

Petrochemical Industry Outlook

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Agenda

- Introduction to Petrochemicals
- What happened in 2008?
- Challenges for 2009?
- Medium term outlook
- Longer term outlook

Alberta's Petrochemical Industry

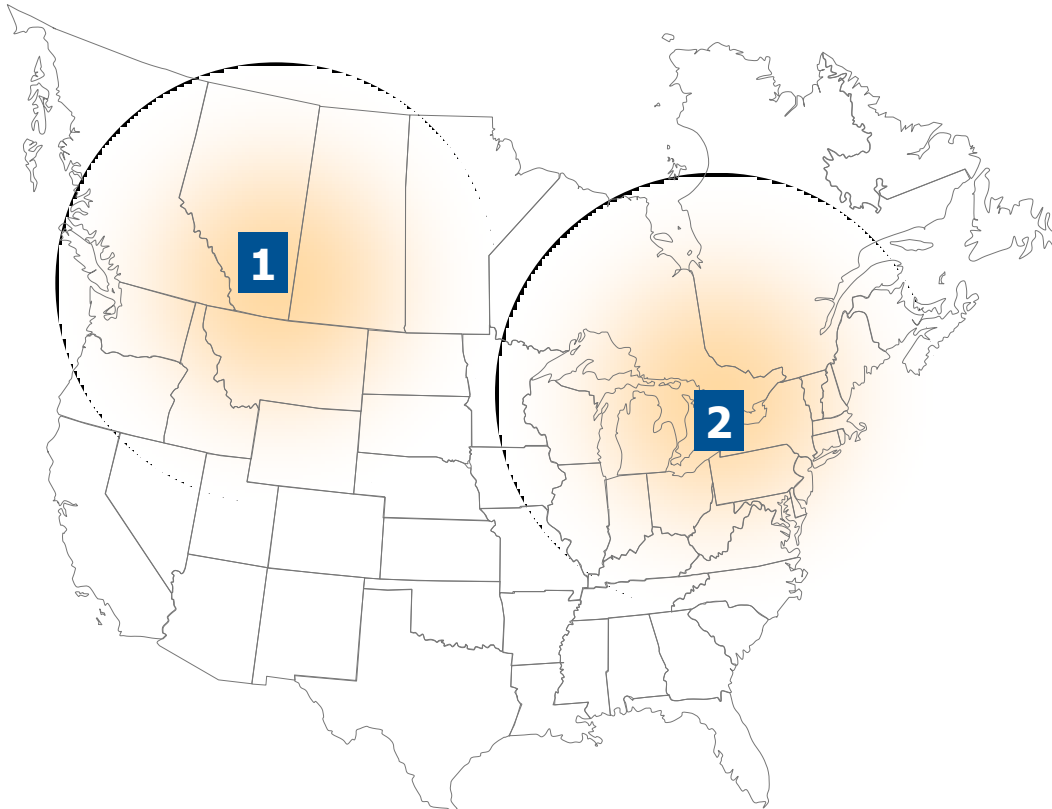


- Petrochemical production is one of the largest manufacturing industries in Alberta
 - ▶ \$9 billion/year of products and \$5.3 billion/year of exports
 - ▶ Alberta is Canada's leading producer of petrochemicals
 - ▶ Investment since 1974 totals over \$9 billion
 - ▶ Employs more than 6500 Albertans with \$400 million/year payroll
 - ▶ Creates 2.5 jobs for every direct job
- Primary benefit is the upgrade of ethane from exported natural gas value
 - ▶ Products have significantly higher value than raw resource
 - ▶ Provides economic diversification, job creation, capital investment and infrastructure growth
 - ▶ Provides incremental market for 700,000 GJ/day of natural gas in Alberta

Major Petrochemical Sites in Alberta

- **Fort Saskatchewan**
 - ▶ Dow Chemicals: ethylene, ethylene glycol, ethylene oxide, polyethylene, foam polystyrene, and electricity co-generation
- **Joffre**
 - ▶ Ineos Chemicals: linear alpha olefins
 - ▶ Dow/NOVA joint venture: ethylene
 - ▶ NOVA Chemicals: ethylene, polyethylene and electricity co-generation
- **Edmonton**
 - ▶ AT Plastics: polyethylene
- **Prentiss**
 - ▶ Dow Chemicals: ethylene glycol, polyethylene
- **Redwater**
 - ▶ Williams Energy: propylene
- **Scotford**
 - ▶ Shell Chemicals: monoethylene glycol, styrene monomer

NOVA Chemicals Two World Class Petrochemical Complexes



*including a 50/50 joint venture with Dow
(NCX portion is 4,800 MMlbs)

**50/50 joint venture with INEOS

1

Joffre: World's Largest Ethylene Manufacturing Centre

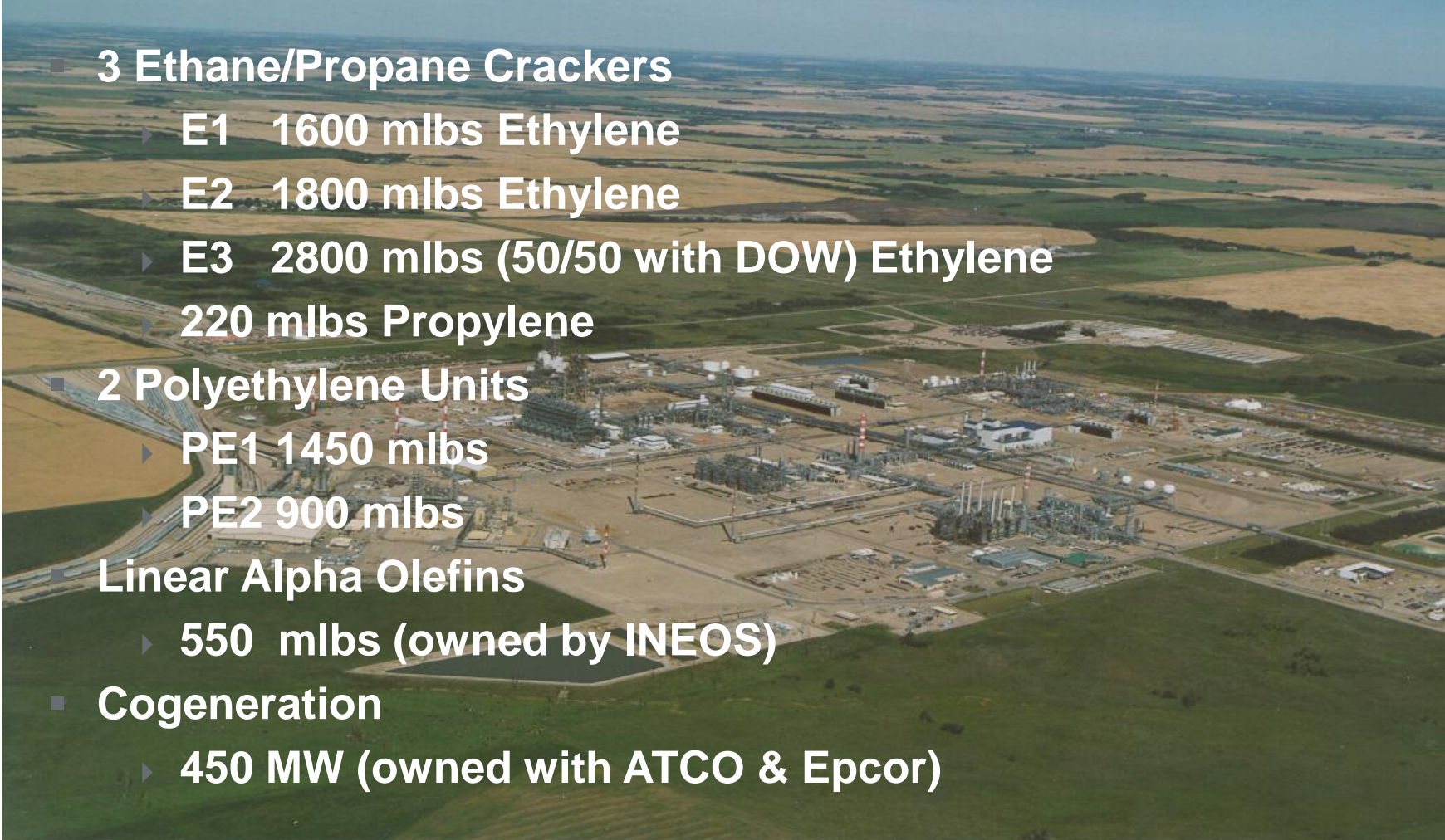
6,200 MMlbs Ethylene*
2,350 MMlbs Polyethylene
220 MMlbs Propylene

2

Sarnia-Lambton: Centrally Integrated into Canada's Largest Petrochemical Cluster

1,850 MMlbs Ethylene
4,700 MMlbs Co-Products
755 MMlbs Propylene
1,225 MMlbs Polyethylene
950 MMlbs Styrene Monomer**

NOVA Chemicals' - Joffre Site

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- An aerial photograph of the NOVA Chemicals Joffre Site, showing a large industrial complex with numerous buildings, pipes, and storage tanks, surrounded by green fields and a road.
- **3 Ethane/Propane Crackers**
 - ▶ E1 1600 mlbs Ethylene
 - ▶ E2 1800 mlbs Ethylene
 - ▶ E3 2800 mlbs (50/50 with DOW) Ethylene
 - ▶ 220 mlbs Propylene
 - **2 Polyethylene Units**
 - ▶ PE1 1450 mlbs
 - ▶ PE2 900 mlbs
 - **Linear Alpha Olefins**
 - ▶ 550 mlbs (owned by INEOS)
 - **Cogeneration**
 - ▶ 450 MW (owned with ATCO & Epcor)

2007 – Unprecedented Volatility

- Escalating crude and gas caused significant increases in operating costs
- Ethylene and polyethylene price increases required to maintain margins
- Rapid de-escalation of energy in 4th quarter
- High cost inventory through the energy to petrochemical chain needs to be depleted
- Slow down in economic activity and inventory depletion has led to weak short-term demand

Petrochemical feedstock costs

NYMEX Crude Prices
(\$/b)



AECO Natural Gas
(\$/GJ)



Challenges in the immediate short term

- Adjust to the realities of the economy
 - ▶ Adjust production to match weak demand
 - ▶ Maintain low inventories

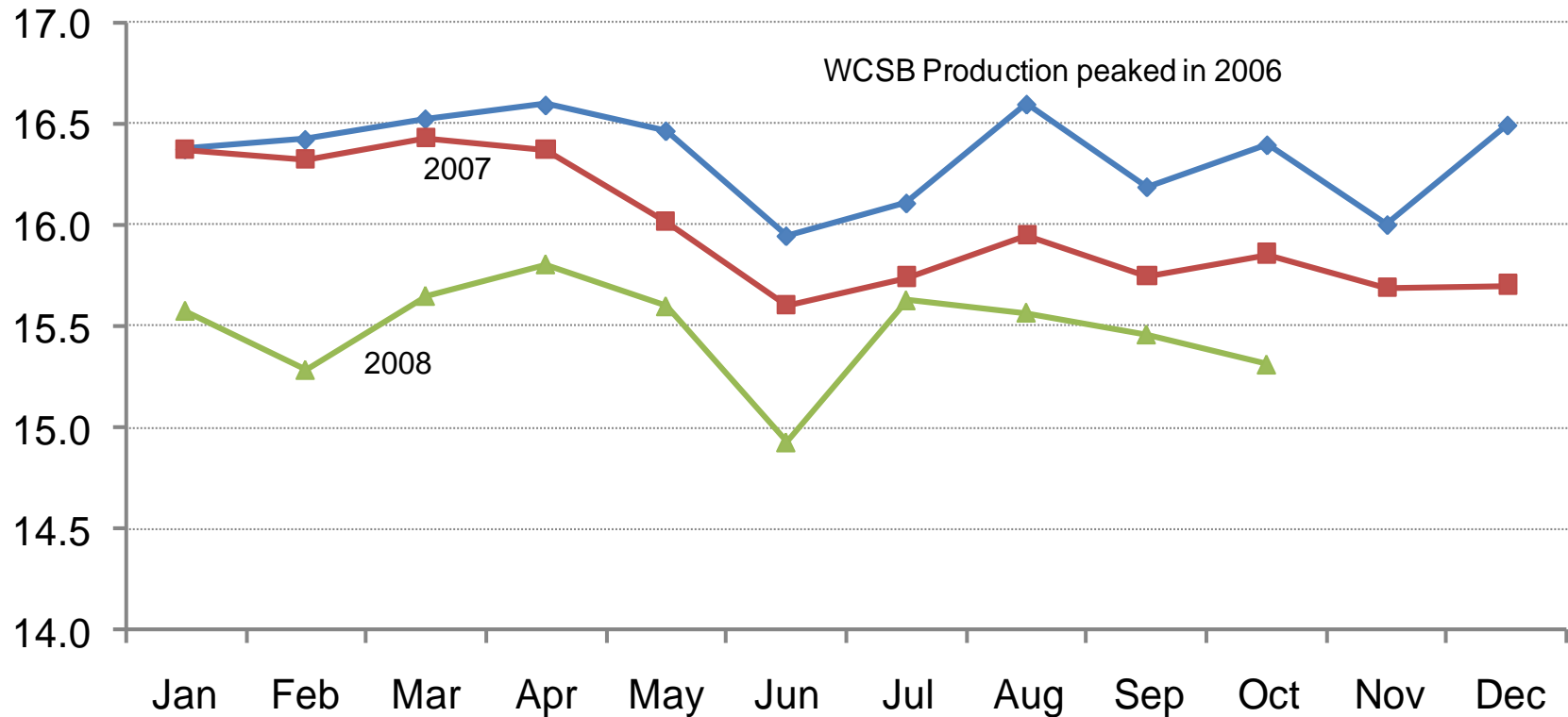
 - ▶ **Conserve cash**

Challenges in the medium term

- Optimize feedstock supply
 - ▶ Declining conventional natural gas production
 - Increasing coal-bed methane & shale gas production
 - ▶ Increased intra-Alberta natural gas demand
 - New gas-fired power generation
 - Increasing in-situ bitumen production
 - ▶ Develop lean gas streaming to burner tip, rich gas to extraction plants
 - ▶ Maximize use of highest ethane extraction efficiency assets

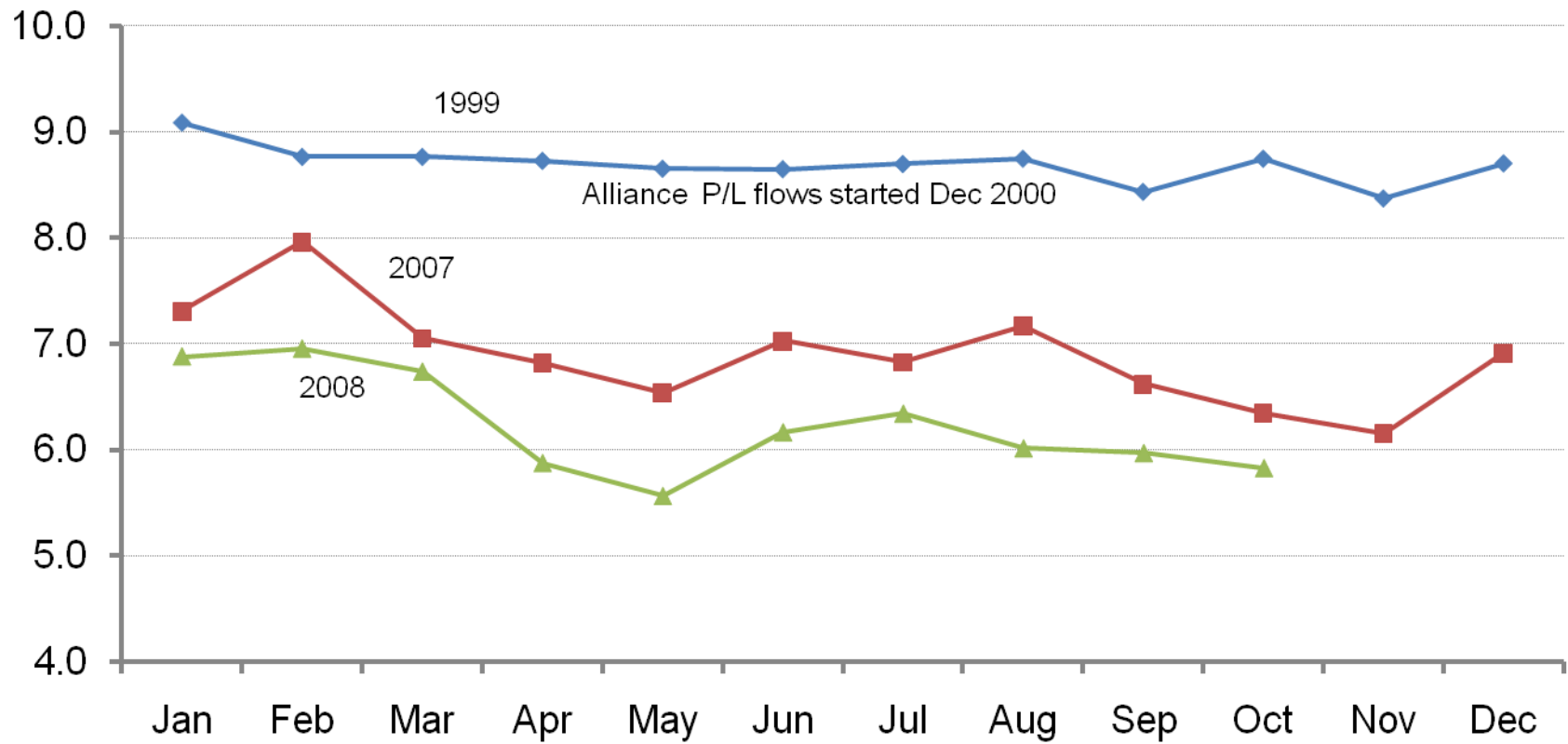
Declining WCSB Production

Western Canadian Gas Production (Bcf/d)



Alberta Natural Gas Flows

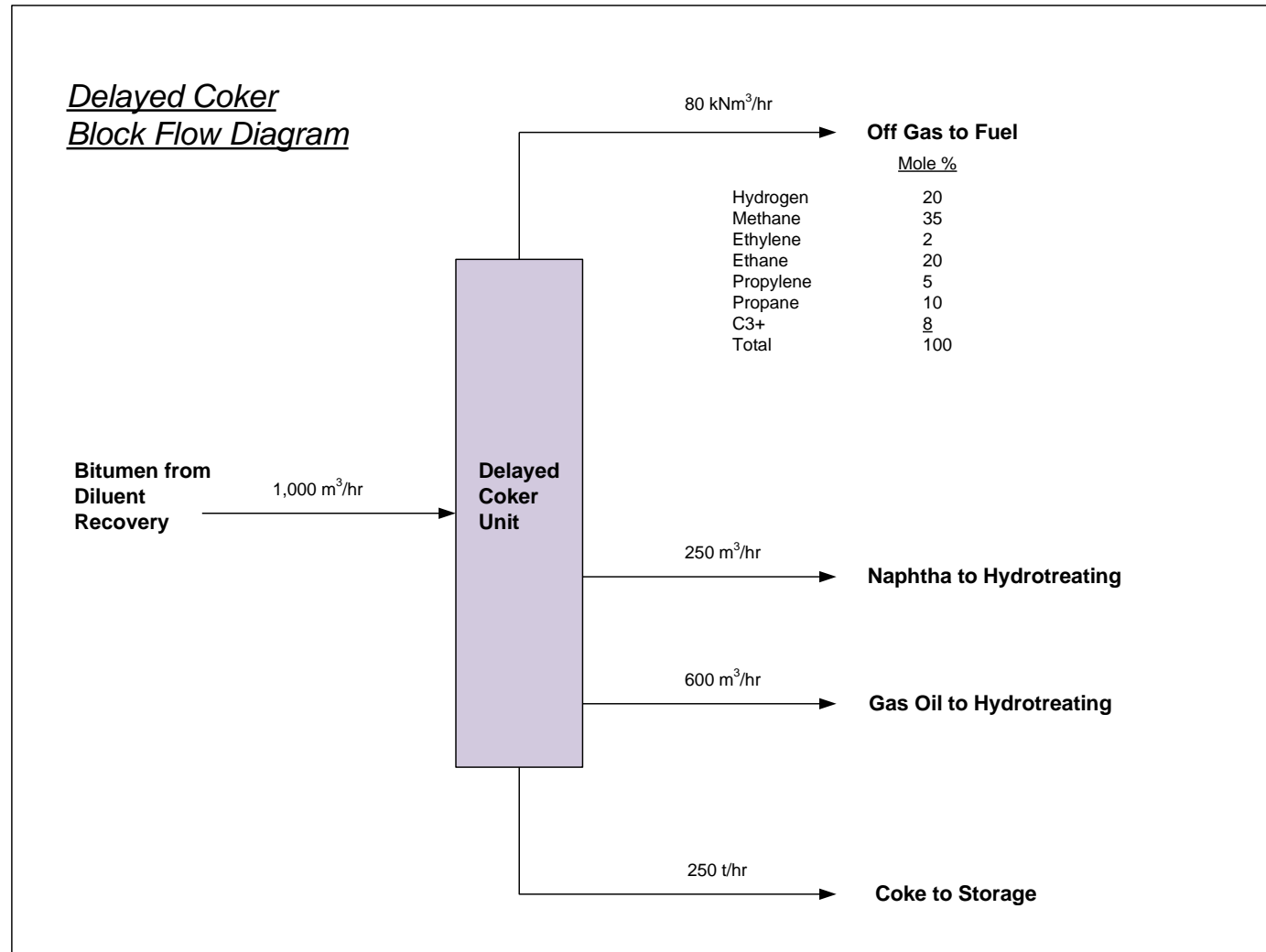
Empress Border Flows (Bcf/d)



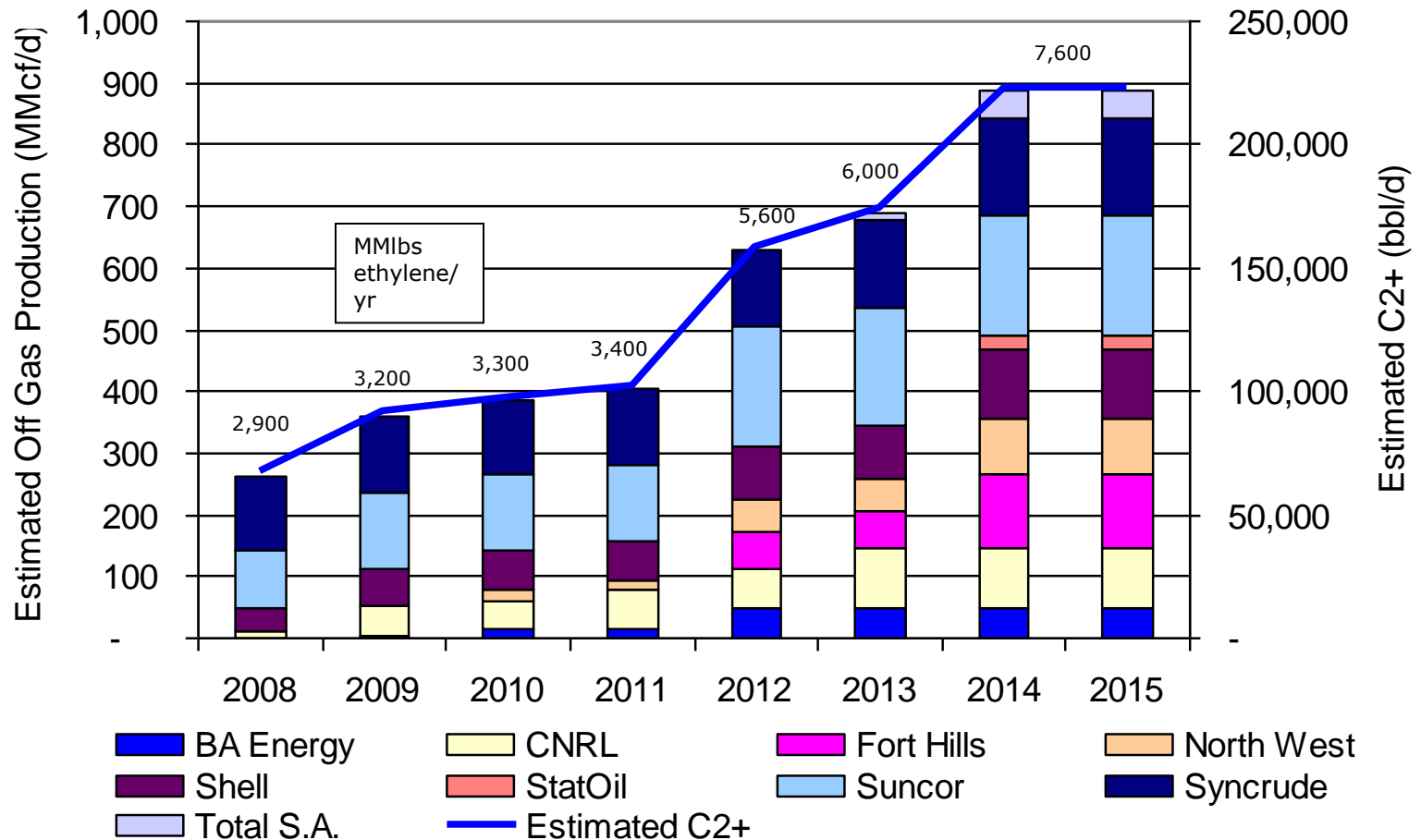
Opportunities in the medium term

- Develop alternate feedstock supplies
 - ▶ Upgrading of bitumen produces petrochemicals
 - ▶ These have typically been recycled as fuel
 - ▶ Concentration in offgas is greater than NGL in natural gas
 - ▶ Recovery and extraction process similar to NGL extraction
 - ▶ Cost and distance from market is challenging

Upgrading Bitumen produces petrochemicals



Potential Off Gas and C₂⁺ Supply from Alberta Upgraders

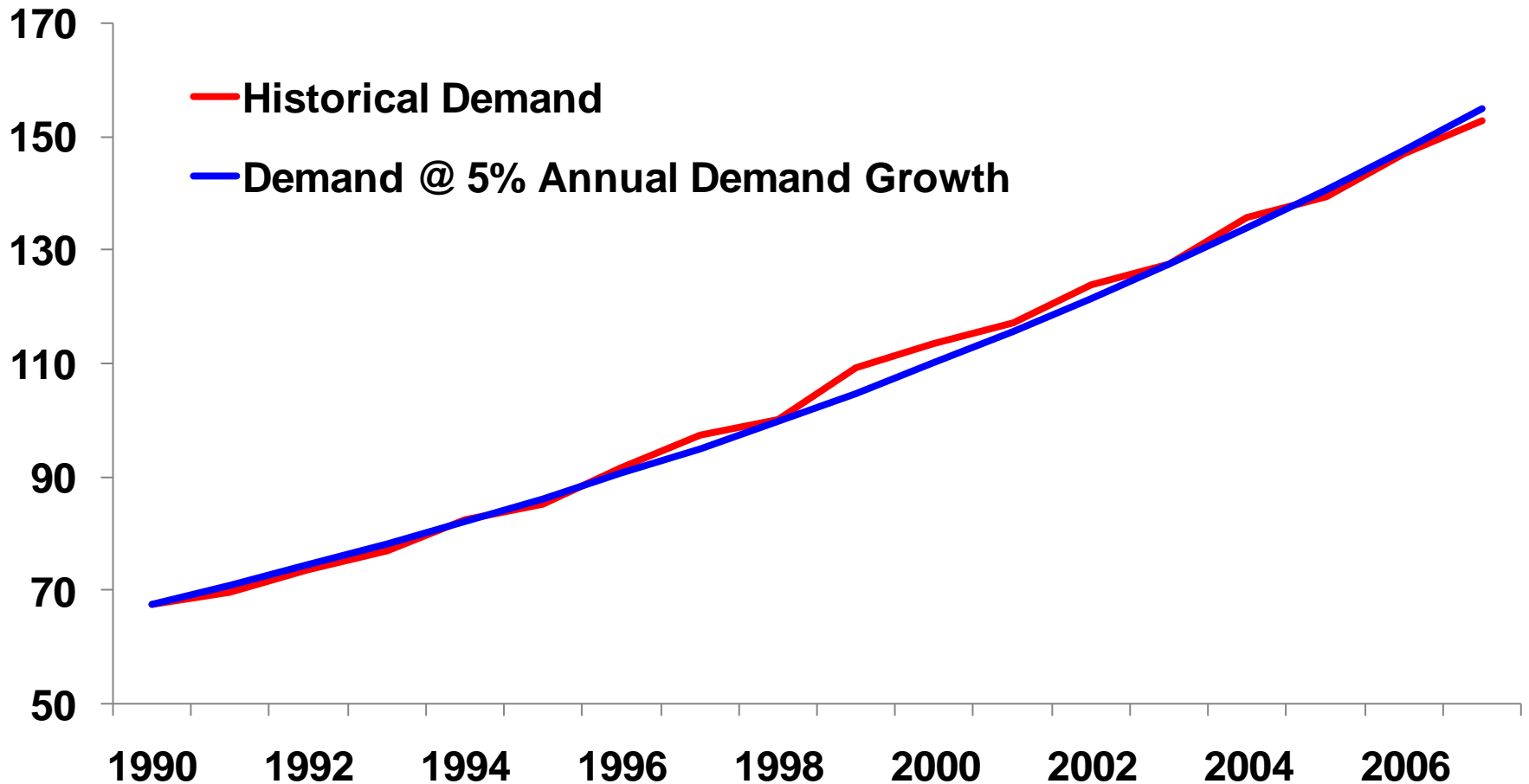


Longer term outlook

- Polyethylene demand growth has consistent long term pattern
- Developing countries consumption is significantly less than industrialized world
- Population of developing world is nearly 6 times greater than developed world.

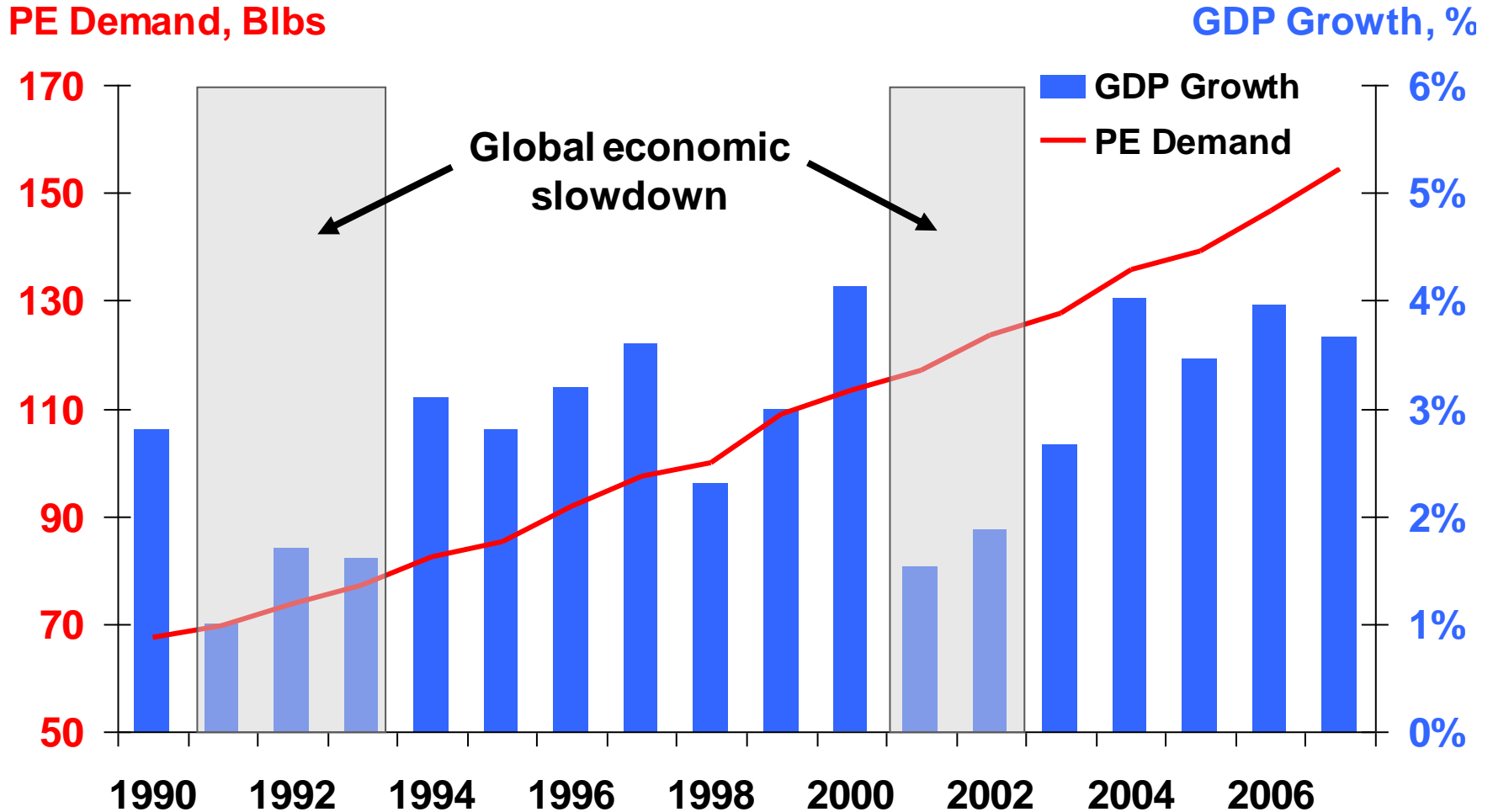
Global Polyethylene Demand Strong, Steady Growth

PE Demand, Blbs

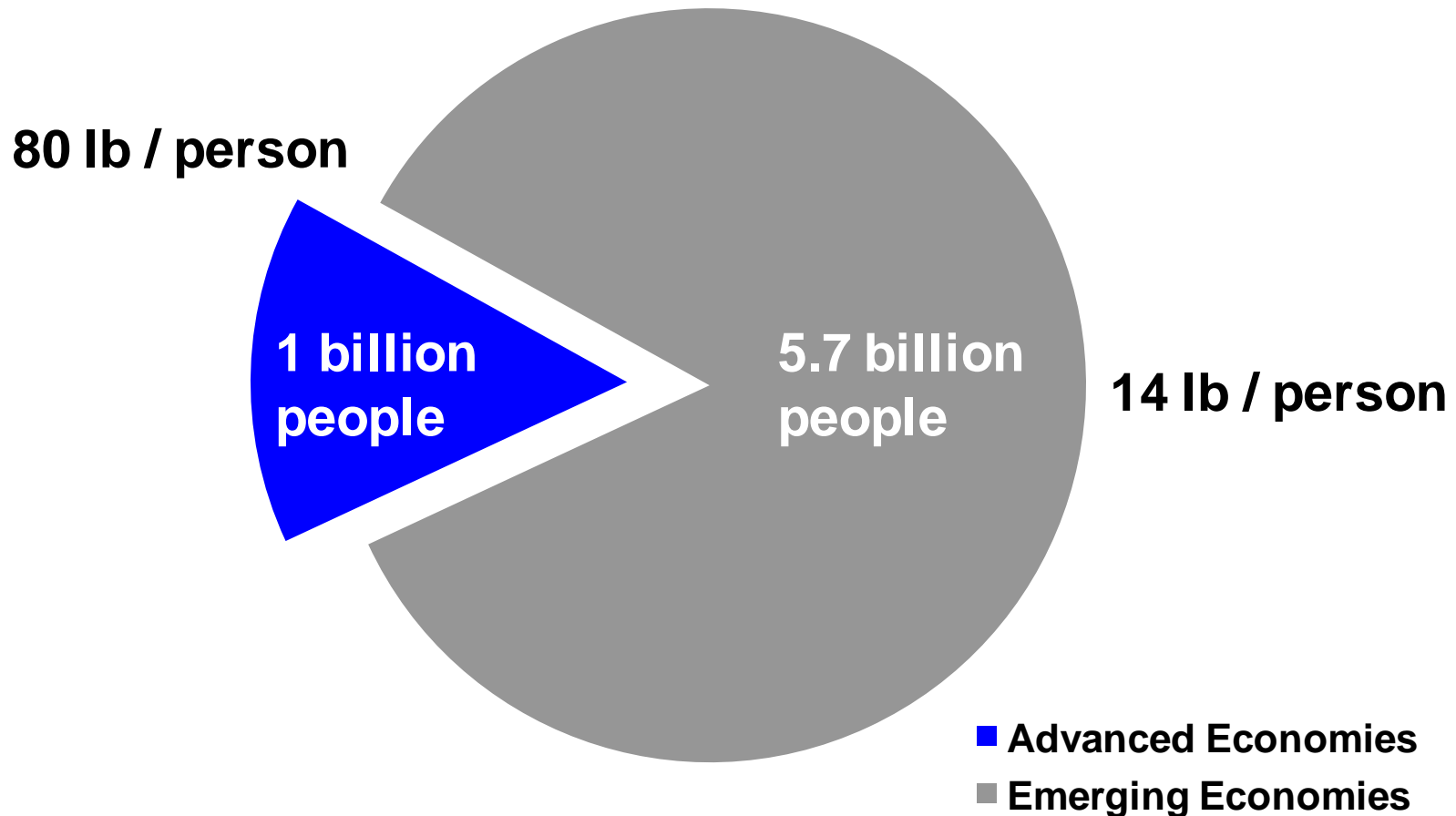


Source: Nexant Chemsystems, NOVA Chemicals.

Long term, steady Polyethylene growth



Global Population and PE Consumption Advanced vs Emerging Economies



Alberta as a Natural Gas Hub

- Alberta is a critical hub for natural gas
 - ▶ integrated and efficient infrastructure moving gas into, around, and out of the province
 - ▶ includes the transparent and sophisticated NIT market that is the largest physical gas market in North America.
 - Alberta Production 13.1 Bcf/d
 - Intra-Alberta Demand 2.7 Bcf/d
 - Exports – Canada 3.4 Bcf/d
 - USA 7.0 Bcf/d
- Efficient NGL extraction and petrochemical manufacturing industrial adds value to Alberta's natural resources.
- In the future, Alberta is a significantly advantaged geographic location due to its position between future gas in the north and the end markets in the south.

Alberta as a Natural Gas Hub

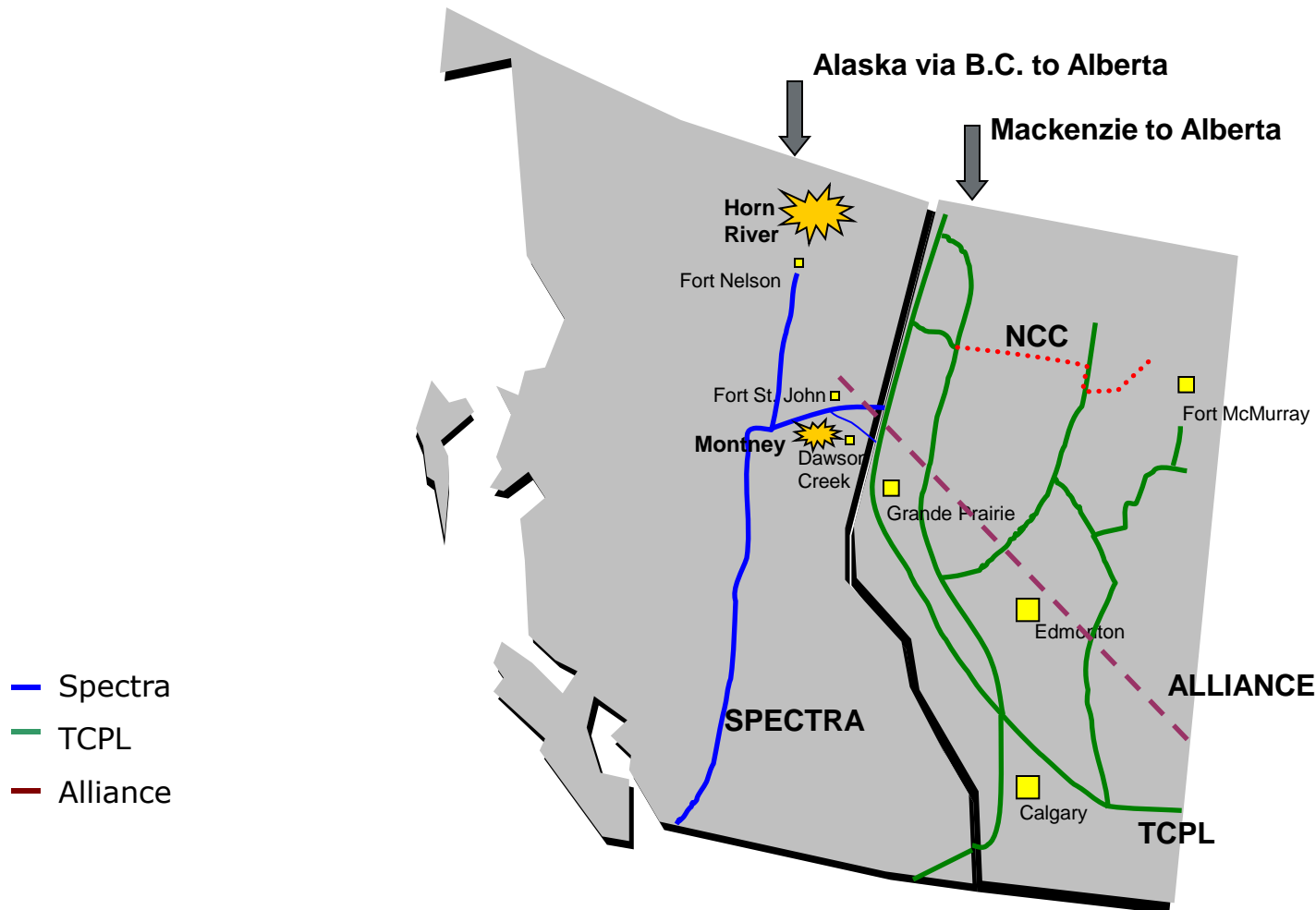


Northern Gas – Mackenzie & Alaska

- Northern Natural Gas Pipeline Options Map



Pipeline Access to new WCSB gas plays.



Northern Gas – Mackenzie & Alaska

- Potential Volumes
 - ▶ Mackenzie – 1.2 bcf/d
 - ▶ Alaska – 4.5 bcf/d
- Expected NGL content
 - ▶ Mackenzie – 16,000 bbls/d ethane = 560 MMlbs ethylene/yr
 - ▶ Alaska – 140,000 bbls/d ethane = 4,900 MMlbs ethylene/yr
- Anticipated Timing
 - ▶ Mackenzie - Consensus that earliest start-up date is 2016
 - ▶ Alaska - Consensus that earliest start-up date is 2019/20

Summary

- NOVA Chemicals' Alberta based Ethylene and Polyethylene assets are among the largest and most efficient in the world.
- NOVA Chemicals' Alberta E/PE assets are 2nd in profitability after the Middle East
- Alberta is a politically favorable location for petrochemical investment.
- Alberta has significant growth potential for petrochemicals (E/PE, Propylene/Polypropylene) over the period 2011-2020.
- NOVA Chemicals is uniquely positioned to grow in Alberta.