morgan's Point to be able to load both ethane and ethylene to increase vessel loading flexibility of the facility by 2H 2024. The terminal will also add a 900,000-bbl refrigerated ethane tank by 2H 2025. Additionally, the company is building a new ethane and ethylene export expansion project at Beaumont, Texas, which will include a 120,000 b/d ethane train and 90,000 bbl refrigerated ethane tank by 2H 2025.

Last year ETP announced it will expand either Marcus Hook or Nederland capacity by 70,000 b/d as early as 2Q 2023. The expansion will include both LPG and ethane capacity.

ETP recently completed a study on a potential expansion at their Nederland Terminal and is currently evaluating next steps. Expanding the USGC terminal could come first, considering the rapid demand growth in China. However, the company also said it will eventually increase the NGLs exports capacity of both terminals.

On the production side of the equation, US shale producers are still leaving ethane in the natural gas stream, which could be extracted when ethane prices are above natural gas heating value. Incremental natural gas production, especially from the Permian basin, will also increase gas plant supply of ethane.

US gas plant ethane production increased 11% y-o-y in 2022 to 49.34 MMt and will increase another 11% in the next two years, according to the EIA. US ethane consumption rose 9% in 2022 to 40.86 MMt and should increase another 8% in the next two years with the addition of new crackers.

US Ethane Supply-Demand Balance

