Renewable Methanol & Hydrogen
Analyzing Methanex's (MEOH) Geismar Facilities
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Key Takeaways

- **Lower-Cost Hydrogen Will Produce Cost Competitive Renewable Methanol: Pipe Dream or Reality?**
  - Global methanol demand is ~75 MTPA; with new EU and U.S. environmental mandates, demand is forecasted to increase.
  - Renewable Methanol (RM) is produced using Hydrogen (H2) from solar/wind and carbon dioxide (CO2) as compared to traditional methanol produced from fossil fuels (i.e. coal & natural gas). *(Page 4)*
  - **Cost-competitive RM** would open the door to green plastics and support various marine, fuel, & vehicle clean energy mandates but, costs are not competitive based on current technology. *(Pages 4 - 5)*
  - Limited project economics hasn't stopped ~10 commercial scale renewable methanol facilities in various stages of development around the world. As these projects develop, lower costs and improved technology would be a game changer for the methanol industry while providing H2 more downstream applications. *(Page 6)*

- **Tracking the 800 lbs. Methanol Gorilla…Methanex (MEOH).**
  - Methanex is the #1 global producer of methanol with 11 facilities and ~13% market share (~2x more than Proman/Helm). *(Pages 8 - 9)*
  - If/when RM becomes competitive against fossil fuel-based methanol, Methanex is well positioned to transition their infrastructure to RM.
  - In 2016, Methanex launched (7) new dual fuel (diesel/methanol) ships to meet new emission requirements.

- **Geismar Unit 3 Well Positioned vs. Competition.**
  - In July 2019, Methanex announced FID on their $1.4B Geismar 1.8 MTPA Unit 3 expansion. As of 2Q20, MEOH spent ~$169MM developing the project.
  - Then COVID-19 hit and MEOH slammed on the brakes on Unit #3 and idled methanol facilities in Trinidad & Chile.
  - When market conditions improve, GU3 is likely one of the first new methanol projects to proceed based on their cost & schedule advantages. *(Page 10 – 13)*

- **The EPC Dynamics…*So Long* KBR, Next Up?**
  - KBR was awarded the FEED with an opportunity for a reimbursable EPC contract. *(Page 15)*
  - In August 2020, KBR exited the energy/EPC business and de-booked $1.2B in backlog.
  - Worley (XASX: WOR) and Wood Plc (LSE: WG) seem positioned to replace KBR but don't sleep on Kiewit or S&B.

Renewable Methanol

W|EPC: Renewable Methanol & Methanex Geismar Review

Methanol Feedstocks & Applications

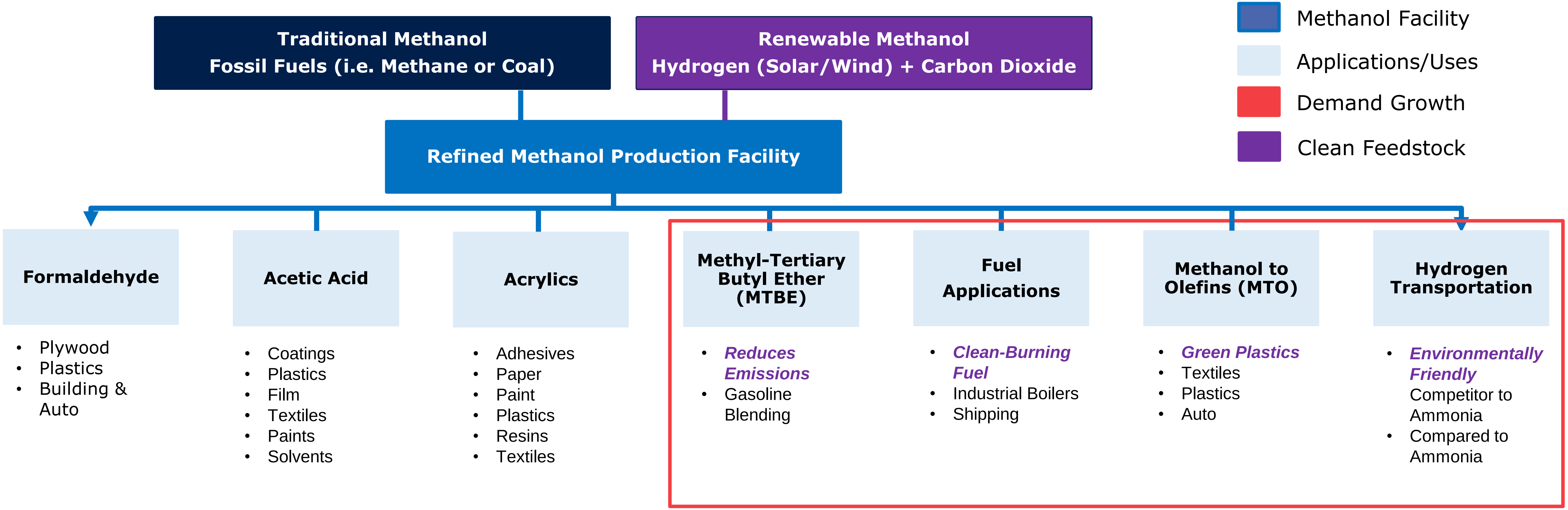
⬛ Feedstock

🟦 Methanol Facility

⬜ Applications/Uses

🟥 Demand Growth

🟪 Clean Feedstock



Traditional Methanol
Fossil Fuels (i.e. Methane or Coal)

Renewable Methanol
Hydrogen (Solar/Wind) + Carbon Dioxide

Refined Methanol Production Facility

Formaldehyde

- Plywood
- Plastics
- Building & Auto

Acetic Acid

- Coatings
- Plastics
- Film
- Textiles
- Paints
- Solvents

Acrylics

- Adhesives
- Paper
- Paint
- Plastics
- Resins
- Textiles

Methyl-Tertiary Butyl Ether (MTBE)

- ***Reduces Emissions***
- Gasoline Blending

Fuel Applications

- ***Clean-Burning Fuel***
- Industrial Boilers
- Shipping

Methanol to Olefins (MTO)

- ***Green Plastics***
- Textiles
- Plastics
- Auto

Hydrogen Transportation

- ***Environmentally Friendly*** Competitor to Ammonia
- Compared to Ammonia

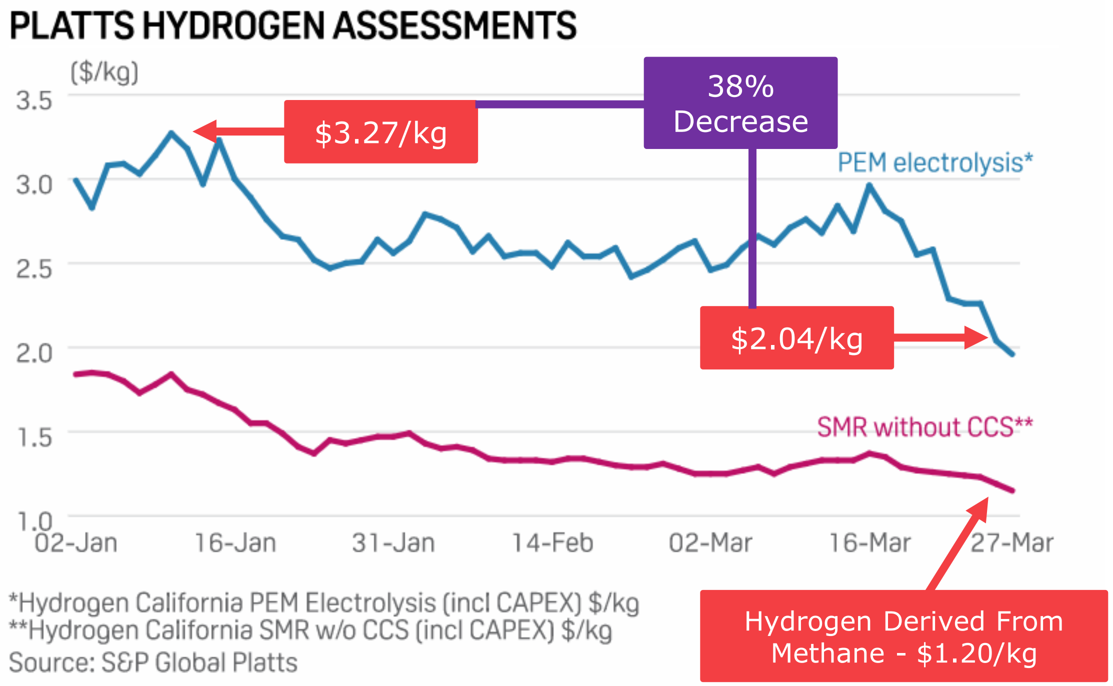
Renewable methanol is produced from Hydrogen & Carbon Dioxide and has multiple green applications.

Source: Company & Regulatory Filings, W|EPC Analysis

Hydrogen is Getting Cheaper

Overview

- **What Changed**: In 1Q20, Hydrogen from electrolysis (wind/solar) decreased 38% ($3.27/kg to $2.04/kg)…technology advancements could decrease H2 costs even further to ~$0.80/kg by 2050.
- **Why Does That Matter**: Lower cost H2 improves the economics for green applications, which includes renewable methanol.
- **What's The Impact**: However, ***without technology advancements*** in emethanol production (i.e. the volume of H2 used to produce renewable methanol decreases), renewable methanol facilities will likely not be competitive against methanol produced from fossil fuels.
- **Key Thoughts & Takeaways**: ~10 standalone renewable methanol facilities are in various development stages. Companies, such as Liquid Wind, are hoping technology refinements and commercial scale applications improve the economics.



PLATTS HYDROGEN ASSESSMENTS

*Hydrogen California PEM Electrolysis (incl CAPEX) $/kg
**Hydrogen California SMR w/o CCS (incl CAPEX) $/kg
Source: S&P Global Platts

Hydrogen costs should continue decreasing but methanol technology needs improved/refined as well.

Source: Bloomberg, Hydrogen Council, S&P Global Platts, 2019 IEA Report, Company & Regulatory Filings, W|EPC Analysis

Renewable Methanol Facilities

Liquid Wind

- **What Changed:** We analyzed Liquid Wind (LW); a company developing a commercial scale renewable methanol facility in Sweden. The first facility is scheduled to be in operations in 2H23 (pending financing, engineering, etc.).
- **Why Does That Matter:** A big benefit of emethanol is the ability to use existing methanol infrastructure (i.e. fuel facilities, storage, etc.) without major modifications.
- **What's The Impact**: Current U.S. & EU emission guidelines are forcing shipping companies to change from diesel to other sources of fuel (LNG & methanol).
- **Key Thoughts & Takeaways**: Liquid Wind is one of the first commercial scale emethanol facilities being developed. If these first facilities can improve the economics, emethanol should have a robust future with hydrogen transportation, fuel for shipping, & feedstocks to produce green plastics.

Liquid Wind – Artist Rendition

Liquid Wind has proposed to develop 6 emethanol facilities by 2030, which could be industry changing.

Source: S&P Global, Methanol Institute, Company & Regulatory Filings, W|EPC Analysis

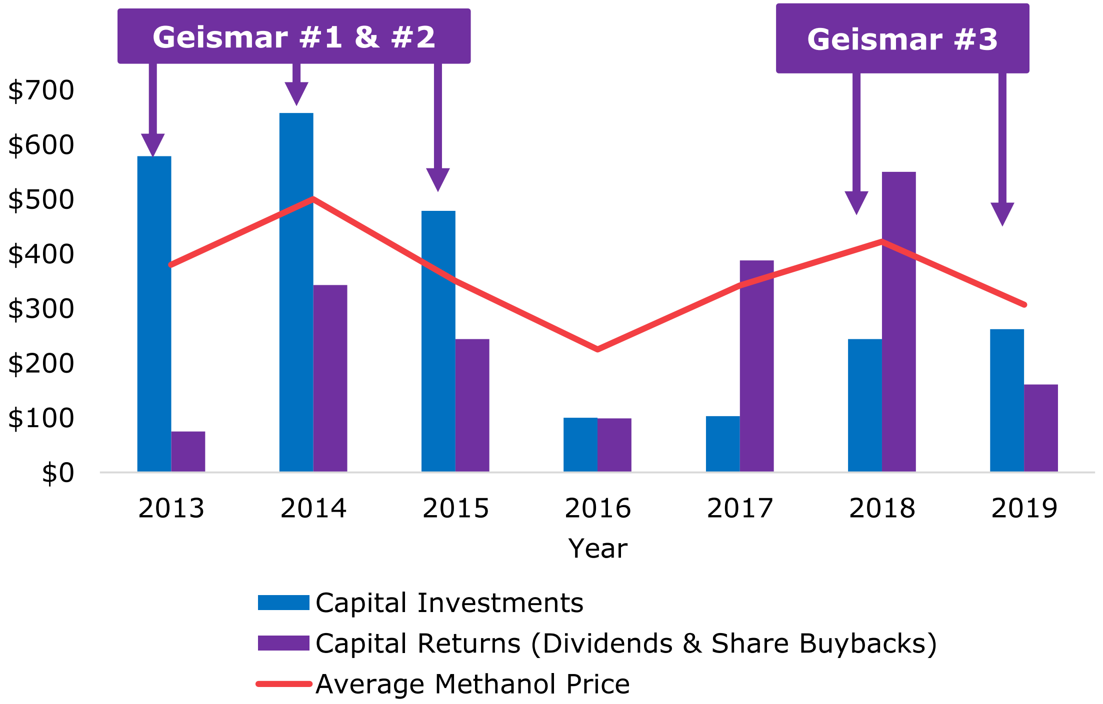
Geismar Methanol Facilities

Methanex Overview

Overview

- **What Happened**: We analyzed Methanex (MEOH) and their temporary delayed Unit 3 expansion in Geismar, Louisiana (the Project).
- **Why Does That Matter**: Methanol production, like all chemicals, relies on innovation (i.e. lower costs, emissions, etc.) to capture market share…and *Methanex's recent capital projects have been innovative.*
- **What's The Impact**: In 2013 & 2015, MEOH's relocated (2) complete methanol units from Chile to Geismar, LA, which was 6 to 12 months shorter and ***~$1B cheaper*** than constructing new facility's on-site. *(Page 9)*
- **Key Thoughts & Takeaways**: Methanex used innovation to reduce the costs of Geismar Unit 1 & 2.

Methanex CAPEX vs. Capital Returns



Methanex is the world's largest methanol producer with 11 global facilities & strategic advantages.

Source: Company & Regulatory Filings, W|EPC Analysis

W|EPC: Renewable Methanol & Methanex Geismar Review

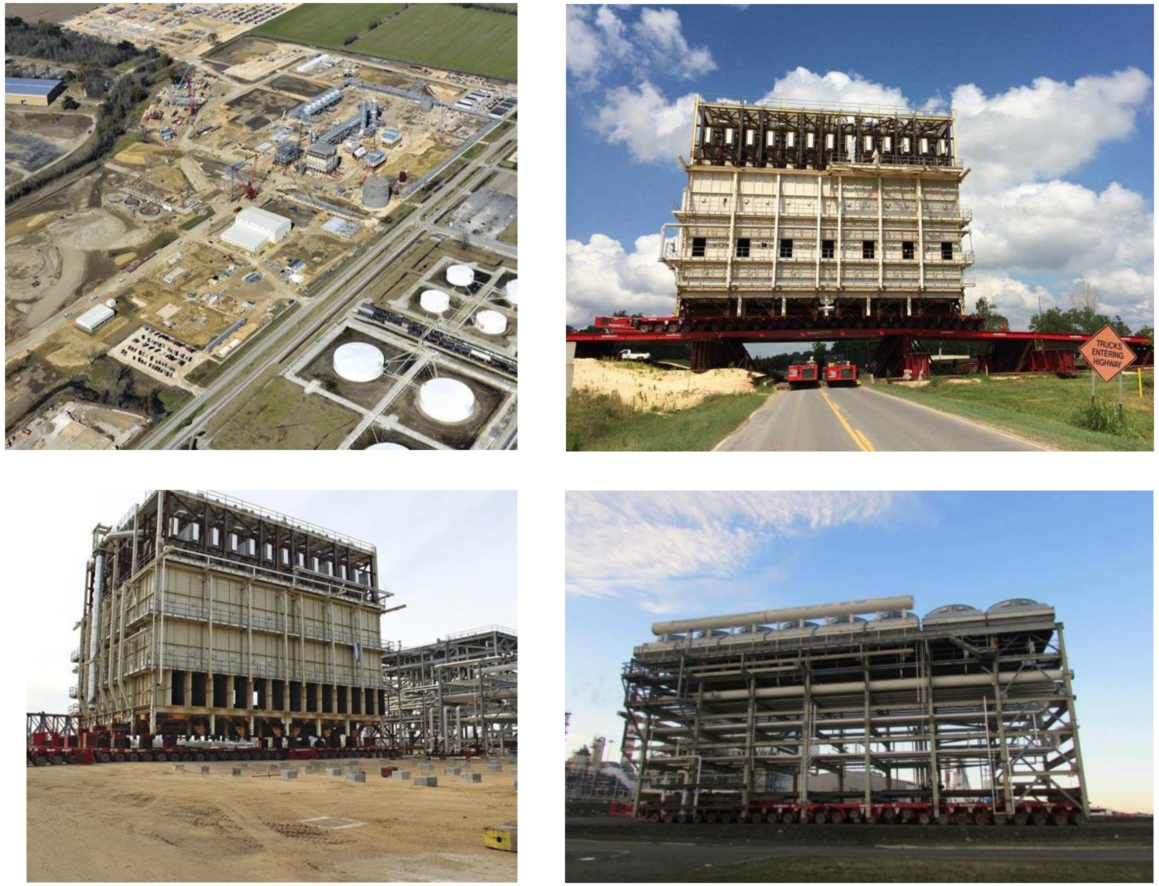
History – Geismar Units 1 & 2

Project Overview

- **What's Happened/ Changed**: Jacobs (now Worley) was the EPC contractor & Mammoet was the heavy haul/lift contractor that relocated (2) complete methanol units, (#1 - 2013 & #2 - 2015) from Chile to Geismar.
- **Why Does That Matter**: Unit 3 is scheduled to be built on-site; therefore, it isn't a copy project from units #1 and #2.
- **What's The Impact**: The different construction strategy & technology limits lessons learned on Units 1 & 2 (i.e. pipe, steel, and electrical quantities & unit rates).
- **Key Thoughts & Takeaways**: Units 1 & 2 EPC cost is roughly the same as Unit #3.

Item	Units 1 & 2	Unit 3
Estimated Costs	$1.4B	$1.4B
Contract Structure	Reimbursable	Reimbursable
Capacity	2 MTPA	1.8 MTPA

Units 1 & 2 – Relocated from Chile to Louisiana



Relocating (2) facilities, ~2 MTPA of production, is nearly the same cost as building one 1.8 MTPA facility.

Source: Company & Regulatory Filings, W|EPC Analysis

Geismar Unit 3 Comps

Project Comps

- **What Happened**: We analyzed two proposed & one Louisiana methanol project in construction:
  1. Geismar Unit 3
  2. South Louisiana Methanol & SABIC (XSAU: 2010) Joint Venture
  3. Yuhuang Chemicals/Koch Industries
- **Why Does That Matter**: GU3 provides the lowest cost MTPA of methanol produced due to shared resources, infrastructure, and equipment on Units 1 & 2.
- **What's The Impact**: GU3 has a better chance of moving forward than SLM/SABIC, based on Methanex's ~$1.4B target cost.
- **Key Thoughts & Takeaways**: Methanex delayed the project due to economic uncertainty. When market conditions improves, Methanex is well positioned to be the first new methanol facility to come online at a lower cost basis than competing projects that are also delayed.

	Proposed		In-Construction
Item	**GU3 Geismar, LA**	**SLM/ SABIC St. James, LA**	**Yuhuang/Koch St. James, LA**
No. of Acres	~156	~1,400	~1,200
EPC Contractor	KBR (FEED)	Fluor (FEED)	Wood (EPC)
In-Service Date	TBD	TBD	2H20
Capacity	1.8 MTPA	2.2 MTPA	1.7 MTPA
Estimated Cost	$1.4B	$2.2B	$1.85B
Est. Construction Hours	2.8MM	3.8MM	3.4MM
Est. Peak Construction	1,000	1,400	2,100
Greenfield/Brownfield	Mix	Greenfield	Greenfield

When market conditions improve, Methanex has cost & schedule advantages over peer group.

Source: Company & Regulatory Filings, W|EPC Analysis

GU3 Cost Overview

Cost Analysis

- **What Happened**: We analyzed Methanex's GU3 "$1.4B target" project costs.
- **Why Does That Matter**: According to Methanex's regulatory filings, the total GU3 investment was $1.63B in Q118 and $1.4B in Q419. In July 2019, *Methanex announced a positive FID for a "target" price of $1.3B to $1.4B*.
- **What's The Impact**: To reduce a project cost from $1.63B to $1.4B, a savings of ~14%, is challenging for any EPC project.
- **Key Thoughts & Takeaways**: While the Project may have been delayed due to COVID-19, market conditions, and project economics may have also played a role in the GU3 delay. The Methanex price at $1.6B is ~11% less per MTPA ($888/MTPA vs. $1,000/MTPA) than the SABIC neighboring project.

GU3 Project Investment Costs

Description	Methanex GU3 Project Costs (in $MM)		
	Regulatory Filings		Target Price
	Q118	Q419	July 2019 (FID)
Construction Payroll	$230	$230	n/a
Machinery & Equipment	$200	$380	n/a
Labor & Engineering	$700	$620	n/a
Building & Material	$700	$400	n/a
Total Investment	$1,630	$1,400	$1,300 to $1,400

Target Price is ~14% to ~ 20% Lower

Methanex's target Project investment cost is up to ~20% lower than regulatory filings.

Source: Company & Regulatory Filings, W|EPC Analysis

Schedule – Key Milestones & Impacts

Company Overview

- **What Changed**: We analyzed the GU3 original schedule (pre-delay) vs. our forecasted Primavera P6 schedule.
- **Why Does That Matter**: The original baseline schedule would have been difficult to achieve based on the monthly progress needed & the late arrival of long-lead equipment. *(Page 13)*
- **What's The Impact**: Methanex has allocated ~$169MM in GU3 costs (as of 2Q20). We believe engineering and procurement activities for long-lead equipment (i.e. reformer module & methanol converter) continued, but engineering was placed on hold between the 30% and 60% model reviews.
- **Key Thoughts & Takeaways**: Delay of the 60% model review would place pipe, steel, bulk purchases, and issued for construction drawings on hold. Between the 30% and 90% model reviews is the most labor-intensive portion of engineering and bringing in a new EPC contractor to replace KBR would cause rework and extend the schedule beyond Methanex's 18-month delay.

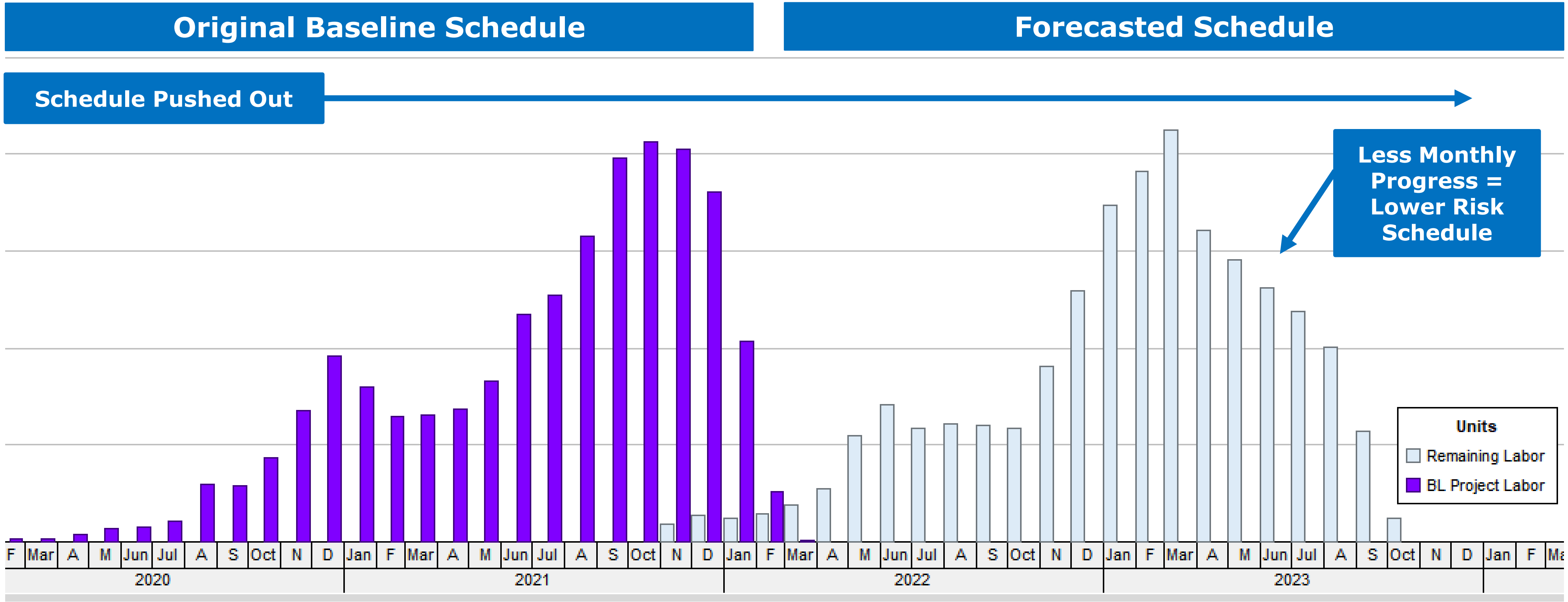
W|EPC Estimated Schedule Milestones

Activity	Original Schedule	Forecasted Schedule	Schedule Delta (months)
Construction Kickoff	Jul 20	Nov 21	17
Engineering Complete	Mar 21	Dec 22	22
Reformer Module Delivery	Aug 21	Dec 21	4
Methanol Converter Delivery	Aug 21	Dec 21	4
Mechanical Completion	Mar 22	Oct 23	19
In Service	June 22	Jan 24	19

Engineering progress with a new EPC contractor will drive the project schedule.

Source: Company & Regulatory Filings, W|EPC Analysis

Monthly Progress Curves



Restart schedule is lower risk due to less monthly progress needed at the end of the project.

Source: Company & Regulatory Filings, W|EPC Analysis

The EPC Dynamics

The EPC Dynamics

KBR's Exit…Worley's Project to Lose?

- **What Happened**: In Jul 2018, KBR was awarded the FEED for GU3 and an opportunity to transition into an EPC reimbursable contract.
- **Why Does That Matter:** KBR winning was of interest since Jacobs (now Worley, XASX: WOR) executed Geismar Units #1 and #2, and Wood Plc (Wood, LSE: WG) is currently executing an EPC Lump Sum $604MM contract for a $1.85B greenfield methanol facility in Louisiana.
- **What's The Impact**: In Aug 2020, KBR announced they were exiting the energy solutions/"low-margin" EPC business and removed ~$1.2B in backlog, which leaves Methanex seeking another EPC contractor/solution.
- **Key Thoughts & Takeaways:** This was likely an example of the "low-margin" work KBR wants to avoid. Worley & Wood had recent U.S. methanol experience, which means KBR's commercial offer was likely below Worley & Wood's to offset their experience & lessons learned.
  - Perhaps, Worley was not given the opportunity to provide a FEED/EPC proposal due to poor performance on GU1 & 2.

EPC Dynamics Worth Watching

- **What Changed**: KBR has exited the EPC/energy solutions business because they want to avoid low-margin/high-risk work; therefore, Methanex is likely in the market for a new EPC contractor/solution.
- **Why Does That Matter**: A new EPC Contractor is needed to pick-up where KBR left off with engineering & procurement activities.
- **What's The Impact**: Worley & Wood have similar experience; however, we are watching to see if engineering software helps push one of these companies (Worley) ahead if EPC costs are similar. Worley and KBR use the Aveva's "cloud-based" engineering/project management software, allegedly preferred by Methanex. Don't sleep on Kiewit…GU3 will primarily be a construction project and Kiewit is among the best.
- **Key Thoughts & Takeaways:** The EPC industry is very competitive and often can come down to something like in-house software, which can be mandated by owner/operators like Methanex.

Worley, Wood, or Kiewit likely leaders to replace KBR; Worley uses Methanex's preferred software, Aveva.

Source: Company & Regulatory Filings, W|EPC Analysis

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