US Merchant CO_2 Market Overview

Presentation for NAMI
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By

Maura D Garvey

Intelligas Consulting, a J. R. Campbell & Associates, Inc. Company
745 High Street, Suite 201-B, MA 02090
mdgarvey@intelligasconsulting.com

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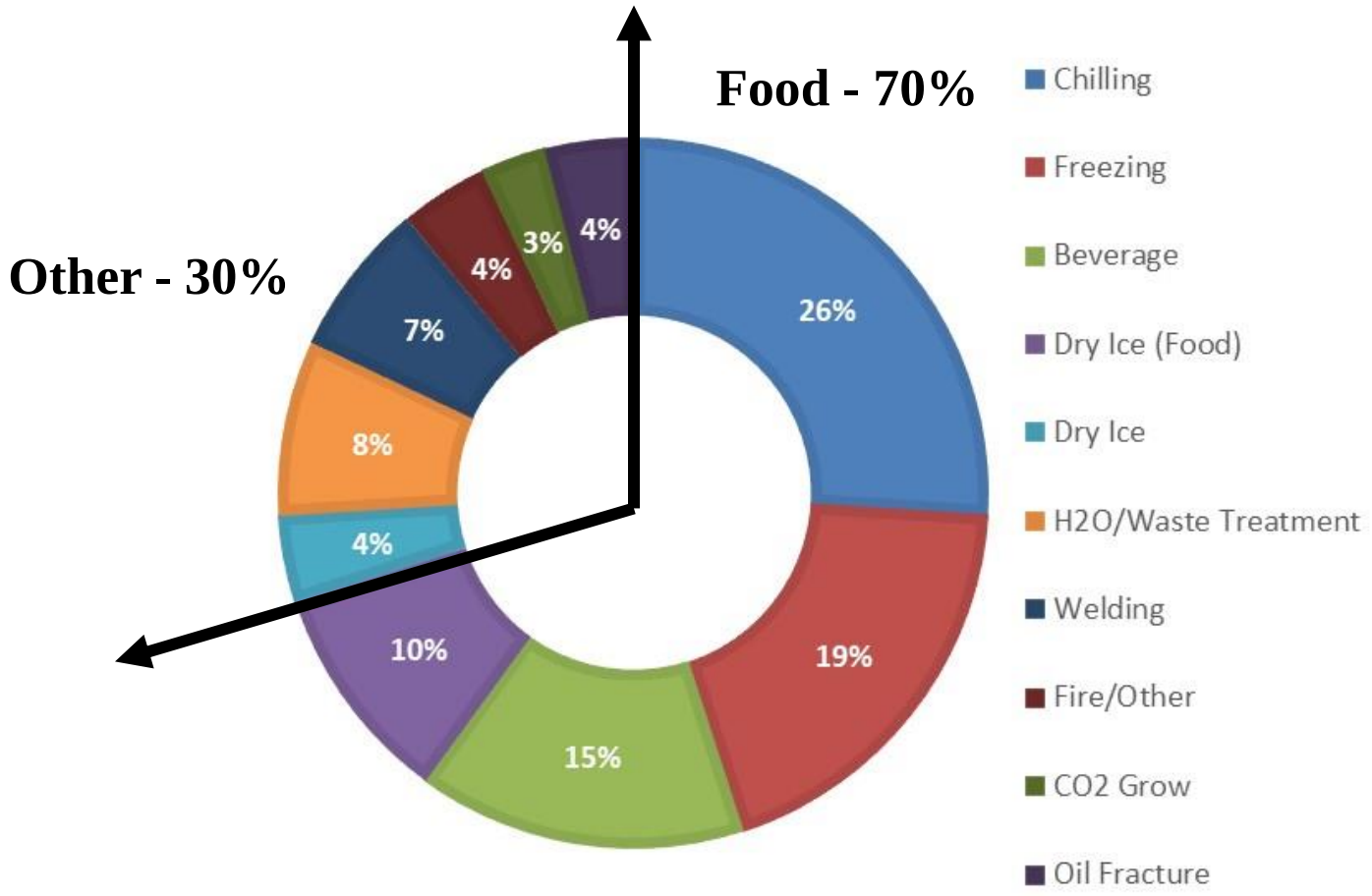
US Merchant CO_2 Demand By Application

2023 Market



US CO_2 Demand = 10.3 million tons per year (mtpy)

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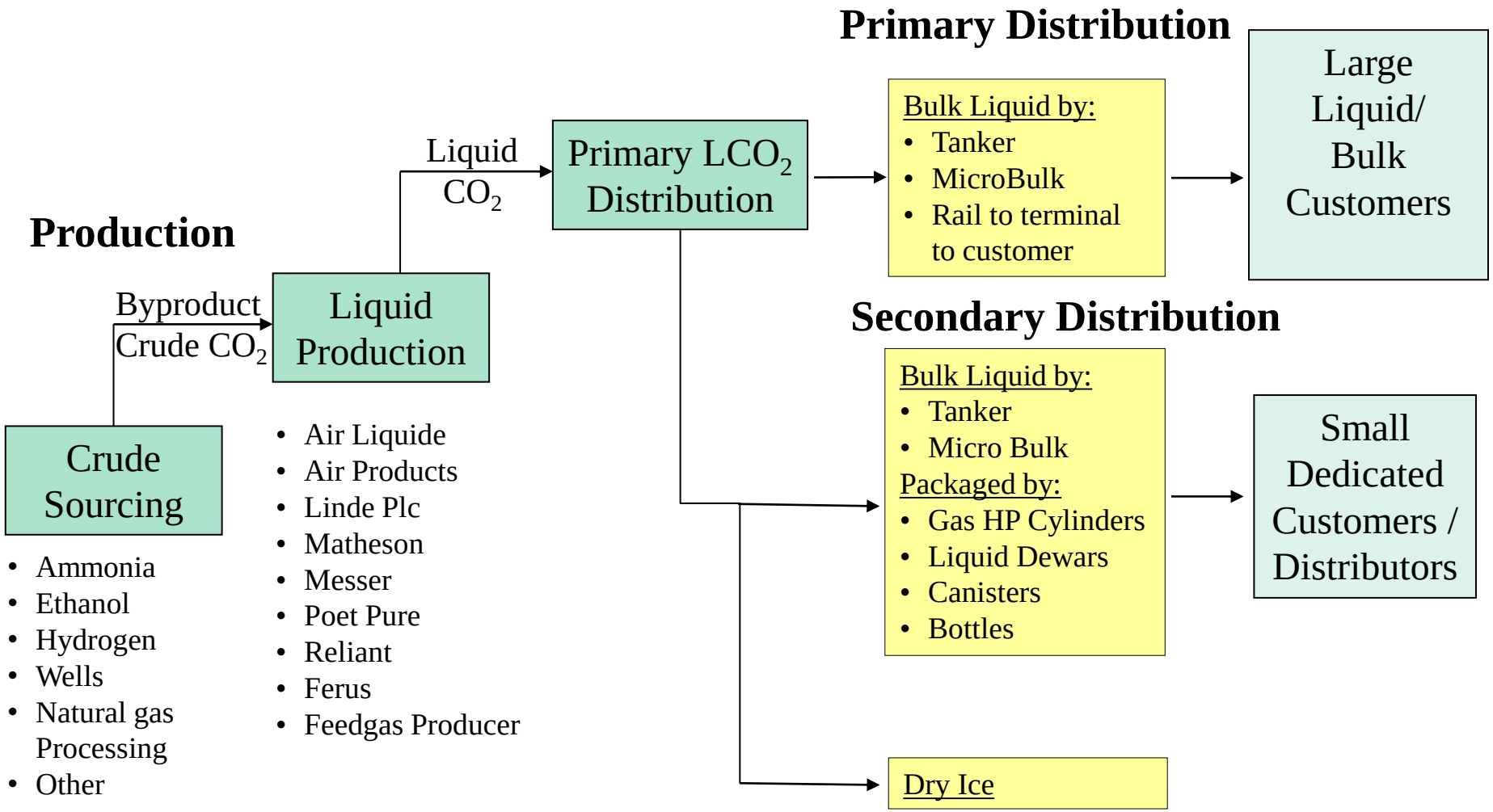
Drivers Of CO_2 Demand

- **Food**
  - Food processing plants – Population, and Geography – key drivers
    - Chilling – Big in Poultry, Pork, and Beef - growing
    - Freezing – Big in Prepared foods - growing
  - Ice/Pellets – Packaging & transport of food – Fast growing area
  - Beverage – Solid growth
    - Big in bottling and fast food/restaurants/taverns – Demand driven by per capita consumption & climate
    - Breweries/microbreweries - Expanding
- **Industrial**
  - Gas Shielding (Metal Working) – Tends to follow the fabrication market in the US
  - H_2O Treatment – Growing in municipal and industrial wastewater treatment – cost effective and environmentally responsible vs sulfuric acid
  - Other (fire extinguisher, cold pellet blast cleaning, cement, etc.)
- **Oil Field**
  - Primarily geography; new discovery and fracking technology – shale frack is mostly water frack – mature application
- **Other**
  - Cannabis and CBD (Cannabidiol) – Fast growing - legalization increasing

US CO_2 Supply Chain – Sources & Players



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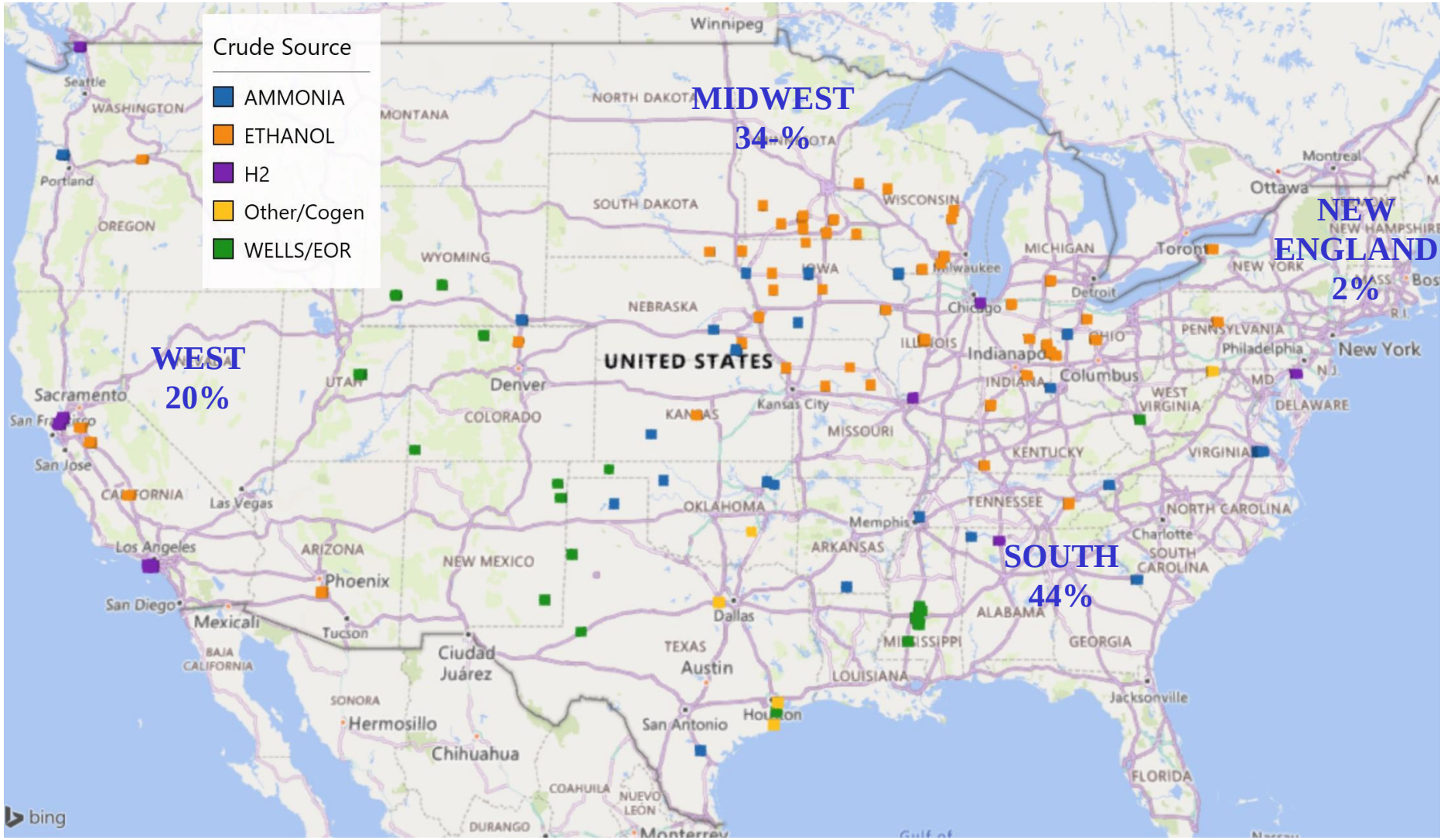
US Merchant CO_2 by Source - 2023



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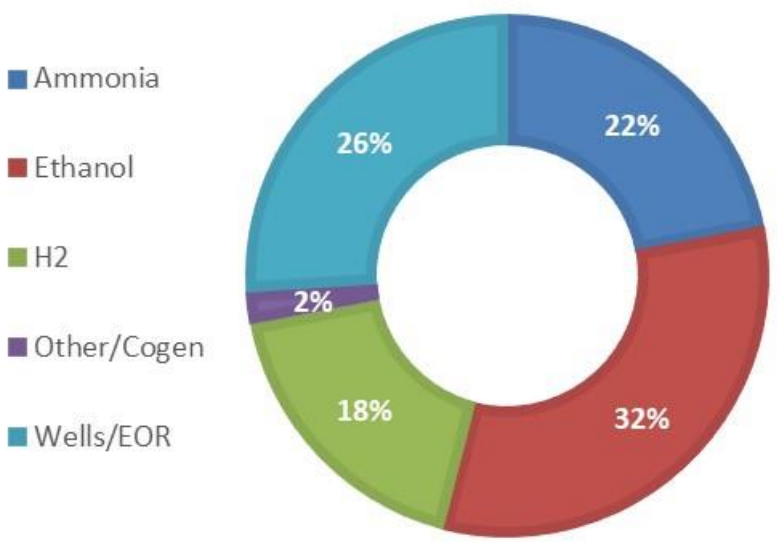
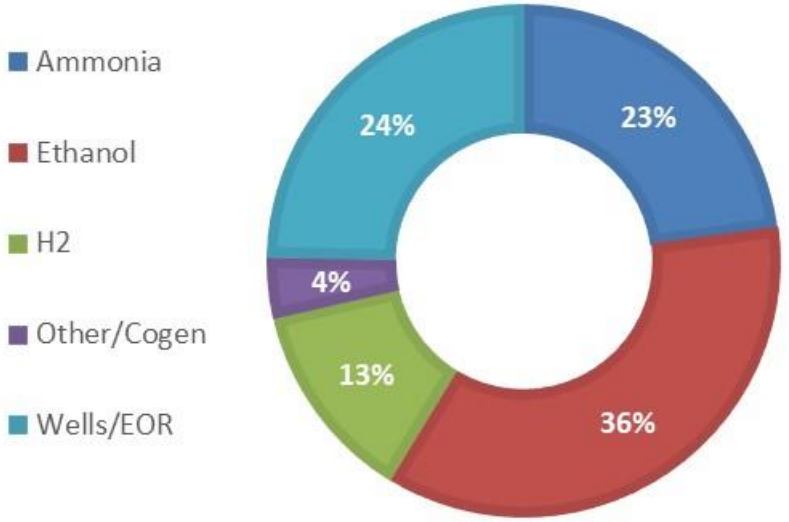
US Crude CO_2 NP Capacity by Source – 2014 to 2023





- Crude sourcing has experienced a shift toward Ethanol - away from H_2/Refining.
- Demand for Merchant CO_2 grew from 9.6 mtpy in 2014 to 10.3 mtpy in 2023 – 0.9% AGR – Covid Impact

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Canadian Merchant CO_2 By Source - 2023

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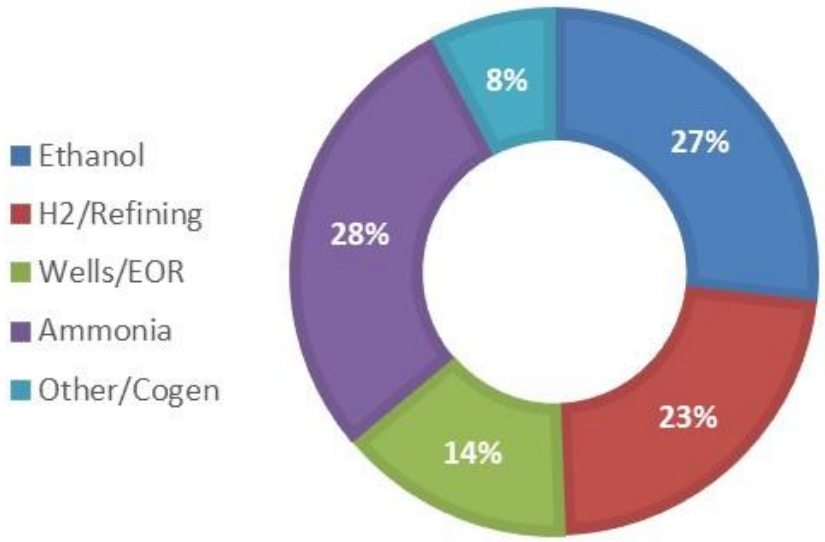
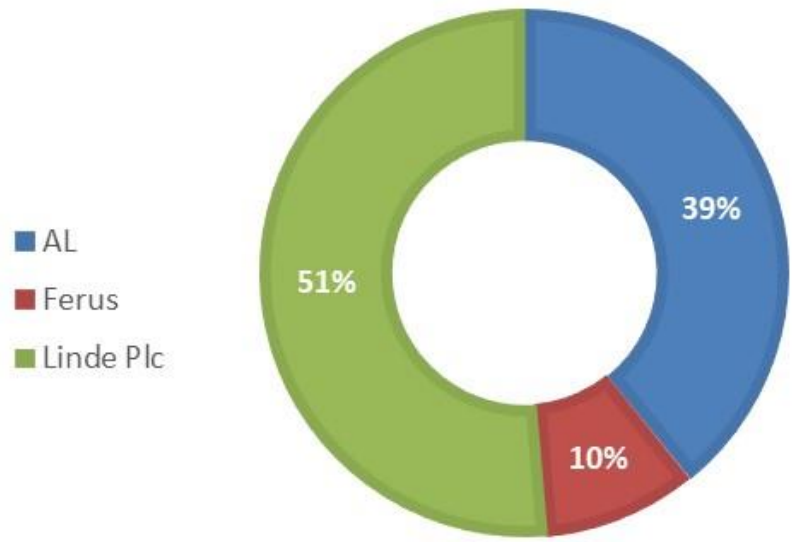
Canadian Merchant CO_2 Nameplate Capacity – 2023

By Player and By Source





2023 Canadian CO2 Capacity = 6.6 KTPD

- Linde Plc and Air Liquide dominate CO_2 sourcing from Canada.
- 78 percent of Canadian CO_2 is sourced from Ammonia, Ethanol, and H2/ Refining

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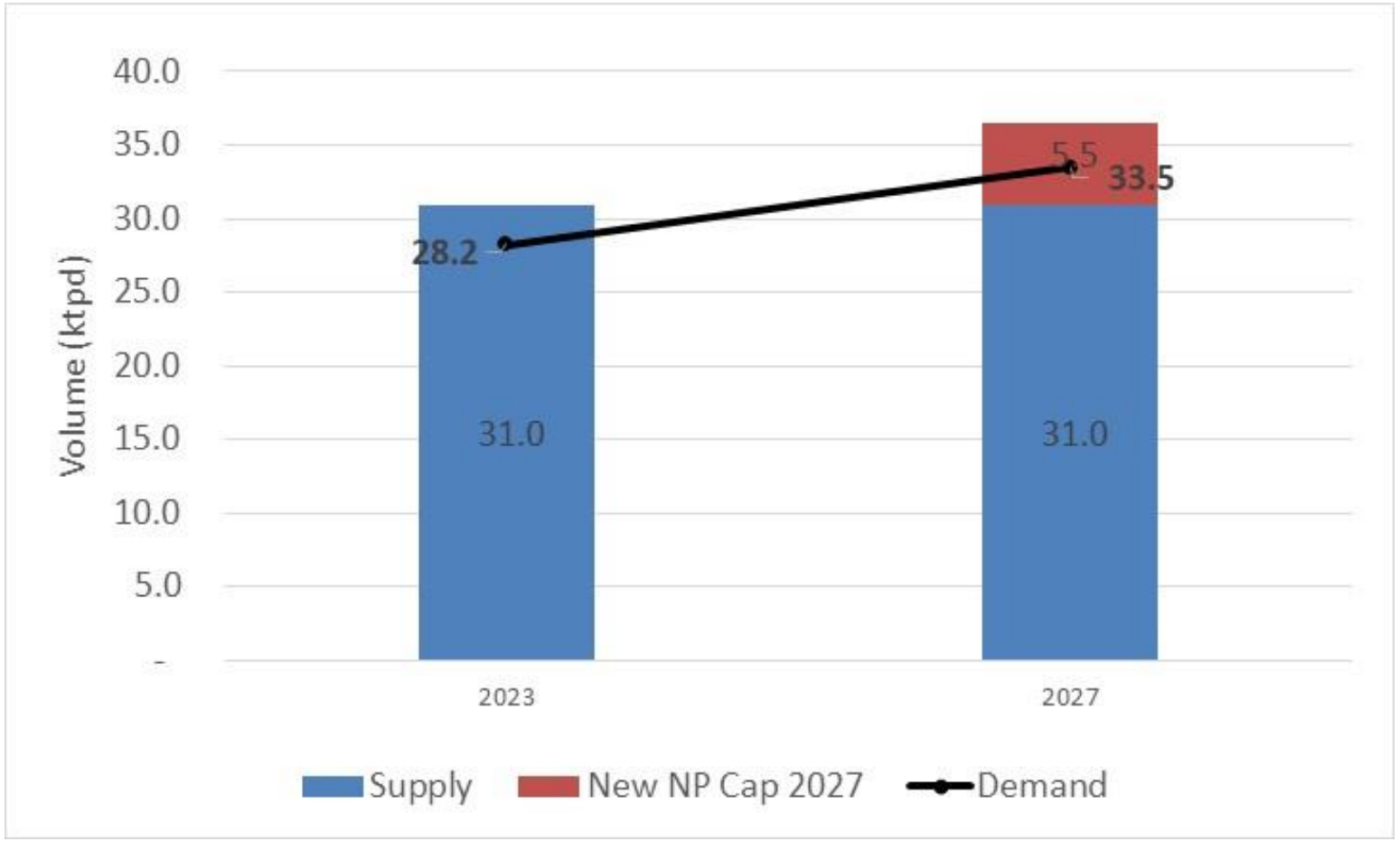
US CO_2 Demand – Supply Balance (ktpd)

2023 to 2027



- CO_2 Demand estimated to grow at 2.0% per year to 12.2 mtpy.
- To support Demand growth – a minimum of five 400 tpd plants need to be added by 2027.

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Conclusions - US CO_2 Business

- US CO_2 demand is 10.3 million tons per year which equals production.
  - Food applications comprise 70 percent of CO_2 demand
- US demand is projected to grow 2.0% AGR during the next five years
- US CO2 nameplate capacity is currently estimated at 13.2 million tons per year.
- To meet five-year growth forecast, 2,000 tpd additional capacity must be developed (5 – 400 tpd plants). Plenty of crude CO2 feedstock
- End-users need to take action to mitigate supply risk
  - Work with suppliers
  - Invest in your supply chain
- Security of the US Food Supply Chain
  - Covid 19 impact on Ethanol and support to Food industry and suppliers by VP Pence
  - CCS and 45Q/IRA and 45Z – this will negatively impact the ability of Merchant CO_2 to keep up with demand. Currently planned CCS pipelines in the upper Midwest already have agreements with Ethanol and Ammonia producers that will take 2,000 tpd out of existing supply after 2025.

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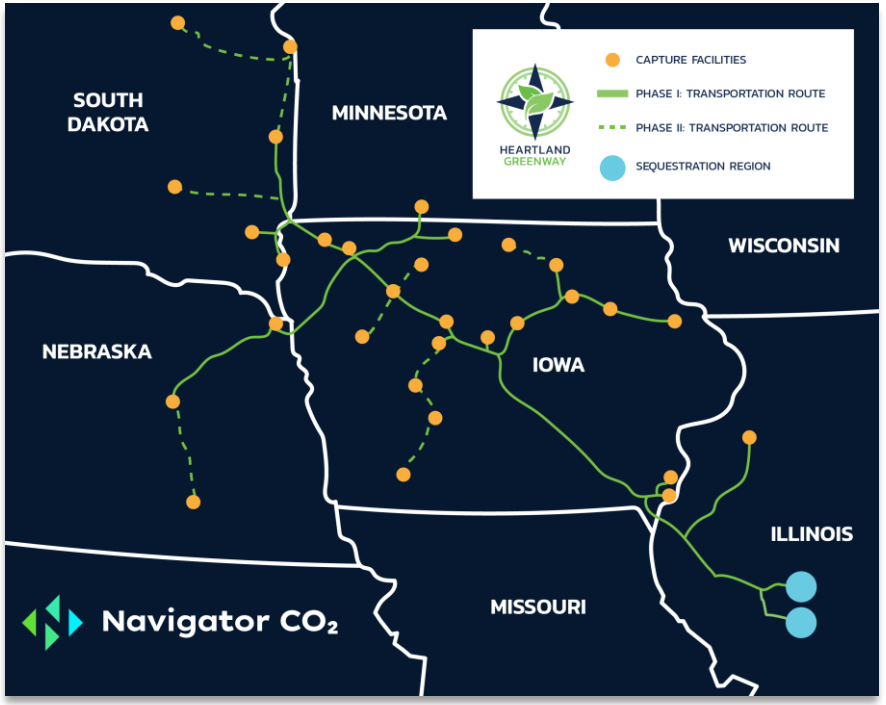
Utilization Market Update

March 2023

Heartland Greenway Project Summary

Large-scale point source CCUS platform across the Midwest for 2025 operational in-service

- **Pipeline**
  - ~2,300 miles of new liquid CO_2 mainline pipeline across 5 states
  - ~32 receipt points across various industries
  - Up to 15 million metric tons/year capacity
  - Filed state and federal pipeline permits
  - Focused on acquiring right of way and obtaining permit approvals in 2023
  - Construct in 2024 and be in service 2025
- **Sequestration**
  - Permanent storage in Illinois, spread across multiple injection sites
  - Filed 8 Class VI wells with the EPA
  - Acquiring pore space and surface sites for injection and monitoring wells



CO_2 Economic Shift Driving Different Market Behaviors

Different value propositions arising due to regulatory changes around decarbonization

- 45Q Credit
  - Eligible if the emitter captures CO_2 that would otherwise be emitted into the atmosphere and contracts for permanent sequestration
  - Construction of capture facility begins before 1/1/2033
  - Minimum emissions capture of 12,500 MT/yr
  - Eligible for the $85/MT credit over a 12-year term
- Additive to the 45Q Credit, the emitter may sell environmental attributes (EA) to third parties in the voluntary credit offset market
- An alternative to selling EA but still additive to the 45Q, an ethanol plant that can sell their ethanol into an LCFS market can achieve a premium uplift for their ethanol
- 45Z Clean Fuel Credit a separate option and could be the most lucrative to ethanol depending on overall CI-score reduction

100M Gallon Ethanol Plant @ 250,000 MT/yr of CO_2 *	45Q + EA	45Q + LCFS
45Q	$85	$85
(+) Environmental Attributes @ $25/MT	$25	$--
(+) LCFS @ $80/MT	$--	$80
(=) Total Value of Carbon	**$110**	**$165**
(-) Capture Equipment	($5)	($5)
(-) Capture Equipment OPEX	($10)	($10)
(-) Pipeline + Sequestration	($35)	($35)
(=) Net $/MT Uplift	**$60**	**$115**
(x) MT per year	250,000	250,000
(=) Net Revenue per year	**$15M**	**$29M**

Numbers are for illustrative purposes only and may vary based on size, location, credit, structure, etc.

CO_2 Price Floor Resetting from "Waste" to Commodity, Shift from Byproduct to Coproduct

45Q + LCFS/environmental attributes value - cost

Assume 100M gallon ethanol plant produces 250,000 MT/yr of CO_2 at full capacity

Current: Waste

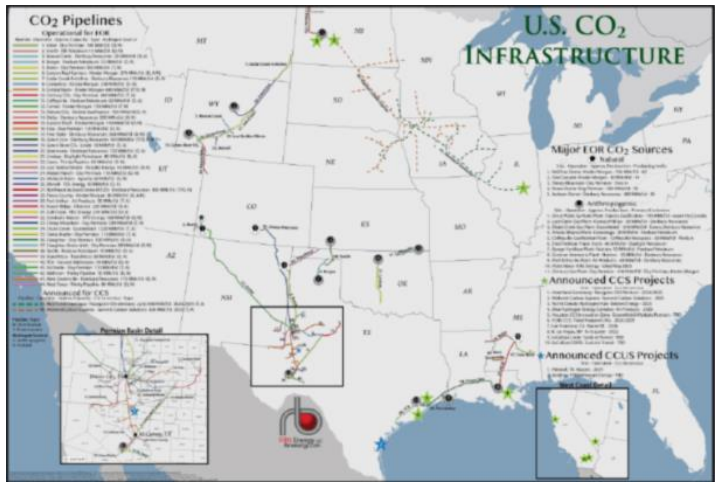
- **CO_2 buyer** invests all capital to capture/process CO_2 + opex + maintenance
- Ethanol plant sells CO_2 to a buyer @ ~**$12/MT**
- Revenue to ethanol plant = **$3M/year**

- **Ethanol plant** invests capital to capture/process CO_2 + opex + maintenance
- Plant sequesters CO_2 for $85/MT less costs of $50/MT to net **$35/MT**
- Plant either 1) qualifies for LCFS for **$80/MT** or 2) sells offsets for **$25/MT**
- Revenue to ethanol plant = **$15M - $30M/year**

Would the ethanol company forgo this opportunity to continue to sell its CO_2 to a buyer for ~$3M/year?

Colocation of CO_2 Pipelines to Supply is No Accident

Significant portion of CO_2 supply will be adjacent to CO_2 sequestration pipelines for ease of connection



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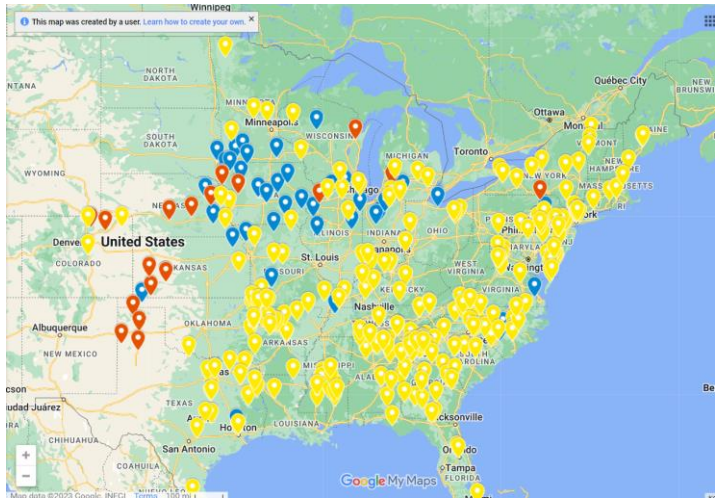
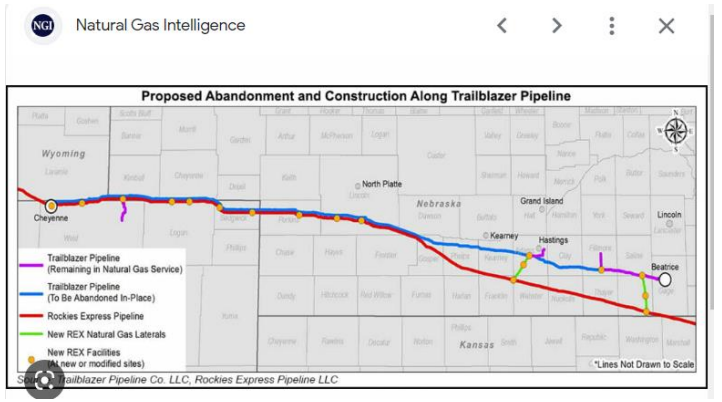
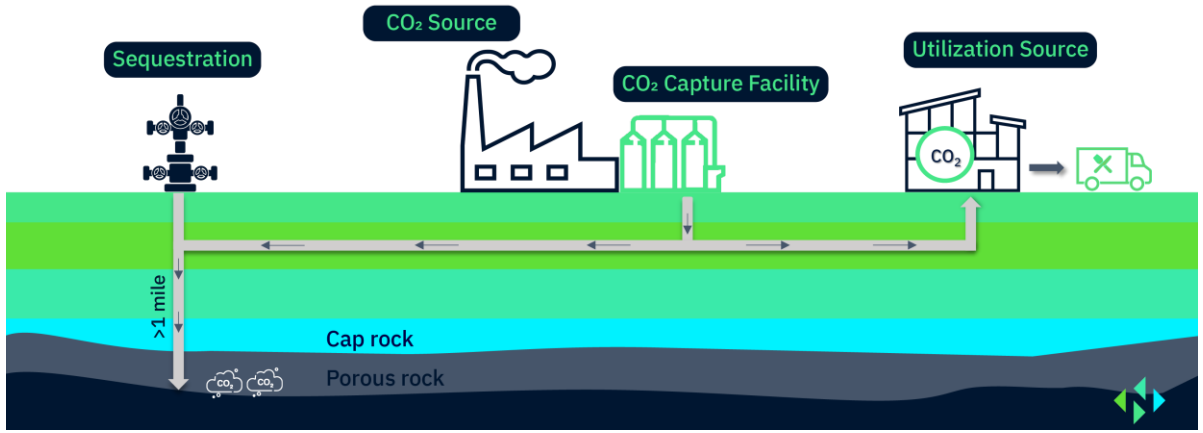




Individual Plant Partnership Is A Challenged Model

CO_2 buyers face increasing risk by aligning with single sources for product

- Single source contracts subjects CO_2 buyer to operational downtime and loss of supply for any reason; interruptible for any time or any reason is not sustainable
- Shift in value proposition driving CO2 prices higher; power shifting to the seller
- End users that want a ratable, diverse supply mix with limited operational disruptions will have to pay a premium
  - CO_2 pipelines source product from multiple ethanol, power, ammonia and other industrial plants
  - Redundancy in supply and resiliency in operations is paramount
- Future regional or federal low carbon fuel market development will further incentivize ethanol plants to participate
  - Selling ethanol is their core business and they will always seek ways to maintain competitiveness
  - Should a CO_2 supply company look to secure a source not connected to any sequestration pipeline, that source will always have 'head on a swivel' to benefit from programs paying low CI ethanol providers
- Additional pipeline development will continue to attract CO_2 pointed towards sequestration
- Incremental capex to integrate with new ethanol plant will put a CO_2 buyer at parity with a pipeline from a single source and at a higher risk



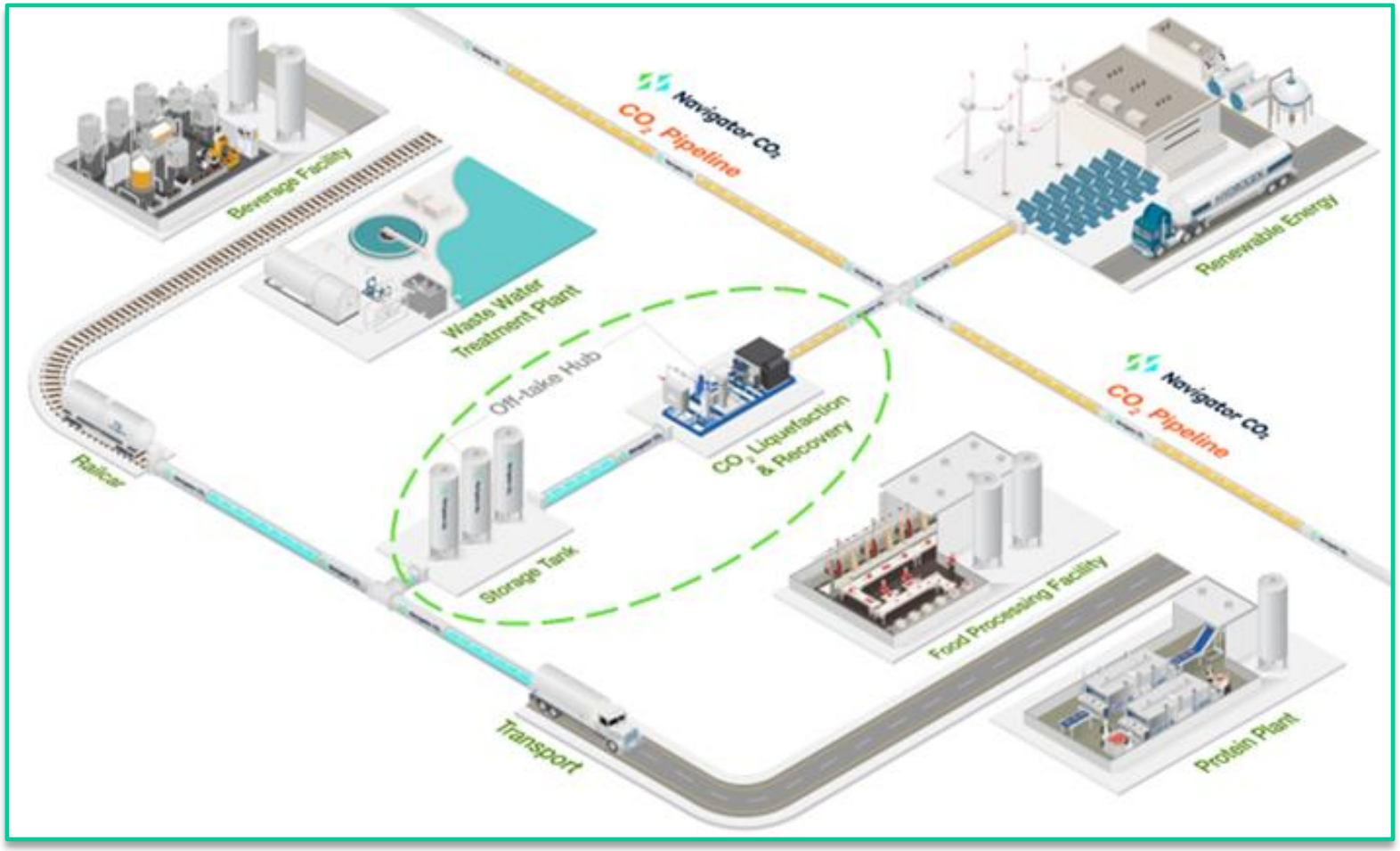
CO_2 End User Acceptance of Market Change

Will bear CO_2 price at the intersection of highest product reliability at the lowest alternative cost

- End users will not pay any price, but they will pay more than what they are paying today
- Reliability and resiliency command a premium
  - Protein plants cannot run without CO_2
  - Only a small volume of cryogenic demand can be substituted with nitrogen
  - CO_2 bid process is cumbersome
- End users realize (or need to continue to be educated) that they will need to compete with 45Q, 45Z, LCFS and other premium value drivers to incent molecules away from sequestration
- Extreme price (e.g., $4,000/MT) seen in Europe recently due to dislocation of the CO_2 market demand against supply
  - Removal of future supply expected to exacerbate already tight US supply/demand balance (~2-3 MTPA CO_2 supply to be taken out of market proforma for CCUS in Midwest); 45Z could materially affect this
  - Growth in dry-ice demand for shipped food products adding stress to liquid CO_2 availability
  - Technology advances for next-gen industrial applications using CO_2 as a feedstock (ex. SAF, efuels, green ammonia, green hydrogen, synthetic biology upgrading, cannabis etc.) will continue to drive demand in the future
- End users need to be willing to term up contracts at a fair price to avoid being subject to extreme spot market price volatility
  - 5-10 years (45Q is 12 years)
  - Prices will be higher but reliability will be significantly improved

Heartland Greenway Offtake Hub Concept

CO_2 purchased FOB at the hub for further transportation via truck, pipe or rail to the end user



Heartland Greenway Offtake Hub Offering

Set it and forget it

- Heartland Greenway building multiple offtake hubs with no rate difference to sequester versus deliver
  - Capacity design of 500 MT/day or 1000 MT/day
  - Targeting locations in IL, IA, and NE near mainline pipeline, good highway access and power availability
  - Pull pipeline quality high-pressure, dense phase CO_2 (1300 to 2100 psig) off the mainline pipeline and reduce the pressure to 200-500 psi
  - Product upgraded to meet beverage specifications for USDA requirements, stored for up to 2 days and then loaded on to a liquid CO_2 truck for service fee of $25-35/MT
  - Product measured into and out of the offtake hub, with title and risk passing to the CO_2 buyer at the flange of the truck offload
  - Considering rail loading capability
- CO_2 buyers can purchase product from any seller at any available offtake hub on a term or spot basis
  - Hub location does not have to be physically downstream of the seller's plant
  - Sellers can sell all or just a portion of their CO_2 to a buyer
- Offtake hubs can be strategically located to end users
  - Reduces distance, saving truck transportation cost and turnaround time
  - Coupled with more efficient transportation fuels, the savings could negate a portion of the CO_2 price increase
- CO_2 buyers and sellers can keep existing business relationships and renegotiate terms to transition activity from the plant to the pipeline once in service

Key Takeaways

Action must be taken in 2023 to set up for 2025 and beyond

- Opportunity to completely restructure how the CO_2 markets work: your input is paramount
- Supply will materially decrease over the next 2-3 years with pipeline start ups
- Demand continues to increase with energy shift to make next generation fuels (SAF, e-fuels, renewable diesel)
  - Example: Denbury/HIF/Monarch deal announced for 2M+ tons CO_2 /year which represents 17% of current market
  - Many more are coming
- Consider two paths:
  - If pipelines get built and the market continues to move forward, how will your facility be affected by the various CO_2 constraints? Can you take action now to avoid this?
    - Navigator offtake is an option
  - If pipelines aren't built, it's business as usual
- Get input and insights from various stakeholders in the entire CO_2 supply chain NOT just suppliers
- Use federal $$ to help your operations reduce their carbon footprint
  - Combined heat and capex (CHP) has significant capex incentives (up to 50% of capex)
  - Capture CO_2 from boilers?
  - Develop new brands if you decarbonize a processing plant to become carbon negative
  - Consider next generation fuel to transition your own transportation fleet
  - Band together and support the proposed legislation to allow the utilization tax credit to match the sequestration credit
- **Time to act is NOW**

Key Contacts

Navigator CO_2

Laura McGlothlin
EVP & Chief Commercial Officer
M: 214-537-6341
lmcglothlin@navco2.com

Jim Mullin
Executive Director of Carbon Utilization
M: 970-397-9053
jmullin@navco2.com

Eric Leigh
Executive Director of Carbon Supply and Markets
M: 309-310-2814
eleigh@navco2.com

Jordan Jones
Director of Business Development
M: 281-660-8958
jjones@navco2.com