

Logistics: Embracing the Resin Export Surge

Outflows are beginning to ramp up



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Platts

US Shale Gas Boom = Polyethylene Export Surge

It's coming, bit by bit

- Hurricane Harvey forced widespread shutdowns of existing petrochemical plants while new facilities faced startup delays or extended commissioning
- Post-Harvey, the industry focused on feeding domestic demand, reducing 2017 PE exports 9.1% compared to 2016
- Exports began ramping up in 2Q
- New, expanded resin packaging capacity waiting for new flows
- Ports planning for resin export growth
- Logistics issues: truck driver and chassis shortages, inconsistent container availability



Photo courtesy Dow Chemical

First wave of new US polyethylene plants, 2017-2019

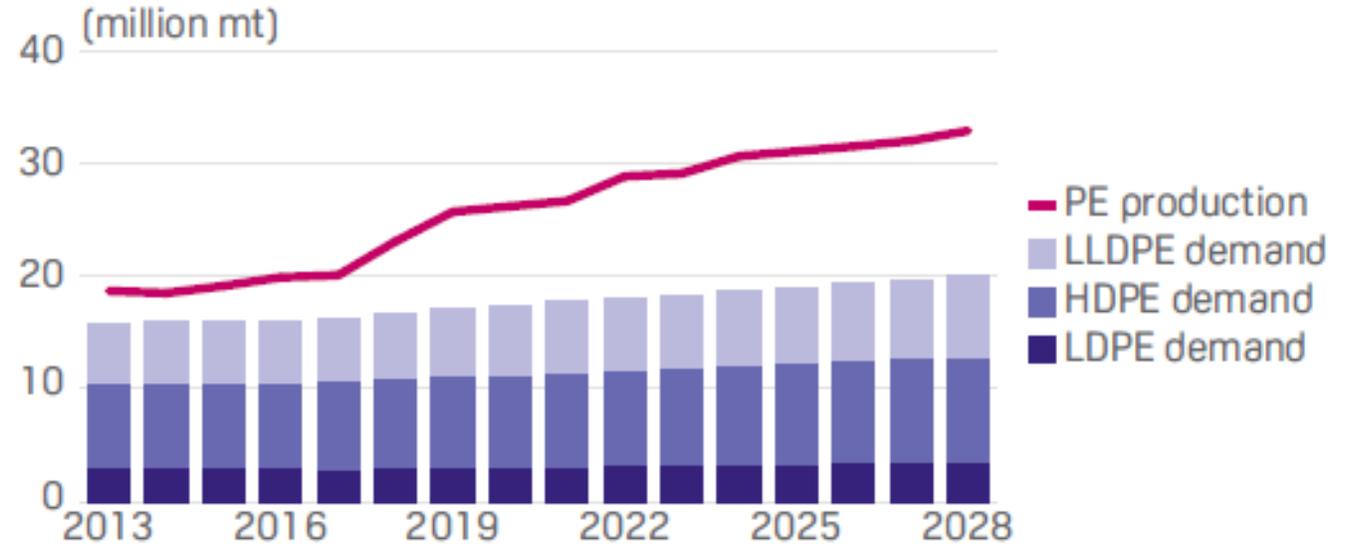
Company	Location	Product	Capacity (,000 mt/Year)	Startup
CP Chem	Sweeny, TX	HD, LLD	500, 500	Sept 2017
DowDuPont	Freeport, TX	LLD	400	Sept 2017
ExxonMobil	Mont Belvieu, TX	HD, LLD	650, 650	Oct 2017
Ineos/Sasol	LaPorte, TX	HD	461	Nov 2017
Dow Chemical	Plaquemine, LA	LD	350	Q1 2018
Sasol	Lake Charles, LA	LLD, HD	450, 450	2H 2018/1H 2019
Formosa Plastics	Point Comfort, TX	LD/HD, LLD	400, 400	1H 2019
LyondellBasell	LaPorte, TX	HD	549	Mid-2019
ExxonMobil	Beaumont, TX	LLD	650	2019
Total First Wave:			6.4 million mt/year	

2020 and beyond to bring at least another 4.4 million mt/year

North America already is oversupplied

- The US exported 3.47 million mt in 2017, 15% of capacity, down from 3.8 million mt in 2016 because of Hurricane Harvey
- The first wave of PE startups from 2017-2019 will increase US capacity by 6.4 million mt, or 31%, to 27 million mt through 2019
- Another 4.4 million mt planned in the US in the 2020s, not including Exxon/Sabir and PTTGC-Daelim
- Nearly 70% of US exports in 2017 went to Mexico, Canada, China, Brazil, Colombia, Chile and Peru

NORTH AMERICA TO HAVE PE EXPORT GROWTH

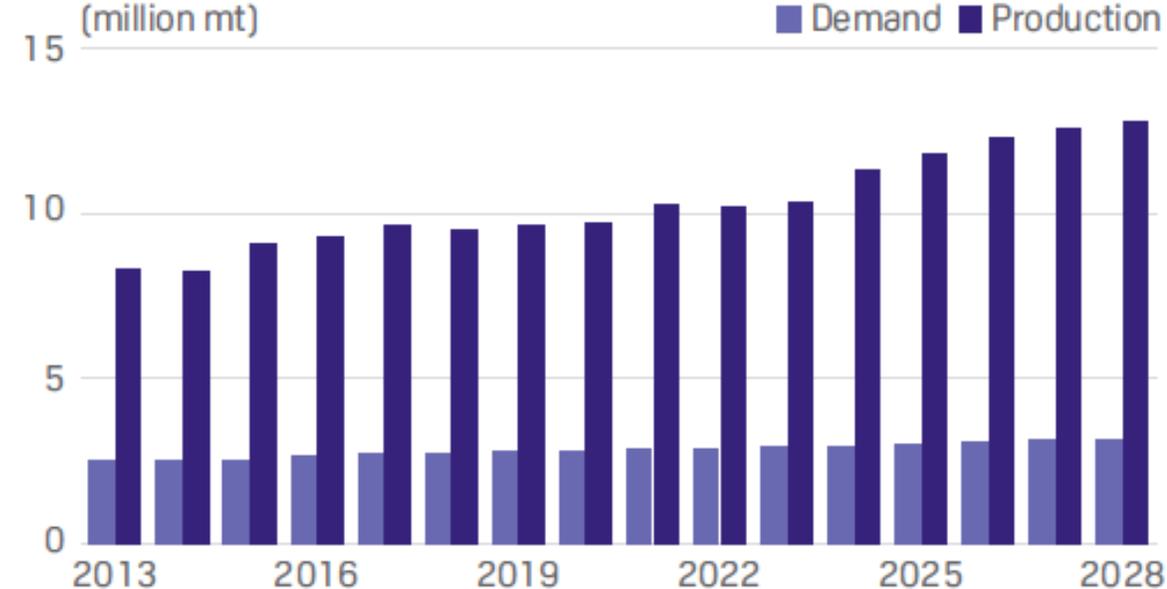


Source: S&P Global Platts Analytics

North American surplus trails Middle East

- Middle East surplus to average 15 million mt/year from 2018 onward
- The Middle East will remain the largest global supplier
- Capacity additions expected in Iran, Saudi Arabia, Oman and the UAE; US-Iran tensions could restrain Iran's petrochemical plans
- Top export destinations: Asia, Europe, Africa
- US to compete for market share; Middle East controls about 80% of the export market into Asia

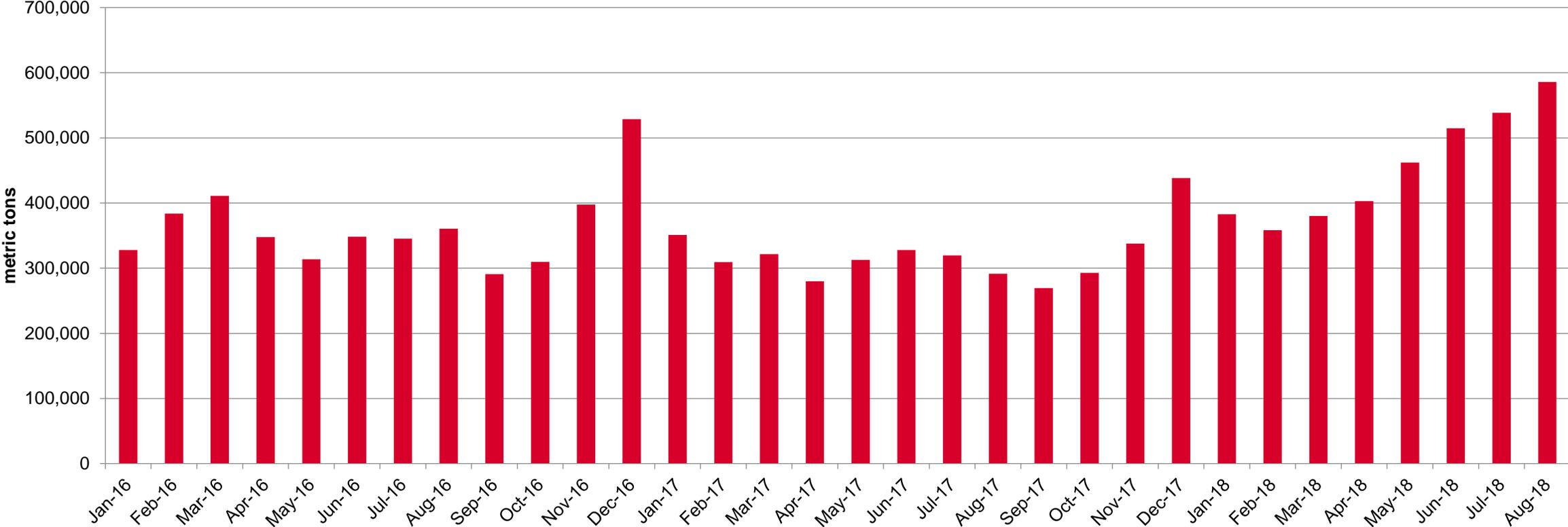
MIDDLE EAST HDPE TO REMAIN IN AMPLE EXPORTS



Source: S&P Global Platts Analytics

PE exports rising; August 2018 flows higher than year-end 2016

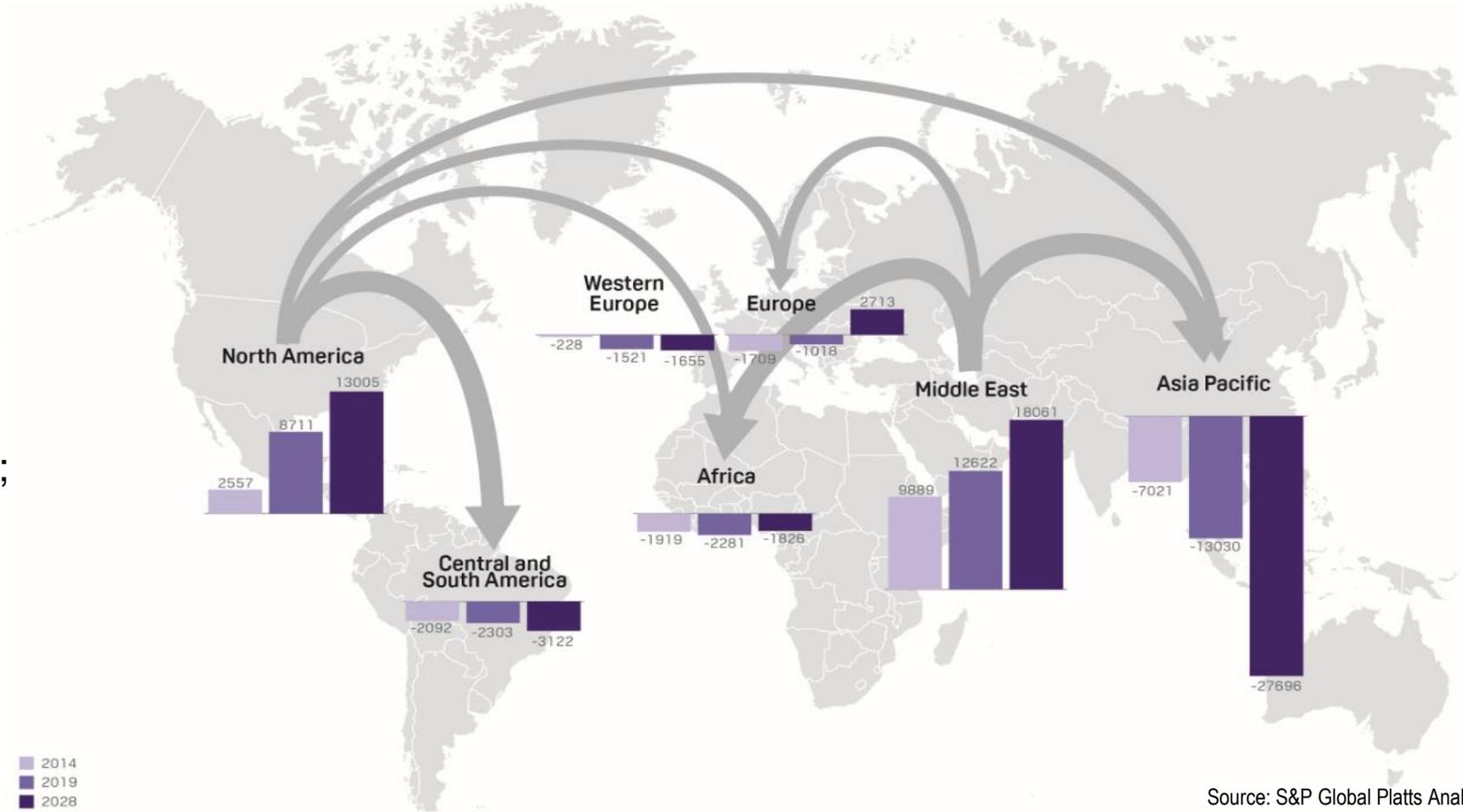
PE exports US/Canada



Source: American Chemistry Council

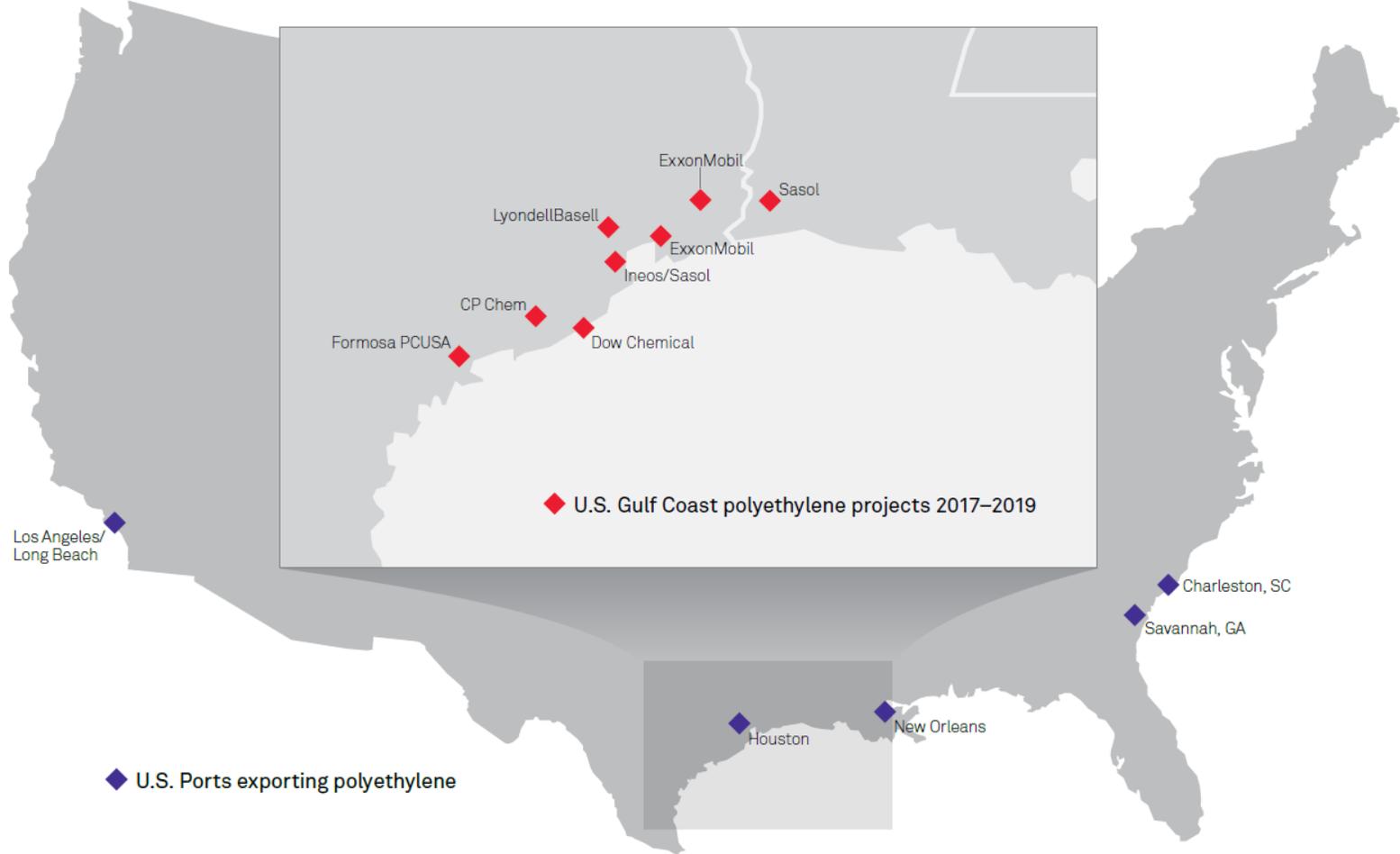
Where will the surplus PE go?

- Main global export markets: Asia, Central and South America, Europe, Africa
- North American output to target Central and South America, Asia, Europe
- Asian demand to account for 60% of global PE consumption
- China the No. 3 market for US PE, having received 18% of all exports through July 2018; tariffs expected to shift some trade flows, could pressure prices



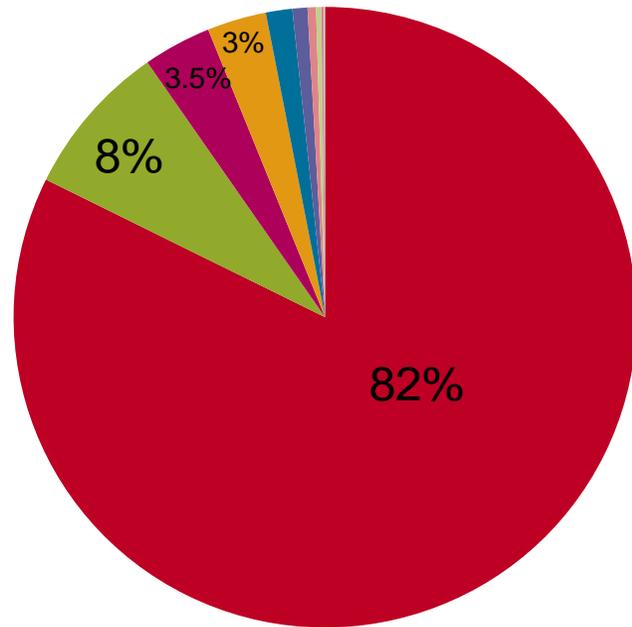
Source: S&P Global Platts Analytics

Where will surplus PE exit the US?



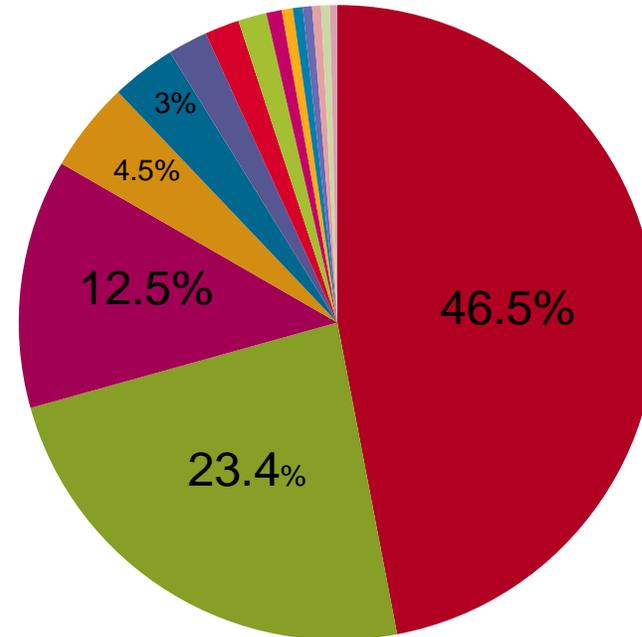
Houston dominates US PE exports- 2017

Waterborne only



Total exports: 1.9 million mt

Waterborne, rail and truck



Total exports: 3.47 million mt

- Houston-Galveston, TX
- Los Angeles, CA
- New Orleans, LA
- Charleston, SC
- New York, NY
- Seattle, WA
- Savannah, GA
- Philadelphia, PA
- Norfolk, VA
- Mobile, AL
- Baltimore, MD

- Houston-Galveston, TX
- Laredo, TX
- Detroit, MI
- Los Angeles, CA
- Pembina, ND
- New Orleans, LA
- Charleston, SC
- San Diego, CA
- New York, NY
- Duluth, MN
- Ogdensburg, NY
- Buffalo, NY
- El Paso, TX

Source: US International Trade Commission

Houston preparing, but challenges expected

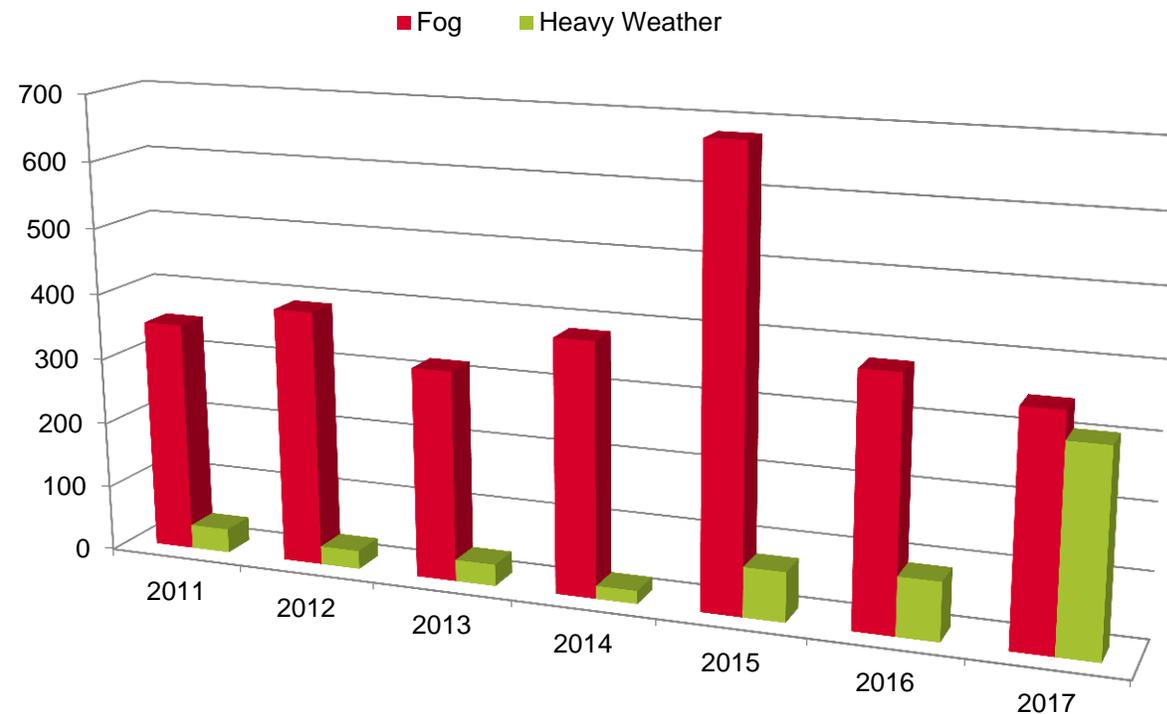


- Port Houston investing nearly \$1.2 billion 2017-2021 in wharf and dock upgrades, increased cranes to 26 in March 2018, deepened spurs to match 45-foot channel draft, expanded truck gate hours
- Industry players say Port Houston's challenges include fog shutdowns and inconsistent availability of empty containers to fill with resin as well as balance tonnage on ships
- Shortage of truck drivers and chassis an increasing challenge, not just for Houston
- Houston says concerns overstated, port has thousands of containers available as loaded imports rise; can access empties from Caribbean, Colombia – at a price
- In second of a four-year study with US Army Corps of Engineers on improvements and a possible, though unlikely, deepening beyond 45 feet

Fog: An unwelcome guest at the world's second-largest petrochemical port

- In 2015, the Houston Ship Channel was closed for 680 hours because of fog, the equivalent of 28 days
- In 2017, fog forced channel shutdowns for 347.38 hours, or 14.5 days, down from 379 hours in 2016, or 15.7 days.
- Heavy weather hit 2017 with 305.75 hours of closures, or nearly 13 days, mostly due to Harvey
- The first three months of 2018 brought 333 hours of fog closures, or nearly 14 days

Houston Ship Channel Closure Hours



Source: US Coast Guard

Other ports inviting flows to alternative export options



- Efficiency and motion are key to profitability
- Waiting to load or unload containers – or get empty containers to load or balance ship tonnage – is hours or days lost, and bring “gotcha” costs like per diem charges, demurrage, railcar detention charges and costs for delivered empties
- Planning to move some pellets to alternative ports allows producers to capture lower costs elsewhere or hedge costs of Houston holdups
- Producers balance average 3 cents/lb rail transportation costs against more frequent ocean services, container availability, cheaper drayage – Houston does not have to be mired in fog or problems for alternative export outlets to work

The Port of Charleston (South Carolina) an early player:

- Began exporting resin in 2011 for Chevron Phillips Chemical, other customers include Westlake, Sabic, INEOS, Shintech, Indorama, NOVA; handled 2.2 million TEUs in 2017, up 10% from 2016
- Investing \$2.15 billion through 2021
- Building new three-berth container terminal at a former Naval base to open in phases starting in 2020
- Deepening harbor to 52 feet from 45 to accommodate bigger container ships; carriers will limit export loads in ports with shallow drafts
- Adding 12 cranes in 2018 for 28 total
- Established resin packagers expanding or have space to expand



South Carolina Ports Authority

The Port of New Orleans a smaller player, facing challenges

- Like Houston, has proximity to production
- Upgraded container terminal with new on-dock railyard, adding two cranes by 2020 for total of 6
- Acquired New Orleans Public Belt railroad to control rail access
- Handled 526,703 TEUs in 2017, has capacity to handle 840,000
- Weekly shipments of empty containers via barge from Memphis and Baton Rouge, though availability inconsistent; seeking to bolster imports to balance equipment
- Main markets are Central and South America



Port of Savannah late to the game



- Major import center for southeast US, plenty of empty containers at the largest single domestic terminal with 35 weekly ocean carrier services
- Thirty cranes as of December 2017; ordering six more by 2020
- Often the last port of call from the US East Coast
- Deepening channel to 47 feet from 42
- Behind other non-Houston ports on soliciting resin customers; first resin packaging operation started up in mid-2018
- Port handled a record 4 million TEUs in 2017, but trucking and chassis issues causing headaches

Truck driver, chassis shortages affecting major ports



- US truck driving transportation and warehousing jobs largely stagnated from 2015-2017 at about 1.46 million, slightly above 2006 levels before the global financial crisis; surpassed 1.47 million in July 2018
- Electronic logging devices (ELDs) restrict driving time to 11 hours per day, regardless of whether a driver is stuck in traffic or waiting in line to get to a dock
- Texas “heavy haul” law allows gross truck weights of 100,000 lbs, but undercuts itself by requiring three-axle chassis and \$6,000 permits
- Inspection/maintenance rules take chassis out of use, so older chassis discarded with too few to fill out fleet; US tariffs on Chinese chassis imports expected to further squeeze availability

Packaging critical to efficient exports



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- Packaging companies have expanded and added new operations at ports in Houston, Charleston, Savannah, New Orleans, Freeport TX
- Ports say reliable packaging key to attracting export business
- At least 4.8 million mt/year of new or expanded capacity in operation by the end of 2017 as 3.16 million mt/year in new PE capacity started up; disparity fueling concern about overbuilding as more projects planned
- By 2020 and beyond, packaging capacity already operating or announced will catch up with known PE additions; Exxon/Sabir and PTTGC projects would add more PE, but could come with new packaging as well



PBP
PLASTIC BAGGING & PACKAGING, INC

A&R bulkpak



Railroads see opportunity as well



- Union Pacific, BNSF working with packaging companies to move pellets to their Dallas-area terminals to load empty containers brought in from Asia to the West Coast, providing another export outlet and a railroad netback
- Kansas City Southern promoting an option to move pellets into Mexico to auto facilities, molding operations or packaging for export out of the Port of Lazaro Cardenas on Mexico's Pacific coast to Asia or South America; still in early innings
- KTN about to unveil a new packaging facility near UP's terminal for Asia-bound resin

Ethylene too: Competing projects aim to export



- 1 million mt/year terminal under construction with export capacity with 1,000 mt/hour loading rate
- 30,000 mt on-site refrigerated storage
- Long-term contracts from anchor shippers include Flint Hills Resources; startup 1Q 2020
- Converting ethane cavern to hold up to 272,000 mt ethylene; operational 1Q 2019
- 24-mile bilateral ethylene pipeline connecting Mont Belvieu and Bayport, startup 2020
- Under construction

- 750,000 mt/year export capacity and 900 mt/hour loading rate
- 2,000 mt/day chilling train to liquefy ethylene
- 45,000 mt on-site refrigerated storage
- Facility would be at Odfjell's Bayport terminal
- Terminal is near ethylene pipelines run by Shell, Chevron, INEOS, Lyondell and Flint Hills Resources
- FID pending customer commitments; CEO said in early 2018 if EPD goes forward, Odfjell less likely

Key takeaways:

- Cheap feedstock prompted unprecedented petrochemical investment along the US Gulf Coast
- Most if not all new output will be exported, though Harvey delayed expected surge
- Houston remains the overwhelming top exporter of US PE, other ports offering alternatives for overflow
- Other ports, railroads providing export options and flexibility producers want
- Central and South American markets are key, proximity gives the US an edge over the Middle East; Asia will have strongest demand
- Logistics challenges include trucker and chassis shortage, container availability



Thank you!