

NOVA Chemicals' CO₂ Experience



PTAC CO₂ Enhanced Hydrocarbon Recovery Forum
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Speaker: Graeme Flint, NOVA Chemicals Corporation

NOVA Chemicals Corporation

NOVA Chemicals ethylene and polyethylene



Joffre

2.2 kt Ethylene

1.0 kt Polyethylene

Sarnia

0.7 kt Ethylene

0.7 kt Polyethylene

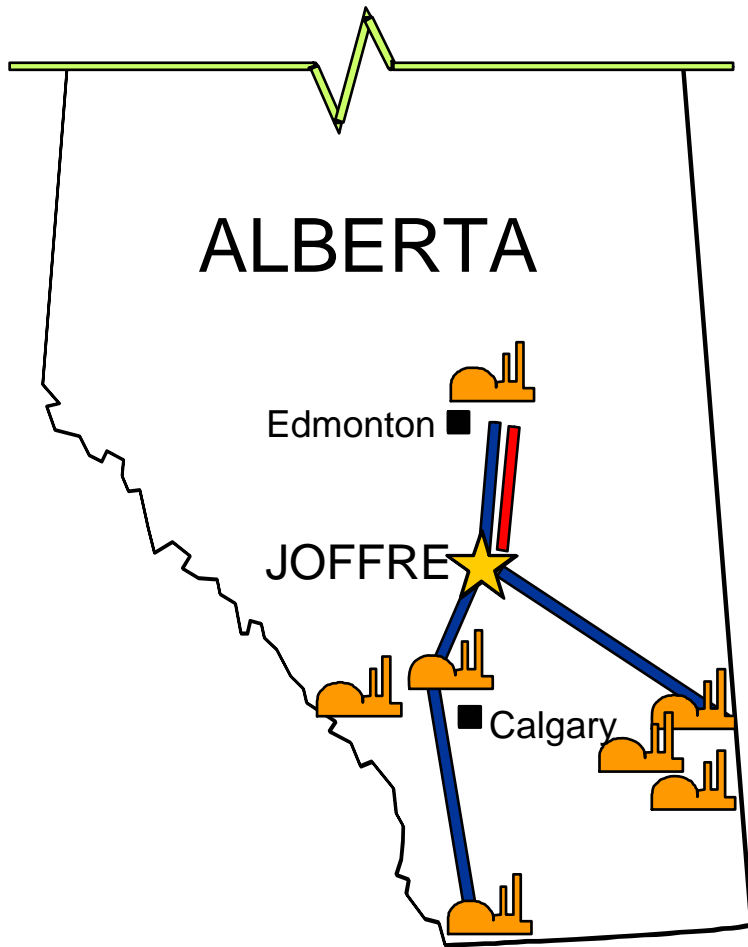
1.7 kt Co-Products




Pilot Plant

Calgary

Technology Centres

Alberta Ethane Gathering System

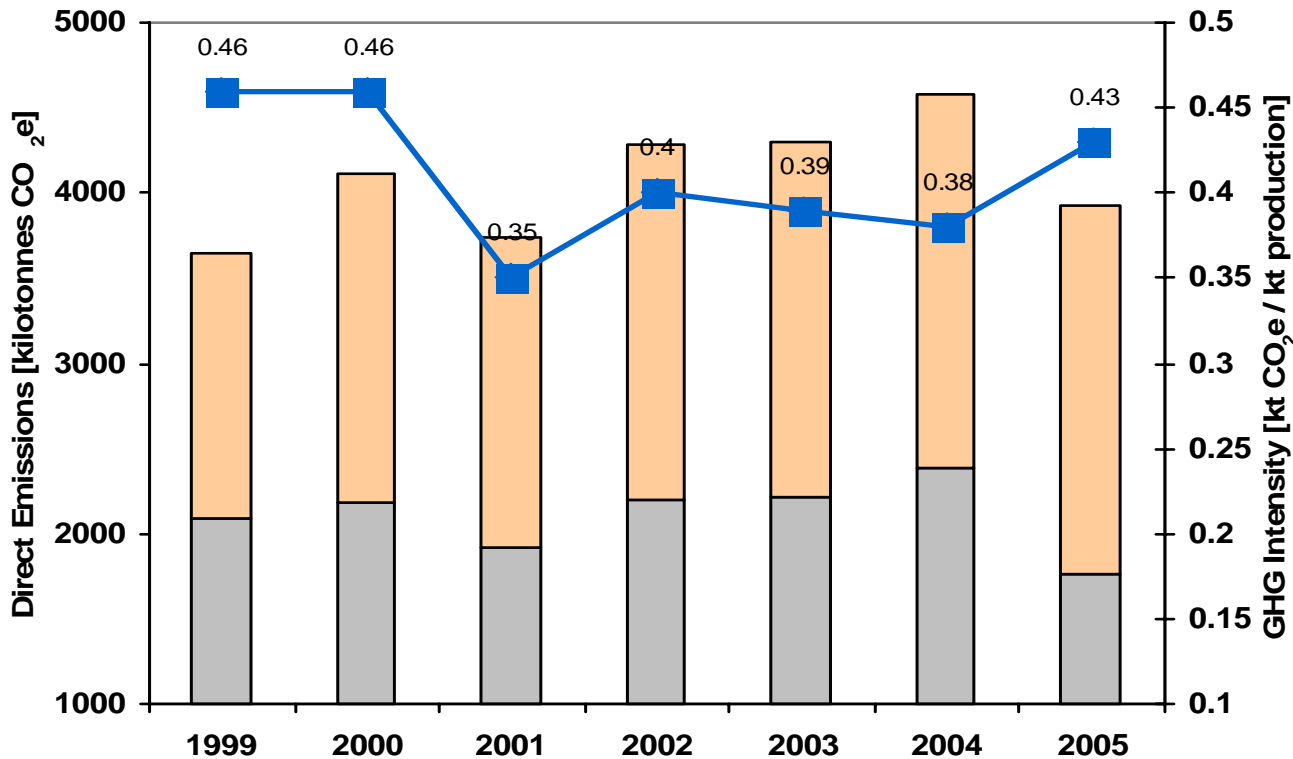


-  Ethane Gathering System
-  Ethylene Pipeline
-  Ethane Suppliers

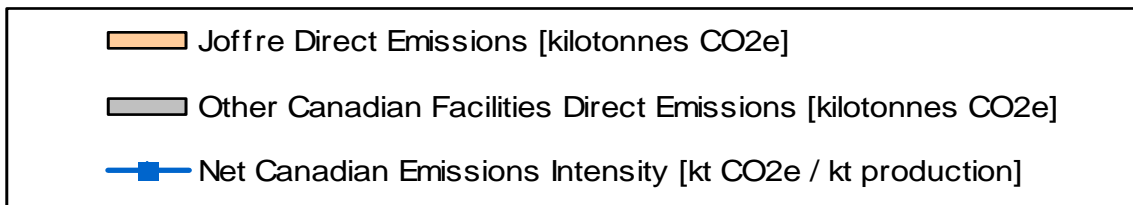
Managing Greenhouse Gas Emissions

- NOVA Chemicals reports GHG data federally and provincially
 - One of the first companies to participate in the voluntary GHG emission reporting program (VCR)
 - NOVA Chemicals achieved Gold Level Status for their reporting from 2001-2004
- NOVA Chemicals reports emissions of CO₂, CH₄ and NO_x

Direct GHG Emissions at NOVA Chemicals



- More than 99% of NOVA Chemicals' direct greenhouse gas emissions are carbon dioxide



Source: NOVA Chemicals – Managing Greenhouse Gas Emissions - 2006

NOVA Chemicals' CO₂ Sources

- NOVA Chemicals captures CO₂ from ethane feedstock used at the Joffre site
 - Represents approximately 10-15% of total greenhouse gas emissions generated from chemical manufacturing activities
 - Capture of CO₂ contained in flue gas is outstanding opportunity currently limited by technology

NOVA Chemicals' Merchant CO₂ Capture

Joffre Viking Flood

- Commercial CO₂ miscible flood since 1984
- Relationship with an oil & natural gas energy trust

Enhanced Oil Recovery Project

- Commercial EOR of existing oilfields in Central Alberta since 2005
- Relationship with an oil & gas exploration company

CO₂ capture represents approximately 160 kta CO₂e emissions reduction from NOVA Chemicals' Joffre site

Commercially Successful CO₂ Capture

- Commitment to Responsible Care[®] ensures focus on continuous energy efficiency improvements
 - ✓ Leadership prioritized emission reduction objectives
 - ✓ CO₂ capture identified as an early win
- CO₂ source strategically located near sink or flood
 - ✓ NOVA Chemicals' Joffre site is located in the midst of a viable area for miscible flooding in the Western Canadian Sedimentary Basin
- Use of existing infrastructure to transport CO₂
 - ✓ CO₂ transport is primarily most economic by pipeline. Investment for pipeline construction is a hurdle. On one project, NOVA Chemicals overcame this situation by using an existing pipeline to transport CO₂.

Commercially Successful CO₂ Capture

- Increase in crude oil pricing has improved economic viability of opportunities
- Economic evaluation of projects needs long-term perspective
 - ✓ CO₂ capture is a long-term project. Infrastructure (i.e.: pipelines and compression equipment) require several years to reach breakeven.
 - ✓ NOVA Chemicals structures CO₂ capture arrangements to cover costs and seeks opportunities to share in producer benefits over lifetime
- Capitalize on a short planning and implementation window
 - ✓ Experience and in-house resources allowed NOVA Chemicals to successfully take their 2005 CO₂ capture (EOR) project from conception to commercial operation in 2 years

Future Direct Emissions Reduction

- NOVA Chemicals has 85-90% of direct emissions remaining for processing
 - 10-15% from feedstock
 - 85-90% from flue gas
- Suitable technology to process flue gas volumes is currently not available on an economic basis
- NOVA Chemicals continues to seek and promote practical, economically viable, technology-focused solutions

CO₂ Capture – Future Opportunities

- To facilitate Alberta-wide commercial CO₂ capture opportunities, all sectors must strategically and jointly create solutions to the following challenges:
 - Technology development
 - Infrastructure planning and development
 - Economics of CO₂ capture

Technology Development

- Monitoring development of flue gas technology to increase emission reduction opportunities at Alberta based facilities
- Planning for exhaustion of current floods and merchant CO₂ projects
 - Development of future generation of CO₂ capture projects

CO₂ Capture Infrastructure Development

- Economic delivery of CO₂ from source to sink
 - Typically, commercial CO₂ capture must address infrastructure between CO₂ source and sink (pipelines, etc.)
- Future planning opportunities
 - Development of rights-of-way for future CO₂ transport lines during project vision or design phase
 - Networks of CO₂ pipelines in strategically located areas

CO₂ Capture Economics

- Strategic plans for Alberta markets
 - Joint venture/partnership efforts to enable economics of scale to support CO₂ capture for Alberta
 - Preferentially selecting a CO₂ partner and allowing this to influence an expansion
- CO₂ Project and Credit Valuation
 - No consistency in valuation for carbon capture
 - Recent changes in Canada's participation in Kyoto leaves further uncertainty in economic valuation of CO₂ capture



NCX