

The Future of Global Downstream Project Activity

Lee Nichols – Editor/Associate Publisher

Hydrocarbon Processing

Gas Processing

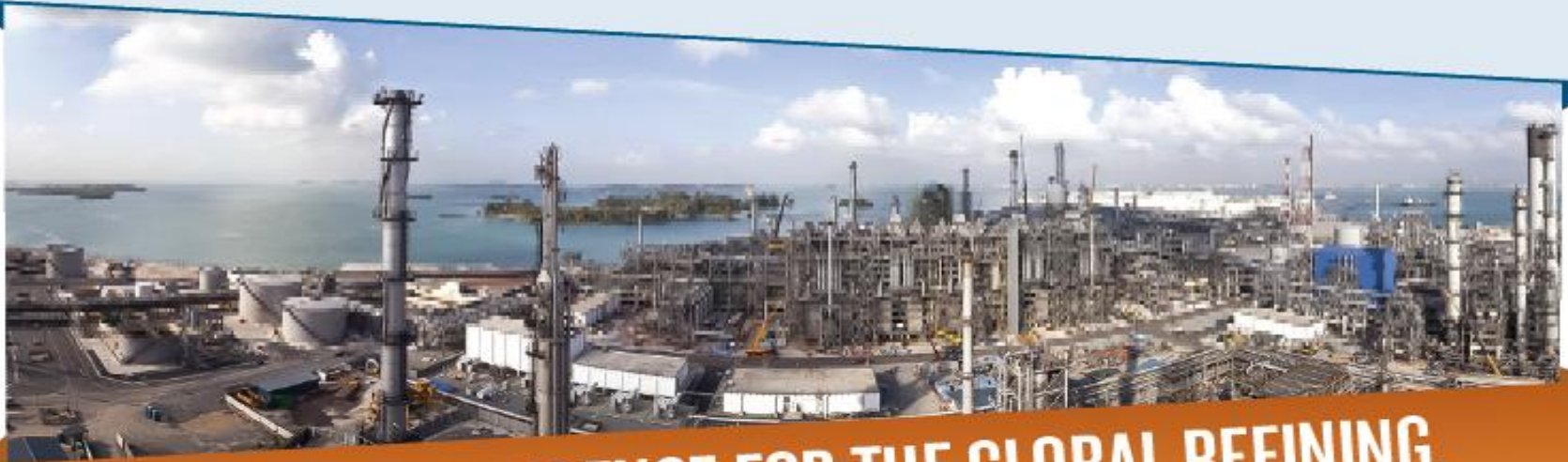
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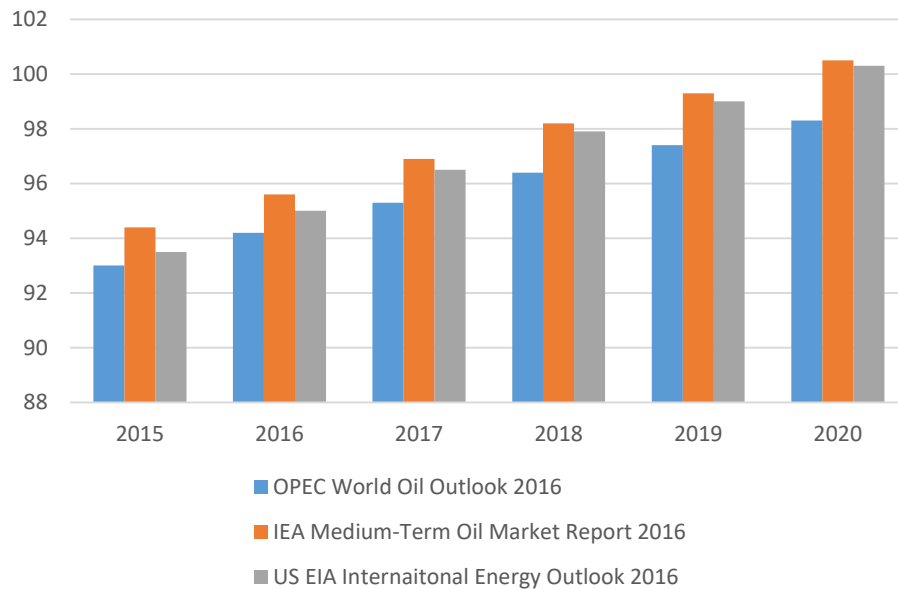
Detailed and up-to-date information for active construction projects in the refining, gas processing, LNG and petrochemical industries across the globe

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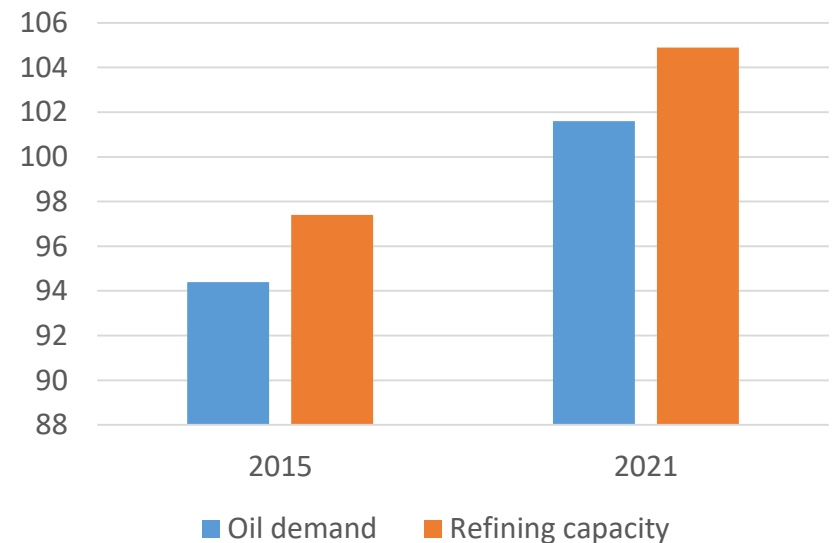
1980's Hair Bands



Oil demand vs. refinery capacity builds, 2015-2021

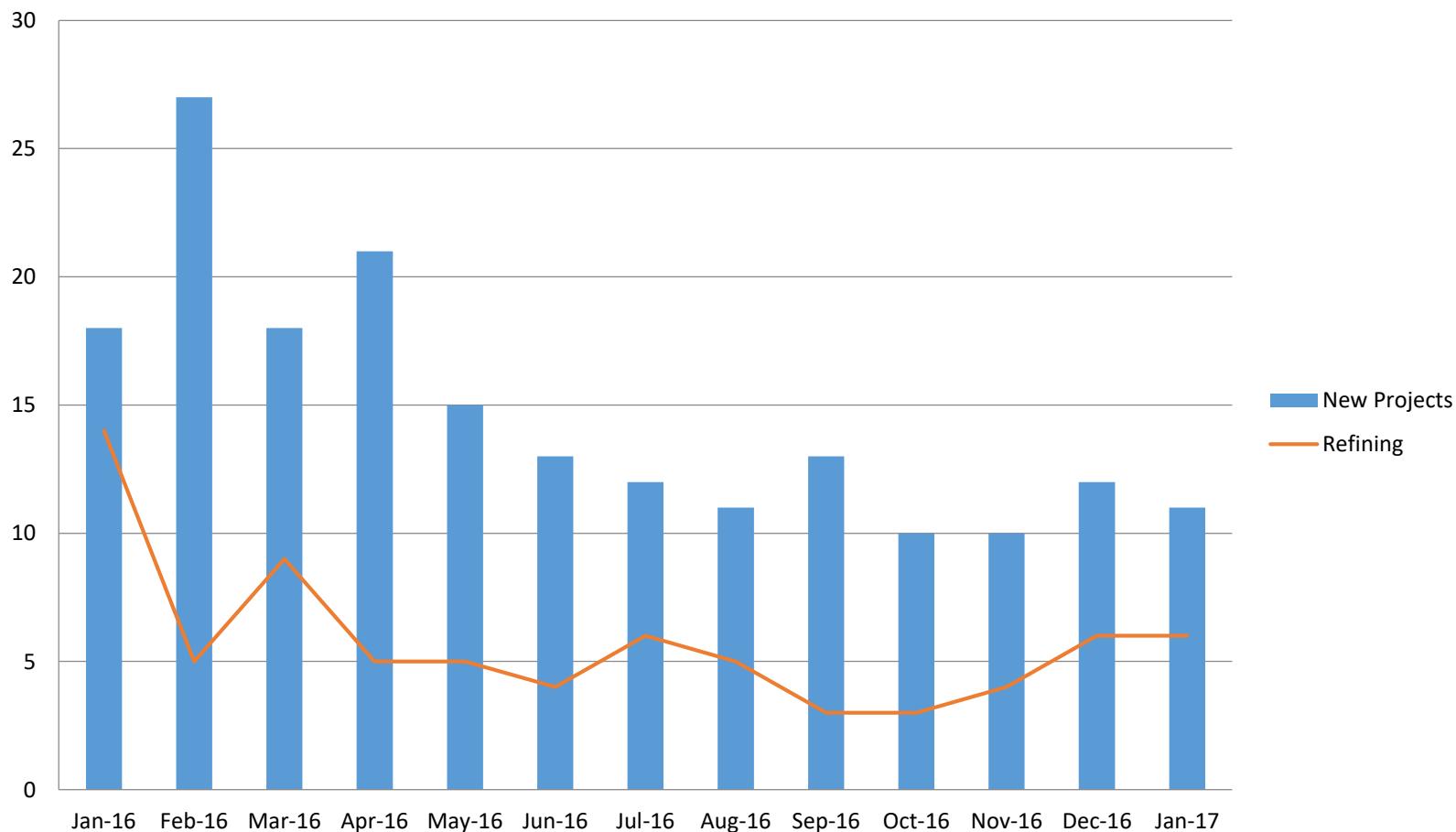


Global oil demand (MMbpd) from three major industry forecast, 2015-2021.



Global oil demand vs. refinery capacity builds, MMbpd (2015-2021)

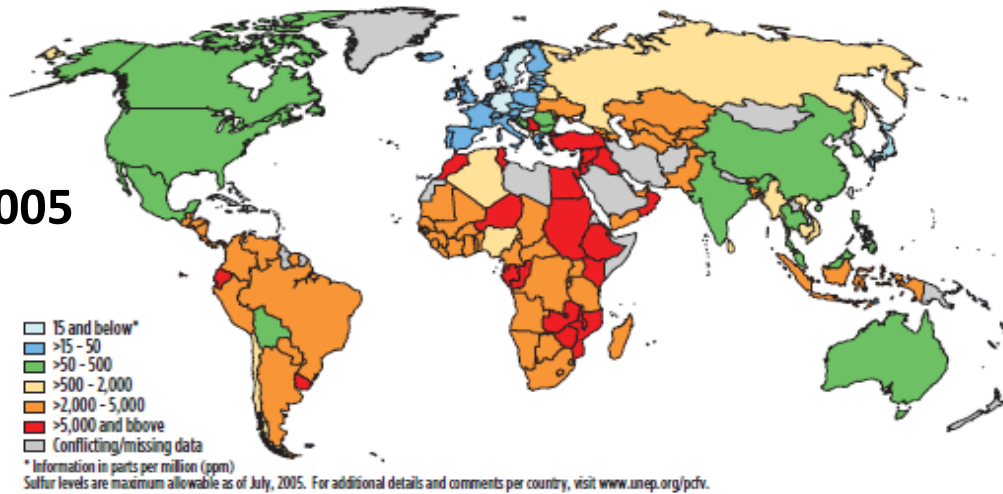
New refining project announcements vs new downstream projects (globally), January 2016 – January 2017



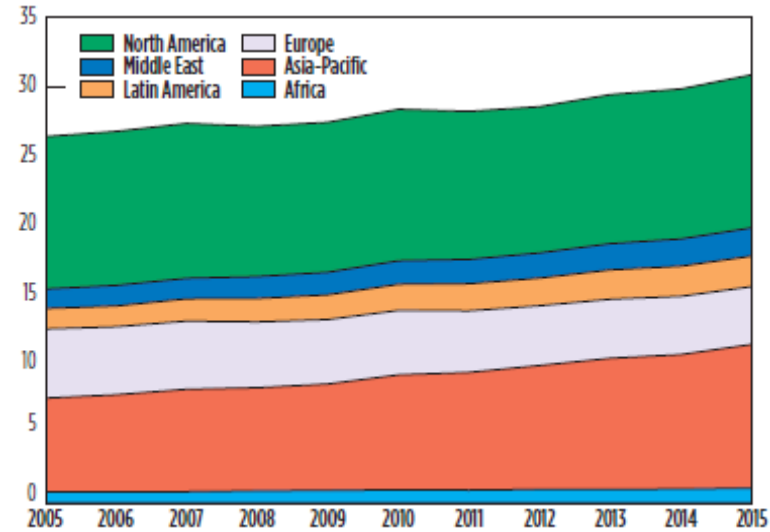
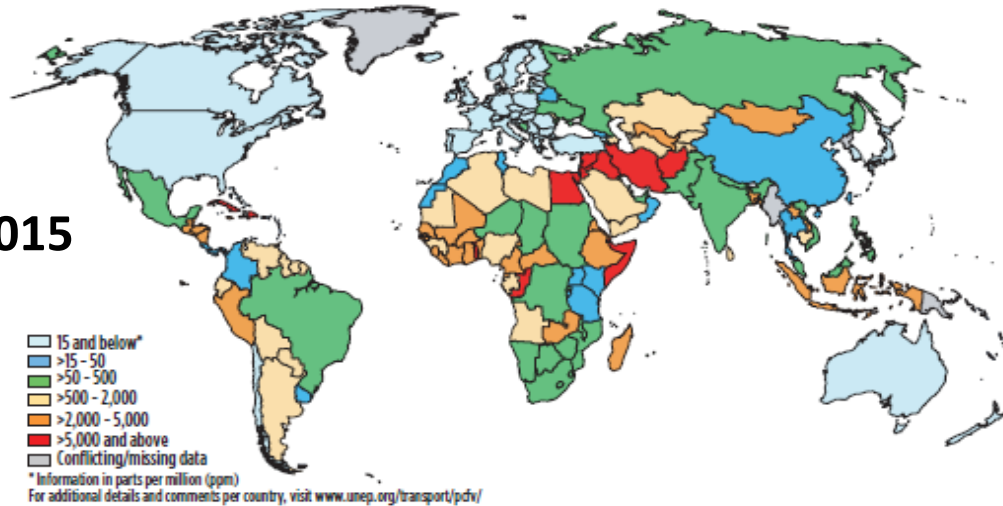
Source: *Hydrocarbon Processing's* Construction Boxscore Database.

A low-sulfur world

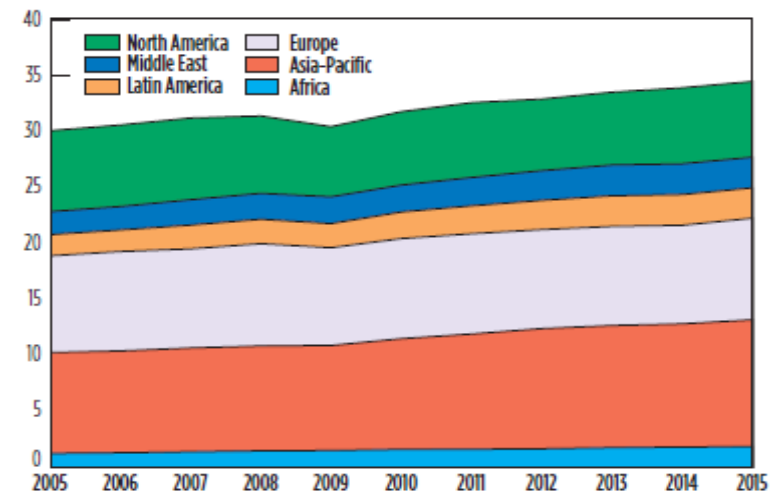
2005



2015



Light distillate consumption (source: BP)



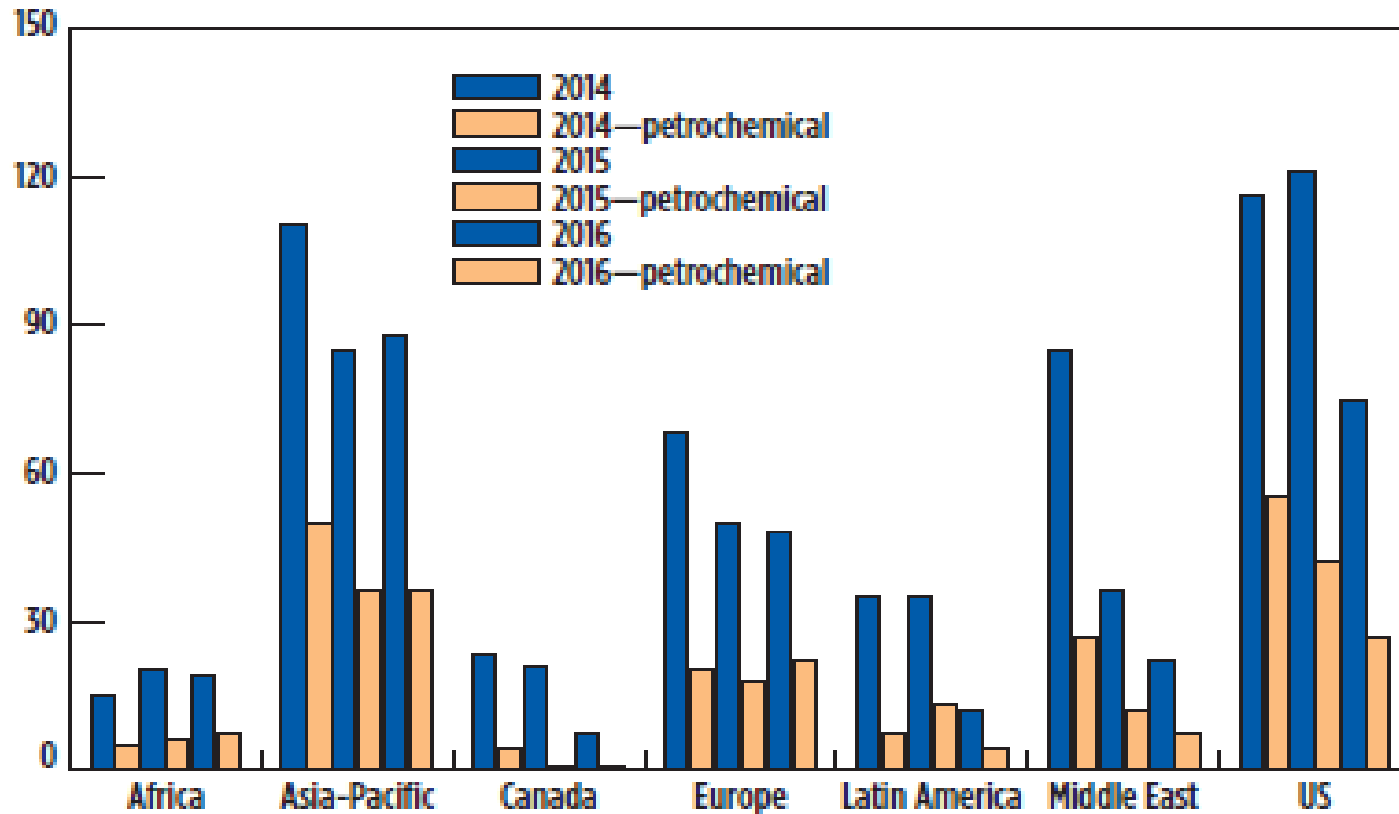
Middle distillate consumption (source: BP)

Petrochemicals



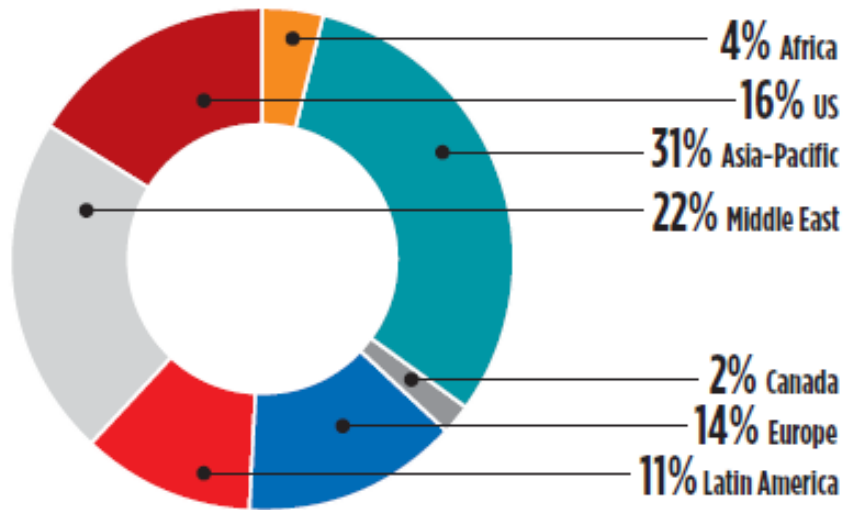
- Global petrochemical sector to see strong growth through the end of the decade
 - However, industry has shifted from bullish to optimistic
- Most significant expansions will be in developing countries in the Asia-Pacific and Middle East regions
- US will see tremendous growth, as well
- Oil-based naphtha crackers making a comeback
 - Ethane remains advantaged feedstock

New petrochemical projects

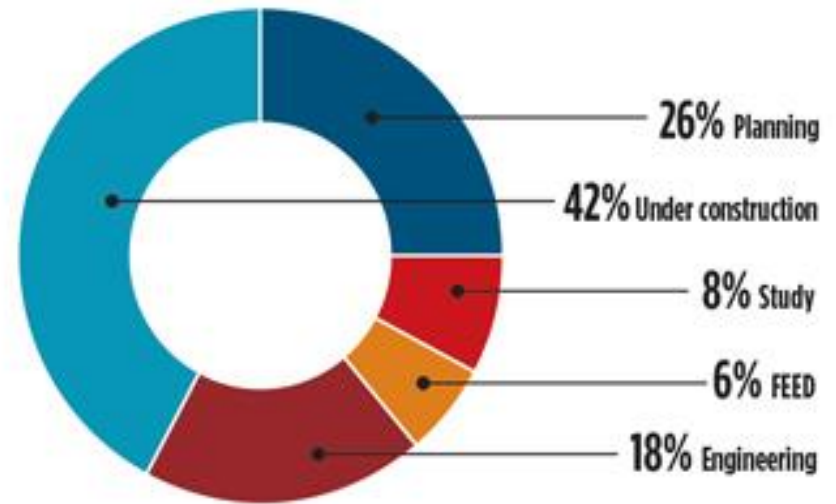


- As total new project announcements have decreased since 2014, so has new petrochemical project announcements
- Over the past three years, over 400 new petrochemical projects have been announced

Active petrochemical projects



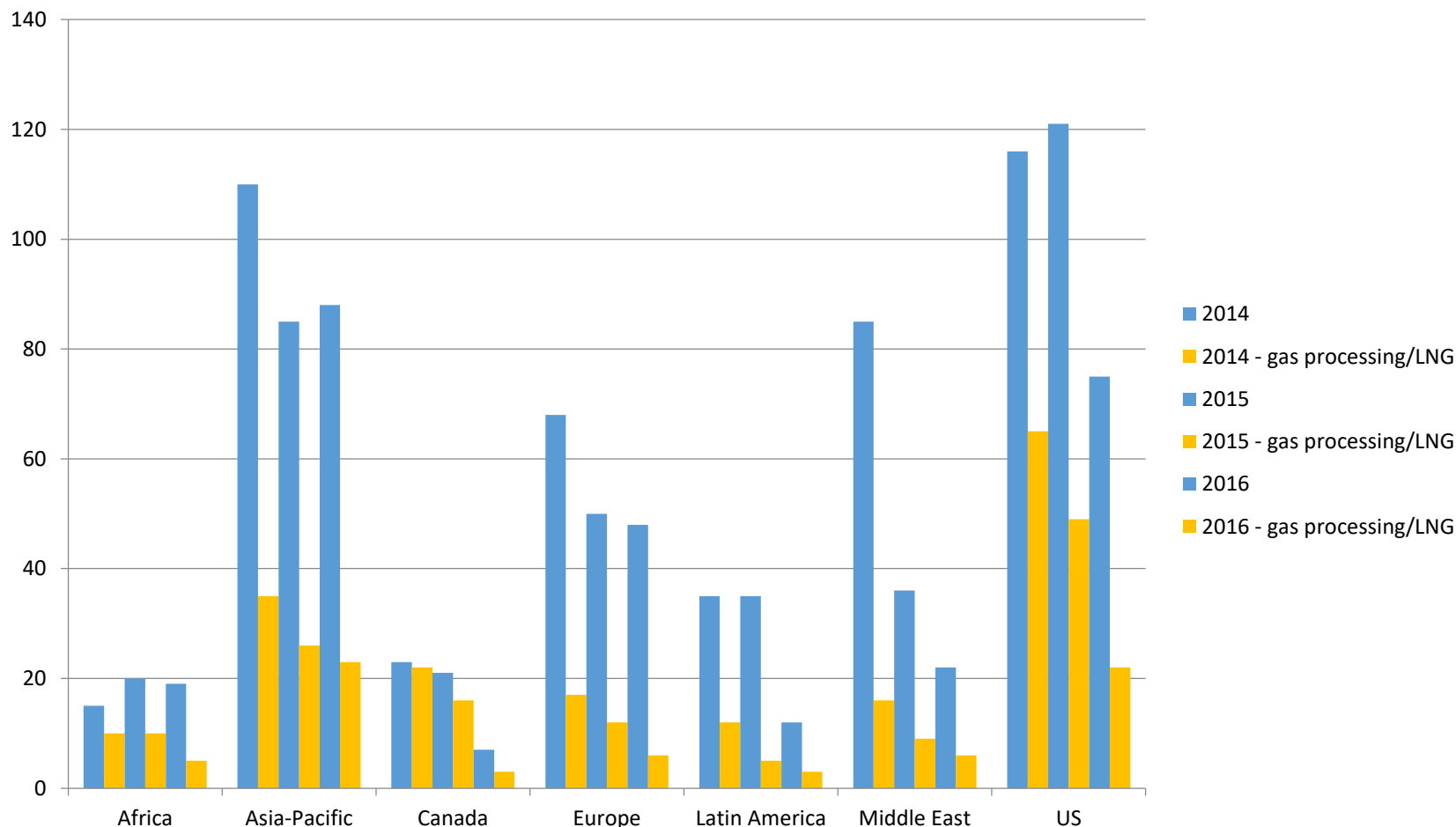
Total active petrochemical market share by region, 2016



Breakdown of 2016 petrochemical projects by activity level

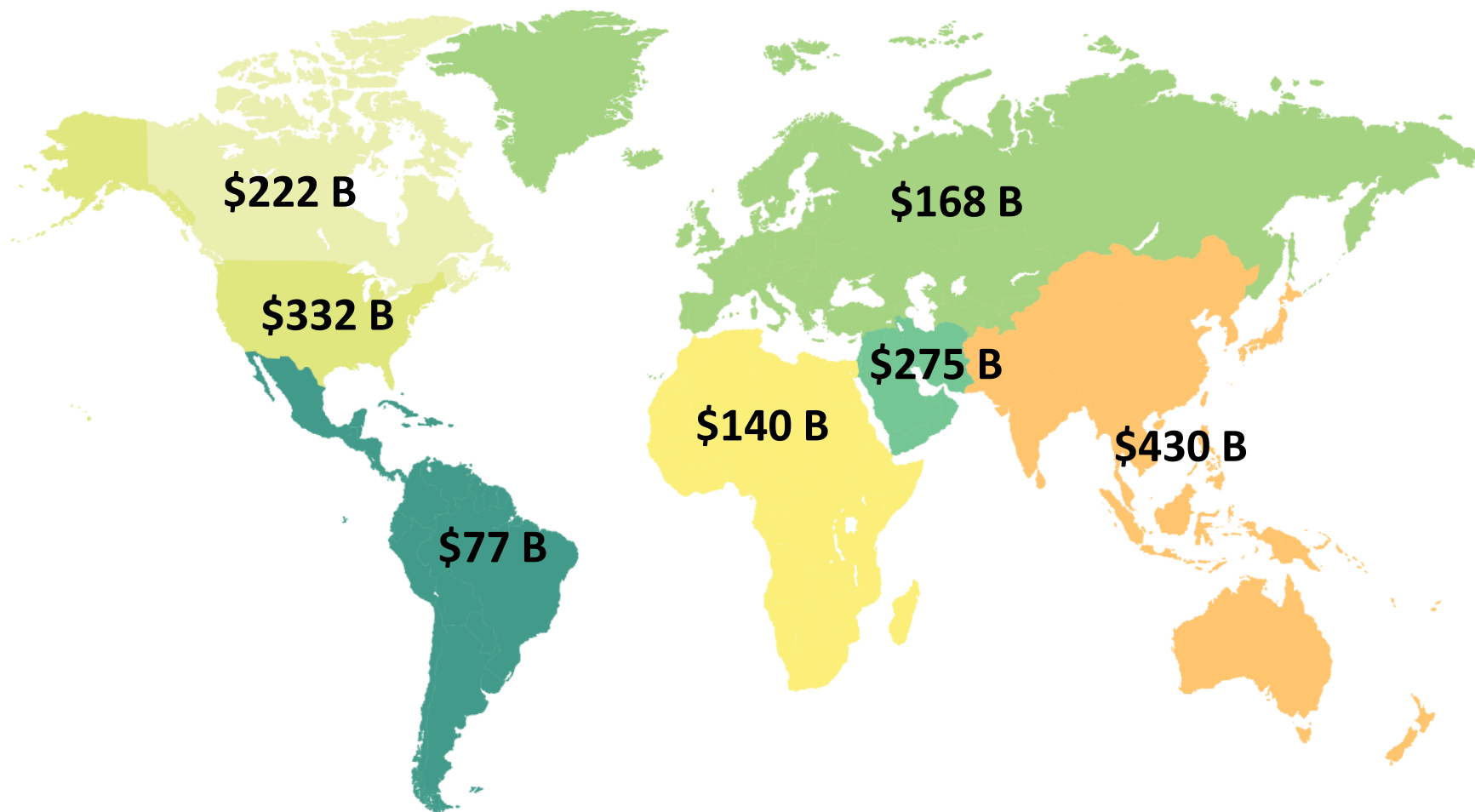
Source: *Hydrocarbon Processing's* Construction Boxscore Database

New project announcements vs. new gas processing/LNG projects by region, 2014-2016

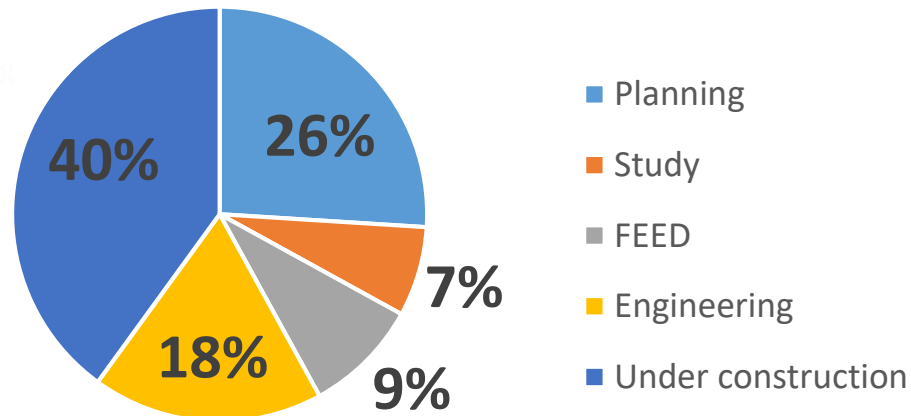
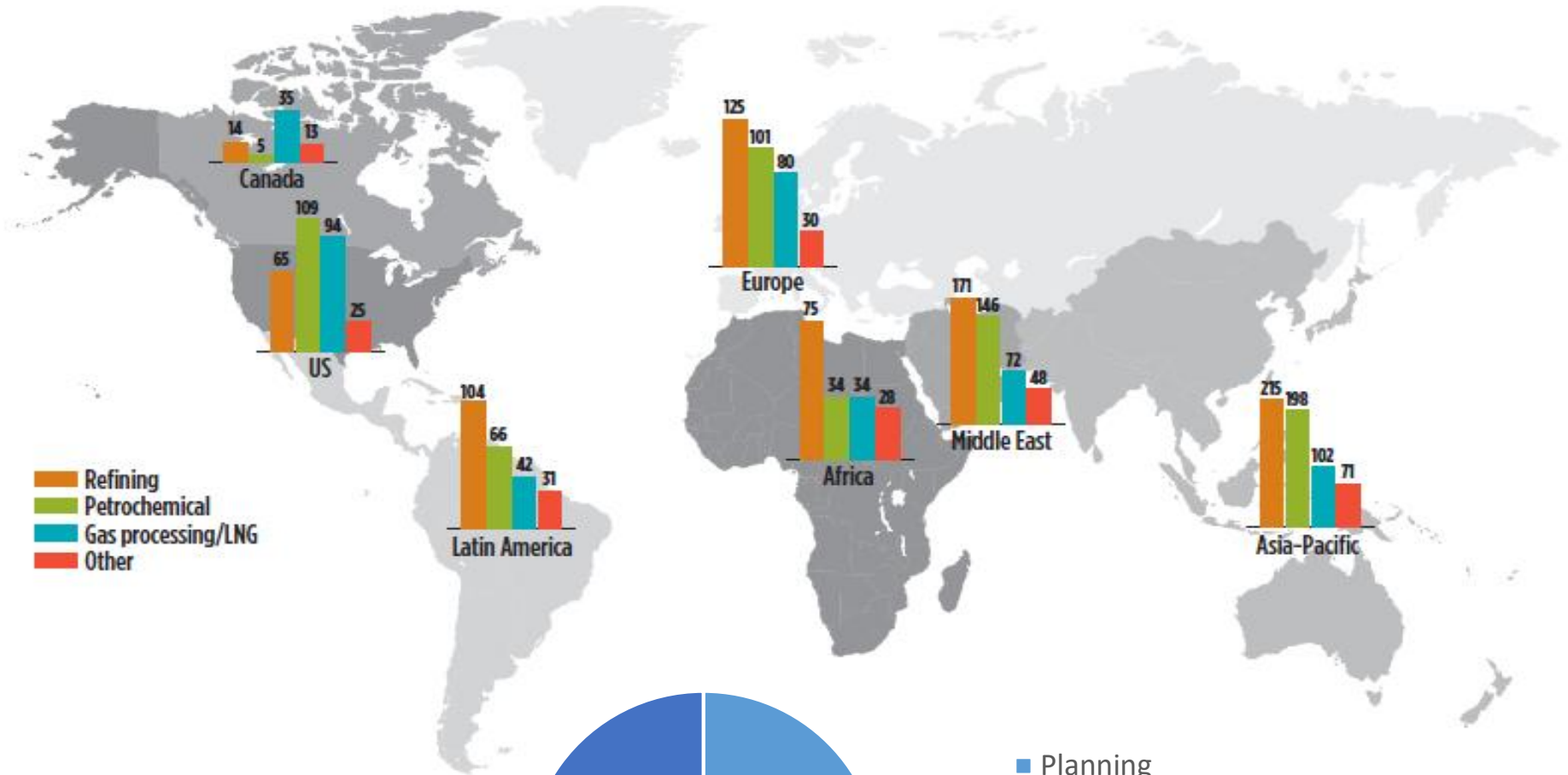


Source: *Hydrocarbon Processing's* Construction Boxscore Database.

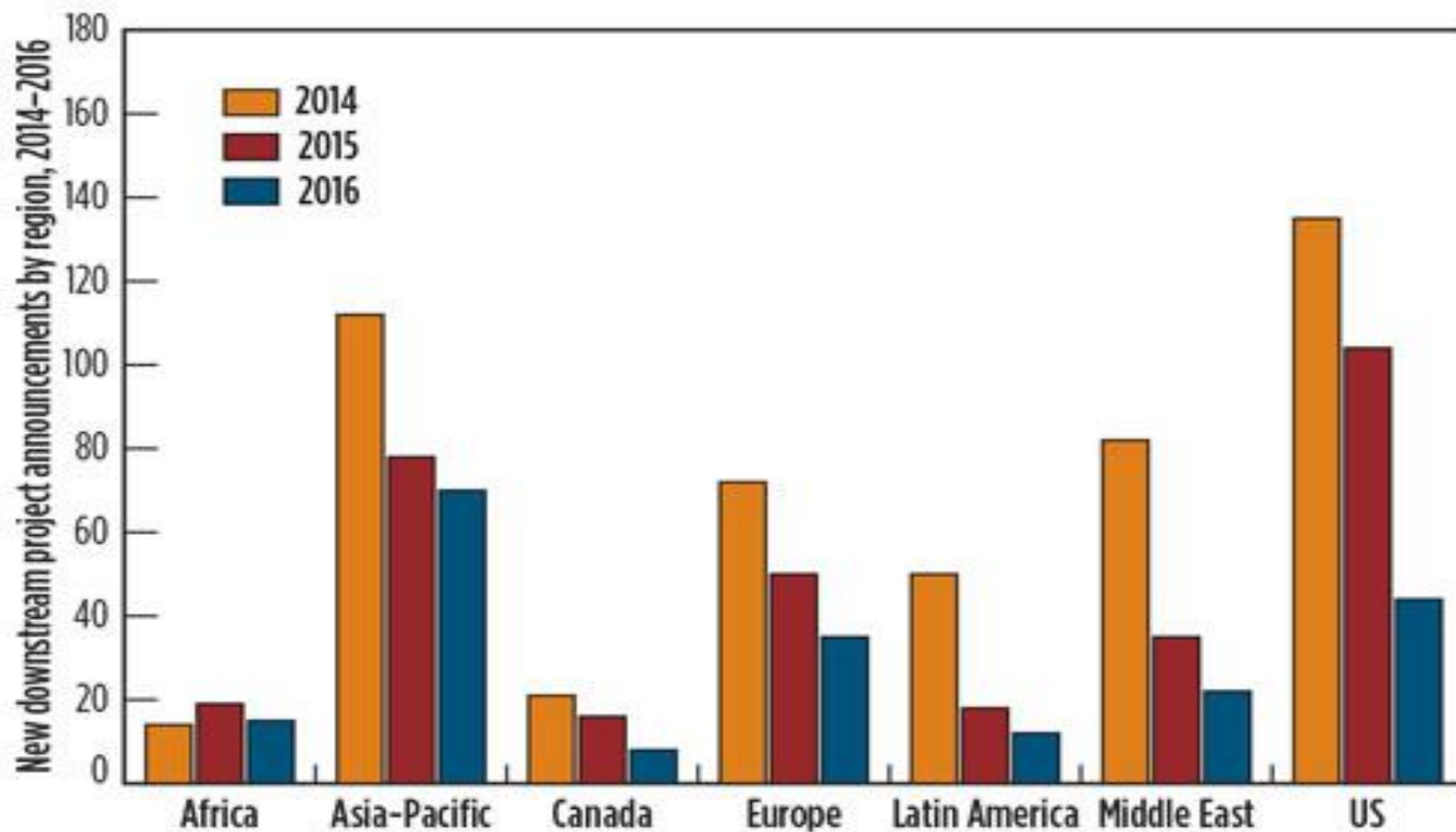
Announced downstream project investments by region, 2015-2030



Total active projects breakdown

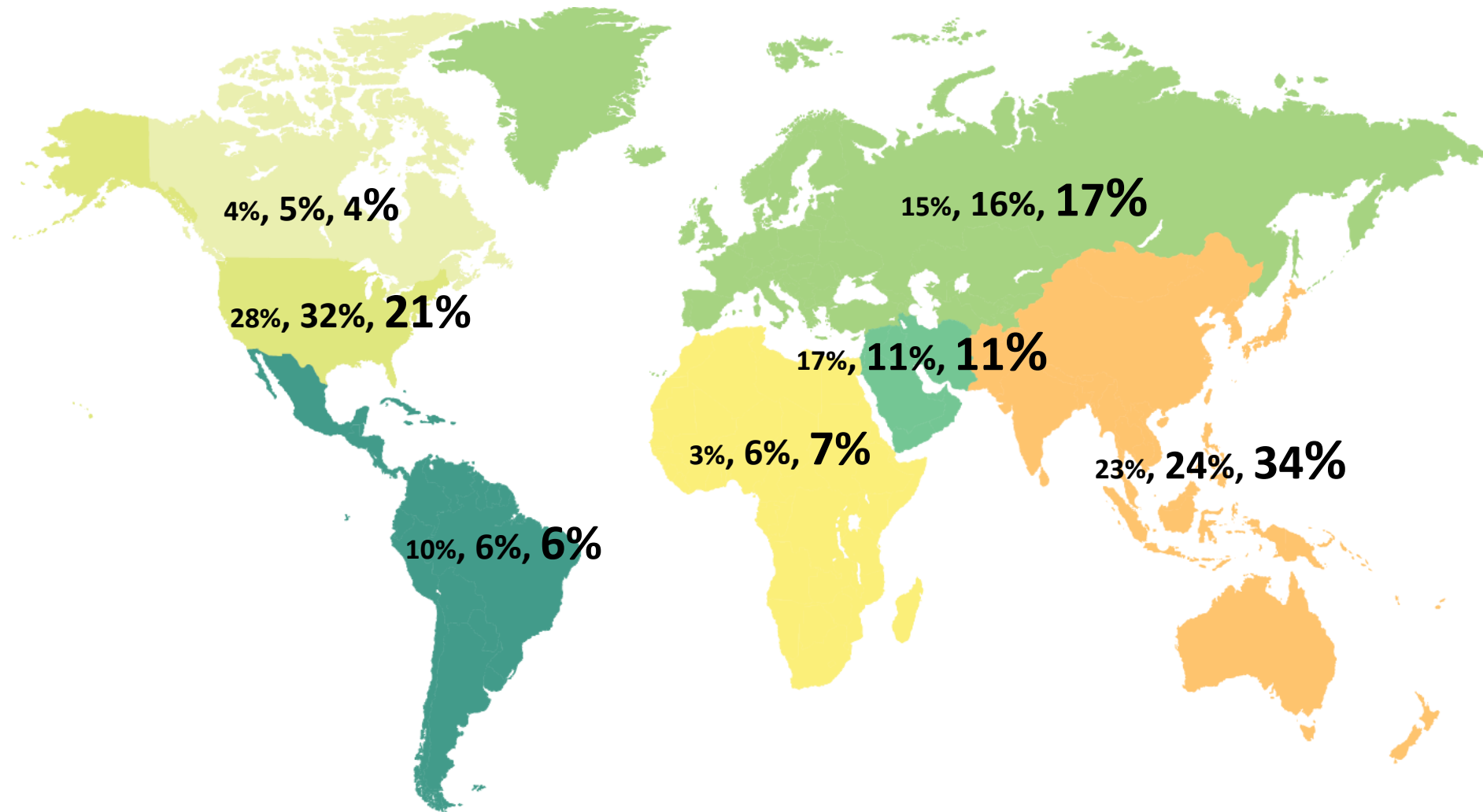


Total new project announcements by region, 2014-2016.



*Europe includes Eastern Europe, Russia and the CIS

Market share analysis of new projects, 2014-2016



Morocco

- LNG Power Project



Egypt

- ERC Mostorod refinery project
- Tahrir Petrochemical Complex
- Sidpec/TCI Sanmar Port Said petchem projects
- MIDOR & Assuit Refinery projects
- FSRU #3 – delayed

Algeria

- Updated Rehab Program
- Three new refineries (Biskra, Hassi-Messaoud, Tiaret)
- Boost in petchem capacity



Nigeria

- DIL project
- Brass Fertilizer
- Eleme Indorama
- NLNG Trains 7 & 8?
- Brass LNG back on?



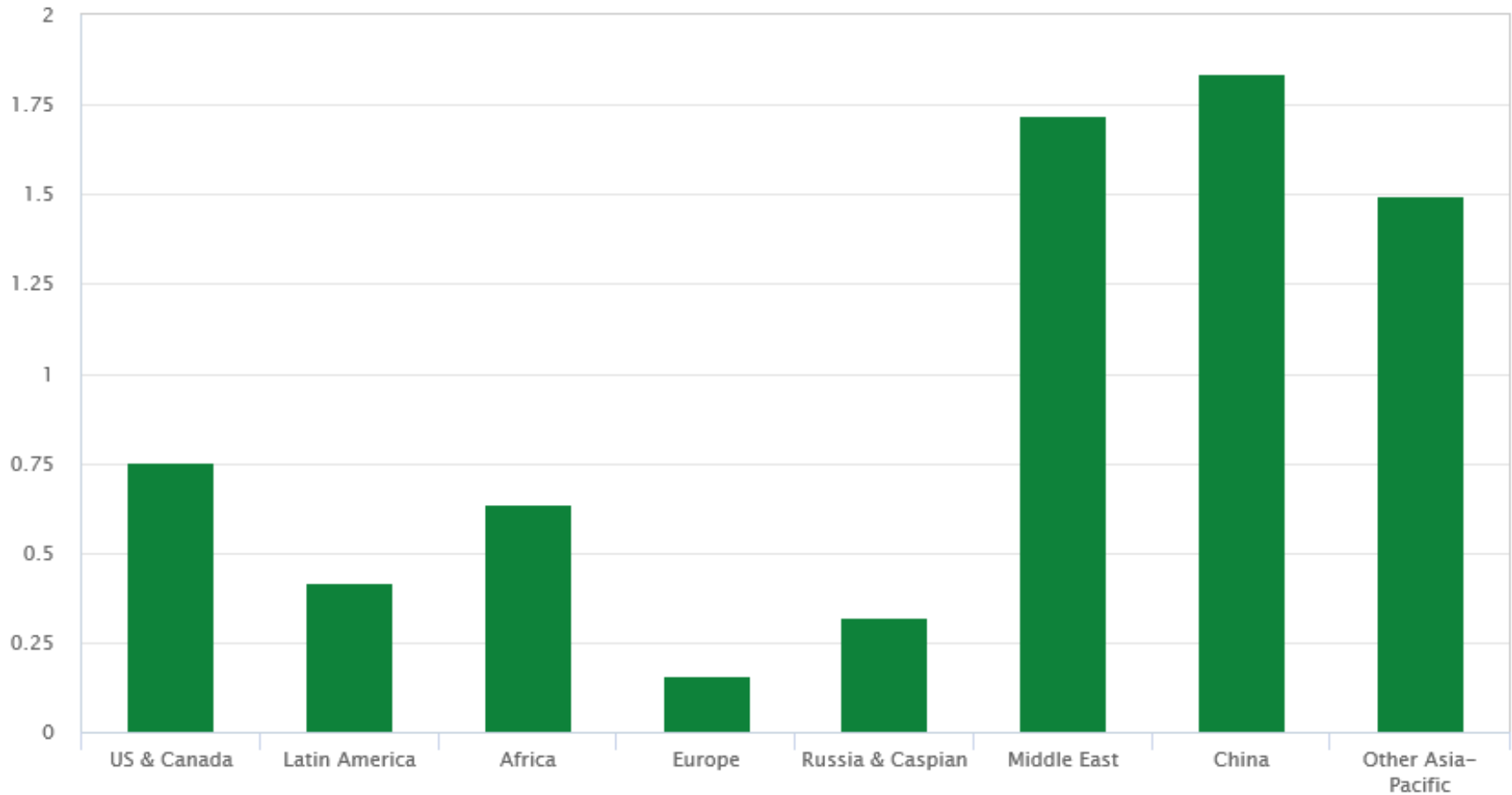
Mozambique/Tanzania LNG projects

South Africa

- CF2 (not any time soon)
- Project Mthombo? Iran to build?
- Gas to Power program

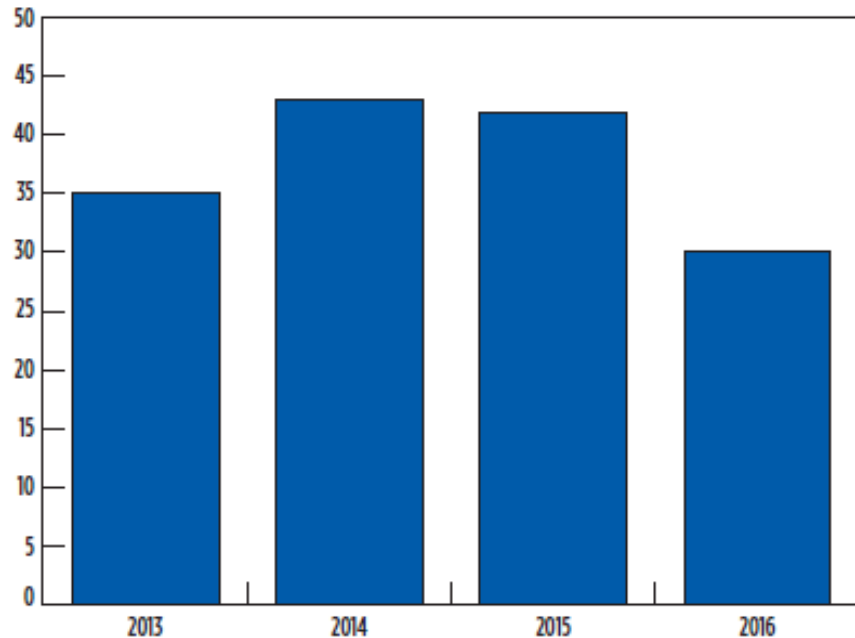


Distillation capacity additions, 2016-2021



- Asia-Pacific region will lead in distillation capacity additions through 2021
- AP will add over 3 MMbpd of distillation capacity over the next 5 yrs
- Led by projects in China and India

Asia-Pacific



New petrochemical project announcements in the Asia-Pacific region, 2013-2016.

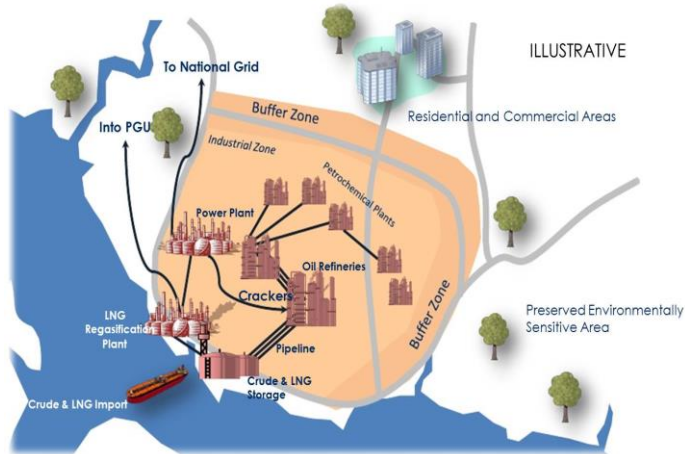
- The region will lead in petrochemical demand and production for the foreseeable future
- Fun facts you can share with friends at the dinner table that will make you sound smart:
 - Region represents 1/3 of total global ethylene capacity,
 - Over half of the world's propylene capacity,
 - Nearly 70% of the world's methanol capacity
- China/India will be the leaders in petchem capacity
- New petchem projects #s down from 2014
- Region is short on ethylene, especially with closing/consolidation of Japanese naphtha crackers

Asia-Pacific



INDONESIA

- Production falling/consumption rising
- \$25 B Refinery Development Master Plan
 - Balongan, Cilacap, Dumai, Plaju, Balikpapan
- New refineries???
- 35 GW program...got gas, we need it!



MALAYSIA

- Economic Transformation Program
 - Pengerang Integrated Petroleum Complex
 - RAPID
- Bintulu
- PFLNG 1 and PFLNG 2



SOUTH KOREA

- S-Oil's RUCP and ODC projects
- Expanding petrochemical capacity
- New LNG capacity going online during falling demand

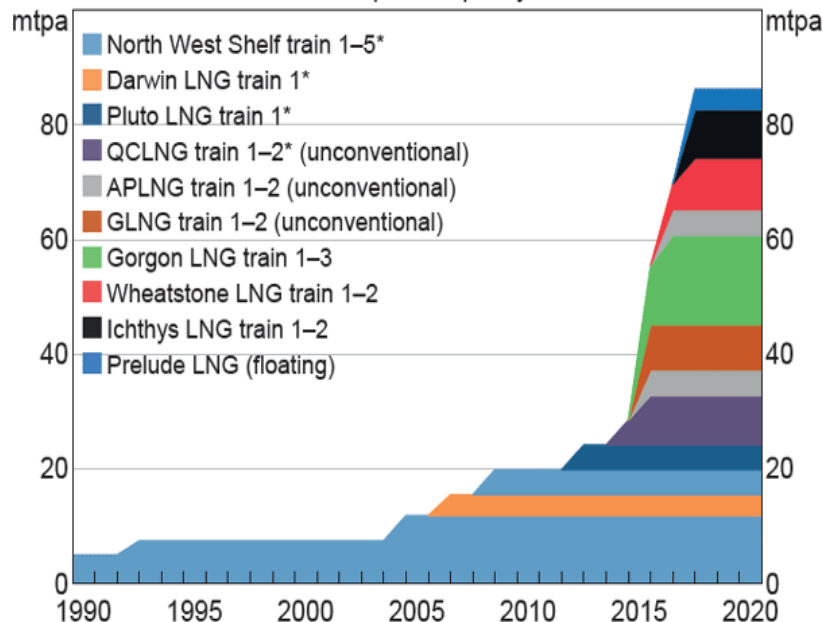


VIETNAM

- Refining/Petrochemical buildout – part of country's 2020-2025 plan
- Five large-scale projects: Dung Quat expansion, Nghi Son, Vung Ro, Nam Van Phong, Long Son...Nhon Hoi (cancelled)

Australian Liquefaction Capacity

Nameplate capacity



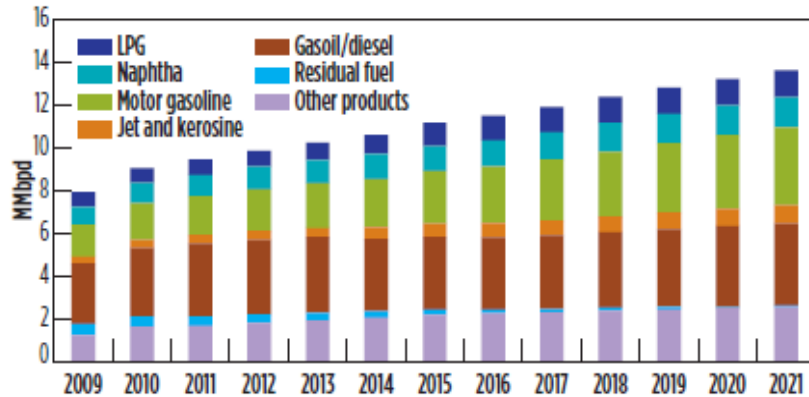
* Indicates projects currently producing LNG; only train 1 of QCLNG is in production

Sources: Department of Industry (DOI); RBA

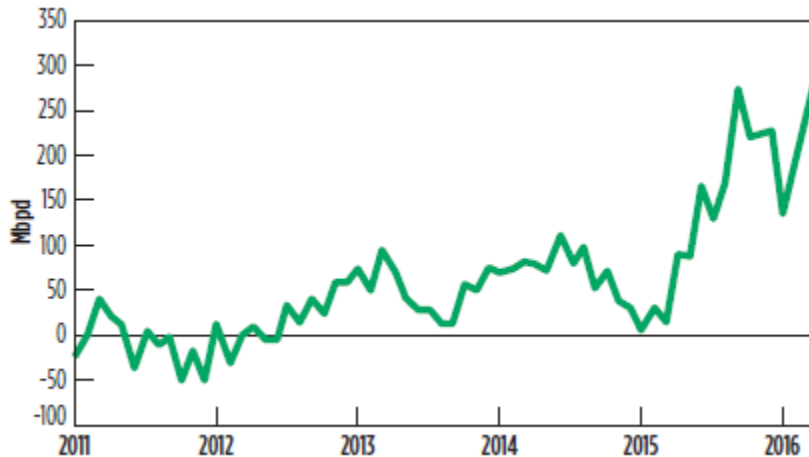
AUSTRALIA

- LNG liquefaction capacity to reach 66 MMtpy in mid-2017
- LNG exports expected to reach between 52 MMtpy and 60 MMtpy in 2017, and could eclipse 70 MMtpy in 2018

China



Chinese oil demand, 2009-2021. IEA.



China's monthly net diesel exports, January 2011-April 2016

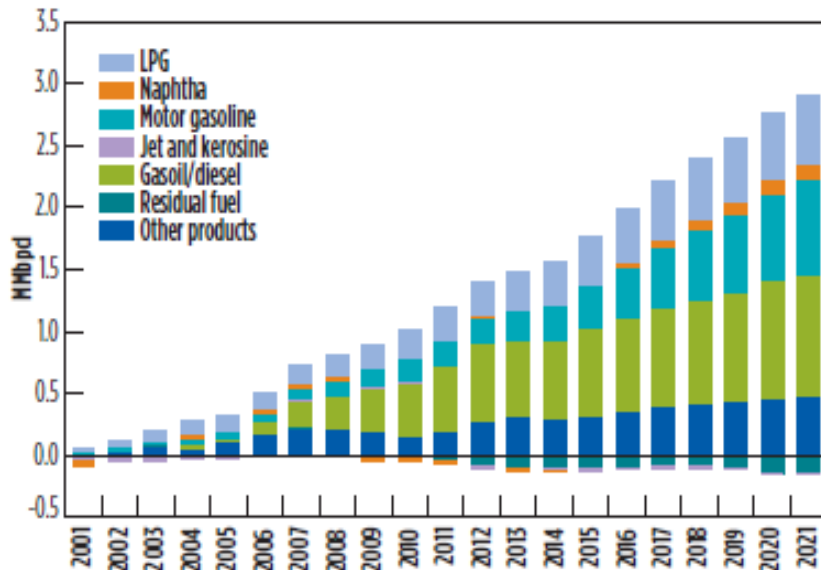
Company	Project	Capacity, Mbp/d	Completion
Sinopec	Tianjin refinery	240	2020+
Sinopec	Zhanjiang refinery	300	2019/2020
Sinopec	Hainan refinery	100	2020+
Sinopec	Luoyang refinery	160	2020
CNPC/PetroChina	Huabei refinery	100	2017
CNPC/PetroChina	Anning refinery	260	2016
CNPC/PetroChina/PDVSA	Jieyang refinery	400	2021
PetroChina/Rosneft	Tianjin refinery	200	2020
CNOOC	Huizhou expansion	200	2017
Zhejiang Petrochemical	Dayushan Island Complex	400	2020+
PetroChina/Qatar Petroleum	Taizhou refinery	300	2021+
Rongsheng Petrochemical Co.	Zhoushan Island refinery	400	2018/2020

China - Petrochemicals

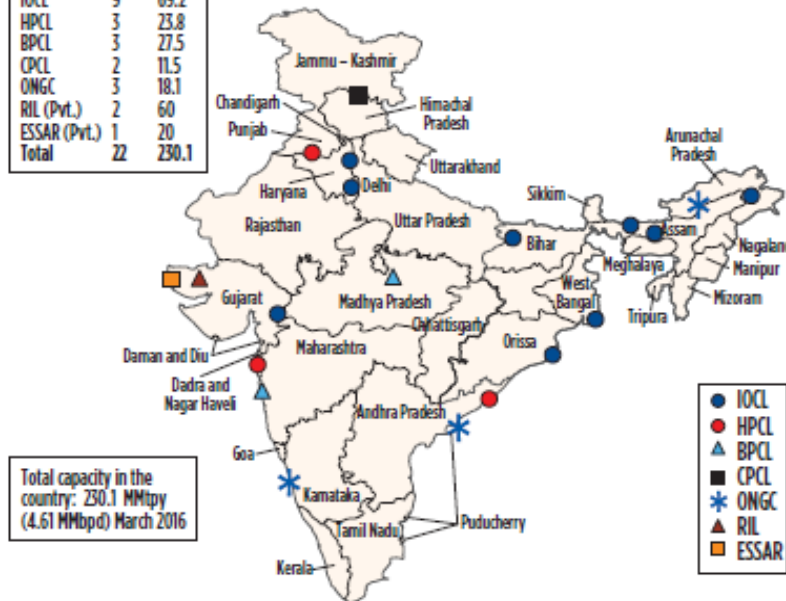


- Over \$50 B in new petrochemical capacity additions by 2020
- Looking at alternative supply routes: CTO, MTO, PDH, MTP
- Capacity growth:
 - MTO = 5 MMtpy by 2017
 - CTO = 6 MMtpy – 7 MMtpy by 2018
 - PDH = over 10 MMtpy by early 2020s

India



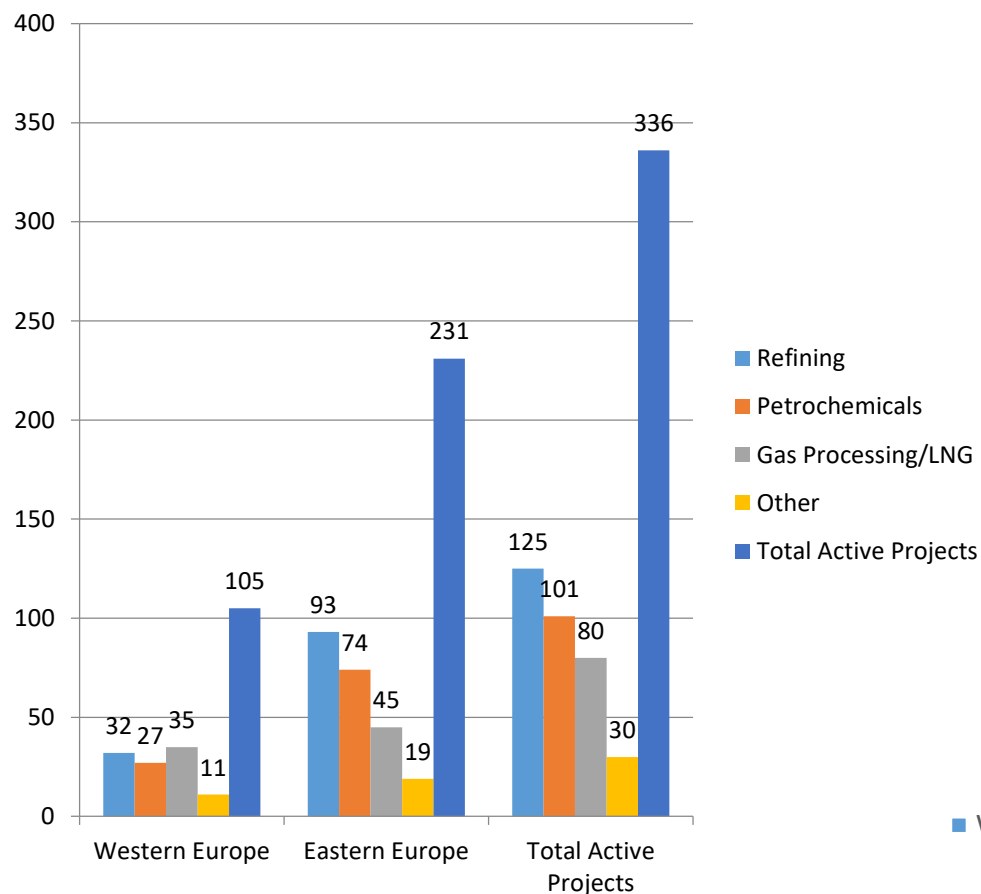
Refineries	No.	MMtpy
IOCL	9	69.2
HPCL	3	23.8
BPCL	3	27.5
CPCL	2	11.5
ONGC	3	18.1
RIL (Pvt.)	2	60
ESSAR (Pvt.)	1	20
Total	22	230.1



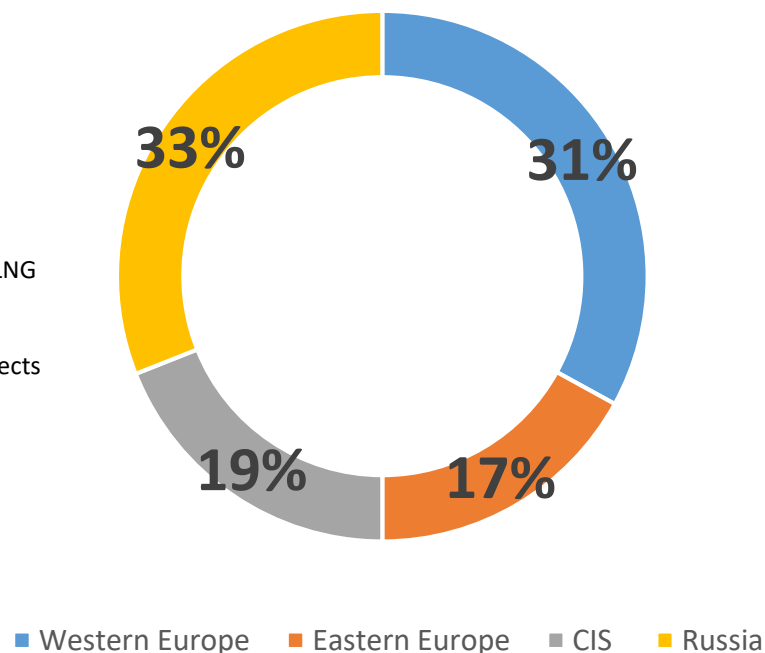
Total capacity in the country: 230.1 MMtpy (4.61 MMbpd) March 2016

Company	Refining investment
Hindustan Petroleum Corp.	Investing nearly \$8 B to increase refining capacity by two-thirds
Reliance	Investing over \$18 B in refining/petrochemical projects
Essar Oil	Investing nearly \$280 MM in upgrades to Vadinar refinery
Chennai Petroleum	Study to increase Nagapattinam refinery capacity nine-fold
Indian Oil Corp.	\$600 MM to upgrade Paradip refinery, also \$6 B to expand domestic refining capacity by early 2020s
Bharat Petroleum Corp.	Invested \$4 B in Kochi refinery (operating)
Numaligarh Refinery (BPCL subsidiary)	\$3 B Numaligarh refinery expansion project
IOCL, BPCL, HPCL, Engineers India	Study for \$15 B west coast refinery

Total active European projects by region and sector, 2016



Total active European projects by sector



Market share of active projects in the European region

Russia - Refining



Rosneft – Tuapse Refinery



Rosneft – Achinsk Refinery



Rosneft – Komsomolsk Refinery



Lukoil – Volgograd Refinery

- \$55 B modernization program to produce higher-quality fuels
- Focuses on upgrading/conversion capacity
- Rosneft and Lukoil led charge on refinery upgrades
- Additional projects underway from GazpromNeft's Omsk refinery, NeftGaz's Afipsky refinery, etc.

Commonwealth of Independent States (CIS)

KAZAKHSTAN

- Atyrau refinery modernization, \$697 MM, completion 1Q 2017
- Shymkent refinery modernization, \$2 B, completion 2017
- Pavlodar refinery modernization, \$2 B, completion 2018
- A fourth refinery?
- Atyrau \$2-B integrated complex – produce up to 500 Mtpy of PP

AZERBAIJAN

- Oil and Gas Processing and Petrochemicals Complex has restructured
- Heydar Aliyev refinery expansion and upgrade project
- Sumgait petrochemical complex

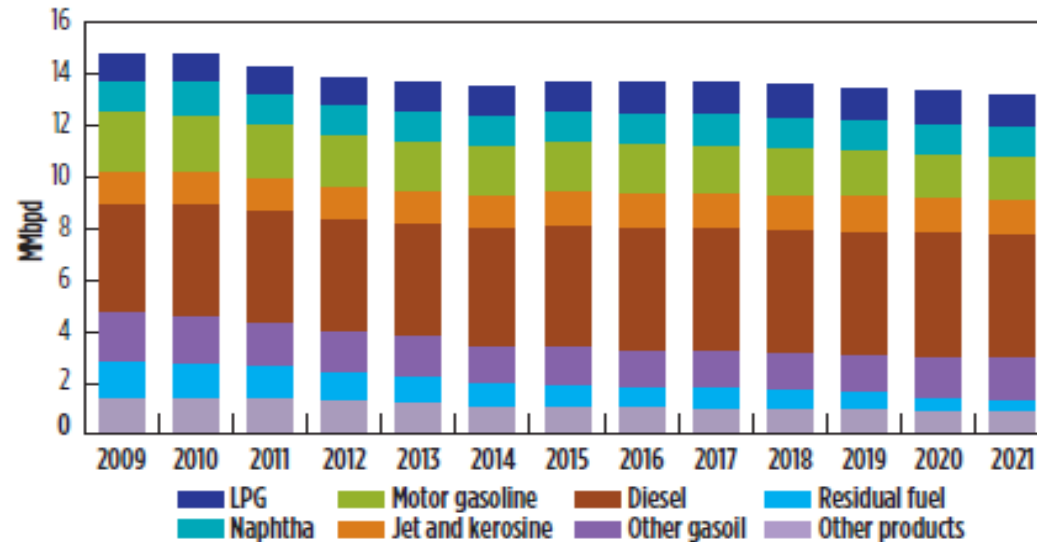
TURKMENISTAN

- Kiyanly petrochemical complex - \$7 B
- Garabogaz fertilizer project - \$1.3 B
- Ovadan-Depe GTL project, the country's second GTL facility

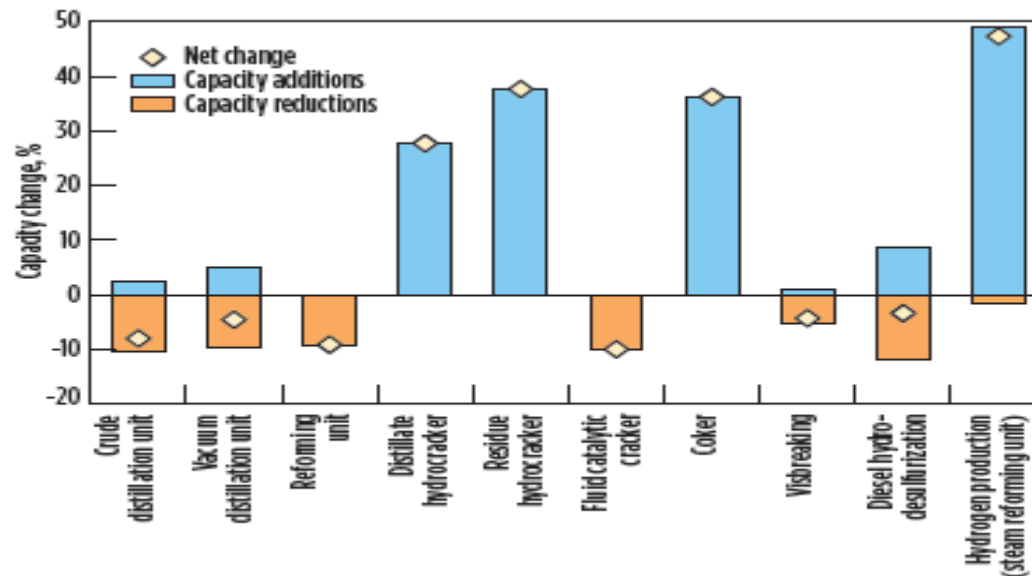
UZBEKISTAN

- Surgil Natural Gas Chemicals (\$4 B) project completed in late 2015
- Navoiy ammonia-urea plant (2-Mtpd of ammonia, 1.75 Mtpd of urea)
- Oltin Y'ol GTL plant
- Kandym Gas Processing Plant

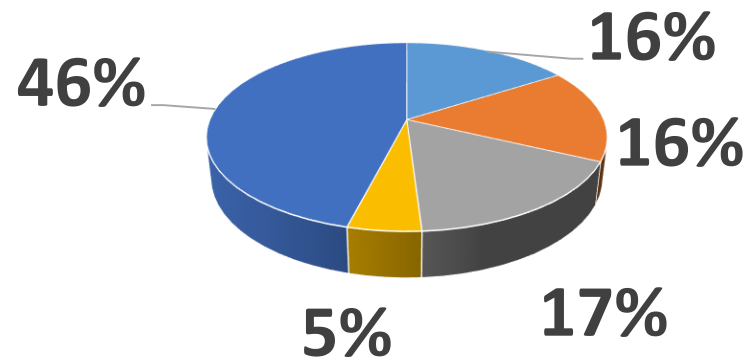
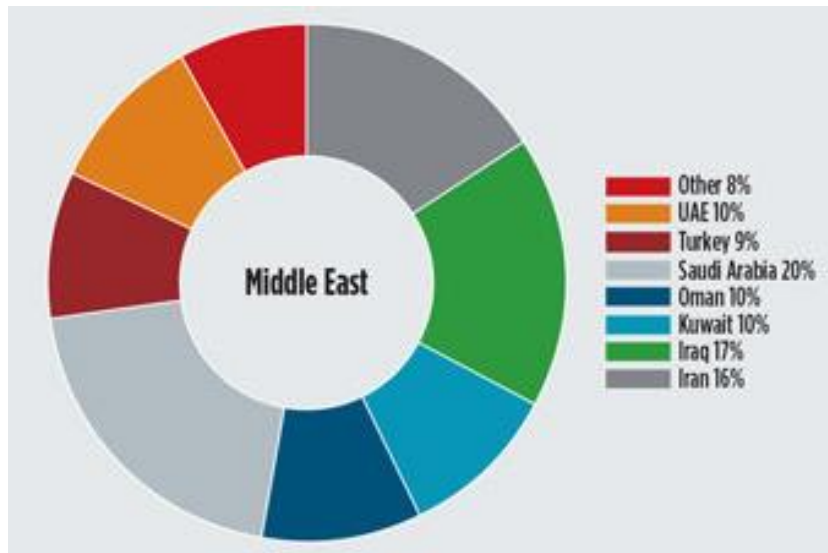
Western Europe



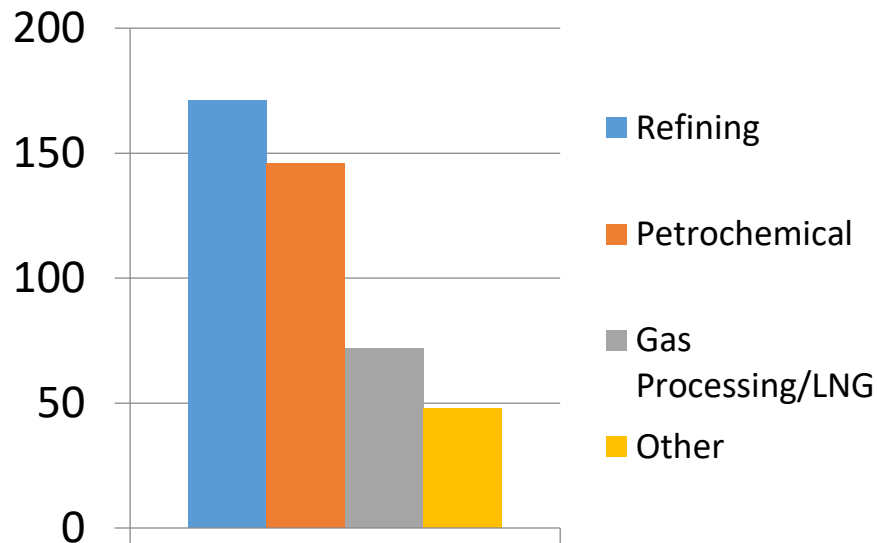
- OECD Europe rode the wave of high margins for the past two years, but is it delaying the inevitable?
- EU still suffers from:
 - Surplus processing capacity
 - Competition from ultra-modern refineries
 - Imbalanced product mix
 - Energy efficiency laws/regulations
- Push for renewable and biofuels usage
- Europe 2020 Program (20-20-20)
 - Reduce GHG emissions by 20% from 1990 levels
 - Increase share of renewable energy consumption to 20% of total energy consumption
 - Achieve an increase of 20% in energy efficiency
- Low-sulfur bunker fuels
 - In ECAs – already enacted
 - Non-ECAs – 2020
- Projects focus on: upgrades, more ULSD
 - Ex. ExxonMobil & Shell's refineries in the Netherlands
 - Total's "Refining Roadmap" program in France



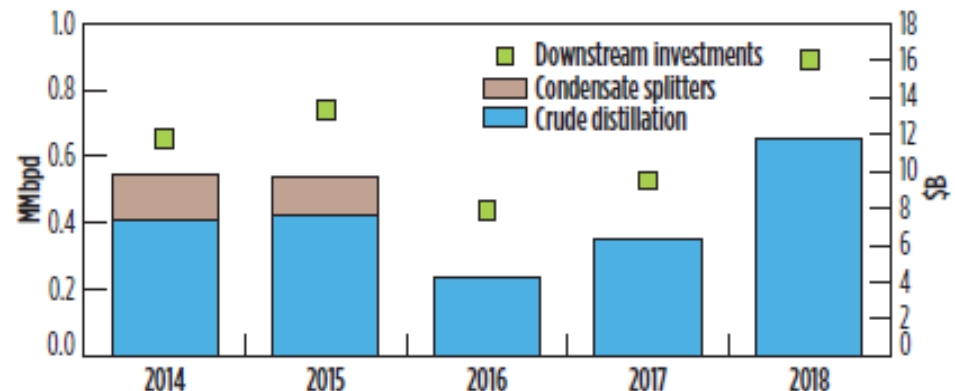
Middle East total active projects breakdown



- Engineering
- FEED
- Planning
- Study
- Under construction



Middle East



Downstream investment includes investment in secondary processes but excludes infrastructure costs beyond refinery gate.

Refining capacity additions in OPEC member countries

Saudi Arabia leads the way



- Saudi Arabia continues to develop its refining and petrochemical sector with multiple multi-billion-dollar projects
- Investing heavily in its Transformation Program (Vision 2030)
- Added 800 Mbpd since 2014 with startup of Satorp and Yasref refineries
- Clean fuels project initiative (near-zero sulfur fuels)
- \$60 B in petrochemical investment through 2020
- Utilize natural gas for power gen instead of burning oil. Program centers around three large-scale plants: Fadhili, Wasit, Midyan

Saudi Arabia - Petrochemicals



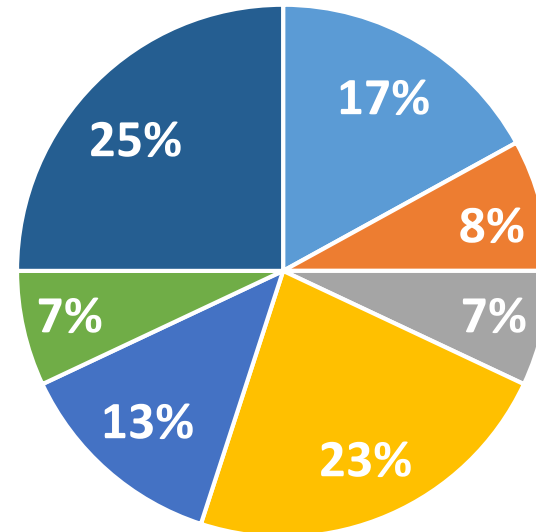
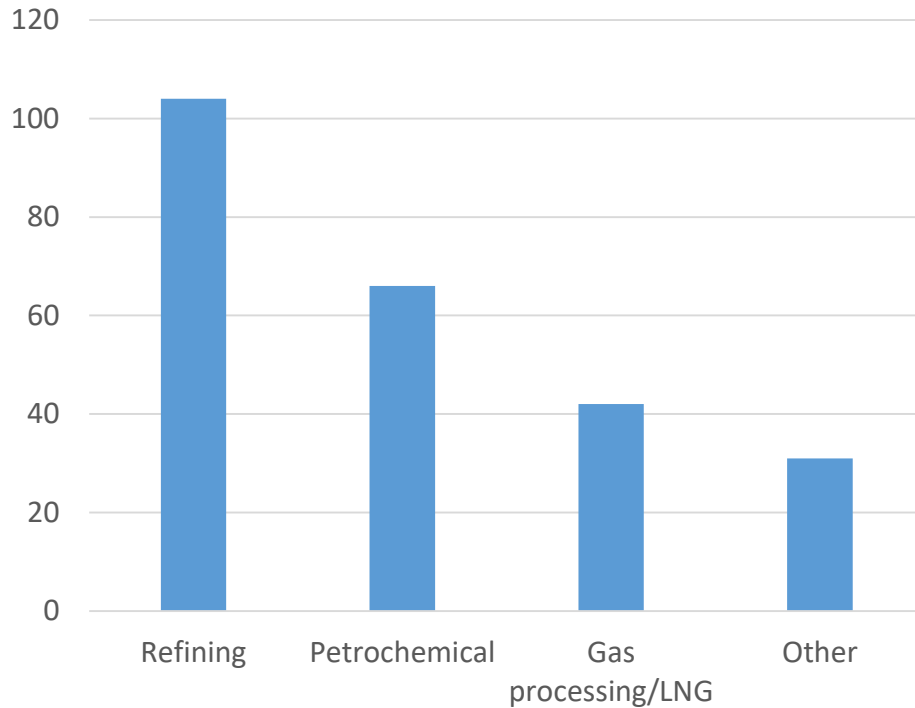
- Petrochemical production build-out is a major initiative of Vision 2030
- Saudi Arabia investing over \$60 B in its petchem sector
- Major projects:
 - Rabigh II expansion
 - Sadara complex
 - Jubail MMA/PMMA plants
 - Waad Al Shamal Phosphate
 - Ma'aden ammonia project
 - Saudi Kayan ethylene capacity exp.
 - Sabc oil-to-chemicals?
- Feedstock price reforms:
 - Ethane: \$0.75/MMBtu to \$1.75 MMBtu
 - Methane: \$0.75/MMBtu to \$1.25/MMBtu

COUNTRY	PROJECT	CAPACITY	COST	COMPLETION
Oman	Sohar Refinery Improvement Project (SRIP)	60 Mbpd (expansion)	\$2 B	1Q 2017
Oman	Liwa Plastics Project	880 Mtpy (HDPE), 300 Mtpy (PP)	\$6.5 B	4Q 2019
Oman	Duqm Refinery and Petrochemicals Complex	230 Mbpd	\$6 B (\$9 B if petrochemical complex is built)	2019
UAE	Jebel Ali Expansion and Upgrade Project	70 Mbpd (expansion)	\$1 B	2020
UAE	Fujairah Refinery	200 Mbpd	\$3.5 B	2019
Turkey	SOCAR Turkey Aegean Refinery (STAR) Project	10 MMtpy	\$5.6 B	1Q 2018
Bahrain	Sitra Refinery expansion	100 Mbpd (expansion)	\$5 B	2019
Qatar	Laffan Refinery 2 (LR2) project	140 Mbpd	\$1.5 B	Completed 4Q 2016
Iraq	Karbala, Missan, Kirkuk (?), Nassiriya (?) refineries	740 Mbpd	\$20 B	2020+
Iraq	Nibras Petrochemical Complex	-	\$11 B	Proposed
Kuwait	CFP and NRP projects	@ 679 Mbpd	\$31 B	2020
Kuwait	Olefins III	1.4 MMtpy	\$10 B	2020

- Iran needs foreign investment and construction expertise to carry out ambitious downstream buildout: Boost refining cap from 1.85 MMbpd to 3.2 MMbpd (2025), Triple petchem output to 180 MMtpy (please make the \$60 B check out to the Mr. Rouhani, seeking \$100 B to rebuild gas industry)

Latin America

Total active projects by sector

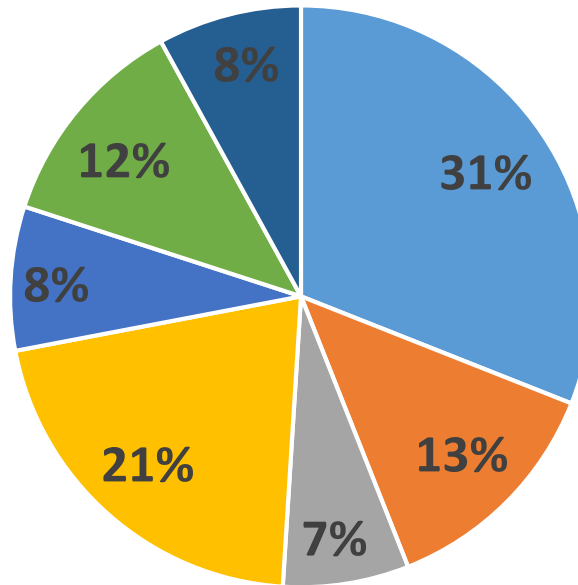


■ Brazil ■ Bolivia ■ Jamaica ■ Mexico
■ Peru ■ Venezuela ■ Other

Active project market share in Latin America

- Oil demand has increased 2 MMbpd (2004-2015), surpassing 7 MMbpd...decelerating presently
- Drop in oil prices have hammered LatAm countries dependent on oil export revenues
- Decreased revenue = little dinero to fund expansions (will rely on imports in the near-term)
- Projects are progressing:
 - Region to add over 400 Mbpd of new refining capacity through 2021

Latin America - Petrochemicals

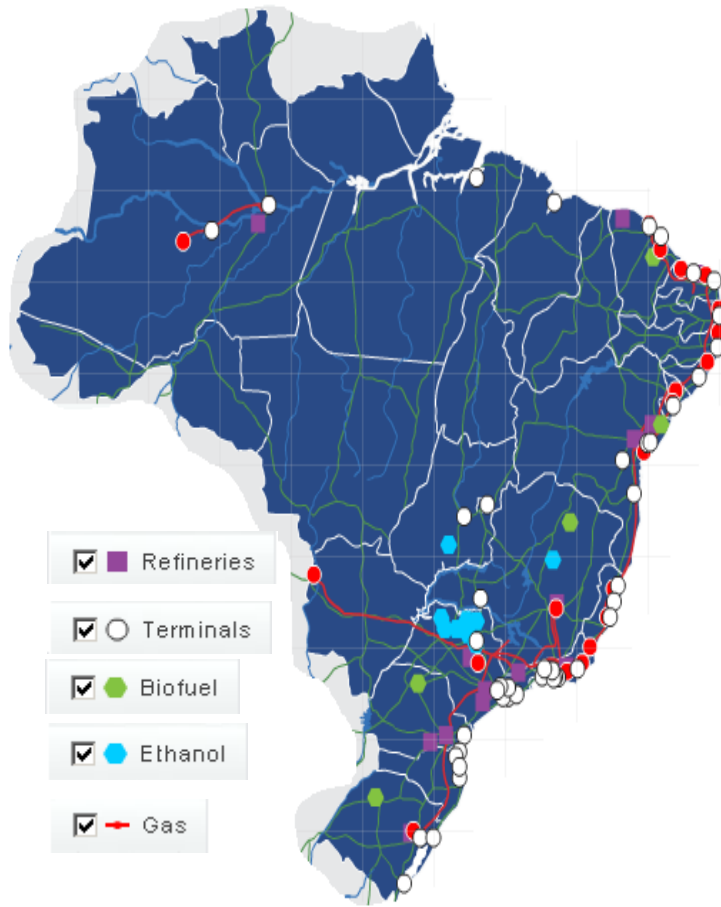


■ Bolivia ■ Brazil ■ Ecuador ■ Mexico ■ Peru ■ Trinidad and Tobago ■ Other

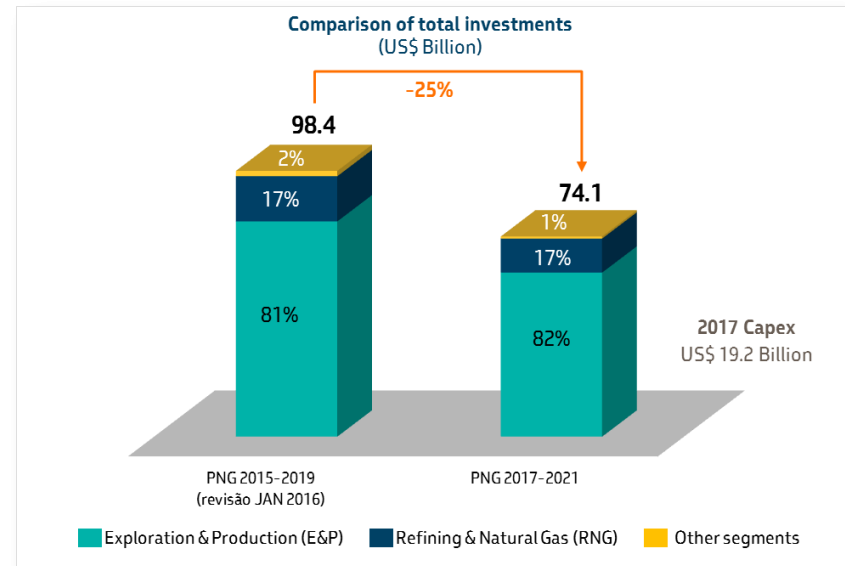
Active petrochemical project market share in Latin America

- Total active petchem projects = 60
- LatAm needs additional petchem capacity, but the investments are not there
- Large PE deficit (@ 3 MMtpy) and could continue to grow
- US to the rescue?

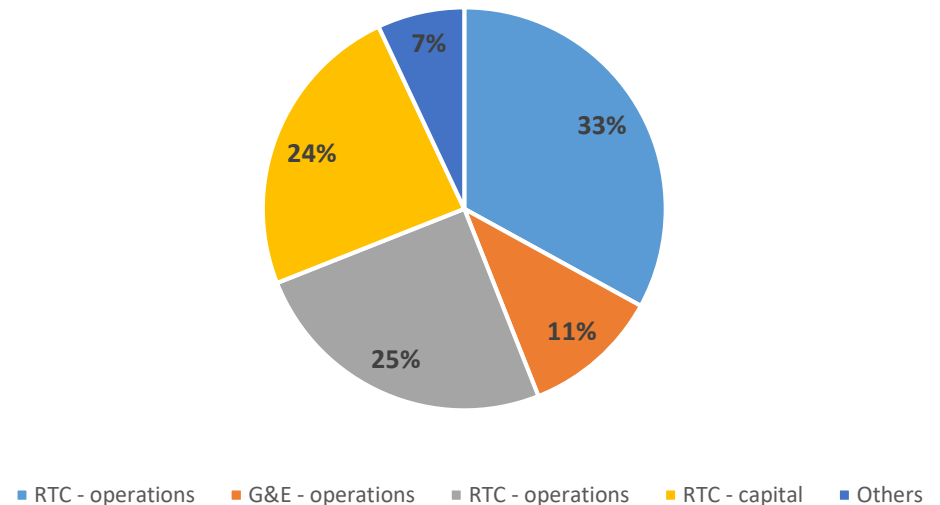
Brazil



Petrobras' capital investment plan, 2017-2021



Breakdown on Petrobras' downstream capital investment plan, 2017-2021

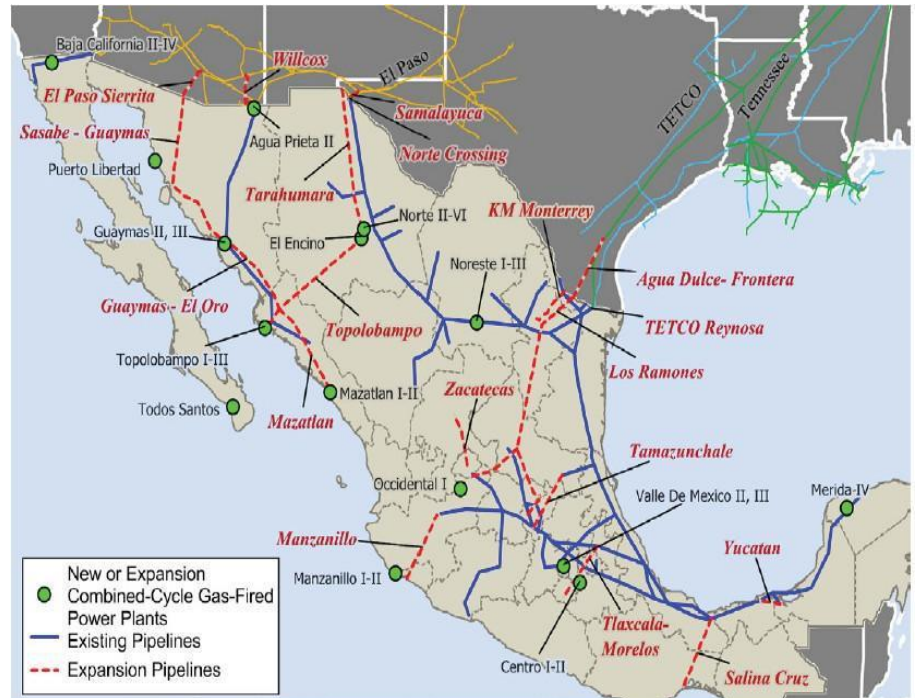


- Fuel sales dropped for a second consecutive year
- Petrobras has vowed to let the markets set the price for refined fuels, NOT government policy
- Catch 22: country needs additional infrastructure, but lacks financial strength to build it
- Ambitious refinery build out is no more, actually looking into selling stakes in refining assets
- Capital budgets have been cut severely over the past several years

Mexico



- The country has a \$23 B plan to increase the production of refined fuels and help mitigate refined fuels imports. Refineries involved:
 - Miguel Hidalgo refinery (Tula)** – \$5 B reconfiguration/expansion to produce clean fuels
 - Salamanca & Salina Cruz refineries** - \$8 B reconfiguration of both refineries, also includes the construction of the first four cogeneration projects to be developed by Pemex Cogeneration Services
 - General Lazaro Cardenas refinery (Minatitlan)** - > \$800 MM clean-fuels project
 - Hector R. Lara Sosa refinery (Cadereyta)** – building a ULSD fuel plant, sulfur recovery units, WW, etc.
 - Madero refinery** - \$1-B clean-fuels project to add two diesel hydrodesulfurization trains & addt'l facilities
- Etileno XXI (pictured)
- \$10 B in natural gas pipeline construction to fuel power plants

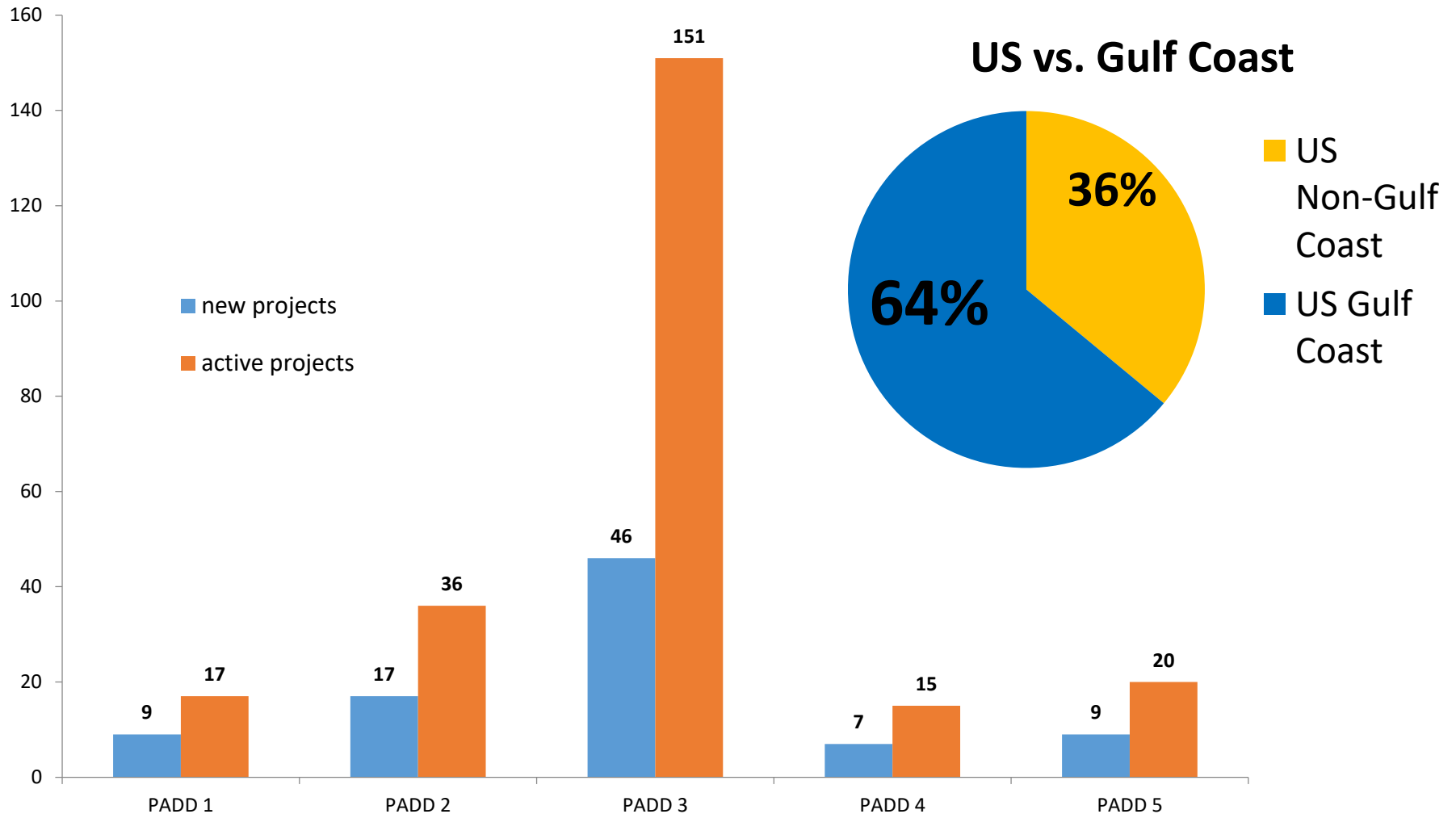


Additional notable Latin America projects

COUNTRY	PROJECT	CAPACITY	COST, US \$MM	COMPLETION
Peru	Talara Refinery Expansion and Modernization Project	30 Mbpd (expansion)	3,500	2018
Argentina	Campana refinery expansion project	87 Mbpd (present capacity that will be expanded/upgraded)	1,500	-
Jamaica	Old Harbor LNG project (FSU will be used in the interim)	138 Mcmd	-	3Q/4Q 2018
Puerto Rico	Aguirre Offshore GasPort	500 MMcfd	-	2Q 2017 the project is massively behind schedule
Peru	Arequipa Petrochemical Complex	1.2 MMtpy (PE)	3,500	2021+ no FID has been taken yet
Trinidad and Tobago	DME complex	1 MMtpy (methanol), 20 Mtpy (DME)	1,000	1Q 2019
Uruguay	GNL del Plata LNG Regasification Project (FSRU)	10 MMcfd	-	4Q 2016 3Q/4Q 2017
Jamaica	Kingston refinery upgrade project	-	1,300	-
Ecuador	Refineria del Pacifico	200 Mbpd	10,000	2020+ finalizing EPC contracts and financing
Panama	Panama LNG terminal (FSRU)	-	700 +	2019
Venezuela	Puerto la Cruz refinery expansion	50 Mbpd (x2) deep conversion units, 130 Mbpd vacuum unit, and more	5,600 8,800	2Q/3Q 2018
Bolivia	Bulo ammonia plant, Gran Chaco petrochemical complex	-	2,650	Bulo plant (4Q 2016), Gran Chaco (2020+)
Aruba	Aruba refinery reactivation project	235 Mbpd	650	2Q 2018
Curacao	Isla refinery revamp/nat gas terminal	335 Mbpd	5,500	-

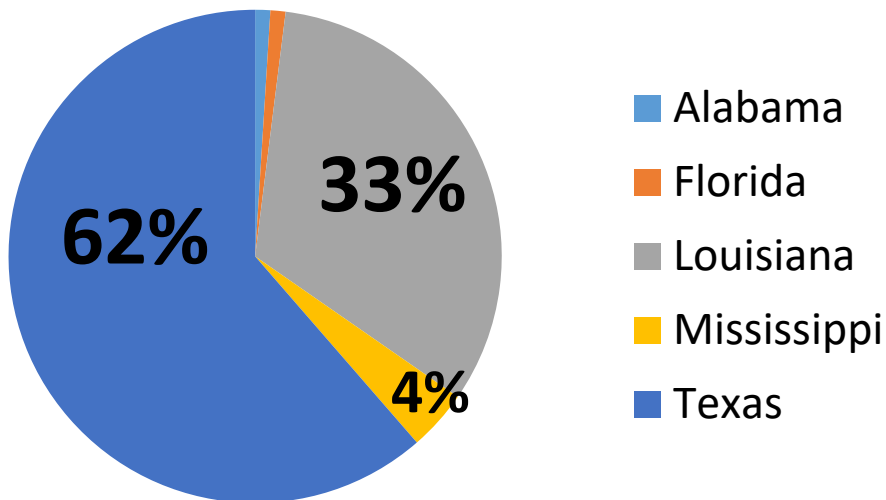
- Chile – ENAP will invest \$800 MM/yr to 2020 to mitigate energy imports. Program includes the construction of 950 MW to energy grid, modernizing/expanding Concon and Hualpen refineries, adding regas cap at Quintero LNG terminal

US new/active projects by PADD, 2015-present

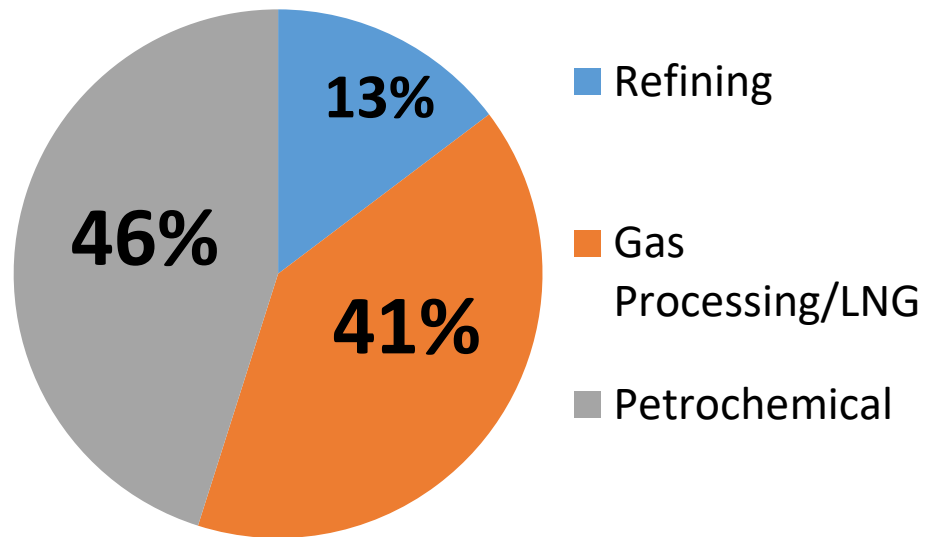


USGC market breakdown

USGC Market Share Breakout

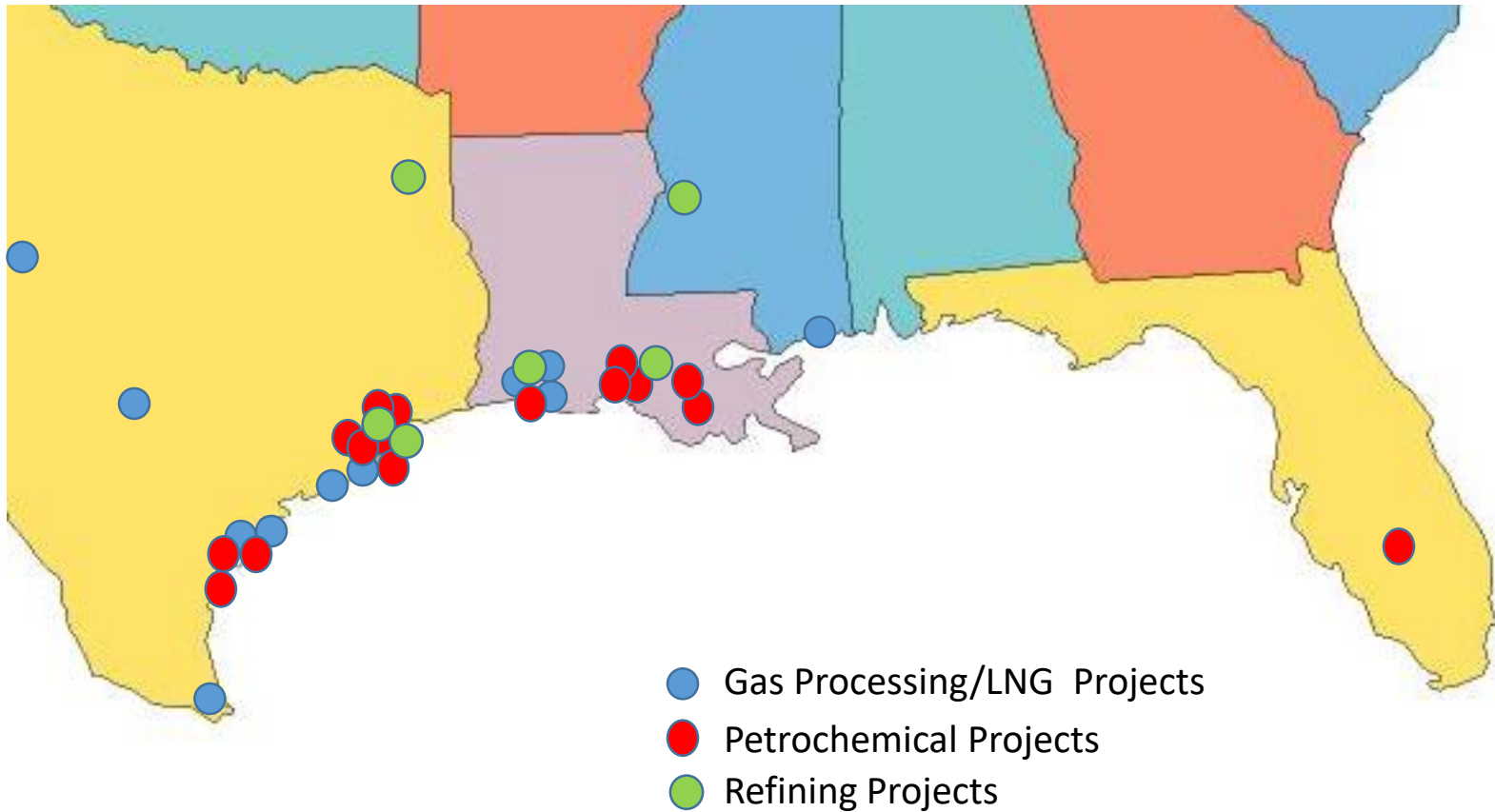


USGC Sector Breakdown

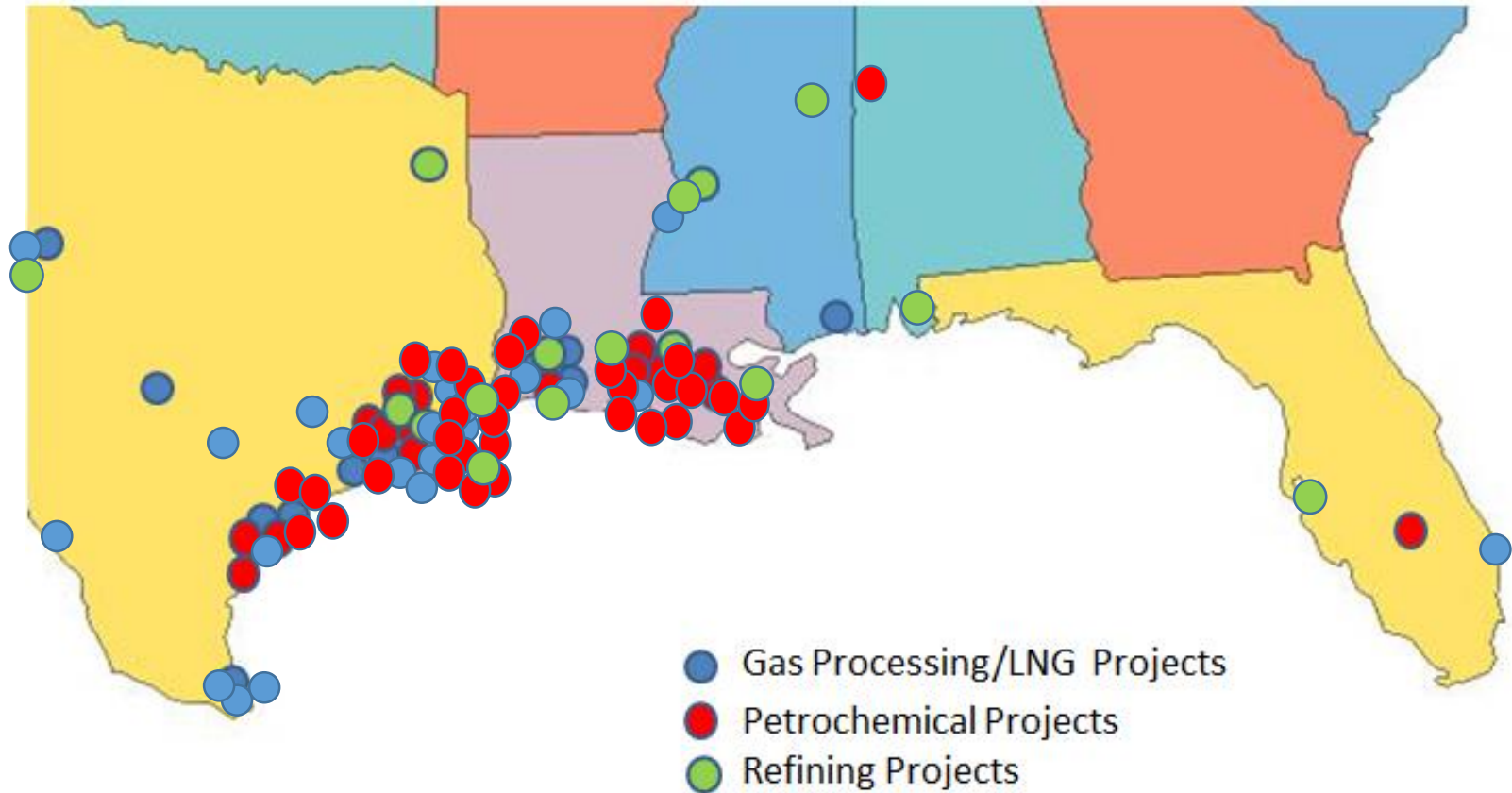


- 95% of active USGC projects are located in Texas and Louisiana
- Nearly 90% of USGC active projects are in the gas processing/LNG or petrochemical industries

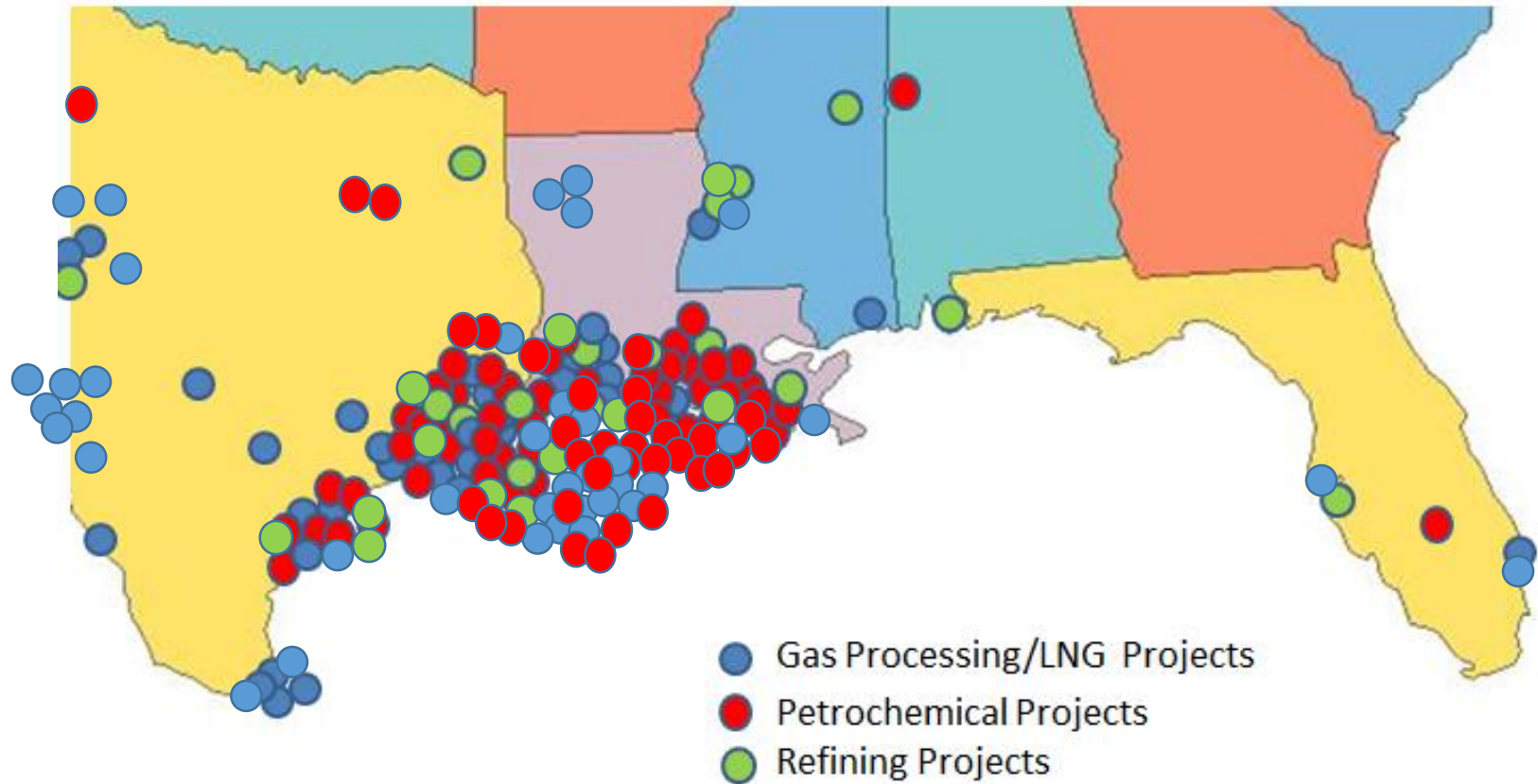
New project announcements along the Gulf Coast, 2012



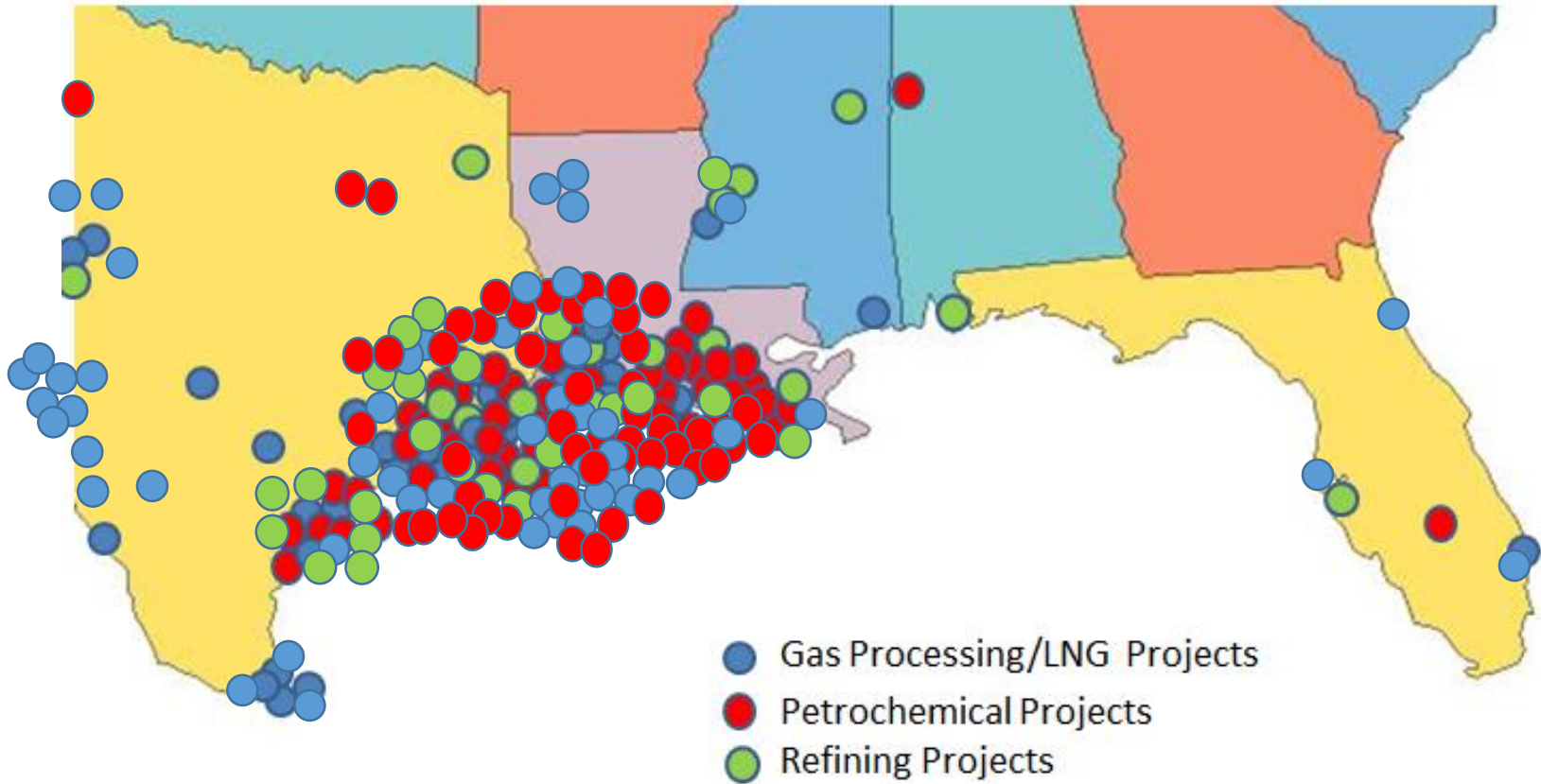
New project announcements along the Gulf Coast, 2013



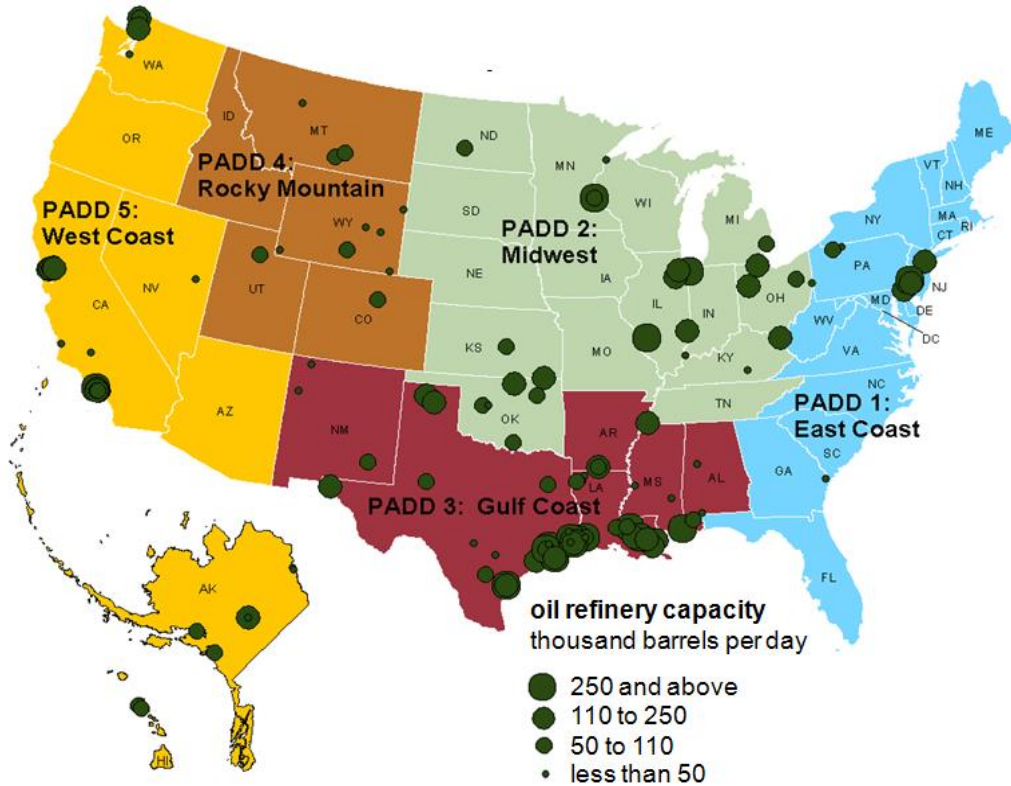
New project announcements along the Gulf Coast, 2014



New project announcements along the Gulf Coast, 2015-present



US refining capacity set to increase through 2020



- Surge in light crude refining capacity
- Upgrades to meet Tier 3 fuel regulations
- US refiners: victims of their own success?
- US fuel exports have more than quadrupled over the past 15 yrs.

PAD District	Region	Operating refineries	Total refining capacity
PADD 1	East Coast	9	1.277 MMbpd
PADD 2	Midwest	27	3.922 MMbpd
PADD 3	Gulf Coast	57	9.514 MMbpd
PADD 4	The Rockies	16	679 Mbpd
PADD 5	West Coast	30	2.924 MMbpd

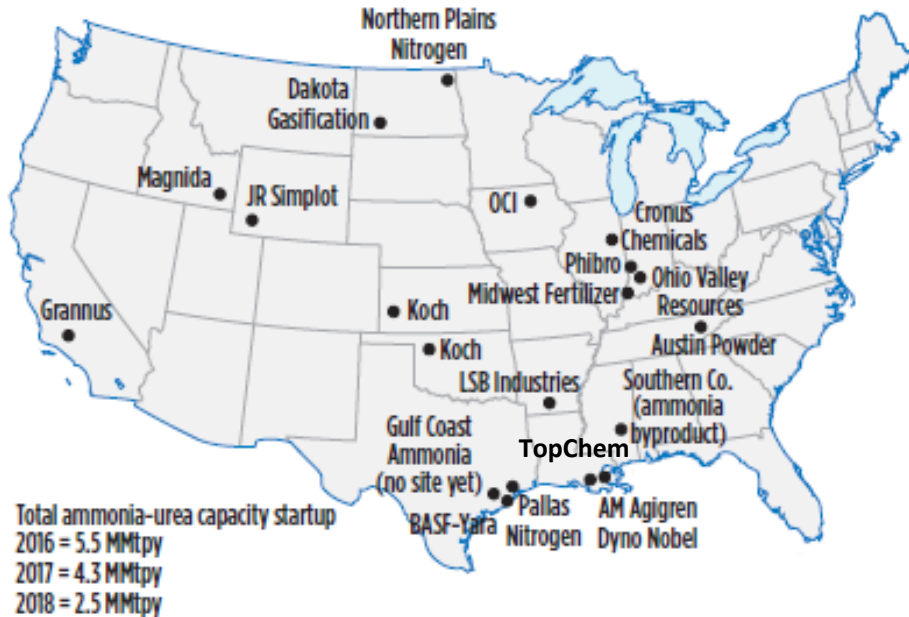
US petrochemical surge

Company	Location	Capacity	Derivatives	Startup
Dow Chemical	Freeport, TX	1.5 MMtpy	PE, LDPE, EPDM, elastomers	2Q 2017
Chevron Phillips Chemical	Cedar Bayou, TX	1.5 MMtpy	HDPE, LLDPE	3Q/4Q 2017
ExxonMobil	Baytown, TX	1.5 MMtpy	LLDPE	3Q/4Q 2017
Ingleside Ethylene (Occidental/Mexichem)	Ingleside, TX	544 Mtpy	VCM	1Q 2017
Formosa Plastics	Point Comfort, TX	1.5 MMtpy	PE, LDPE, MEG	1Q 2017
Sasol	Lake Charles, LA	1.5 MMtpy	LDPE, LLDPE, EO/EG, specialty alcohol, ethoxylates, etc.	3Q/4Q 2019
Formosa Plastics	St. James Parish, LA	1 MMtpy-1.5 MMtpy	LDPE, HDPE, EG	2020+
LACC LLC (Axial/Lotte)	Lake Charles, LA	1 MMtpy	PE	1Q/2Q 2019
Shell	Monaca, PA	1.6 MMtpy	HDPE, LLDPE	2020+
Shintech	Plaquemine Parish, LA	500 Mtpy	PVC, VCM	1Q/2Q 2018
Total	Port Arthur, TX	1 MMtpy	-	2020+
Indorama Ventures Olefins (refurbishment)	Lake Charles, LA	370 Mtpy	-	4Q 2017
PTT/Marubeni	Belmont County, OH	1 MMtpy	EO, HDPE, MEG	2020+
Williams Olefins	Geismar, LA	850 Mtpy (est.)	-	2020+

Source: Hydrocarbon Processing's Construction Boxscore Database

- Ethylene expansion projects will add an additional 1 MMtpy of capacity by 2018
- ExxonMobil-SABIC JV? If built, would be the world's largest ethane cracker
- Total ethane construction CAPEX > \$50 B

US, cont.

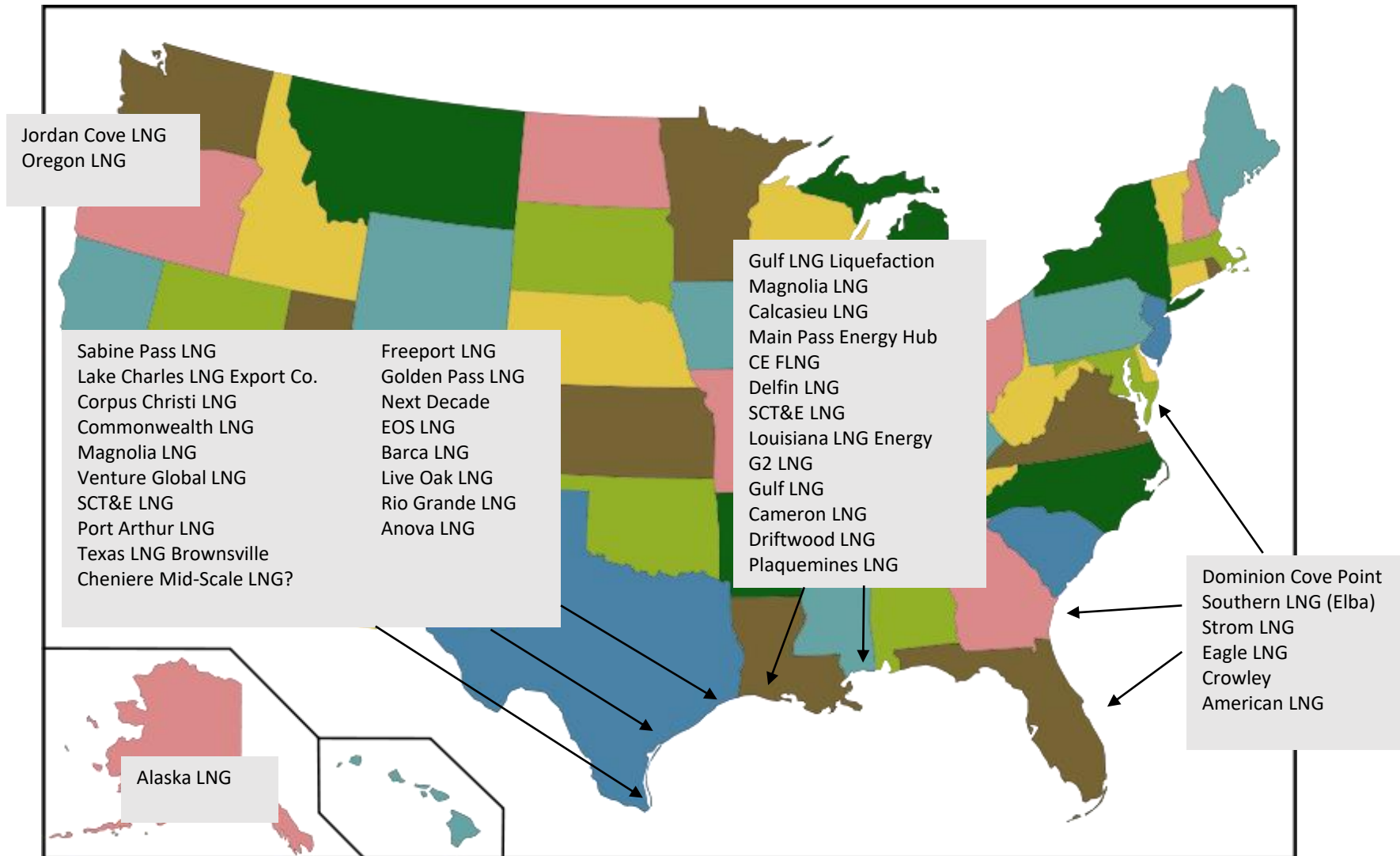


- Ammonia-urea capacity could top 12 MMtpy by 2019
 - CAPEX > \$16 B
- Methanol capacity = 15 MMtpy, could top 30 MMtpy if all projects are built (not likely though)

Active US methanol projects

Company	Location	Capacity, MMtpy	Cost, US \$ MM	Completion date
OCI (Natgasoline)	Beaumont, TX	1.75	1,600	3Q/4Q 2017
NWIW	Port of Kalama, WA	3.5	1,800	2019
NWIW	Port Westward, OR	3.5	1,800	2020+
Celanese	Bishop, TX	1.3	700-800	2020+
South Louisiana Methanol	St. James Parish, LA	1.825	1,300	2019/2020
Yuhuang Chemical	St. James Parish, LA	3 (Phase 1&2)	1,850	2018/2020
Big Lake Fuels	Lake Charles, LA	1.4	1,600	4Q 2019
Lake Charles Methanol	Lake Charles, LA	1	5,000 (includes pet coke/CCS)	2020

US LNG Export Terminal Projects



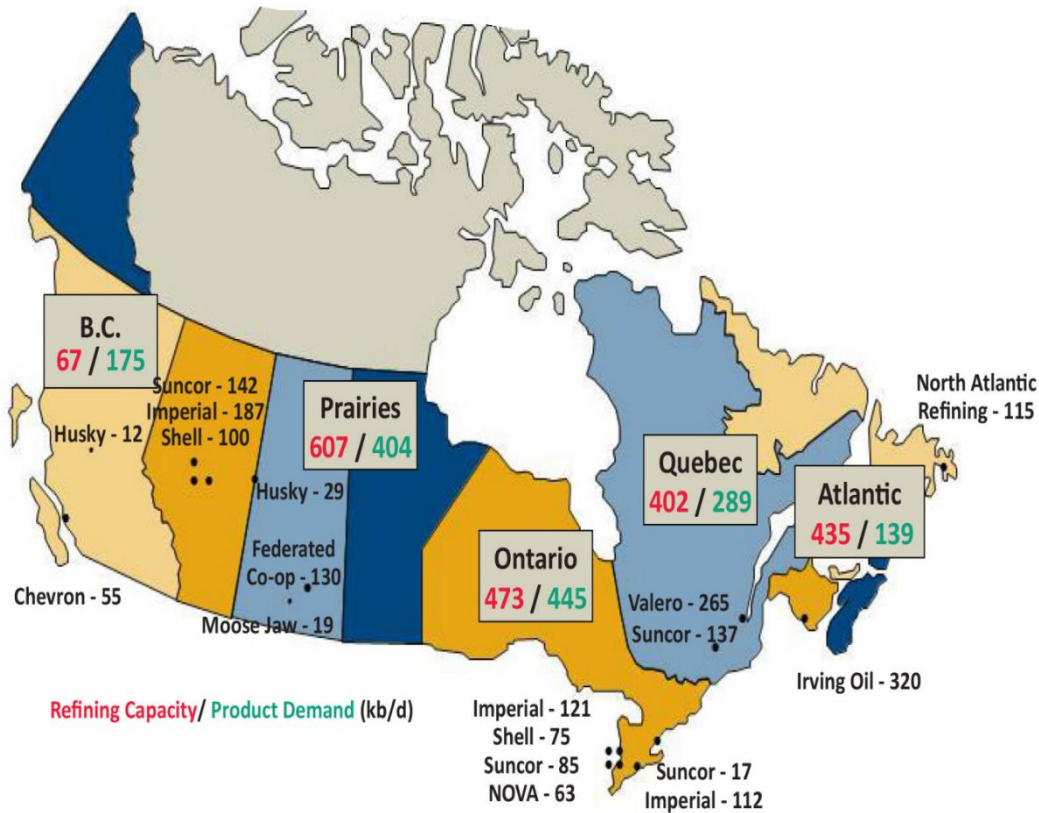
- US is the world's leading gas producer
- Surge in LNG project announcements
- Over 3 dozen LNG export projects have been announced
- Equates to over 330 MMtpy of LNG export capacity
- Total announced CAPEX = nearly \$300 B
- Will all these go through...no

US LNG export capacity due online by 2020

Project	Location	No. of liquefaction trains	Capacity
Sabine Pass LNG	Sabine Pass, LA	5	27.5 MMtpy
Cameron LNG	Hackberry, LA	3	13.5 MMtpy
Freeport LNG	Freeport, TX	3	13.2 MMtpy
Cove Point LNG	Lusby, MD	1	5.75 MMtpy
Corpus Christi LNG	Corpus Christi, TX	2	9 MMtpy

- Second wave of projects could add nearly 30 MMtpy
 - Additional trains at Sabine Pass, Freeport, Corpus Christi, Elba Island, Magnolia LNG and Cameron LNG

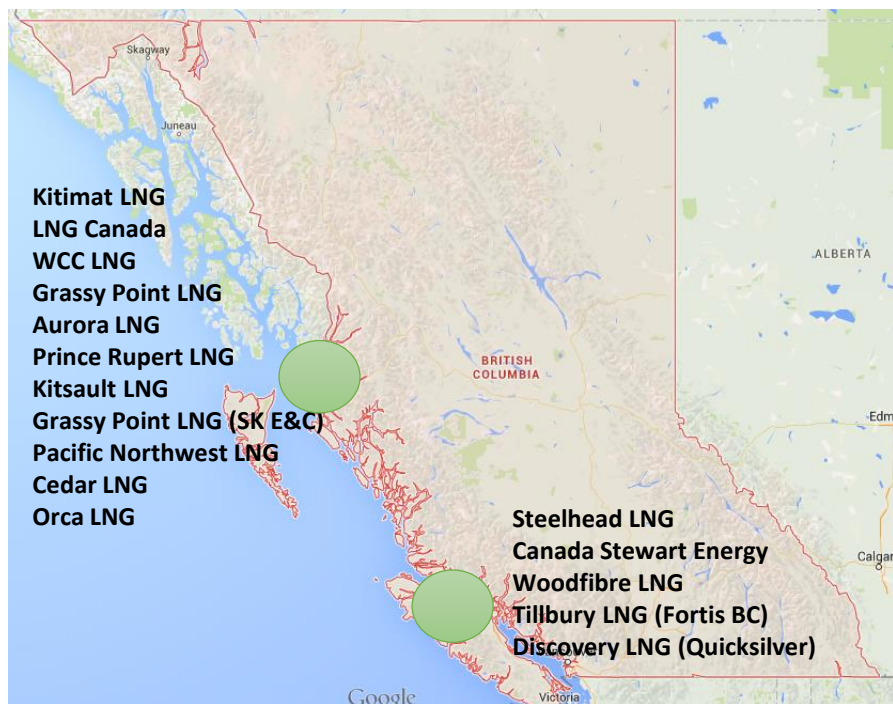
Canada refining sector and proposed facilities



Canada's refining capacity equals 2 MMbpd at 16 operating facilities

Kitimat Clean & Pacific Energy Future's proposed heavy oil refinery projects

Canadian LNG



Proposed LNG terminal projects in British Columbia

- Nearly \$170 B in announced projects
- 217 MMtpy – 250 MMtpy in LNG export capacity



Proposed LNG terminal projects on Canada's East Coast

- \$24 B in planned projects
- Over 38 MMtpy of LNG export capacity

Thank you for your time!

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