USA & Canada Chemical Industry Outlook

Presented By:

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Industrial Info Resources, Inc.

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Rice Global E&C Forum
Engineering & Construction

Complete Industrial Market Coverage

Power

- ELECTRIC POWER GENERATION AND TRANSMISSION & DISTRIBUTION

Energy

- TERMINALS
- PIPELINES
- PRODUCTION
- ALTERNATIVE FUELS
- PETROLEUM REFINING

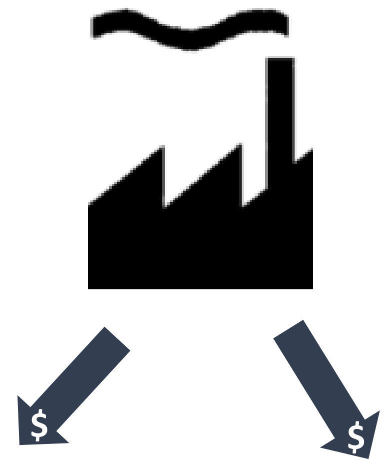
Industrial Infrastructure

- INDUSTRIAL MANUFACTURING
- CHEMICAL PROCESSING
- PULP, PAPER & WOOD
- METALS & MINERALS
- FOOD & BEVERAGE
- PHARMACEUTICAL & BIOTECH

Project Analysis Underlying Methodology

IIR Market Intelligence Core Service Offering

400+ researchers



Capital Expenditures [Grassroot, Unit Additions, Expansions]

Maintenance, Repairs & Overhaul Spending

Globally we are tracking:

157,000 projects globally
189,000 plants globally
285,000 installed unit assets
<u>51,000 future offline events</u>
Plus much more: boilers, turbines, compressors

Total Investment Value
Project Status (Planning, Engineering, Under Construction)
Project Milestones (AFE, RFQ, Bid Doc, KO, Completion)
Project Scope & Key Equipment Needs
Key Personnel Contacts – Plant Owners, Plant Operators & Contractors

Chemical Processing Industry

More than 1,100 chemical types across the supply chain

Upstream Feedstock

1,144 Chemical Product SIC Codes

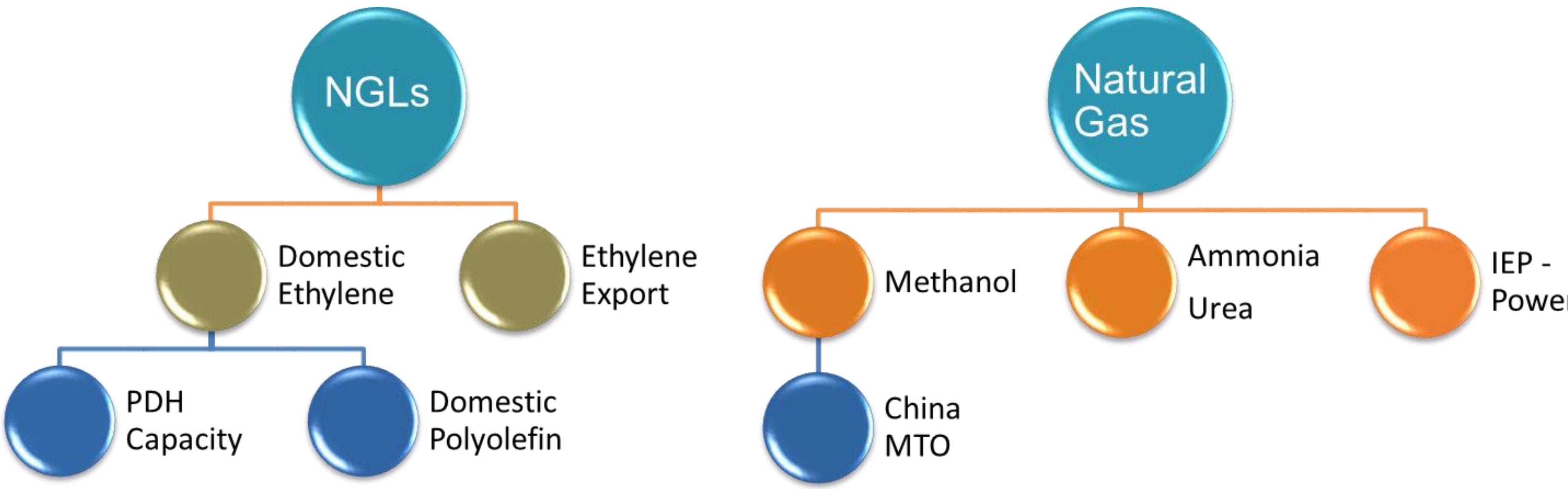
	Base Chemicals	Intermediates
Petrochemicals	Ethylene, Methanol, Propylene, Cyclohexane, Ethylbenzene, Cumene, Phthalic Anhydride, Butadiene, Phenol	Ethylene Oxide/Glycol, Acetic Acid, VCM, Acrylonitrile, Adipic Acid, Alcohols, Vinyl Acetate, Acrylic Acid, EDC, Propylene Oxide, Aniline, Benzene, Isocyanates, Maleic Anhydride, Nitrobenzene, Styrene, Toluene, TDI, MDI, Styrene Monomer, LAB, Isocyanurates
Plastics & Rubbers	Polyethylene, Polypropylene, Polyvinyl Chloride, Styrene-Butadiene Rubber	EP Rubber, Acrylates, Polybutadienes, Polyethylene Terephthalate, Polystyrene, Polyesters, ABS Resins, Elastomers, Nylon, Epoxy Resins, Monomers, Specialty Polymers, Polysulfides, Neoprene, EPDM
Specialty Chemicals	Sulfuric Acid, Peroxides, Sulfide and Sulfate compounds	Chemical Catalysts, Perchloric Acid, Nickel Carbonate, Sulfur Dioxide, Sodium Phosphate, Compounds of Potassium, Nickel, Lithium, Magnesium, Sodium; Sodium Cyanide, Zinc Chloride, Sodium Hydride, Sulfur Dioxide, Calcium Sulfate,
AG Chemicals	Ammonia, Urea, Nitric Acid, UAN Solutions	Ammonium Nitrate, Aqua Ammonia, Phosphoric Acid, Ammonium Phosphates, Diammonium Phosphates, Mixed Fertilizers, Pesticides, Herbicides, Fungicides, Pyrethrin Concentrates, Plant Hormones, Lime Solutions, Ag Disinfectants, Rodent Poisons
Chlor-Alkali	Chlorine, Alkalis not produced at a mine	Sodium Hydroxide (caustic soda), Soda ash, not produced at a mine, Potassium Hydroxide, Potassium Carbonate, Sodium Carbonate, Chlorine packaging/Pool Chemicals, Washing Soda
Industrial Gases	Oxygen, Nitrogen, Argon, Hydrogen, Helium	Nitrous Oxide, Carbon Dioxide, Carbon Monoxide, Dry Ice, Acetylene
Pigments	Titanium Dioxide, Iron and Lead Oxide Pigments, Inorganic Pigments	Barium Sulfate, Ferric Oxide, Metallic Pigments, Mineral Colors and Pigments, Zinc Oxide
Fibers	Polyester Fibers, Nylon Fibers, Acrylonitrile Fibers, Acrylic Fibers, Elastomeric Fibers,	Nitrocellulose Fibers, Fluorocarbon Fibers, Non-cellulosic Yarn, Vinyl Fibers, Cigarette Tow, Acetate Fibers,
Surfactants	Emulsifiers, Surface Active Agents, Sodium Hypochlorite (bleach)	Degreasing Solvents, Polishes and Waxes, Finishing Agents (textile & Leather), Cleaning Compounds, Disinfectants, Foam Control Agents, Sulfonated Greases, Engine Treatment Chemicals, Soaps
Other Chemicals	Carbon Black, Explosives, Drilling Mud	Adhesives, Core Wax, Correction Fluid, Deicing Fluid, Curing Compounds, Fuel Stabilizers, Glues, Fluxes, Guar Powder, Fire Retardants, Sealing/Joint Compounds, Blasting Powder, Detonators

Industrial Consumers

Oil-to-Gas Ratio

May 2014	Jan 2016	May 2018
23:1	12:1	24:1

Natural Gas and NGLs maintain their strong advantage over the price of Crude Oil
Making them the feedstock of choice for USA petrochemical producers



Source: IIR

Oil-to-Gas Ratio

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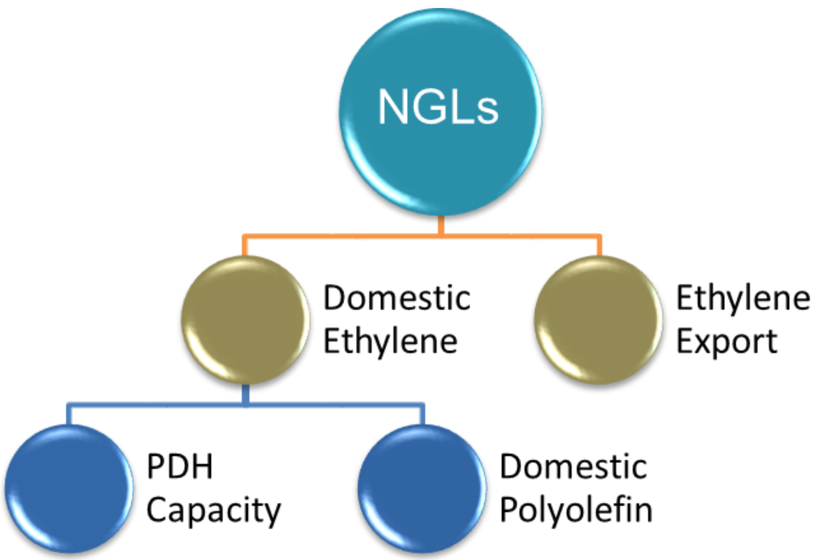
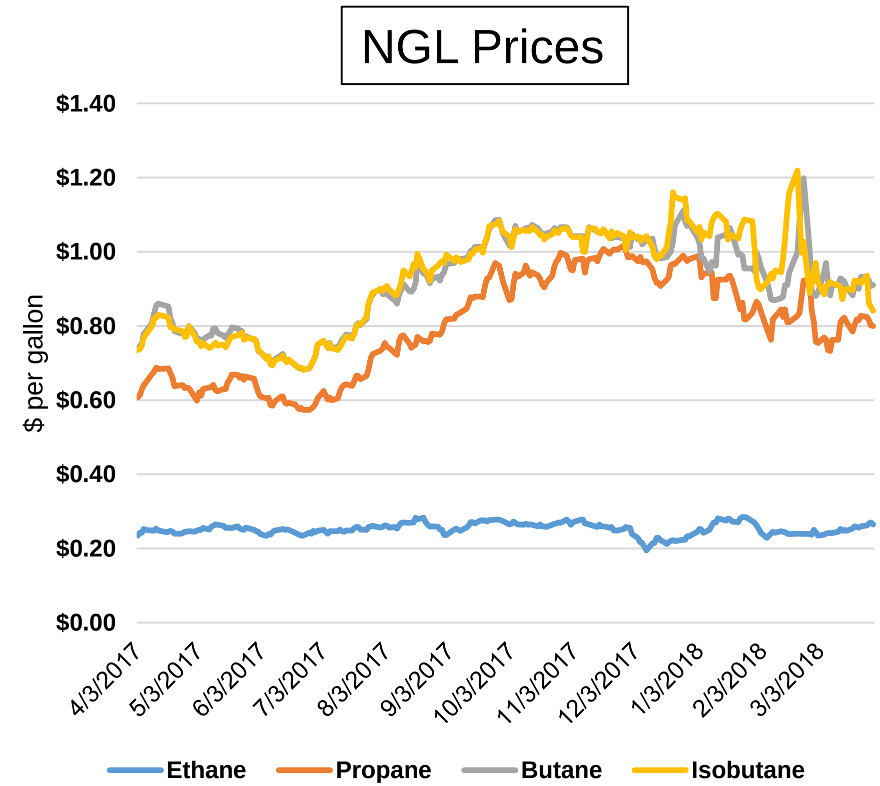
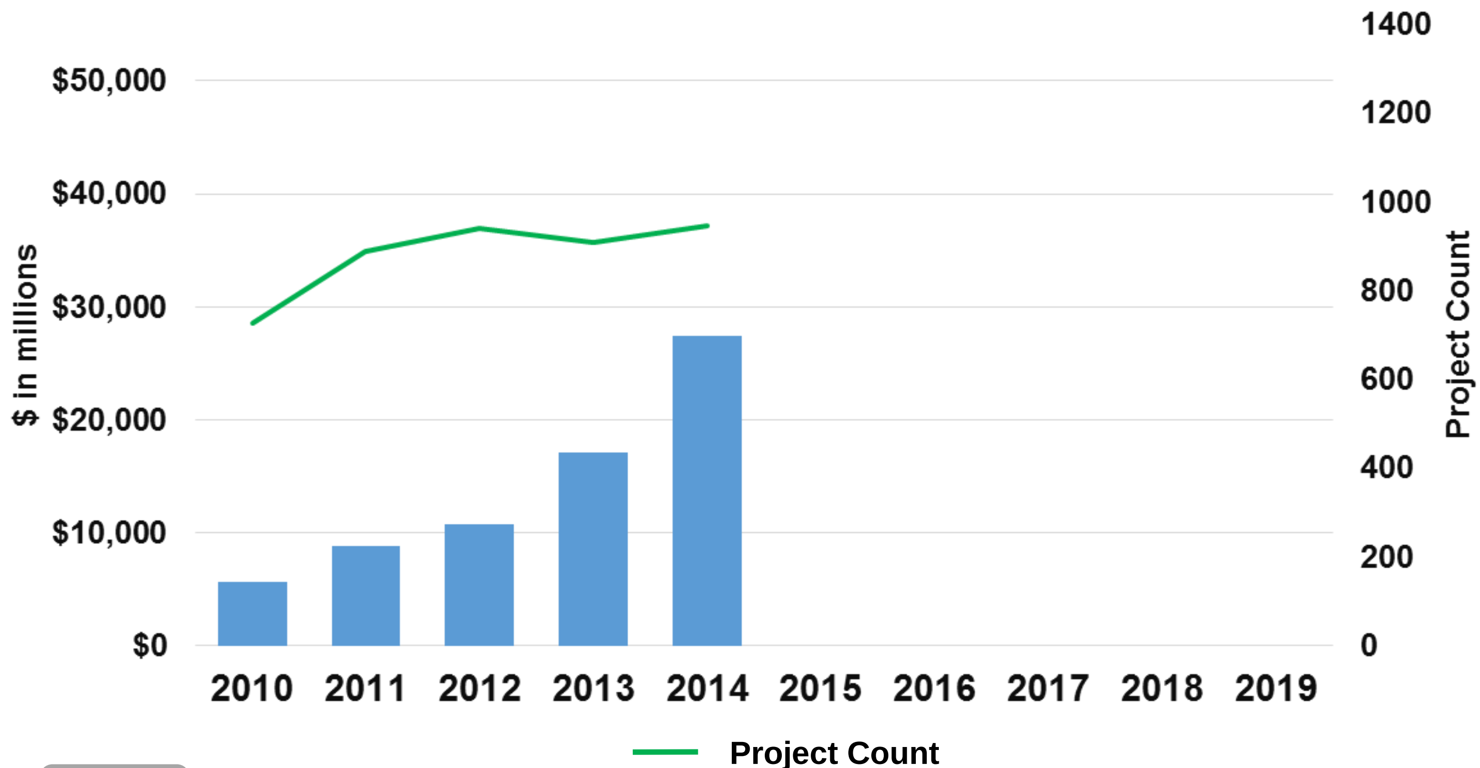




Source: Petrochem Wire

U.S. & Canada Chemical Industry

Comparison of Construction Starts by Year



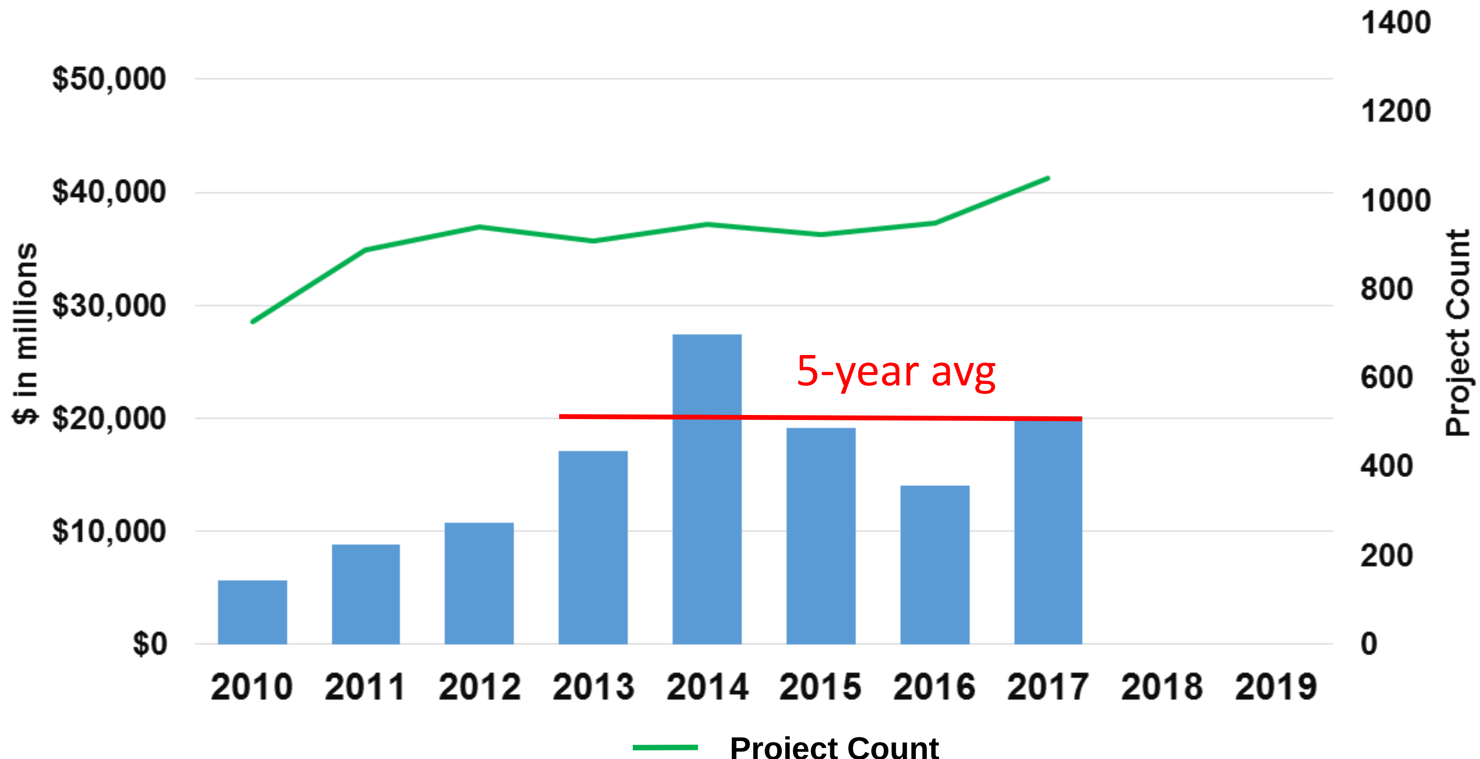
2013 $7.2 billion in new ammonia capacity

2014 $12 billion in ethylene projects; 16 billion Lbs by 2018

Source: IIR PECWeb

U.S. & Canada Chemical Industry

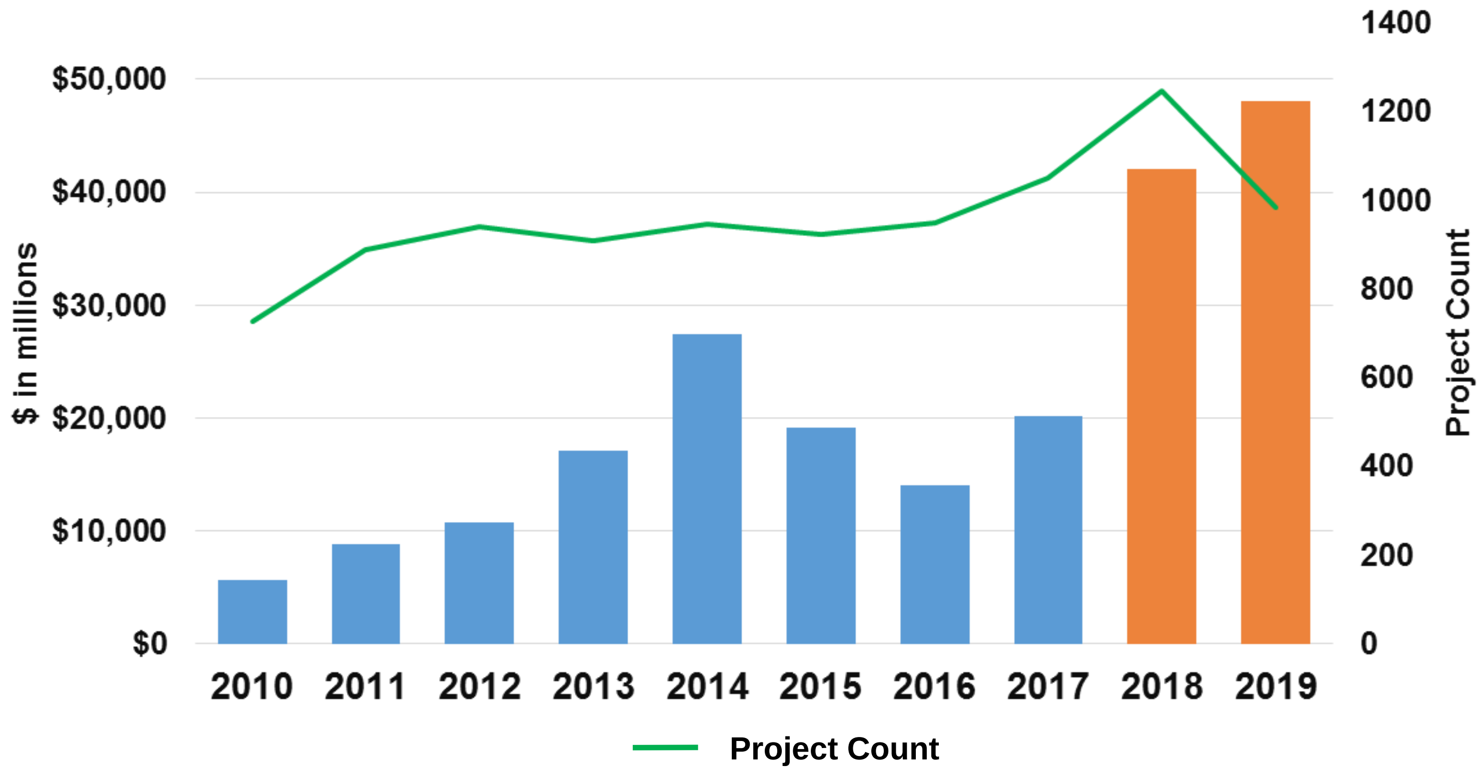
Comparison of Construction Starts by Year



2013	$7.2 billion in new ammonia capacity
2014	$12 billion in ethylene projects; 16 billion Lbs by 2018
2015	$9.5 billion in ethylene and polyethylene capacity projects
2016	$5.5 billion in derivative spending begins construction
2017	$10 billion in ethylene, methanol & derivatives

Source: IIR PECWeb

U.S. & Canada Chemical Industry
Comparison of Construction Starts by Year



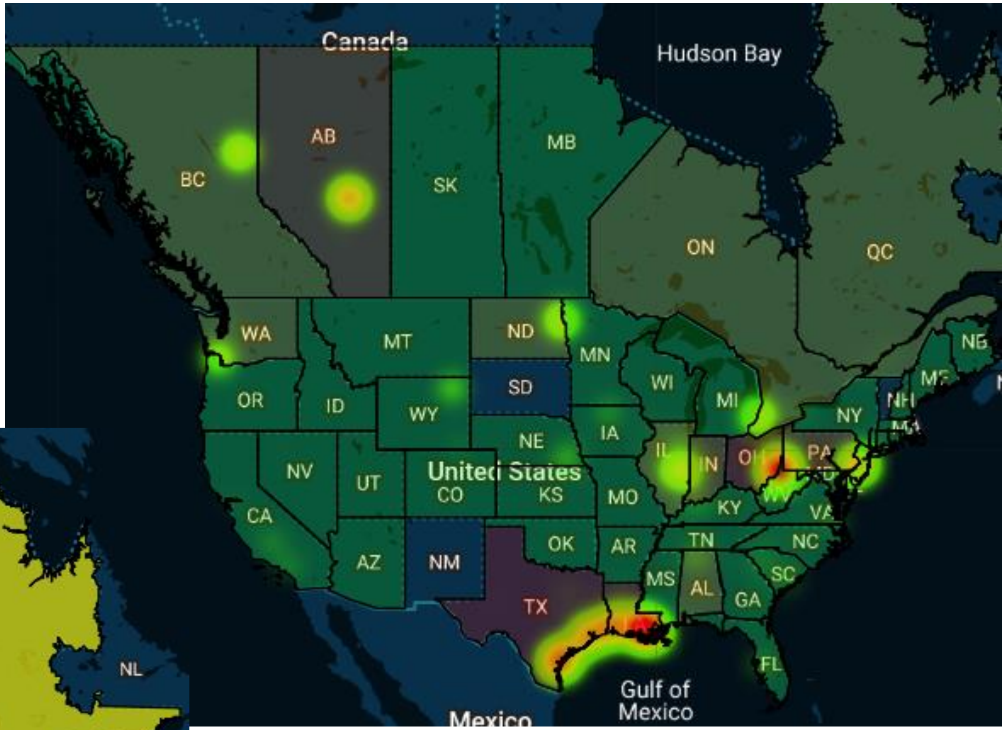
2015	$9.5 billion in ethylene and polyethylene capacity projects
2016	$5.5 billion in derivative spending begins construction
2017	$10 billion in ethylene, methanol & derivatives
2018	$20 billion in ethylene, PDH, methanol & derivatives (PE, MDI, EO)
2019	$21 billion in ethylene, PDH, methanol & derivatives (PE, PP)

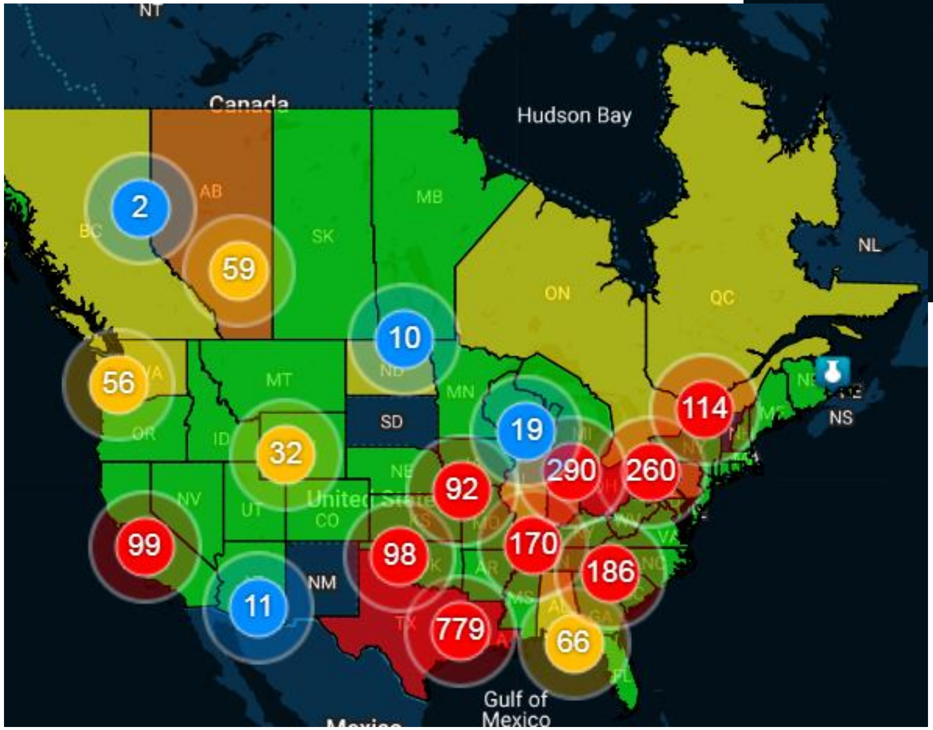
Source: IIR PECWeb

U.S. & Canada Chemical Industry

Spending Density

2018 and 2019 Construction Starts

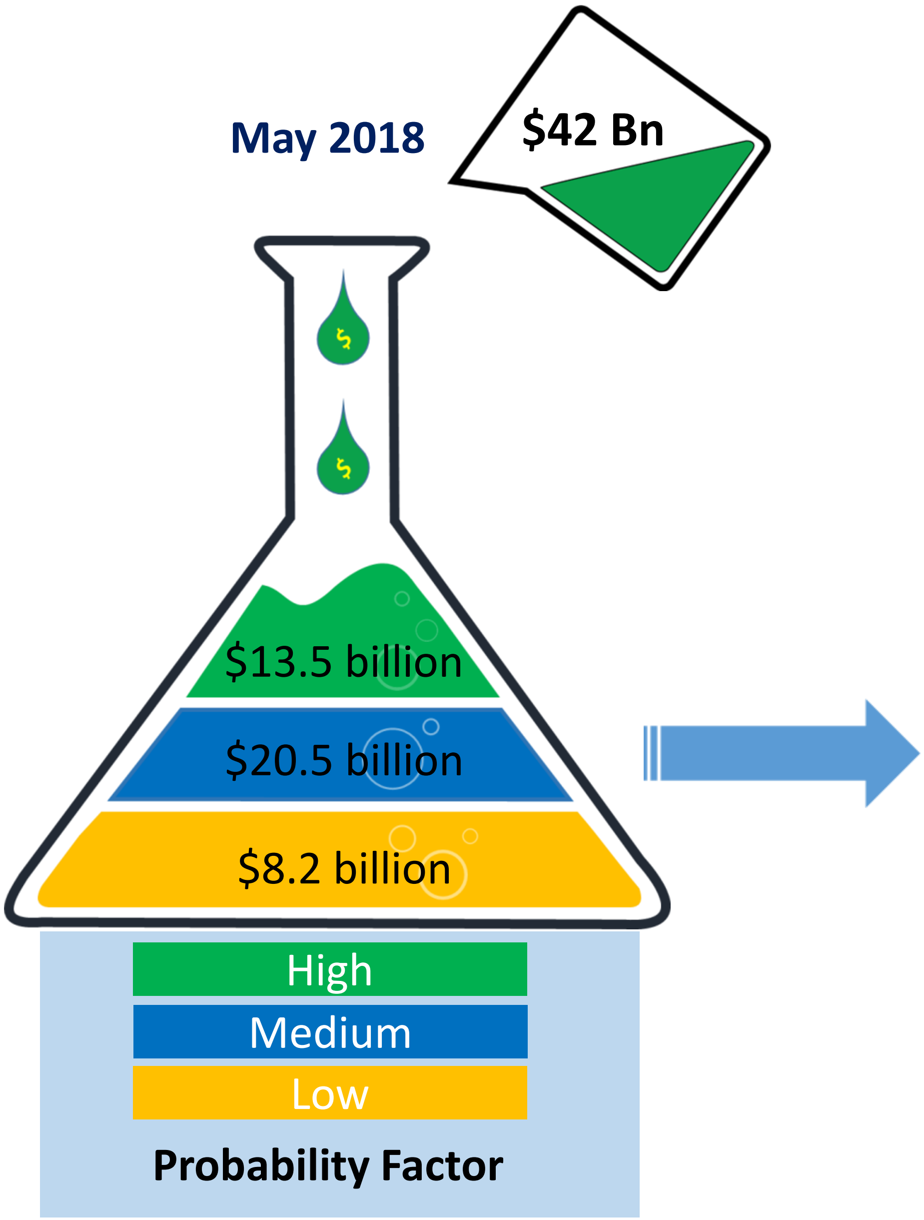




Source: IIR Geolocator

U.S. & Canada Chemical Industry

2018 Construction Starts by Probability Factor

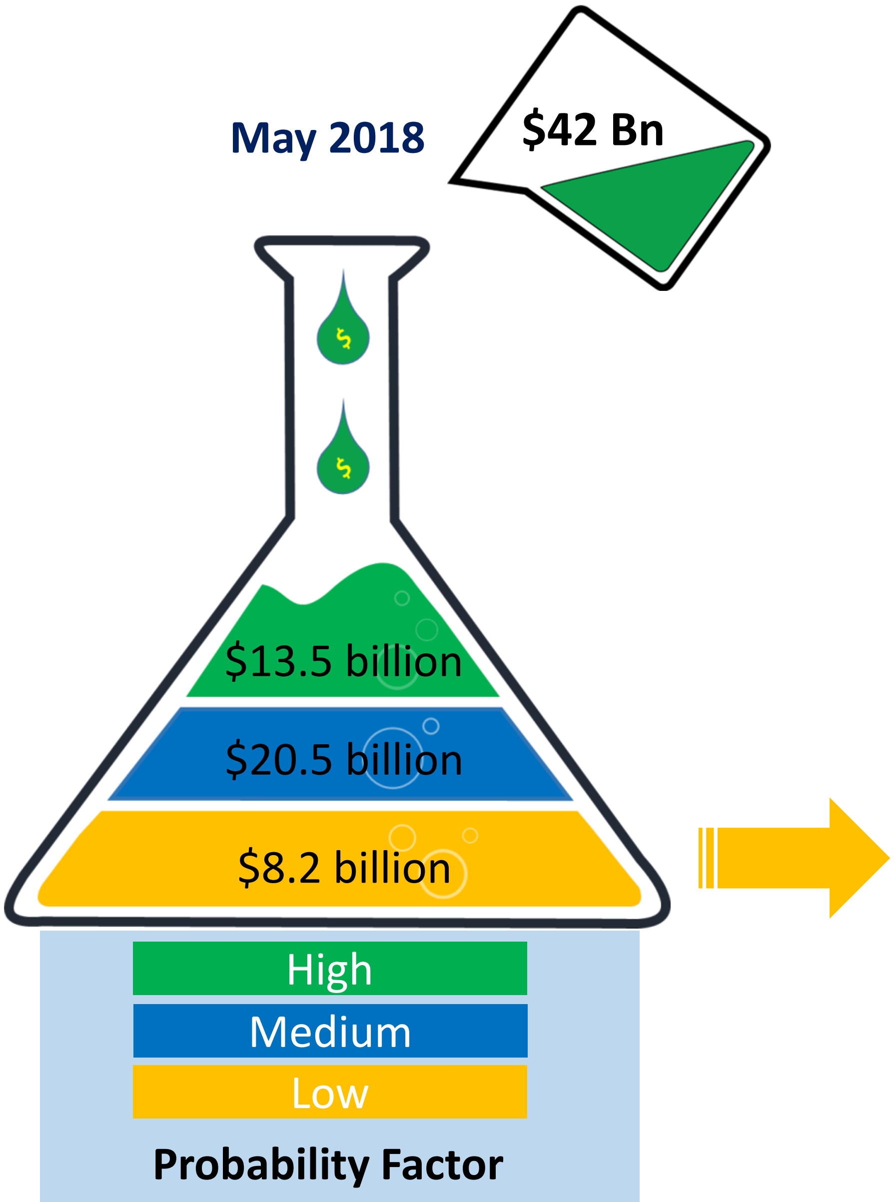


Key Commodities	$ in millions
Ethylene	$5,800
Polyethylene	$2,000
Ethylene Oxide	$2,000
Methanol	$1,375
Ammonia	$1,121

Source: IIR PECWeb

U.S. & Canada Chemical Industry

2018 Construction Starts by Probability Factor



Key Commodities	$ in millions
Methanol	$2,900
Ammonia	$1,800
Ethylene	$850

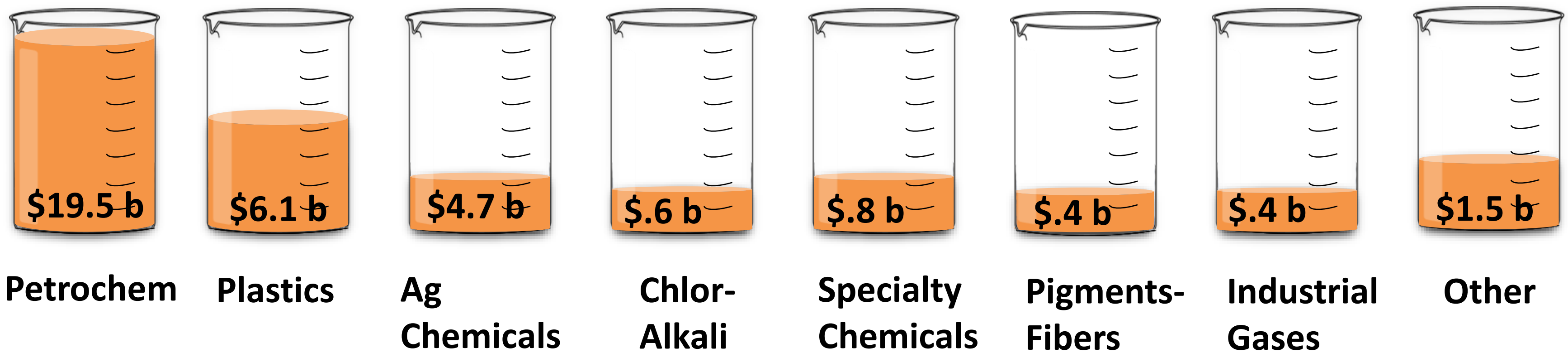
Source: IIR PECWeb

U.S. & Canada Chemical Industry

Future Outlook on spending by Sector

Projects with a High & Medium Probability planned for construction start in 2018

2018 $34 billion in potential spending



Source: IIR PECWeb

U.S. & Canada Planned Ethylene Capacity

44 billion pounds of additional capacity planned

Oil-to-Gas Ratio

May 2014	Jan 2016	May 2018
23:1	12:1	24:1

1st Wave

16.7 billion Lbs/yr
Online by 4Q18

- CP Chem
- ExxonMobil
- Formosa
- Ingleside (Oxy)
- Dow Chemical
- Shintech
- Indorama
- Sasol

2nd Wave

10.3 billion Lbs/yr
Online by 4Q20

- LACC (Lotte)
- Dow Chemical
- DowDuPont
- INEOS
- Shell
- Lyondell
- Total
- Siluria

3rd Wave

7.1 billion Lbs/yr
Online by 4Q22

- Exxon/Sabic
- Formosa
- Shintech

4th Wave

9.9 billion Lbs/yr
Online by 2023+

- Motiva
- Formosa
- CP Chem

Source: IIR PECWeb

Oil-to-Gas Ratio

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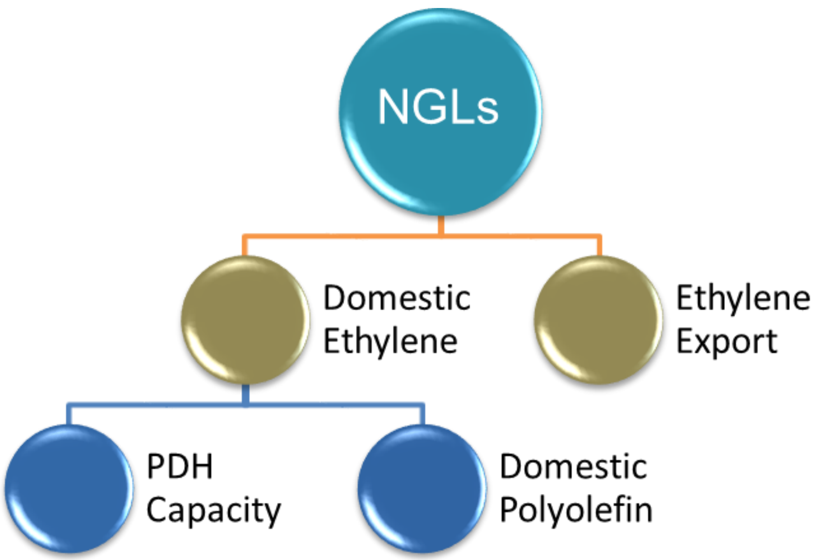
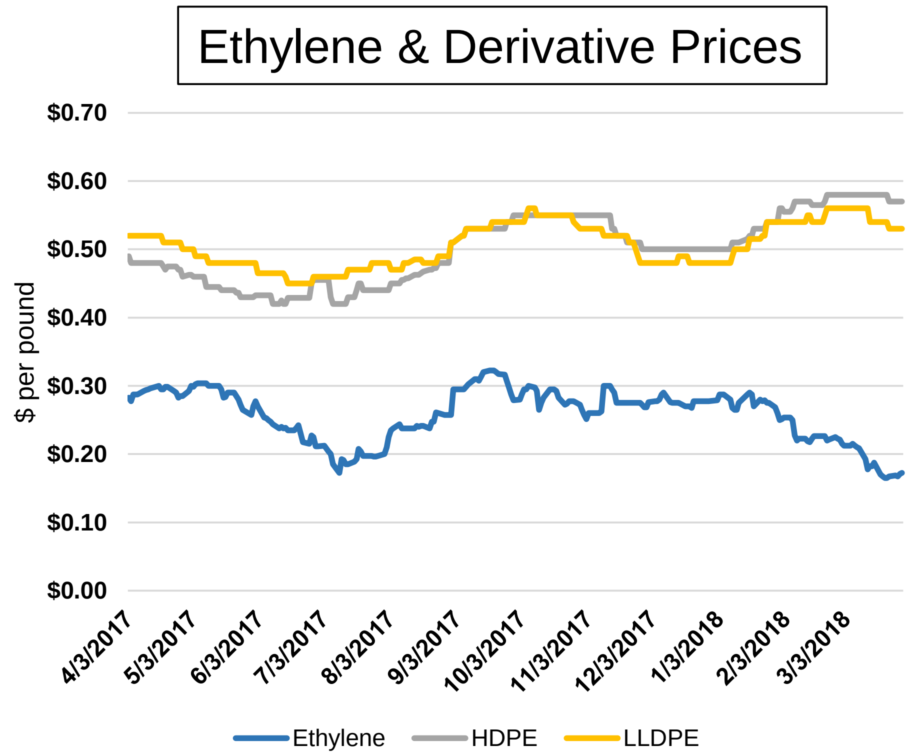
23:1	12:1	24:1

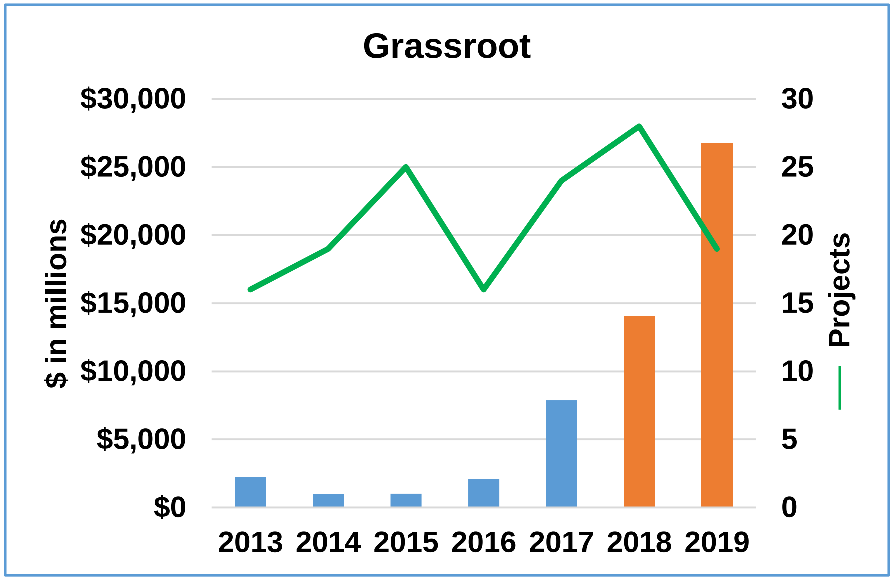


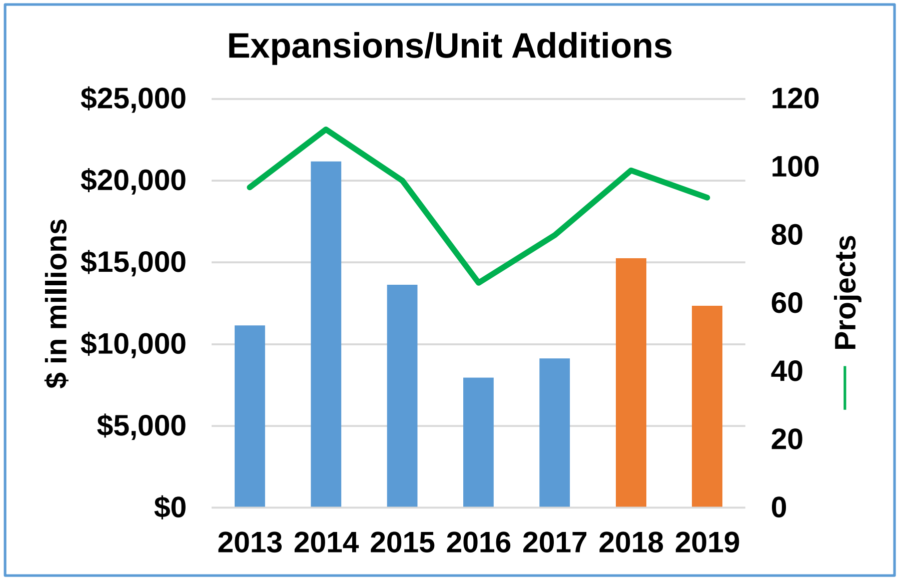


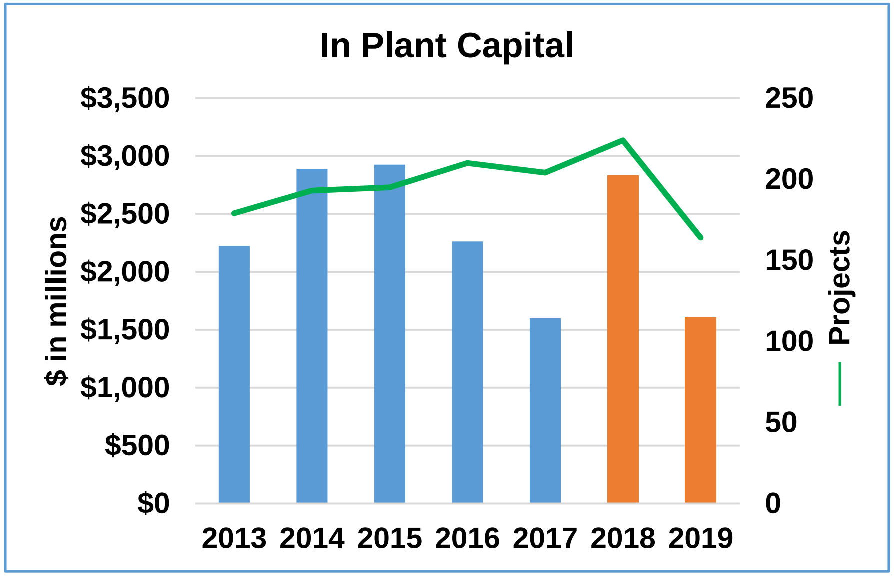
Source: Petrochem Wire

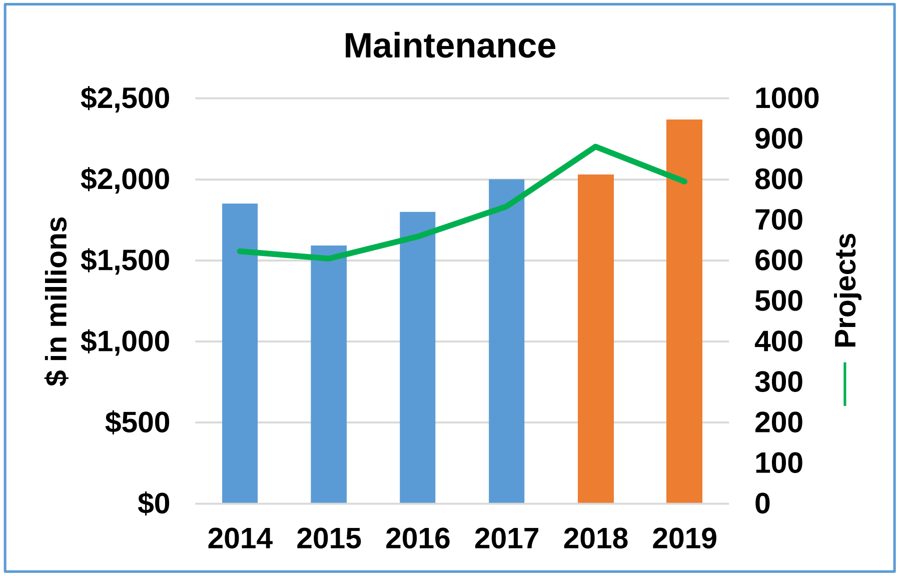
U.S. & Canada Chemical Industry

Project Spending by Project Type



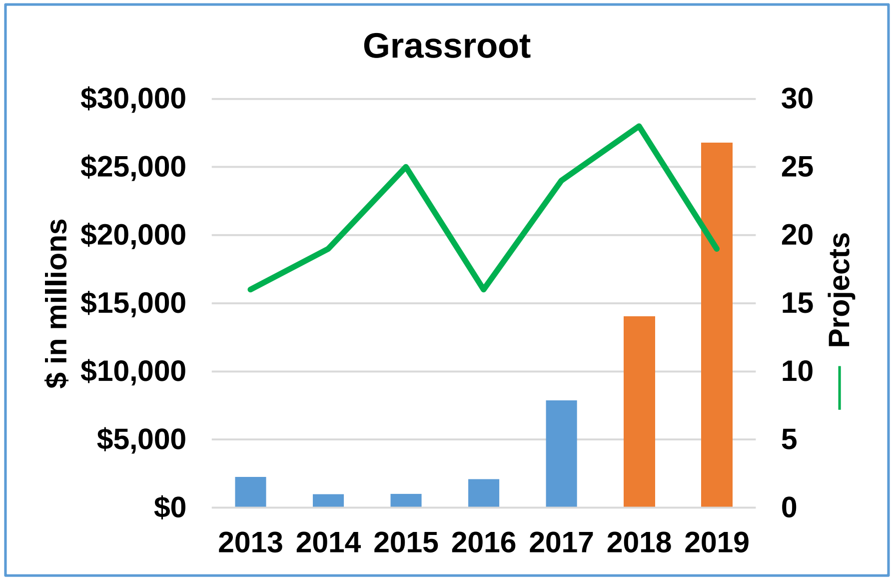






Source: IIR PECWeb

U.S. & Canada Chemical Industry
Project Spending by Project Type



2013 to 2015

Natural gas promotes world scale ammonia capacity

2016 to 2017

Petrochem capacity MEG, Methanol, Ethylene

2018 to 2019

Exxon/Sabic in South Texas

Inter Pipeline PDH in Alberta

Wanhua MDI in Louisiana

Midwest Fertilizer in Iowa

Source: IIR PECWeb

U.S. & Canada Chemical Industry

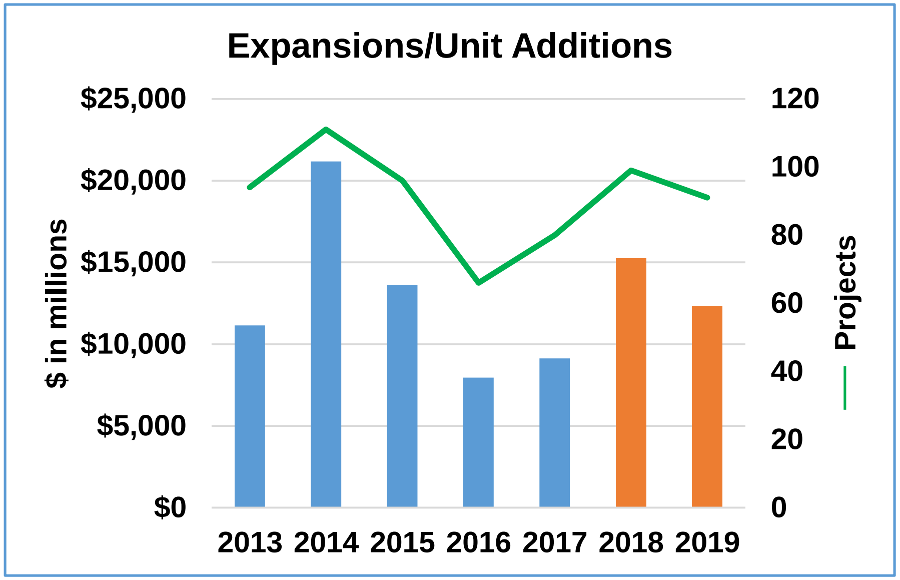
Project Spending by Project Type

2013 to 2015

Low cost NGLs promote confidence for capacity additions

2016 to 2017

Investments in derivatives begin to take shape



2018 to 2019

Nova Chemical PE in Ontario

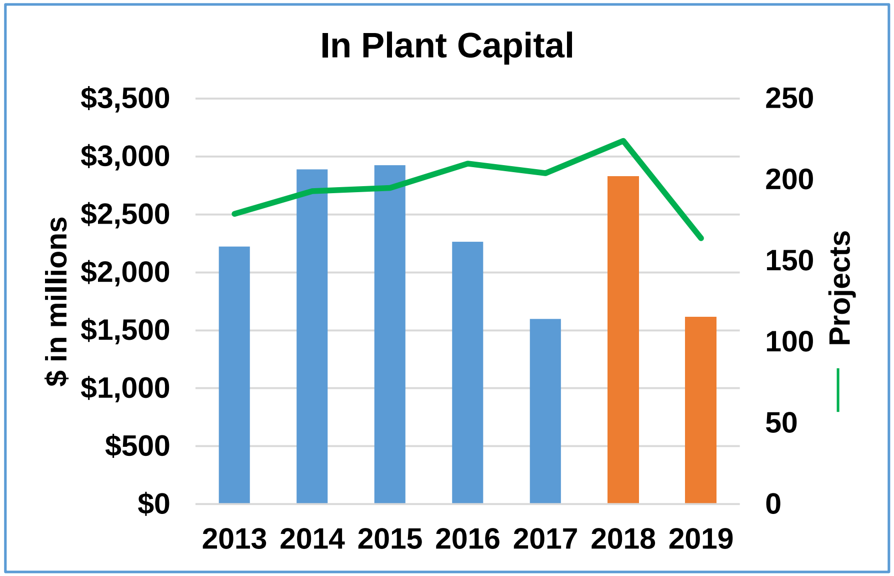
Methanex methanol in Alberta

Formosa EO/EG in Louisiana

Source: IIR PECWeb

U.S. & Canada Chemical Industry

Project Spending by Project Type



2011 to 2015

Strong exit from recession

Confidence in demand

2016 to 2017

Economic uncertainties slow progress

2018 to 2019

Demand remains strong

Operating rates are high

High & Medium Probability planned for 2018

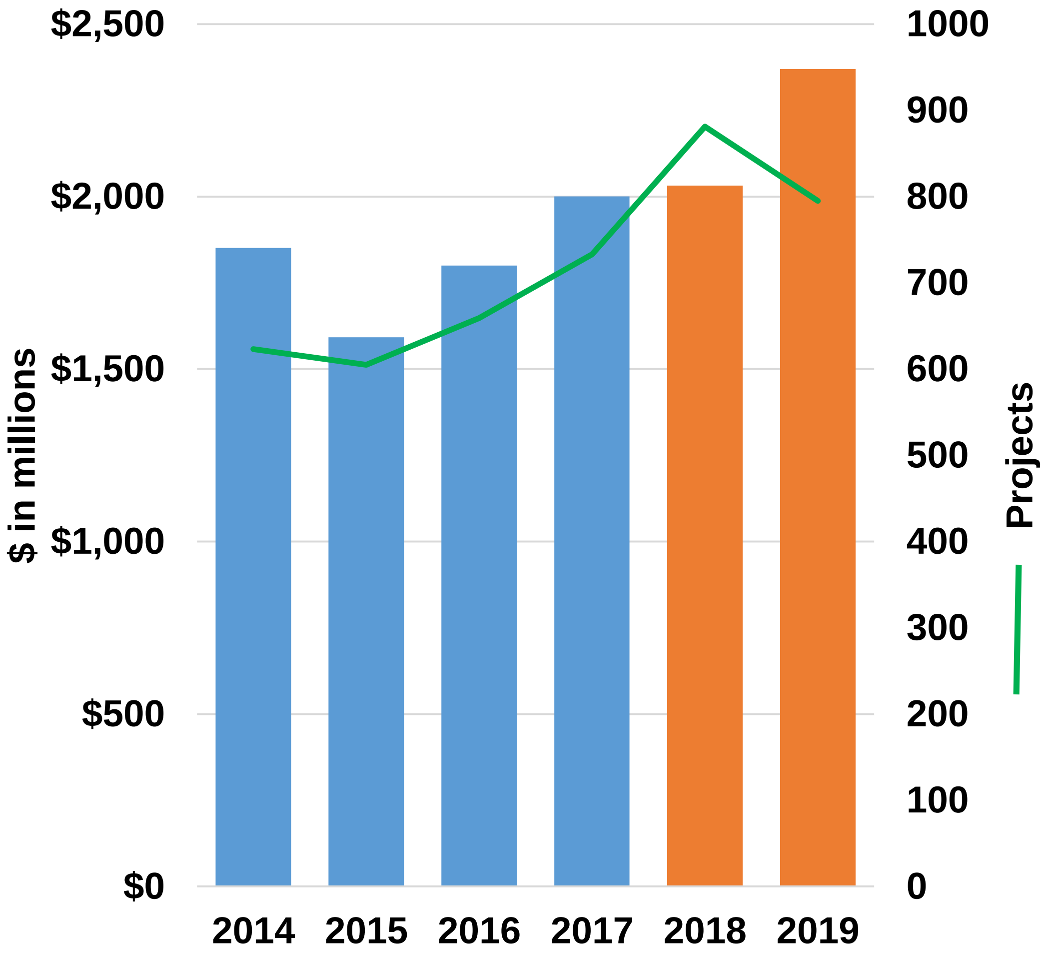
Project Type	Projects	TIV in $'s millions
Conversion	2	$480
Debottleneck	5	$204
Enviro Compliance	9	$55
Equipment Addition	27	$1,002
Modernization	6	$122
Refurbishment	2	$300
Replacement	50	$127
Revamp	7	$182
Storage Addition	9	$14
Upgrade	90	$287
Closure	17	$60
Grand Total	**224**	**$2,833**

Source: IIR PECWeb

U.S. & Canada Chemical Industry

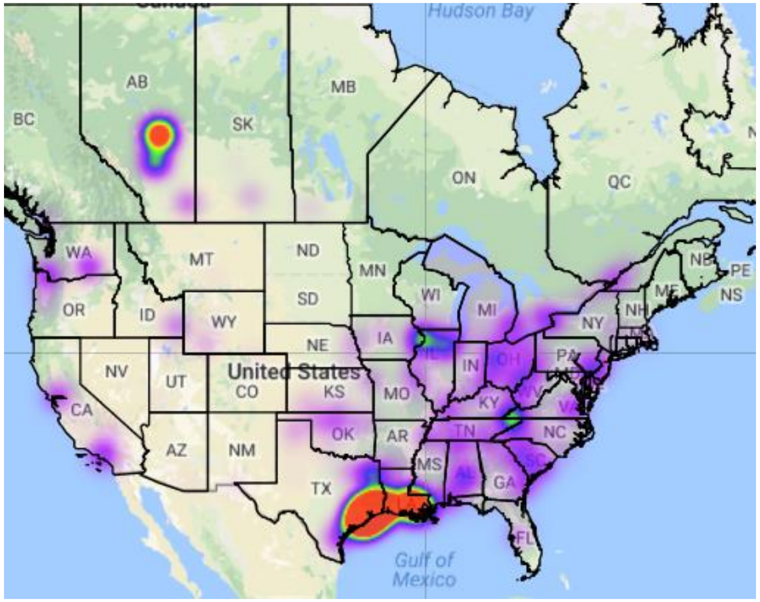
Maintenance Turnaround spending continues to rise

Historical Plant Maintenance T/A activity



- 875+ planned T/As for 2018
- Average T/A investment is $2.3 Million
- Capital projects influencing maintenance schedules

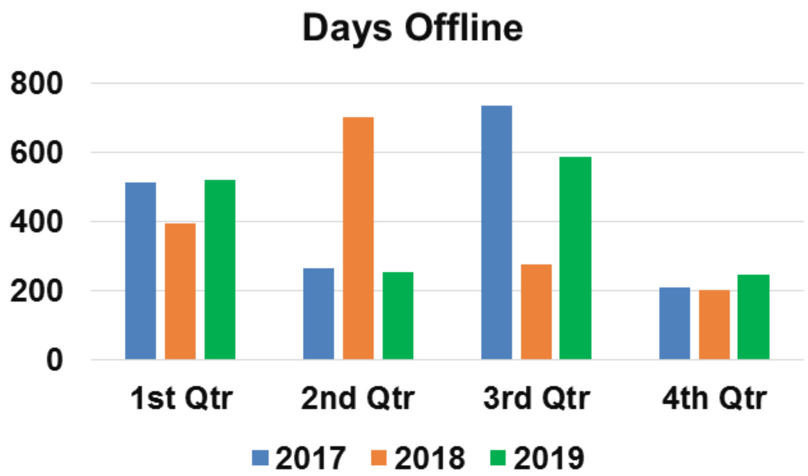
2018 & 2019 T/A activity

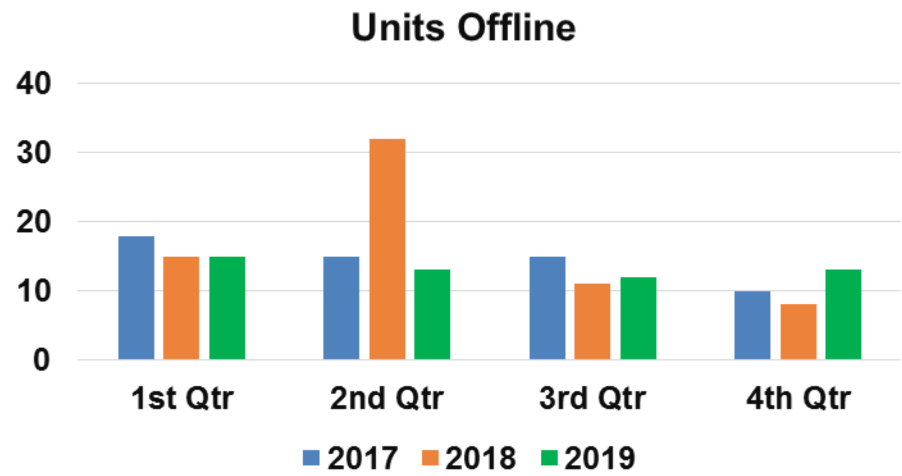


Source: IIR PECWeb

USA & Canada Petrochemicals

Turnaround Outlook [Ethylene, PE & PP, PDH]





Planned Turnarounds

Year	1st Qtr		2nd Qtr		3rd Qtr		4th Qtr		Total	
	Days	Units	Days	Units	Days	Units	Days	Units	Days	Units
2017	514	18	265	15	735	15	211	10	**1,725**	**58**
2018	396	15	705	32	278	11	201	8	**1,580**	**66**
2019	520	15	255	13	589	12	247	13	**1,611**	**53**

2017 unplanned T/As totaled 1,725 days and 58 events
2018 unplanned T/As total 70 days so far from just 10 events

U.S. & Canada Chemical Industry
Conclusion…

- Elevated Oil to Gas ratio continues to drive spending
- Global dependency for demand
- In-Plant Capital spend trends higher in 2018
- Mega projects continue to set the pace for the industry
- Focus on derivatives and specialty chemicals a positive
- Maintenance activity and spend reaches historic high

Industrial Info Resources

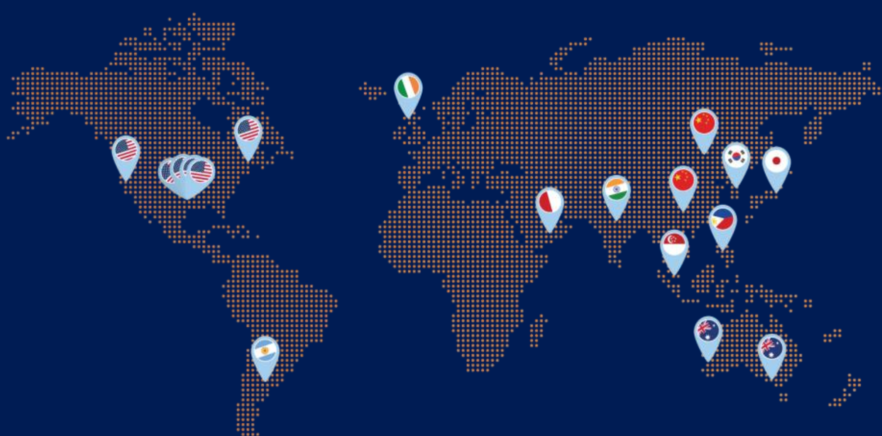
Global Market Intelligence Constantly Updated

Global Presence
18
Offices Around
The World

Over
34
Years of doing
Business

Speaking
59
languages
Globally

Thank You!



- Sugar Land, Texas
- Washington D.C.
- Carlsbad, California
- Cordoba, Argentina
- Galway, Ireland
- Dubai, UAE
- New Delhi, India
- Manila, Philippines
- Kofu-Shi, Japan
- Seoul, South Korea
- Beijing, China
- Yichang, China
- Perth, Australia
- Melbourne, Australia
- Singapore

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