



Dow Chemical Net Zero: Early Analysis – Q124

Ethylene Cracker & Polyethylene Unit

Location: Fort Saskatchewan, Alberta (Canada)

Owner: Dow Chemical Inc. (DOW)
EPCm Contractor: Fluor (FLR)
EP Contractor: Technip Energies N.V. (THNPY)
Technology: Ethylene - Technip Energies (THNPY);
Hydrogen and Air Separation Unit – Linde plc (LIN)

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1. Setting A Baseline: Fluor, Technip, and Dow Reunited For a ~\$7B Ethylene Cracker Expansion....

- **Dow Chemical (DOW):** One of the three largest chemical producers in the world (market cap ~\$36B), Dow uses EPC firms, such as Fluor Corporation (**FLR**) for large engineering and EPC projects.
- **Fluor Corporation (FLR):** Fluor has maintained a long relationship with Dow. In March 2012, Dow and Fluor signed a strategic EPC alliance agreement, which ultimately led to Fluor securing billions of dollars in capital projects in Freeport, TX as part of Dow's "Gulfstream Program." The Gulfstream Program included an Ethylene cracker, polymer units, and a propane dehydrogenation (PDH) facility. Fluor executed the Ethylene cracker and PDH simultaneously on an EPC, direct hire construction basis.
- **Technip Energies (THNPF):** Technip Energies (Technip), is a global leader Ethylene cracking technology with 40-50% of the licensing market share. Technip's market share includes Dow's Freeport, TX Ethylene cracker.

Analysis: Fluor and Technip have executed multiple N. American Ethylene cracking facilities in the last 10-years. Fluor focused on the EPC scope of work and Technip provide the licensed technology, engineering, and procurement services. We are not surprised Dow is leveraging the same EPC (Fluor) and Ethylene technology (Technip) for their new, Net-Zero ethylene project at their facility in Fort Saskatchewan (Alberta, Canada) as they recently completed it during the Gulfstream program.

2. Project Overview, EPC Analysis, & Project Team...

- **Net-Zero Ethylene:** In Nov 2023, Dow took a Final Investment Decision (FID) on a \$6.5B investment to build an integrated ethylene cracker and derivatives plant in Fort Saskatchewan. According to Dow, the project will become the world's first ethylene cracker to achieve net zero Scope 1 and 2 emissions and will decarbonize 20% of Dow's ethylene capacity. The new facility can produce ~3.2 million metric tons of certified low-to zero-carbon emissions polyethylene and ethylene derivatives. (pgs. 5 - 6)
 - To achieve net-zero Scope 1 and 2 emissions, Linde Corporation (**LIN**) will deploy an air separation and autothermal reformer technology to convert "cracker off-gas" into hydrogen. This will produce a clean fuel to produce ethylene. Additionally, the carbon dioxide will be captured and sent to adjacent infrastructure providers.
- **EPC Analysis:** Fluor has issued guidance stating its contract with Dow is for reimbursable services for scopes representing a total installed cost at >\$3B.
 - **Analysis:** Because Fluor's contract is for reimbursable services, they likely have minimal risk for EPC cost overages. We expect this risk to be born by Dow.
- **Project Team:** Dow's Global Mega Project Director, Ron Huijsmans, was the Dow Project Director for the Gulfstream Program and has extensive experience with Fluor's execution model and work process. We expect that to be a significant benefit to the integration of the Dow and Fluor project teams.

3. Schedule Comps vs. Recent Ethylene Cracker Projects

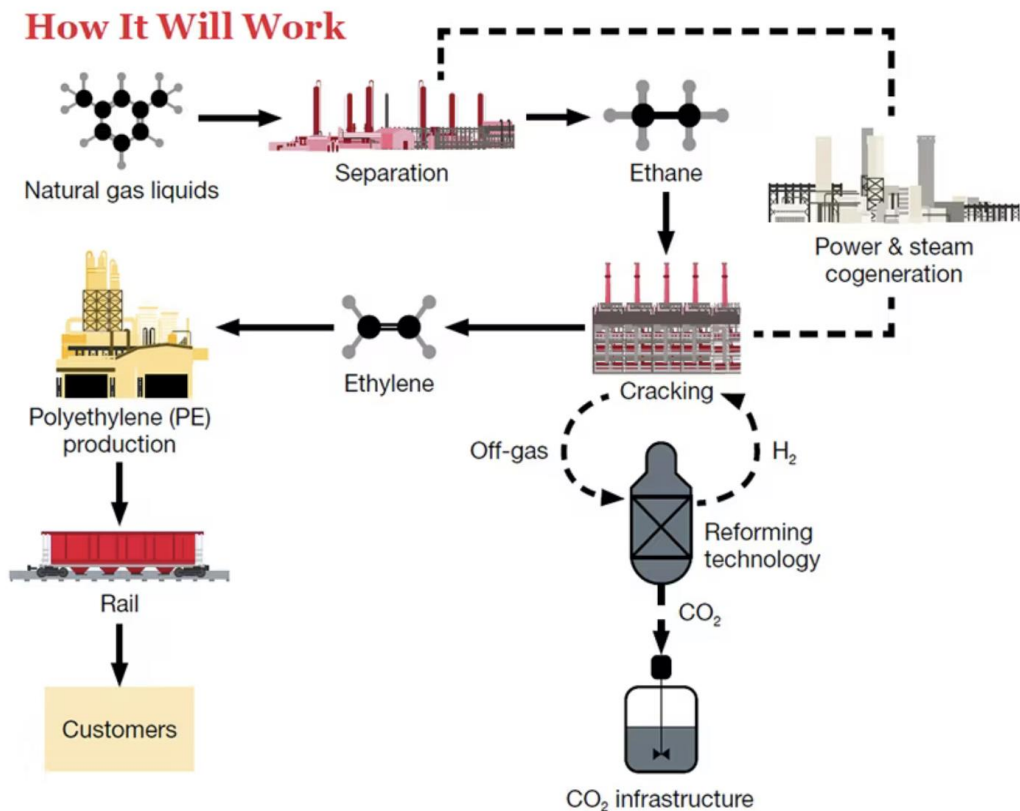
- **Schedule Comps:** W|EPC analyzed three N.A. Ethylene cracking facilities built in the last 10-years that used Technip technology and Fluor as an EPC Contractor. (pg. 8)
 - Dow Chemical – Freeport, TX (in-service 2017)
 - Chevron Phillips – Cedar Bayou, TX (in-service 2018)
 - Sasol – Lake Charles, LA (in-service 2019)
 - These projects averaged 62 months from the start of site-prep activities to placing the Ethylene cracker in-service.
- **Project Challenges:** The Dow ethane cracker project in Freeport, TX, was heavily modularized. The modules were built in low-cost fabrication yards and installed by U.S. gulf coast labor. The Dow Net Zero project will (1) be stick-built, (2)utilize Canadian union craft workers, and (3) must manage cold Canadian winters – all of which should be cost/timeline headwinds.
- **Biggest Risk: Schedule.** Significant delays could impact commodity prices (i.e., ethane, ethylene, and polyethylene) and other projects in the region needing access to the same construction resources.
- **Construction Milestones:** We will monitor multiple milestones throughout the project’s construction to give us a tighter estimated timeline, particularly given the region’s construction history, and Dow’s relatively aggressive schedule. (pg. 8). These milestones include:
 - First concrete
 - Start piping
 - Setting compressor
 - Mechanical completion
 - First Gas
 - In-Service (Full Volume)

4. Aerial Image Analysis...Site Prep Start vs. FID

- **Aerial Image Analysis:** Satellite images of the Dow project site shows site prep activities started sometime in Q223. Applying the same 62-month schedule to a Q223 site prep start would put the Net Zero cracker in-service in Q228, or ~3-6 months after Dow’s relatively value) guidance of a “2027 start.”
- **Site Prep:** We note that satellite images confirm site prep activities for at least two of our three Ethylene projects comps also started well before FID. (pgs. 10 -11)

Dow Net Zero Project Overview

Project Overview & Product Description



Overall Process: Take ethane from natural gas liquids and refine it to higher margin product using carbon capture to reduce facility emissions.

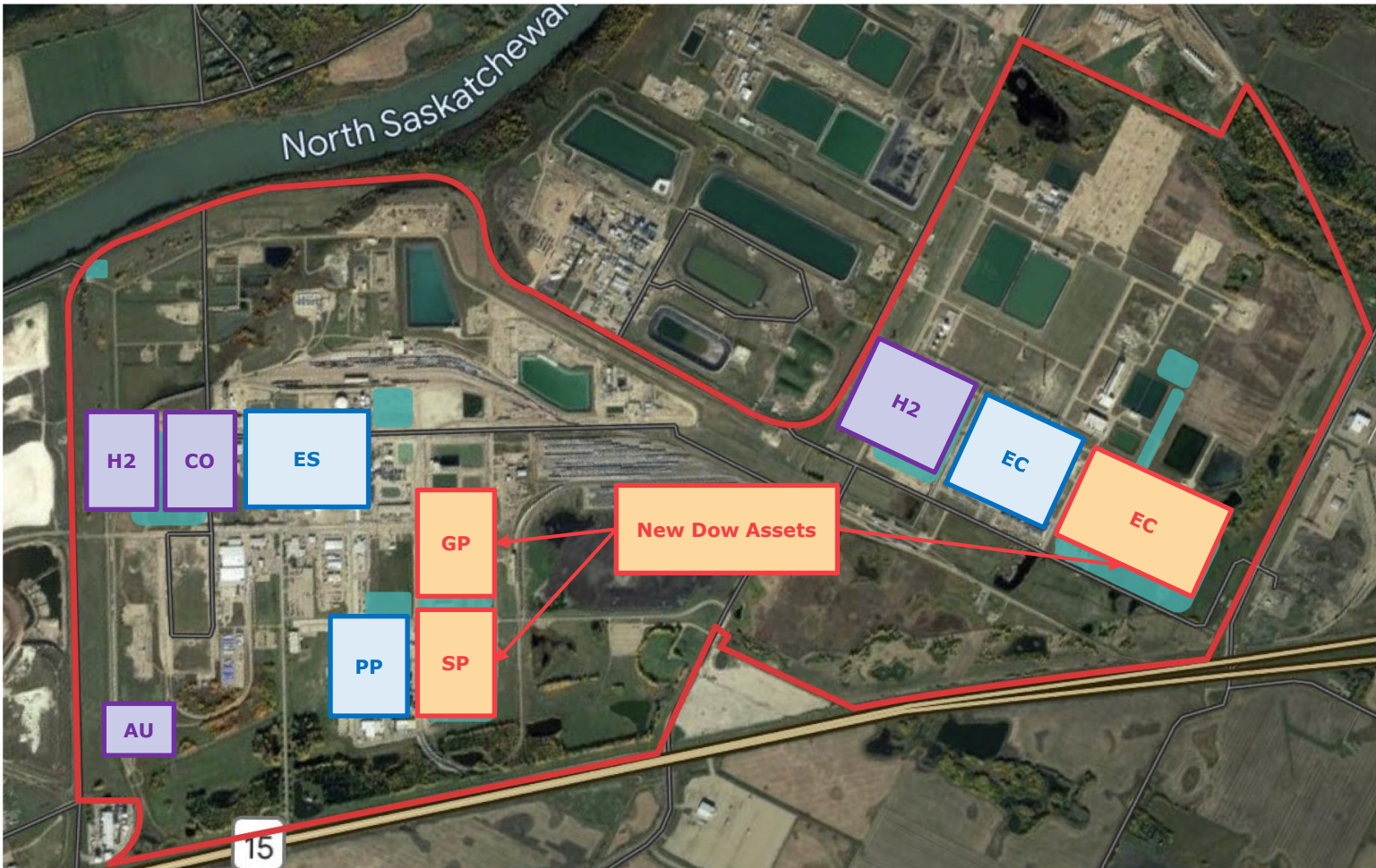
- **Ethane:** feedstock to make Ethylene.
- **Ethylene:** feedstock to make high-density polyethylene (HDPE), low density polyethylene (LDP), and linear low-density polyethylene (LLDPE).
- **HDPE:** used to make milk jugs, banners, boats, chemical resistant piping, coax cable inner insulator, fuel tanks for vehicles, and house wrap.
- **LDPE:** widely used for manufacturing containers, bottles, plastic parts that require flexibility, plastic bags, and soft parts such as snap-on lids.
- **LLDPE:** plastic bags and sheets (lower thickness than LDPE), covers, buckets, flexible tubing, stretch wrap, plastic wrap, and toys.

Source: Dow Chemical

Dow's New Facility Will Convert Ethane To Higher Value Chemicals (Ethylene And Polyethylene).

Source: WJEPAC Analysis of Company & Regulatory Filings

Project Map of Facilities At Dow Site In Fort Saskatchewan



New Third-Party Asset

- AU Air Separation Unit
- H2 Hydrogen, Carbon Capture, and Cogeneration
- CO Cogeneration

Existing Asset

- ES Energy Systems
- PP PE Production
- EC Ethylene Cracker

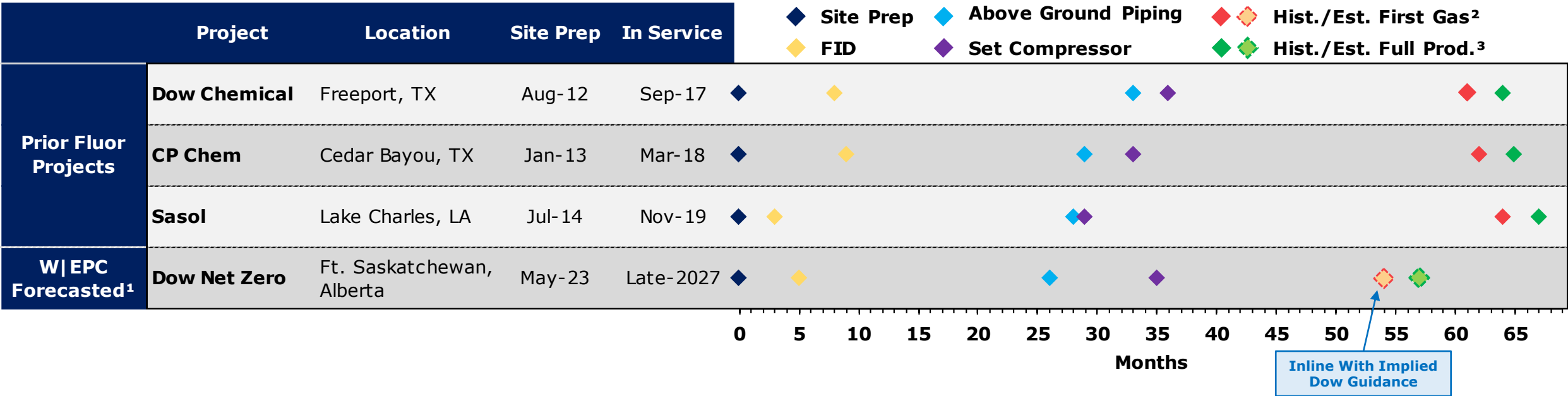
New Dow Asset

- GP Gas Phase PE Plant
- SP Solution PE Production
- EC Ethylene Cracker

Dow Assets: Map Of Existing, Third-Party & New Facilities (Ethylene Cracker & Polyethylene Facilities).

Source: WJEPAC Analysis of Company & Regulatory Filings

Schedule Comps - Fluor Ethylene Projects



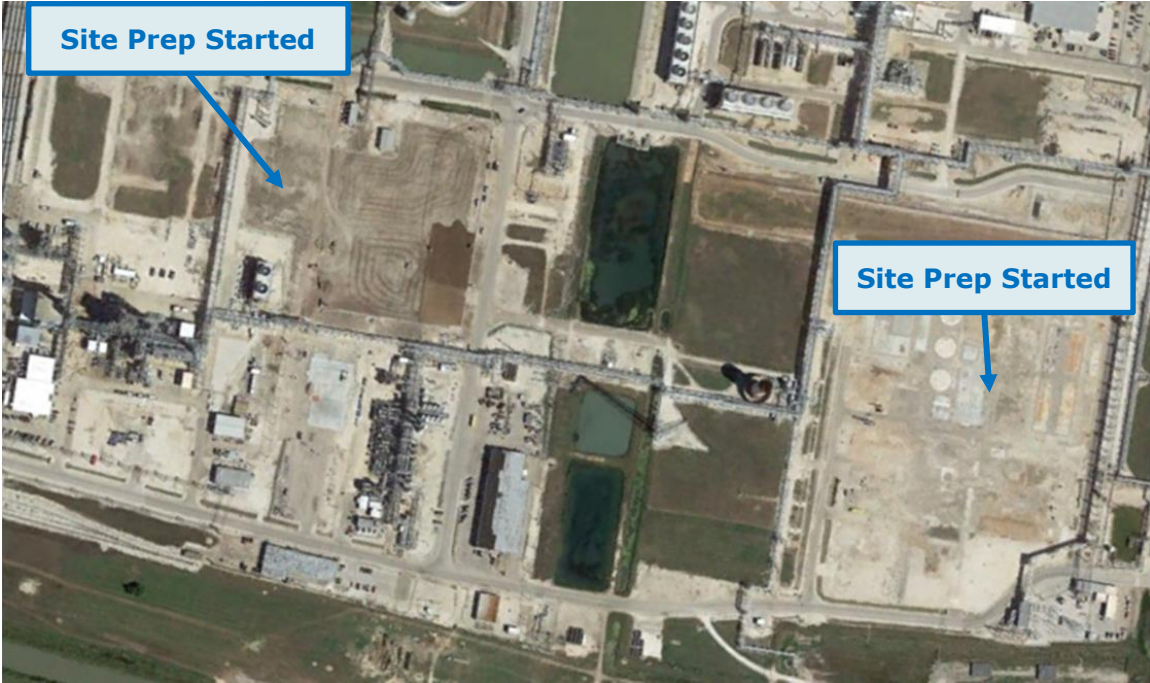
- **Comps:** W|EPC analyzed construction milestones on three prior Ethylene cracker projects to gauge Dow’s schedule for its net zero project.
- **Dow Guidance:** In November 2023, Dow announced FID, said construction would start in 2024, and indicated the first phase (Ethylene cracker) would start in 2027 with the second phase coming online in 2029.
- **Analysis:** Dow’s desire for a 2027 start appears slightly aggressive based on these milestones. While not impossible, it is something we will be monitoring. As of now, we are maintaining an in-service forecast of November 2027 (based on Dow’s implied guidance).

Dow’s Soft Guidance Toward A 2027 Phase 1 Start Appears Slightly Aggressive.

1) Dow forecasted construction milestones are estimated.
 2) Ready for hydrogen carbon introduction (RFHI)
 3) Typically ~2-4 months following RFHI
 Source: W|EPC Analysis of Company & Regulatory Filings; PALNG’s first LNG cargo is estimated.

Aerial Image Analysis – Early Site Prep Comps Vs. FID

Dow – Freeport, TX (Oct 2012)



- ~6-Months Pre-FID (Oct 2012)
- ~57-Months To First Phase of Ethylene Expansion in Service (Sep 2017)
- EPC Contractor: Fluor

Dow – Fort Saskatchewan (Jul 2023)



- ~4-Months Pre-FID (Nov 2023)
- ~48-Months To First Phase of Ethylene Expansion in Service (Nov 2027)
- EPC Contractor: Fluor

Pre-FID Site Prep Activities Were Comparable On Dow Freeport & Fort Saskatchewan.

1) WEPC Analysis OF Company & Regulatory Filings

CP Chem – Cedar Bayou, TX (Apr 2013)



- ~6-Months Pre-FID (Nov 2023)
- ~59-Months To First Phase of Ethylene Expansion in Service (Mar 2018)
- EPC Contractor: Fluor and JGC

Dow – Fort Saskatchewan (Jul 2023)



- ~4-Months Pre-FID (Nov 2023)
- ~48-Months To First Phase of Ethylene Expansion in Service (Nov 2027)
- EPC Contractor: Fluor

Pre-FID Site Prep Activities Were Comparable On CP Chem & Dow Fort Saskatchewan.

1) WEPC Analysis OF Company & Regulatory Filings

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