

# From Oil Sands to a World-Class Eco-Industrial Chemical Cluster for Greater Edmonton

Final Presentation HUTF

*Report for:*



**May 2008**

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Background and objectives of the study

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Stage 1

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Benchmarking of the international clusters

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Conclusions and next steps

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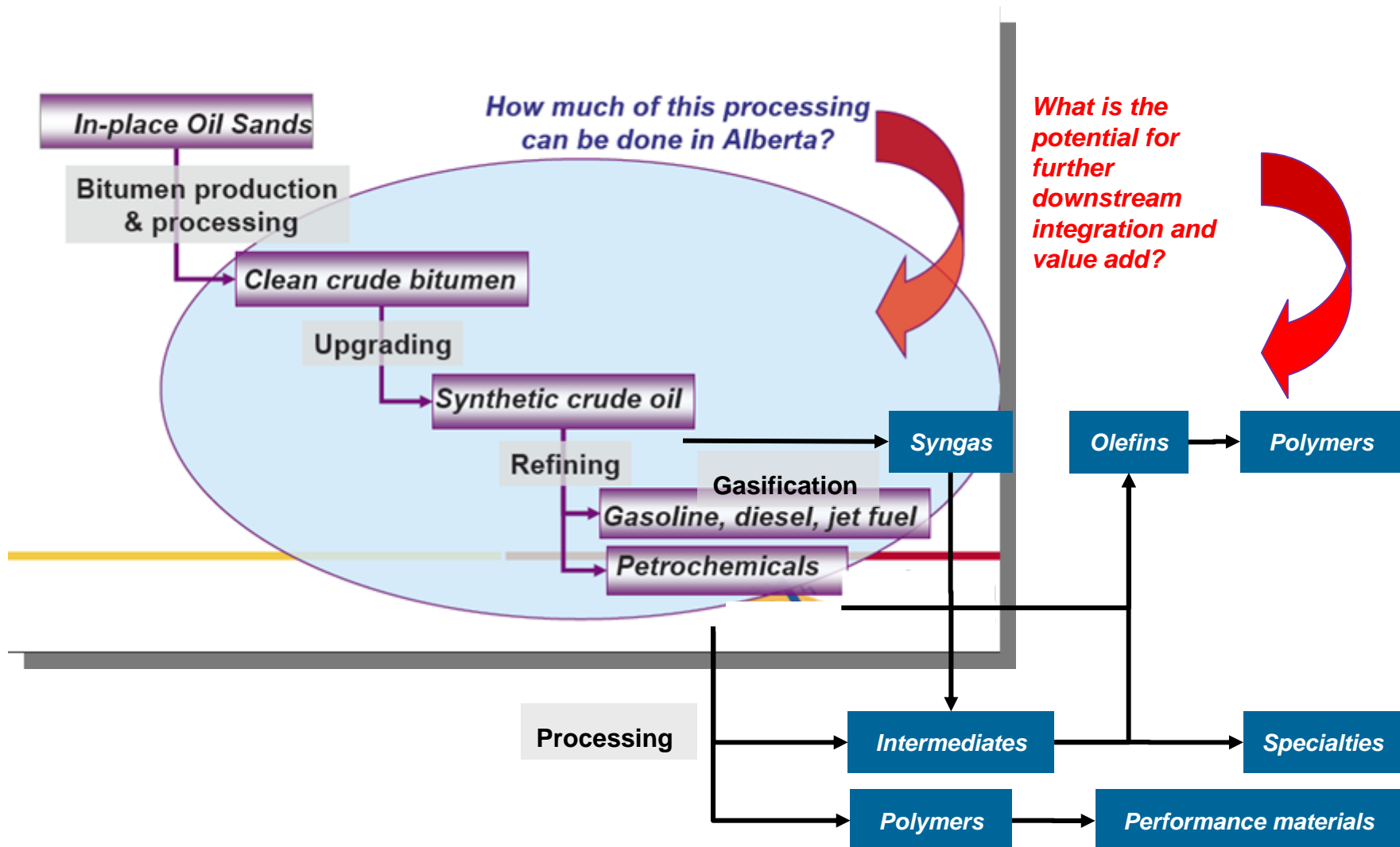
Cluster marketing strategy

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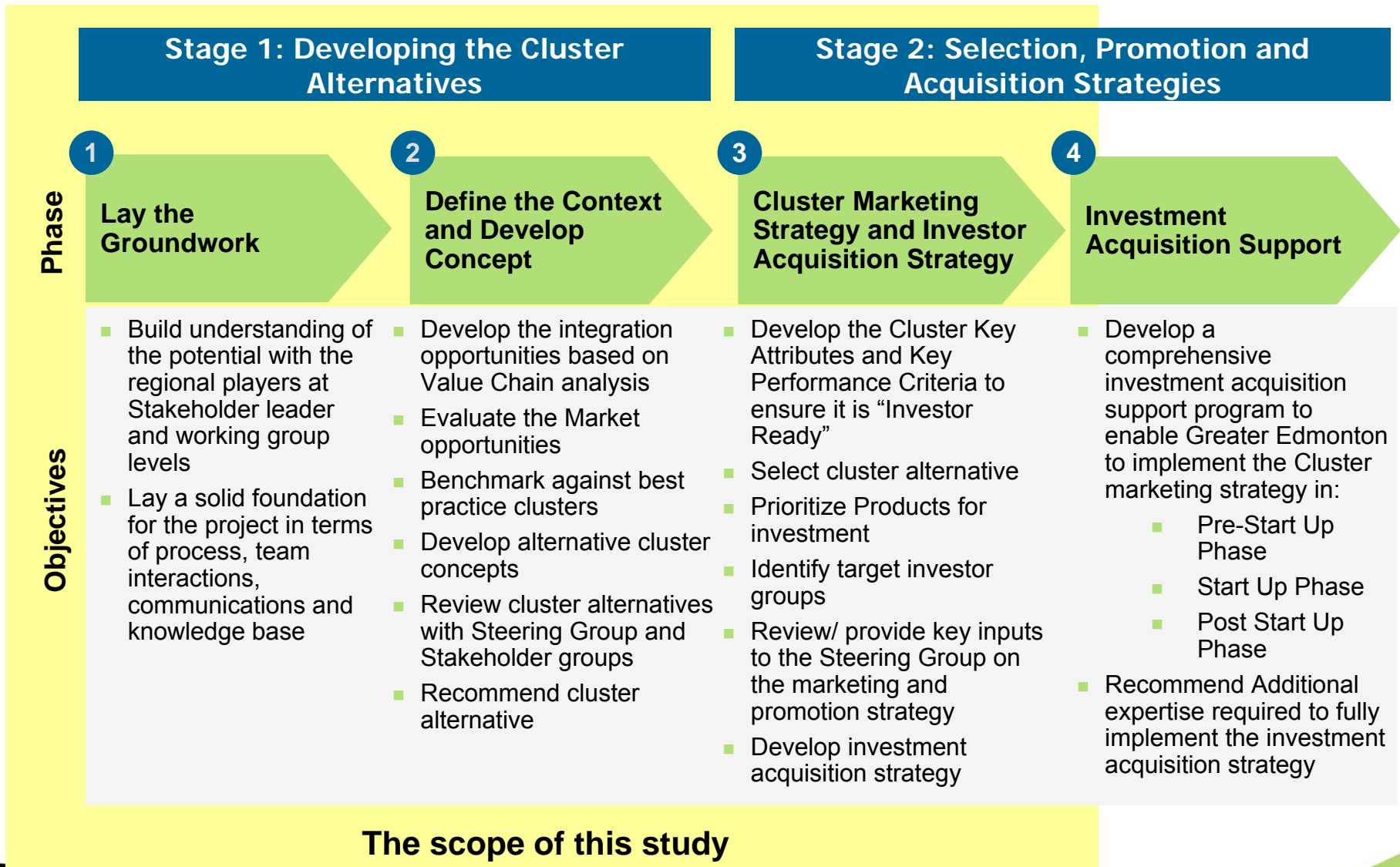
## Project Goals were formulated to address the major issues

- ➔ **Develop world-class eco-industrial chemical cluster alternatives for the Greater Edmonton Area**
- ➔ **Leverage Kline's understanding of the international chemical industry, chemical markets, and the competitive environment to quantify and qualify the potential in the Greater Edmonton Area**
- ➔ **Develop an objective view of Alberta's potential for the development of a world class chemical cluster in the Greater Edmonton Area**
- ➔ **Benchmark the best in class clusters in order to input key learning's into the Greater Edmonton Area's cluster**
- ➔ **Encourage a coordinated, integrated cluster development strategy for the Greater Edmonton Area**
- ➔ **Evaluate the strategic and economic impact of the cluster alternatives, with a view to eliminating associated risks**
- ➔ **Set a clear path to action and results**

## Adding value downstream: Convincing the international oil refining and chemical industry to invest downstream is the key challenge



## Stage 1 Provided the Platform for Action – Stage 2 Addressed the Action



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## Key Underlying Assumptions: The development of the Cluster Alternatives are based on several key assumptions (1/2)

- Bitumen Upgrading will exceed **3.0 million BBL/day by 2020** and **Upgrader bottoms production will exceed demand** for:
  - **Energy generation** in the region (as bottoms or coke)
  - **Energy generation** in export markets (as coke)
- **Outcome: this will result in 300 000\*- 750 000 BBL/day “Stranded Upgrader Bottoms” in Alberta**

### \* Coke

**Whilst this appears to be a problem – this is the key opportunity for Alberta to become the leading Syngas production region in the world**

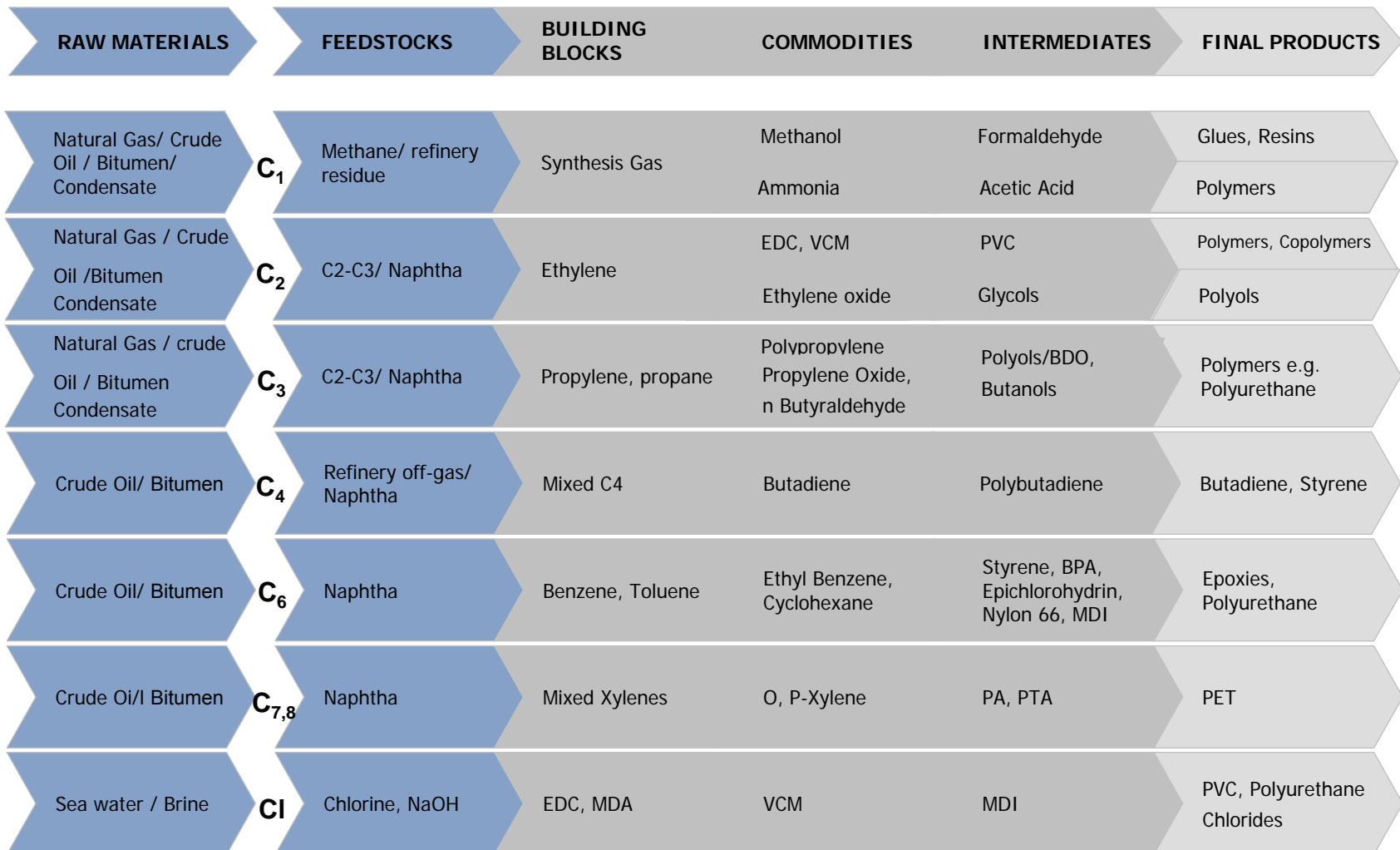
This is the underlying opportunity

## Key Underlying Assumptions: The development of the Cluster Alternatives are based on several key assumptions (2/2)

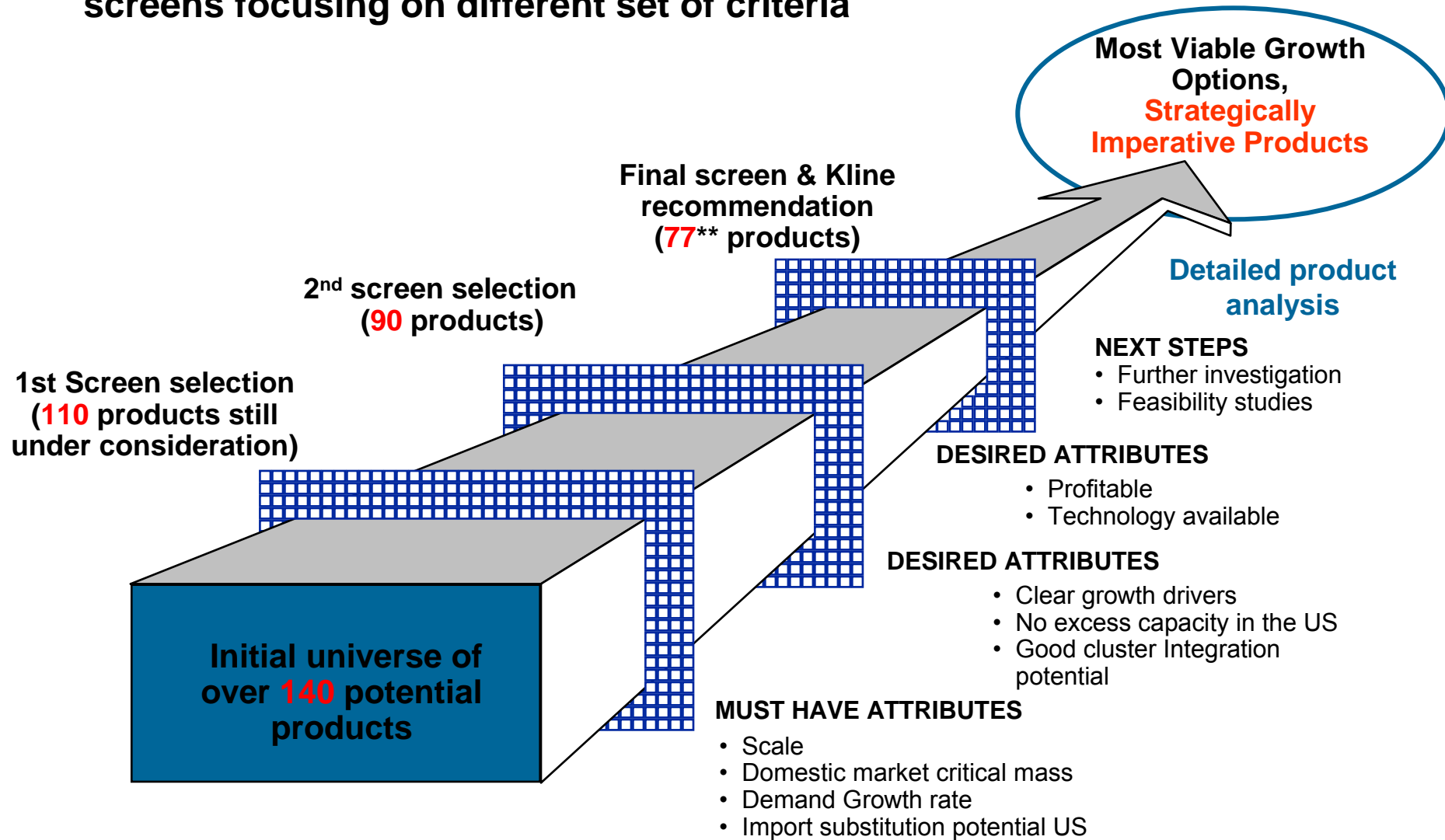
- **Additional refinery capacity** will be added in Alberta, serving **export markets**
- **Pipeline infrastructure will be expanded** to include **clean products** and possibly olefins
- **Upgrader and refinery off-gases** will become increasingly important sources of **petrochemical feedstock**
- **Gasoil and possibly Naphtha** will become **feedstocks of choice for crackers** in North America due to dwindling economic supplies of Ethane
- **Methane** will be an increasingly uneconomic source of **hydrogen** for Upgraders, Refineries and Petrochemical producers

**Unlocking Alberta's Downstream chemical potential requires the industry to recognize the opportunities that "unconventional" raw materials and feedstocks provide**

## Product Flows from Primary Raw Materials (generic)



We arrived to 77 products from initial 140 after three consecutive screens focusing on different set of criteria



\*\* Of 77 chemicals selected, 18 are already made in Alberta

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## A Cluster benchmarking study was performed to provide “key learnings” for Greater Edmonton

- A number of key attributes were identified to characterize the world class clusters
- These attributes are considered as the “**Key Performance Drivers**” - high scores on these attributes are expected to result in a very successful cluster
- A qualitative rating of these attributes enabled a high level comparison between the clusters
- This provided an **understanding of why these clusters are successful**
- The following clusters were reviewed in this study:
  - Antwerp, Belgium
  - Houston, Texas, USA
  - Jurong Island, Singapore
  - Tarragona, Spain
  - Chemsite, Ruhrgebiet, Germany
  - Chemelot, Geleen, Netherlands
  - SCIP : Shanghai Chemical Industry park, China

## Key insights: The detailed analysis hi-lighted several important “key insights” for Greater Edmonton

- **Government participation and leadership** helps in the overall growth of the cluster in a phased manner
- The establishment of a "**cluster promotion body**" can be a **key success factor** (stakeholder representation & strong leadership)
- **Involving global players** early in the cluster development helps in achieving faster cluster growth & stronger integration
- Better **cluster integration** together with **product diversity** helps increase efficiency in material flow and reduce supply chain costs
- **Good infrastructure** is common to all world class clusters
- **Limited cluster scale** (e.g. Tarragona) can be **compensated by a less diversified, yet fully integrated, product range**
- Most clusters **serve a large geographical area, shipping mostly final products** rather than commodities or intermediates
- **Most successful clusters are purpose built**
- All clusters have strengths and weaknesses, the **key is to progressively and consistently focus on the promotion and development of strengths**

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## Strategically imperative product selection assumptions

### Scale

- Sufficient size and potential to support **world-scale investment** either as the basic feedstock and/or as commodity products
- Recognition of the additional potential for development of **'mega' investments** (Mega Methanol, MTO/MTP)

### Products

- Selected chemicals may be dependent on the availability of basic feedstock and therefore **not classified as strategically imperative** (high performance polymers, urethanes, polycarbonates, PET, plasticisers)

## Strategically imperative products

### Feedstock

- **Gasification of Upgrader Bottoms** to syngas
- Refinery **Off-gas** production
- **Naphtha cracking** (from SCO)
- Combined **bitumen upgrading/hydrocracking/hydrotreating and gasification** (potential extension of NorthWestUpgrading type development)

### Technology

- New technology may produce **alternative routes for commodities**:
  - **MTO/MTP** for polyethylene(s) and polypropylenes
  - **Reconfiguration of Upgraders** to generate petrochemical feedstock (e.g. syngas)

## From the initial screening 31 products can be regarded as “strategically imperative”

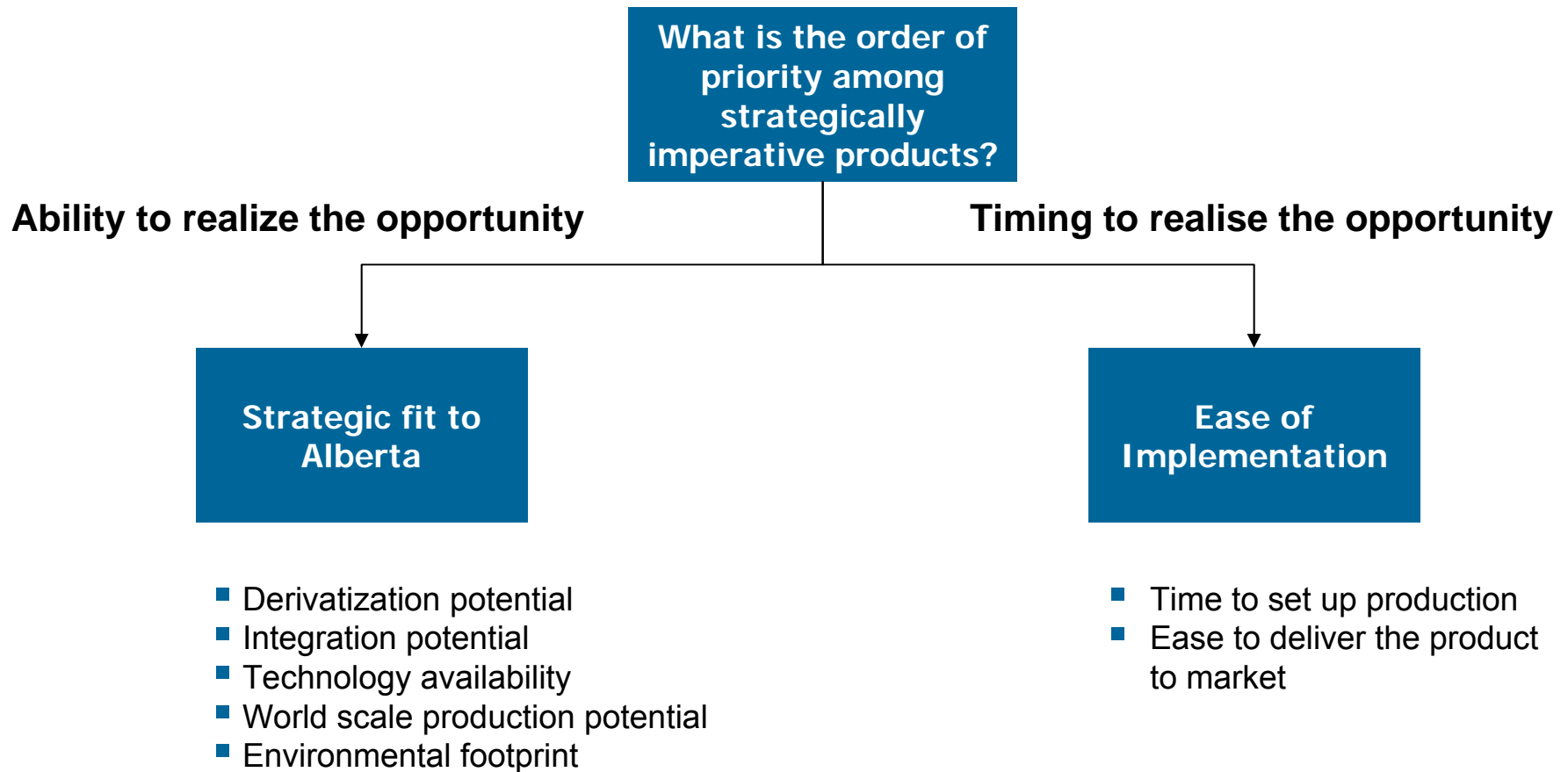
RAW MATERIALS	FEEDSTOCKS	BUILDING BLOCKS	COMMODITIES	INTERMEDIATES	FINAL PRODUCTS	
Natural Gas/ Crude Oil /Bitumen/ Condensate	<b>C<sub>1</sub></b> Methane/ refinery residue	Syn Gas	Methanol Ammonia	Acetic Acid Urea, AN	VAM UAN	7
Natural Gas / Crude Oil / Bitumen/ Condensate	<b>C<sub>2</sub></b> C2-C3/ Naphtha	Ethylene	Ethylene Oxide	EG Polyethylenes**		6
Natural Gas / crude Oil / Bitumen Condensate	<b>C<sub>3</sub></b> C2-C3/ Naphtha	Propylene	Propylene Oxide	Polypropylene Propylene Glycols		4
Crude Oil/Bitumen	<b>C<sub>4</sub></b> Refinery off-gas/ Naphtha	Butanes Butenes	Maleic Anhydride	BDO		4
Crude Oil/Bitumen	<b>C<sub>6</sub></b> Naphtha	Benzene	Cyclohexane Phenol Cumene	BPA		5
Crude Oil/Bitumen	<b>C<sub>7,8</sub></b> Naphtha	Toluene	o-Xylene p-Xylene	PTA Phthalic Anhydride		5

\*Derived from initial 77 chemicals selected plus polypropylene

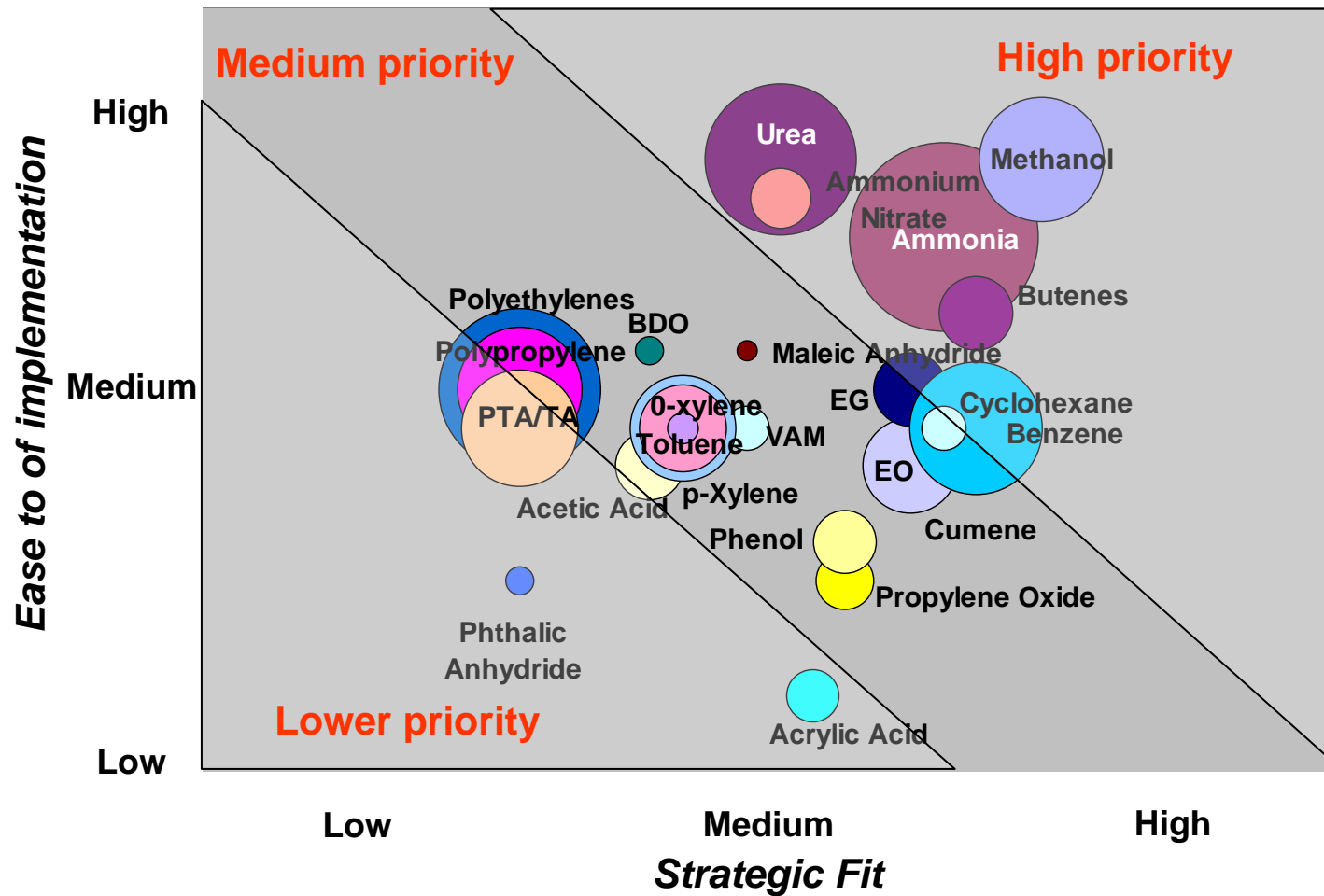
\*\* Includes LDPE, LLDPE and HDPE

**Total: 31\***

## 31 strategically imperative products are further prioritised based on a combination of strategic fit to Alberta and ease of implementation

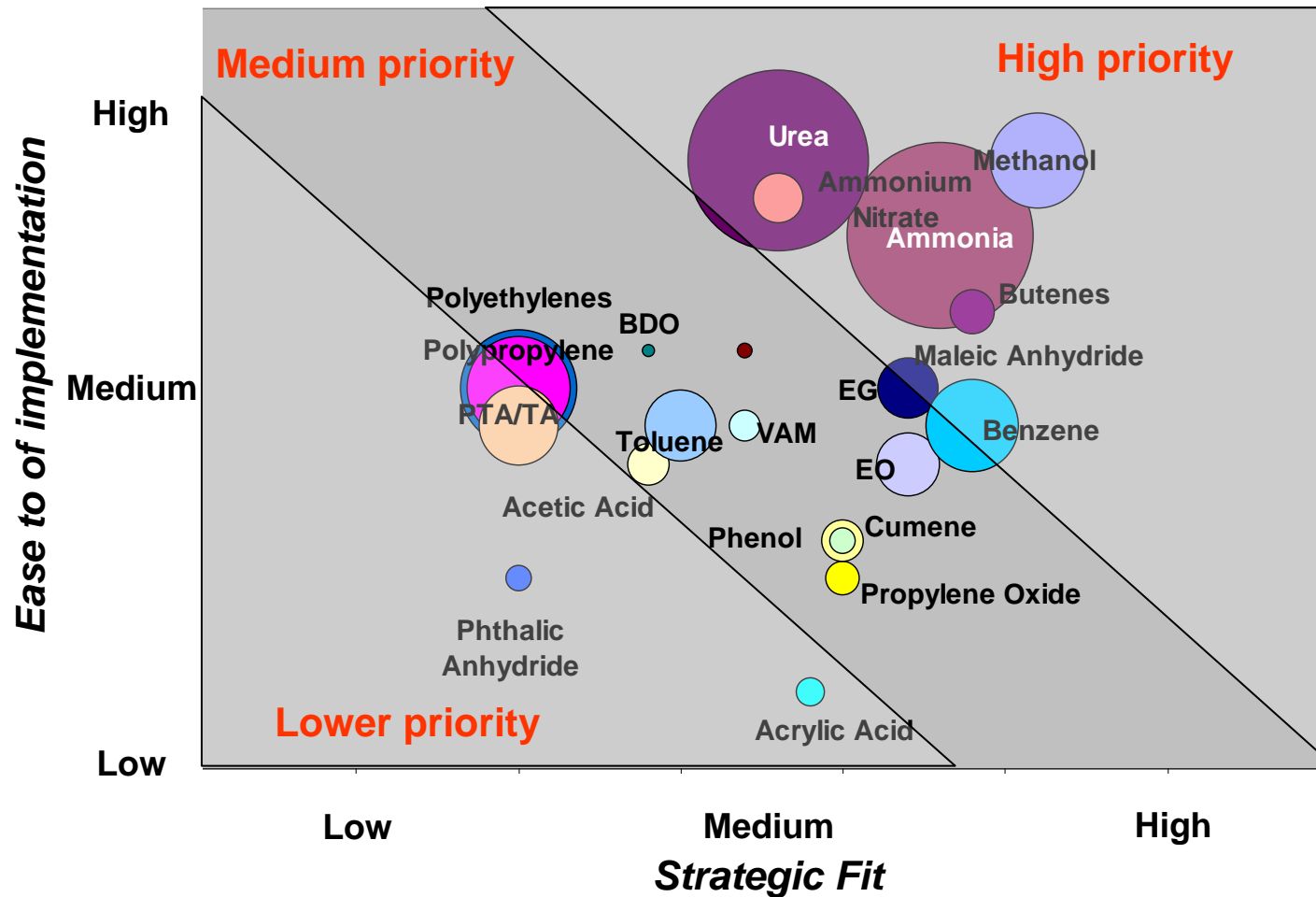


# Prioritisation of strategically imperative products: North American context



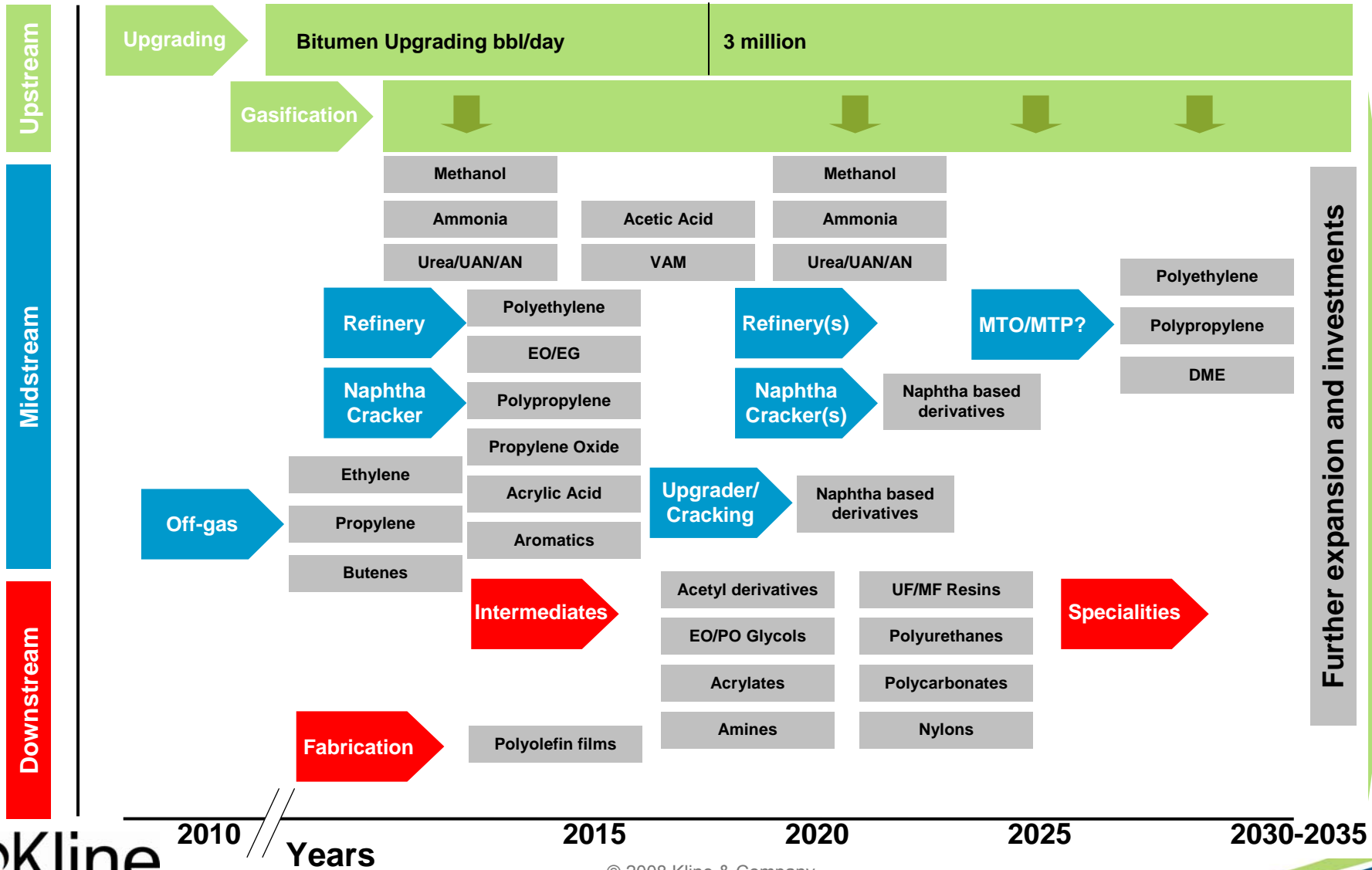
Bubbles proportional to estimated market size, 2007

## Prioritisation of strategically imperative products: Global context



Bubbles proportional to estimated market size, 2007

# The road map envisages a stepwise development with a number of critical investment milestones



# Key building blocks and commodities top the list of priority investment projects

## Key Investments/Value Chain/Products

Gasification  
Refining  
Naphtha Cracking  
Refinery Off-gas

C1  
C2-C8  
C2-C8  
C4, C6-C8

Methanol/Ammonia  
Ethylene  
Propylene  
Aromatics

### Strategically imperative products

Acetic Acid	Cyclohexane	Propylene Oxide
Acrylic Acid	Ethylene	Propylene Glycol
Ammonia	Ethylene Glycol	Phenol
Ammonium Nitrate	Ethylene Oxide	Phthalic Anhydride
Benzene	Maleic Anhydride	o-Xylene
Butanediol (BDO)	Methanol	p-Xylene
BPA	Polyethylenes	UAN
Butenes	Polypropylene	Urea
Butanes	Propylene	VAM
Toluene		
Cumene		

31

77

46

Acetone	Dimethyl ether (DME)	Linear Alpha Olefins (LAOs)	Polybutylene terephthalate
Acrolein	Diocyl phthalate (DOP)	Melamine	Polycarbonate
Acrylic acid esters	DPC	Melamine resins	Polyurethanes
Acrylate polymers	2-Ethyl Hexanol (2-EH)	Mixed C4 / Butane	PPG
Adipic Acid	Ethoxylates	MDI	PTMEG
Adiponitrile	Ethylene Glycol Ethers	MMA	PVA (PVOH)
Aniline	Caprolactam	Nitrobenzene	SAP's
Bisphenol A	EVA Copolymers	N-Methylpyrrolidone (NMP)	TBA
Butyraldehyde	EVOH	Nylon-6 (PA -6)	Tetrahydrofuran (THF)
Di-isooctyl phthalate (DIOP)	Formaldehyde	Nylon-6,6 (PA- 66)	UPR's
Dimethyl carbonate (DMC)	Gamma-Butyrolactone	PET	
	IPA (isopropanol)	PMMA	
	Isooctane		

Increasing investment priority



## The Economic Rationale for Investment in the Strategically Imperative Products in the GEA was Examined in Detail

- Key global players expect **access to advantaged feedstock** as one of the major drivers behind their location decisions.
- We need to demonstrate that **Alberta's economics based on upgrader bottoms as a source of feedstock is better** than production based on other feedstock types.
- We have developed several business cases based on different feedstock scenarios **to compare how different feedstock sources and their prices** affect the economics of Methanol and Ammonia.

## Does syngas produced from upgrader bottoms provide a viable and sustainable competitive position based on potential market futures?

### Methodology:

- Upgrader-based syngas to methanol and ammonia economics competitive cash cost comparison
  - **Alternative stranded feedstock basis:** natural gas, coal
  - **Location:** Alberta, Middle East, Caribbean, USGC
  - **Financials:** Acceptable ROI, global scale and cost position
  - **Sensitivity analysis:** feedstock and capital
  - **Assumption:** further C1 downstream investment will not be considered unless gasification represents a significant advantage over current or alternative routes
- **Scenario analysis** has been used to test the economic robustness under different competitive environments of feedstock pricing and capital expenditure

## The robustness of potential gasification investment has been considered under different scenarios for methanol and ammonia

Drivers
Oil Price
Natural gas prices
Process Technology
Feedstock availability
Emission and carbon values

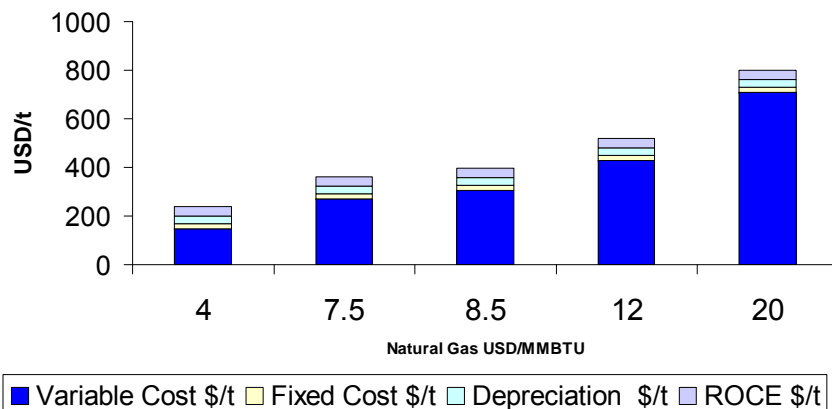
Scenarios
Natural gas price levels: \$4 – 20 / MMBtu
Upgrader bottom price levels: \$0 – 40 per tonne
Coal and Petroleum Coke price levels: \$0 – 60/ST
Capital: 80 - 150% world scale
Locations: USGC, Caribbean, Middle East, Russia



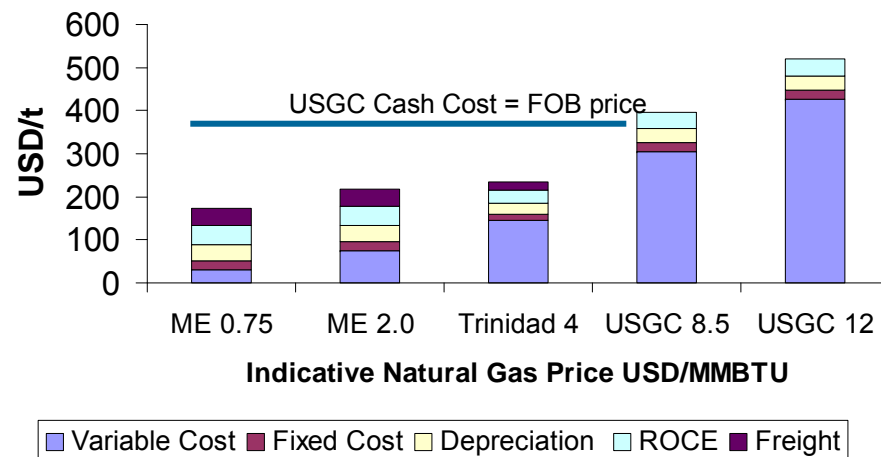
Key Sensitivities
Natural gas prices: will natural gas prices remain at a high enough level such that gasification-based economics are sufficiently advantaged?
Capital investment levels: will escalating capital investment costs make the investment unprofitable?
Product pricing: will product pricing remain at profitable levels looking forward?
Feedstock competition: does an upgrader have a sufficient cost advantage over petroleum coke and coal to engage in aggressive price based competition?

## The global methanol price setting mechanism is determined by USGC natural gas price levels

**USGC Methanol Cost of Production**

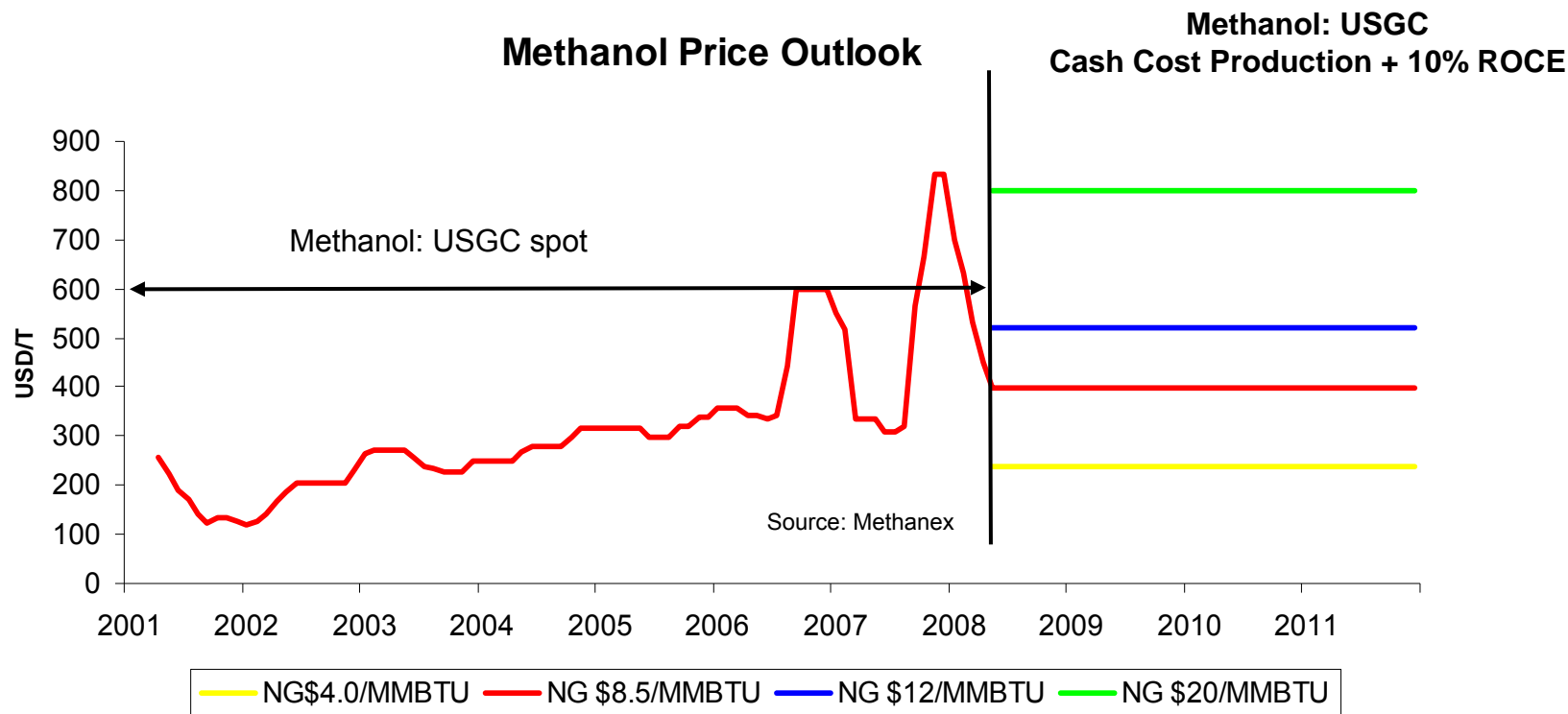


**Methanol Regional Cost Structure**



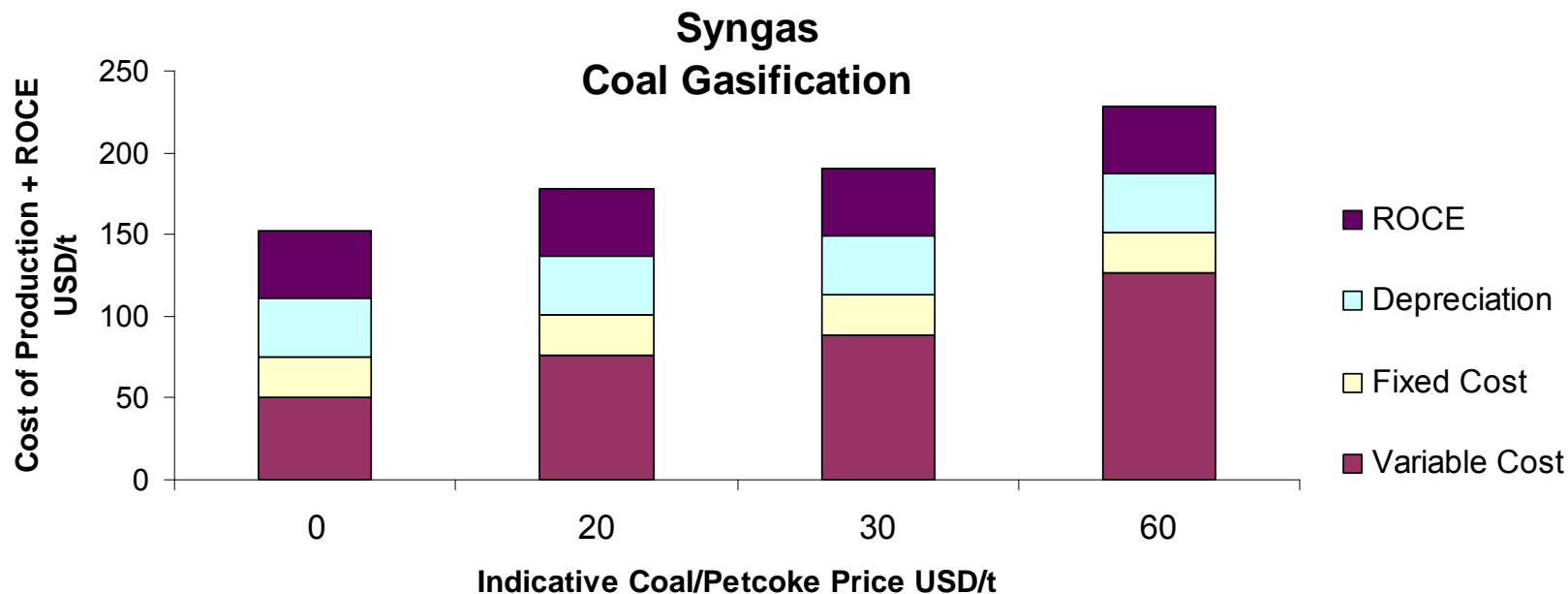
- Variable cost component essentially drives overall cost of production
- Global business based on stranded natural gas developments
  - Key locations: Trinidad, Chile, Middle East, New Zealand
  - US ‘high cost, natural gas’ plants setting overall pricing mechanism
  - USGC Cost of Production = FOB price
  - Trend to higher natural gas prices will initiate further closures of laggard units
- Evidence that alternative energy options, e.g. LNG, is drawing feedstock away from petrochemicals
- China production increasingly met from coal based feedstock although logistic disadvantages
  - Potential upside in demand from DME for fuels
- Significant US demand being met by increasing levels of imports

## Long term methanol pricing reflects changes in natural gas scenarios



- Assumption is that long term pricing will revert to traditional methanol/natural gas price spread
  - Current price volatility function of supply/demand imbalances and manufacturing outages
- Upside in demand from new applications in fuel related sectors especially in China

## Syngas is traditionally produced from coal or petroleum coke and economics reflect capital cost



- Feedstock, either coal, petroleum coke or upgrader bottoms, relative small component of overall total production materials costs
- Significant capital expenditure for gasification, typically in region \$1-1.5+ billion
  - Major redundancy built-in to ensure continuous availability of syngas
  - Manpower intensive
- Critical aspects: Cost and availability of power, steam and water, by-product credits
- Technology: Introduction of alternative gasification options (e.g. partial oxidation, POX)
- China leading proponent of coal gasification. Eastman in US

## Coal gasification versus Partial oxidation (POX) process

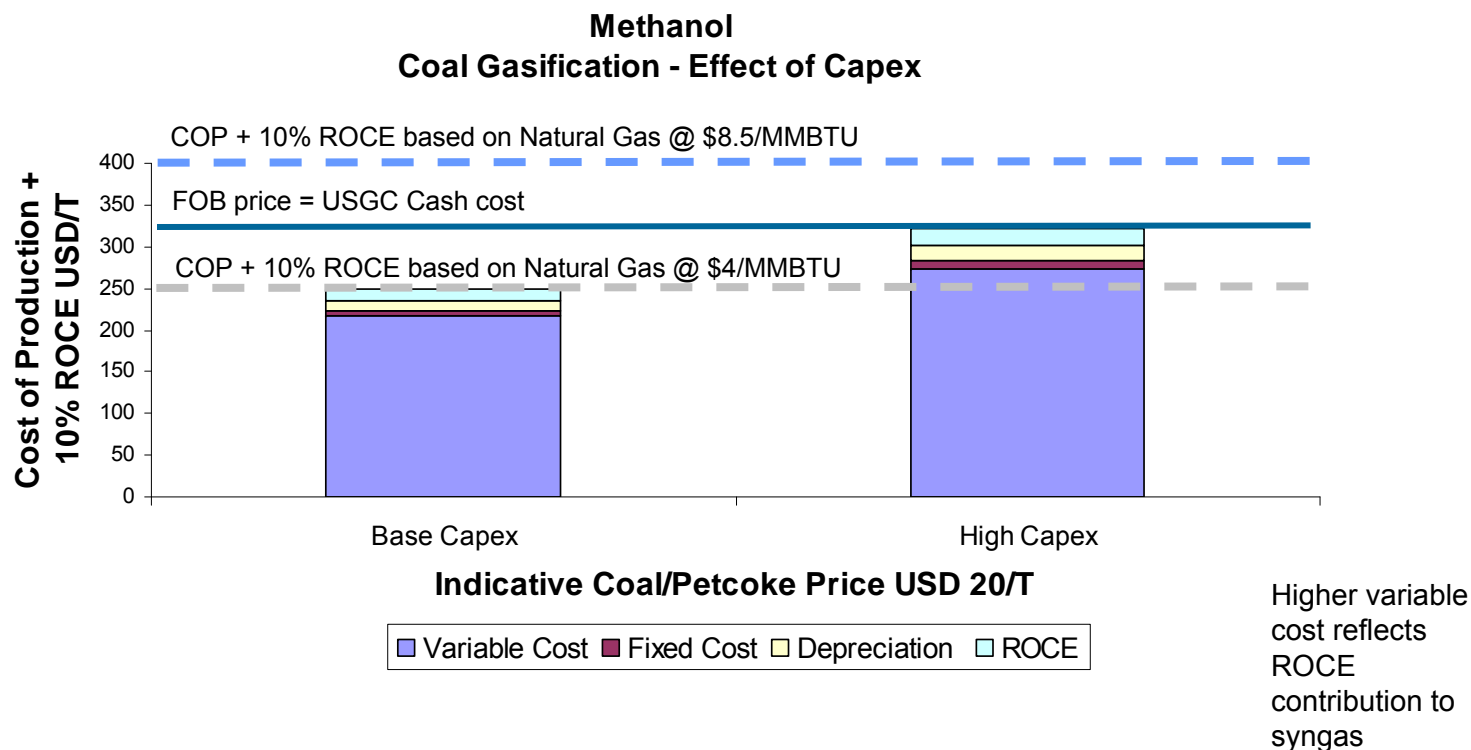
### Coal Gasification

- Feedstock is either coal or petcoke
- Raw material costs is relatively small component of the total variable cost and total production cost
- Significant capital expenditure for gasification is in the range of
  - \$3600/kW upwards in IGCC setup
  - \$0.13 million per million Nm<sup>3</sup> of syngas produced for non-integrated gasification plants
  - Typical plant size: 6500 mn Nm<sup>3</sup> of syngas
  - Manpower intensive
- Critical aspects: Cost and availability of power, steam and water, by-product credits

### Partial oxidation

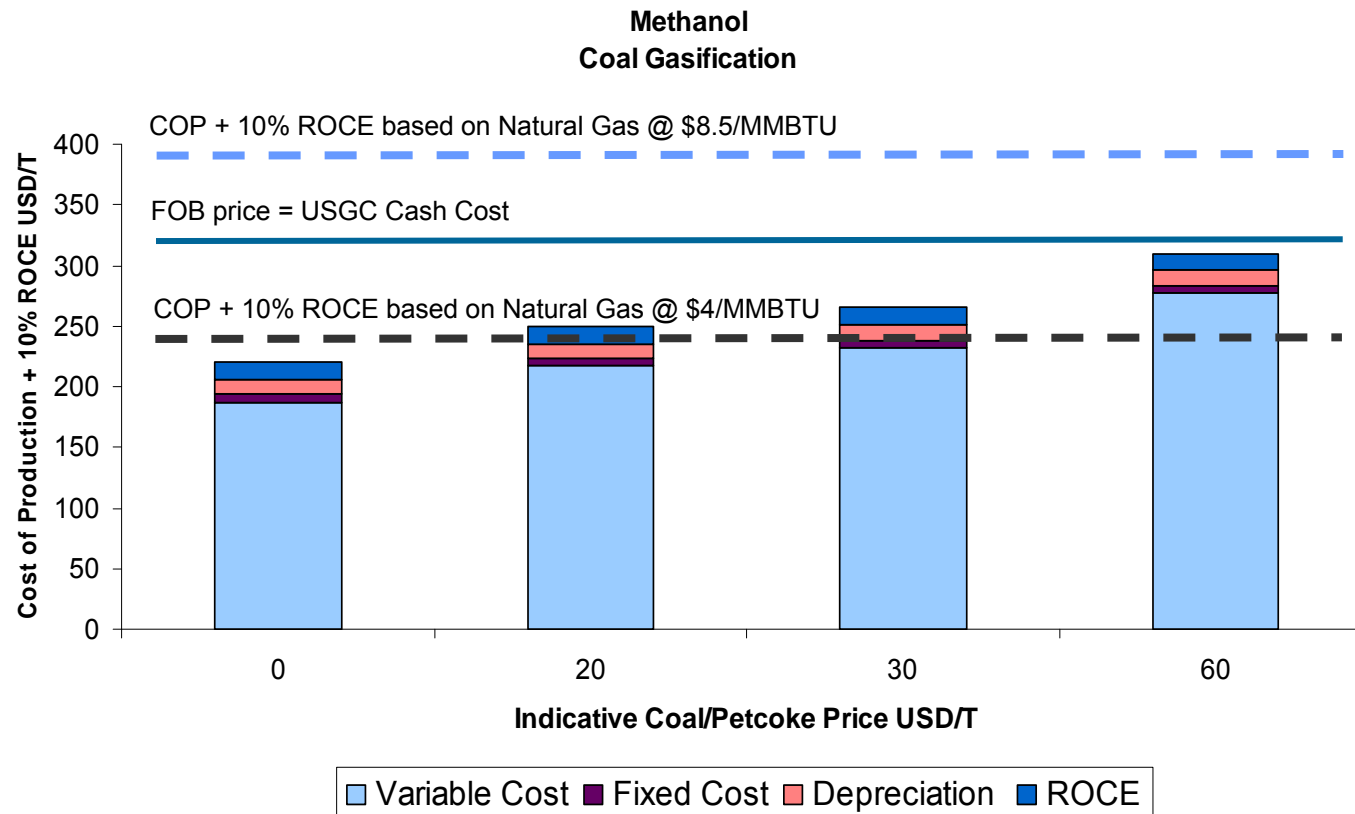
- Feedstock is upgrader bottoms
- Feedstock consumption per kg of syngas produced in POX is higher as compared to feedstock consumption in gasification
- Sulphur is removed early in the process thereby reducing very high investment in corrosion resistant equipment throughout the plant
  - \$0.206 million per million Nm<sup>3</sup> of syngas produced
  - Typical plant size: 2500 mn Nm<sup>3</sup> of syngas
- By-product credit (for hydrogen, as fuel or as chemical feedstock) compensates for increased capital and high utility consumption

## Gasification is capital expensive compared to traditional routes but can still remain attractive



- Assumption is for world-scale integrated gasification/methanol investment with a base CAPEX of \$1.1 bn and high capital sensitivity of \$1.69bn
  - Indicative coal or petroleum coke price of \$20/ST

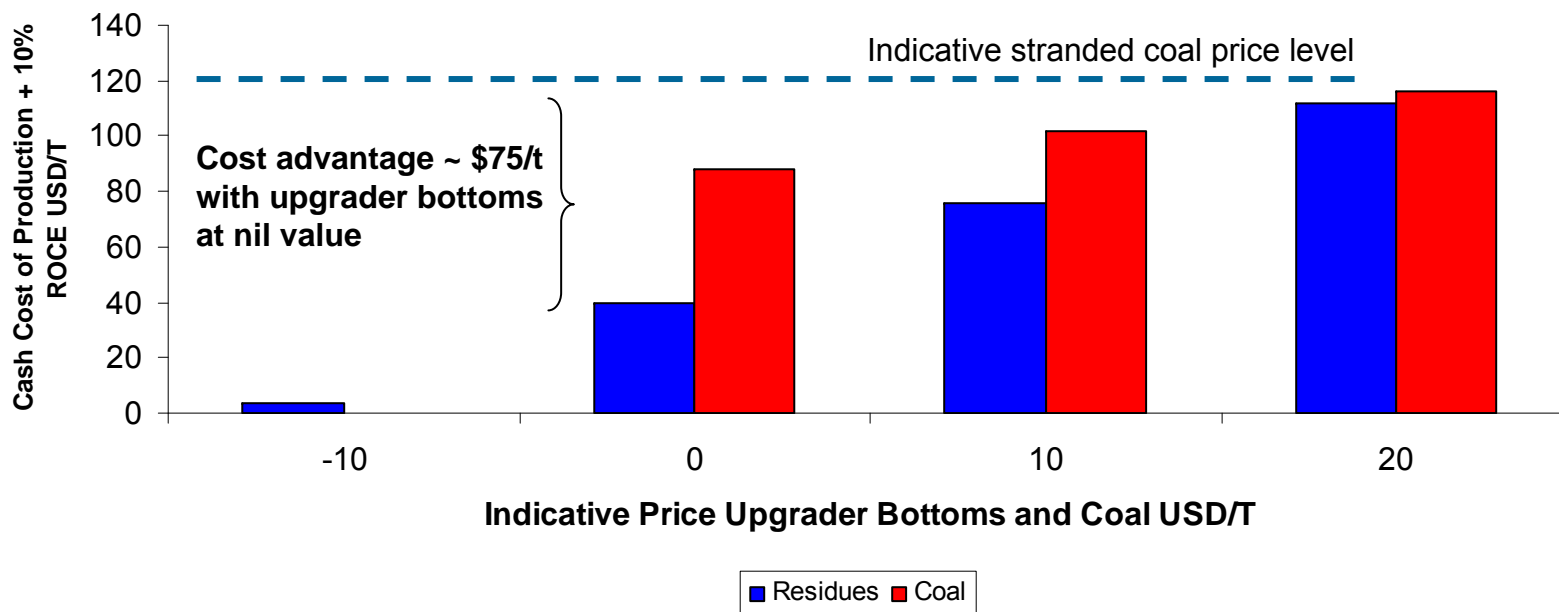
## Coal gasification is attractive with natural gas above \$6/MMBTU



- Long term coal and petroleum coke prices are forecast to remain essentially flat with regional and quality variations
  - Albertan sources may be considered as stranded with limited markets; prices of order \$20-30/T

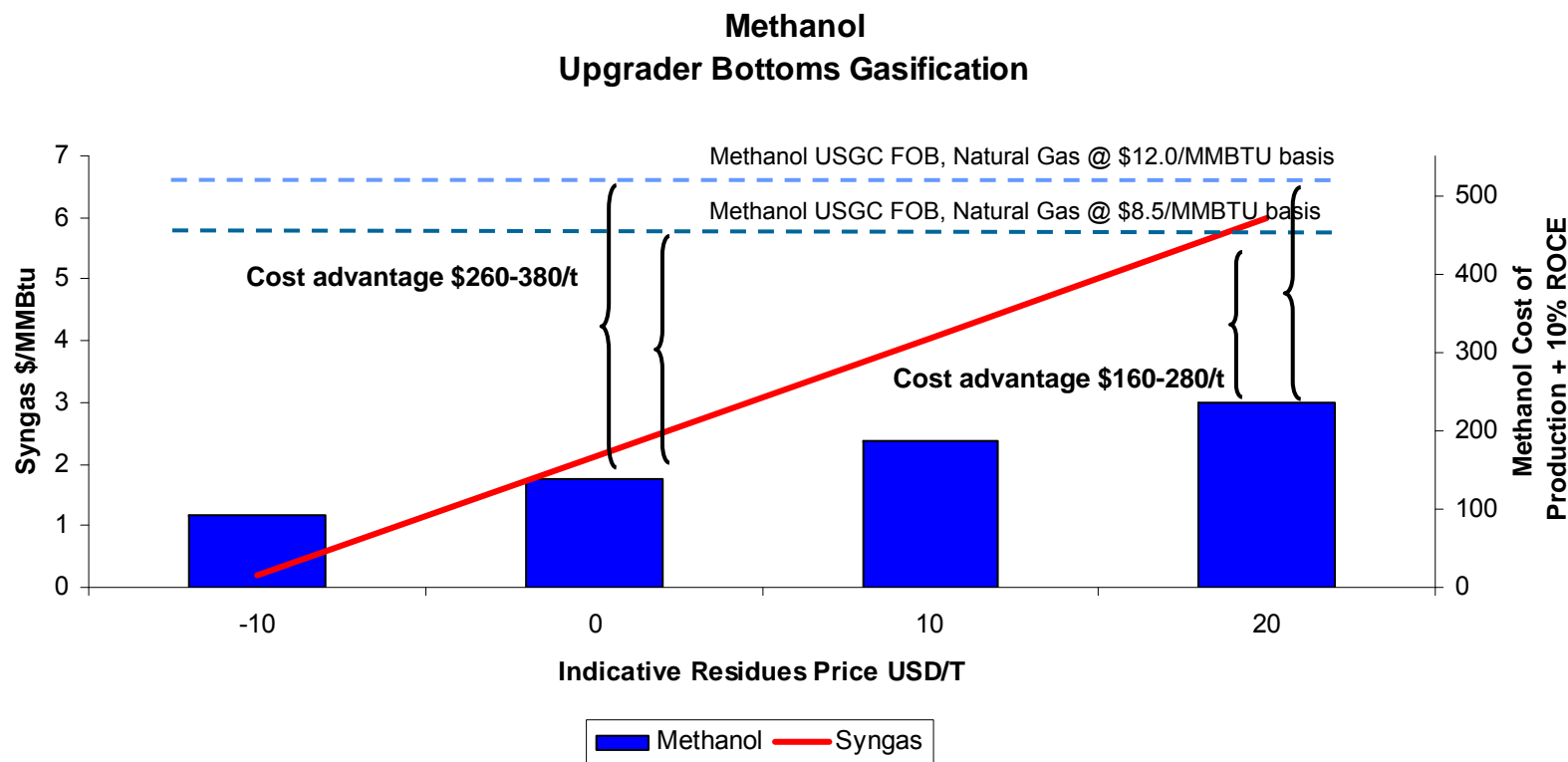
## Syngas from gasification of stranded upgrader bottoms will be highly competitive given no alternative value

### Comparison of Syngas Economics Residues Bottoms and Coal



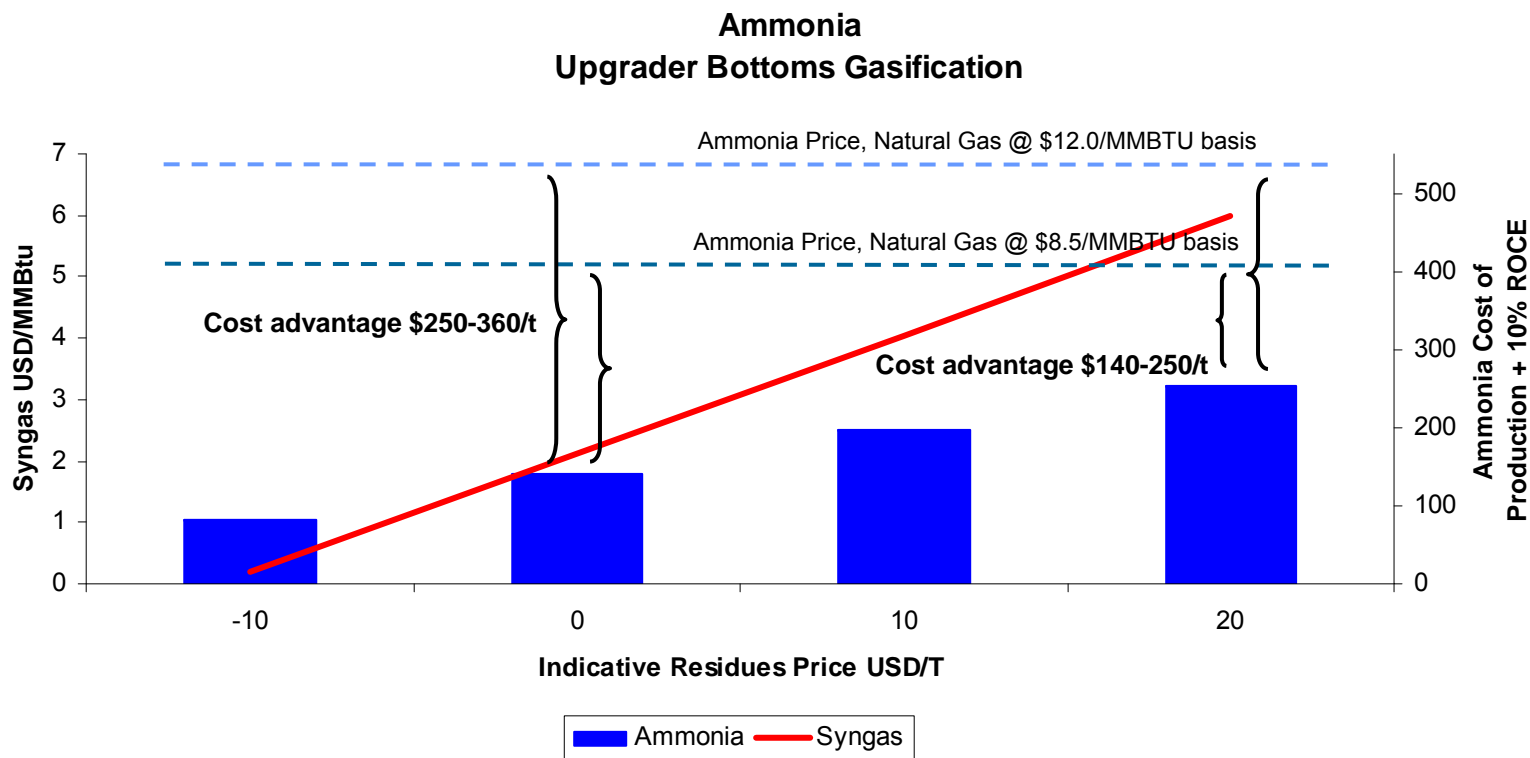
- Stranded location with no alternate option suggests a nil or negative value for Upgrader bottoms
- Gasification of Upgrader bottoms (liquids) is less capital intense than coal or petroleum coke gasification (solids) but is still considerable
- Economics are capex dependent but there are a number of caveats which need to be considered
  - Consideration of by-product credits, hydrogen (assumed as fuel) is a key issue
- The availability (volumes and timing) of Upgrader bottoms and any associated legislation, environmental considerations, etc, is still to be determined.

## Stranded economics are potentially highly attractive



- Syngas production is more attractive from upgrader bottoms than either coal or petroleum coke
- At nil value for residues methanol economics will be of similar order to the existing 'low cost' sources in Middle East and Trinidad
- Current USGC spot prices of \$520/t reflect natural gas levels of \$12/MMBTU

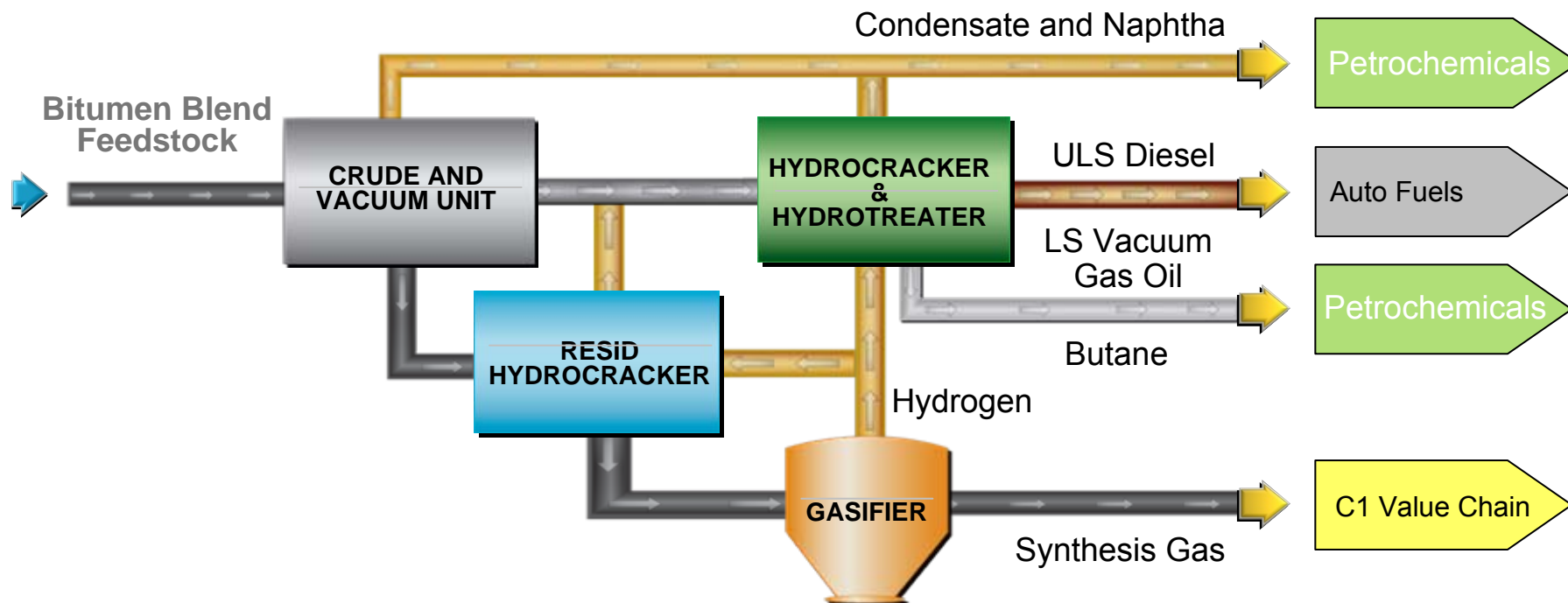
## Upgrader bottoms gasification gives leading economics



- Syngas production is more attractive from upgrader bottoms than either coal or petroleum coke
- At nil value for residues ammonia economics will be of similar order to the existing 'low cost' sources in Middle East, Russia and Trinidad
- Current USGC spot prices of \$550/t reflect natural gas levels of \$12/MMBTU

## Adapting the upgrader configuration could provide a step change to naphtha for petrochemicals\*

### ILLUSTRATIVE



- The potential for **upgrading bitumen blend feedstock to condensate, naphtha and vacuum gas oil** provides the ability to manufacture petrochemicals through traditional cracking routes
- Provides access to C1 value chains **without standalone gasification** of upgrader bottoms
- Provision of low cost, highly competitive naphtha based products **without SCO refining**

\* With permission from North West Upgrading

## Conclusion: GEA – highly competitive petrochemical source!

- Syngas production based on gasification of upgrader bottoms offers a **highly attractive route to globally competitive methanol and ammonia** together with associated derivatives
- Given the stranded nature of the residues and the potential significant volumes arising gasification provides a straightforward route for the GEA to develop as a **leading global centre for C1 petrochemicals**
- Given a nil or negative value of residues will provide the **basis of competing against other global advantaged locations**, especially the Middle East and Trinidad
- Production of naphtha, condensate and vacuum gas oil direct from bitumen feedstock may offer a **highly competitive alternative**

Indicative Price Upgrader Bottoms \$/t	Syngas \$/MMBtu	Methanol GEA Cost of Production \$/t	Cost advantage* \$/t	Ammonia GEA Cost of Production \$/t	<b>Cost advantage* \$/t</b>
-10	0.19	91	310-430	81	<b>310-420</b>
0	2.12	139	260-380	140	<b>250-360</b>
20	5.99	235	160-280	254	<b>140-250</b>

\*Cost advantage: difference between forecast USGC FOB prices and cost of production + 10%ROCE in GEA  
Basis: NG \$8.5 and 12.0/MMBtu (Current spot prices May 2008: Methanol \$ 449/t, Ammonia \$ 507/t fob Black Sea

## **GEA has the potential to develop a globally competitive cluster and create significant added-value**

- **Development in parallel with growth in Oil Sands investment**
- **Access to plentiful and increasing supply of stranded residues**
  - No real alternative outlet given scale of development
  - Upgrader bottoms will have nil or negative value and this will not change
  - Opportunity to negate potential high environmental impact of stranded coke
- **GEA competitiveness benefiting from the increasing differential forecast between oil, natural gas and stranded upgrader residues**
- **Economics to compete with the leading locations based on 'cheap' natural gas**
- **Gasification will provide access to methanol and the fertiliser value chains**
- **Opportunity for SCO as feedstock for refining and naphtha-based chemicals**
  - Associated investments in refining and naphtha cracking will lever further added-value and investment across other value chains rather than as direct sale to export markets
- **Support throughout from national, regional and local government**

***A global opportunity for GEA to develop over the next 25 years***

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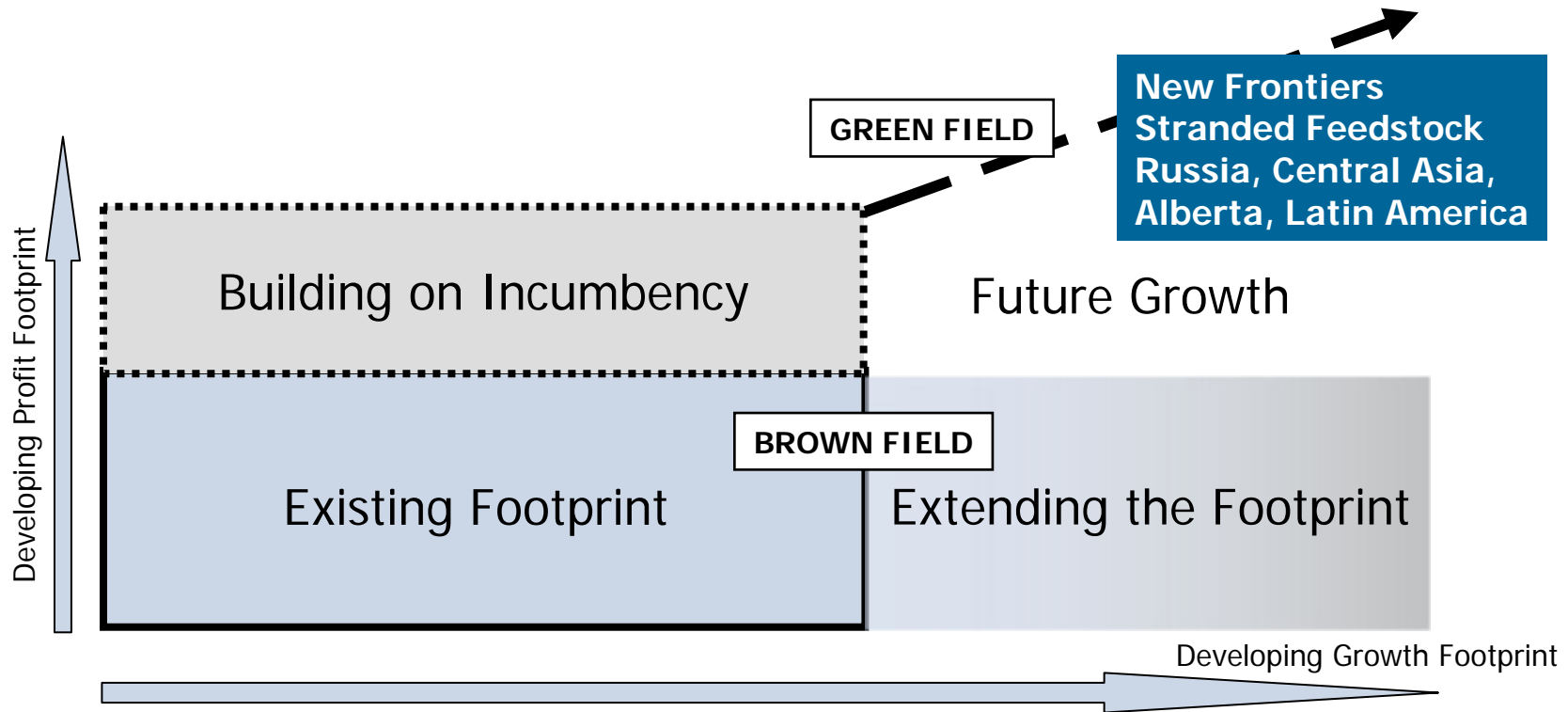
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## What are the major drivers for new clusters? Typically who is involved?

Major Attributes	Characteristics	Leading Participants
<b>Refinery/petrochemical integration</b>	General trend Most oil companies	ExxonMobil, Shell, CPChem, Total, Sinopec, Reliance
<b>Operational excellence</b>	General trend	ExxonMobil
<b>Scale of operations</b>	Trend, most new and green field investments	Dow, Nova, SABIC, BASF, NPC, Reliance, MEGlobal
<b>Regional market share</b>	Traditional regional and state enterprises	
<b>Global market share</b>	Few majors	Dow, SABIC, MEGlobal, BasellLyondell
<b>Technology - licensing</b>	Readily available	Shell/SD/Dow (EO/EG) BasellLyondell (polyolefins)
<b>Technology - added value</b>	Restricted (leading)	BP/Celanese (Acetic acid)
<b>R&amp;D support</b>	Leading licensors	
<b>Corporate commitment</b>	Focused portfolio	Dow, BasellLyondell
<b>Access to long term feedstock arrangements</b>	General trend to increased 'state' involvement and participation	Venezuela, Iran, Middle East in general

## Alberta can meet “brown field” challenge



- **Typically Developed Markets:**  
North America, Western Europe
- **Characterised by size and technical requirements**
- **Subject to low growth with limited or no investments/closures**

- **Feedstock or Market Access:**  
Middle East, China, India, SE Asia
- **Characterised by potential growth but risk**
- **Significant investments by global leaders**
- **Emergence of new players**

## Leadership in the GEA will need to address the identified SWOTs to potential petrochemical investors

### Strengths

### Weaknesses

Internal factors	<ul style="list-style-type: none"> <li>■ Abundant (and increasing) <b>feedstock</b> (Upgrader bottoms)</li> <li>■ Strong and established <b>petrochemical base</b></li> <li>■ Support from <b>government</b></li> <li>■ <b>Industry friendly</b> environment</li> <li>■ Quality of <b>human resources</b></li> <li>■ Political and economic <b>stability</b></li> </ul>	<ul style="list-style-type: none"> <li>■ Predominately <b>natural gas</b> based economics</li> <li>■ Lack of <b>critical mass</b></li> <li>■ <b>Non-integrated</b> clusters</li> <li>■ <b>Land locked</b>, logistics disadvantage</li> <li>■ Generally <b>high cost</b> of doing business (capital, housing, wages ...)</li> </ul>
External factors	<ul style="list-style-type: none"> <li>■ <b>Downstream</b> development potential</li> <li>■ US <b>import substitution</b> potential</li> <li>■ Large scale step-outs in technology to provide <b>new routes</b> to petrochemicals</li> <li>■ Developments in <b>fuels related demand</b></li> </ul>	<ul style="list-style-type: none"> <li>■ <b>Labour availability</b> to support growth</li> <li>■ Uncertainty regarding <b>environmental regulations</b></li> <li>■ <b>Weak infrastructure</b> to reach markets</li> <li>■ Electricity and energy <b>costs</b></li> </ul>

### Opportunities

### Threats

## Regional and global feedback suggests a number of Key Success Factors to be addressed for the GEA

- ***Availability of competitive feedstock and raw materials***
  - To achieve 1<sup>st</sup> quartile or leading economics
    - Pricing structure and mechanisms re Upgrader bottoms
- ***Integration of suppliers and other clusters***
  - To maximize operational efficiency and reduce logistics
    - Need to address common utilities, storage and distribution, etc
- ***Appropriate infrastructure to both domestic and export markets***
  - Access to key US markets and ability to supply Asian markets in a timely and cost efficient manner
    - Rail and port facilities
- ***Competitiveness of construction costs in relation to other potential locations***
- ***Availability of skilled workforce***
  - Recognition of a global issue in both the implementation and maintenance of new operations

## Cluster Management Body is accountable for managing cluster operation with contribution from all the stakeholders

### Contributions of Stakeholders to the Cluster Management Body:

- Funding
- Expertise
- Manpower
- Appointment of top management
- Policies
- Legislation
- General cluster promotion

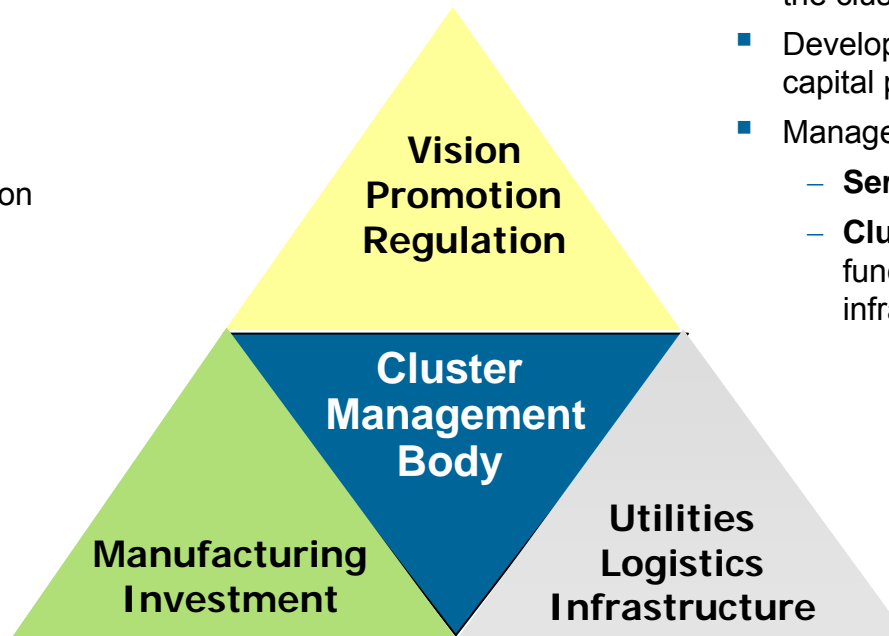
Industry Canada

Government of Alberta

Capital Regions  
Municipalities

### Key responsibilities of Cluster management Body:

- Formulate **cluster development strategy** and vision based on stakeholders' input
- Implement **investor acquisition strategy**
- **Create/maintain/manage and develop** the cluster
- Develop **budgets** and **business plans** for capital projects and operational needs
- Manage **cluster finances**:
  - **Service fees** for cluster tenants
  - **Cluster development fund** – CAPEX fund for developing common infrastructure



Downstream  
Industries

Chem. Producers

Refineries

Upgraders

Service providers

Port Alberta?

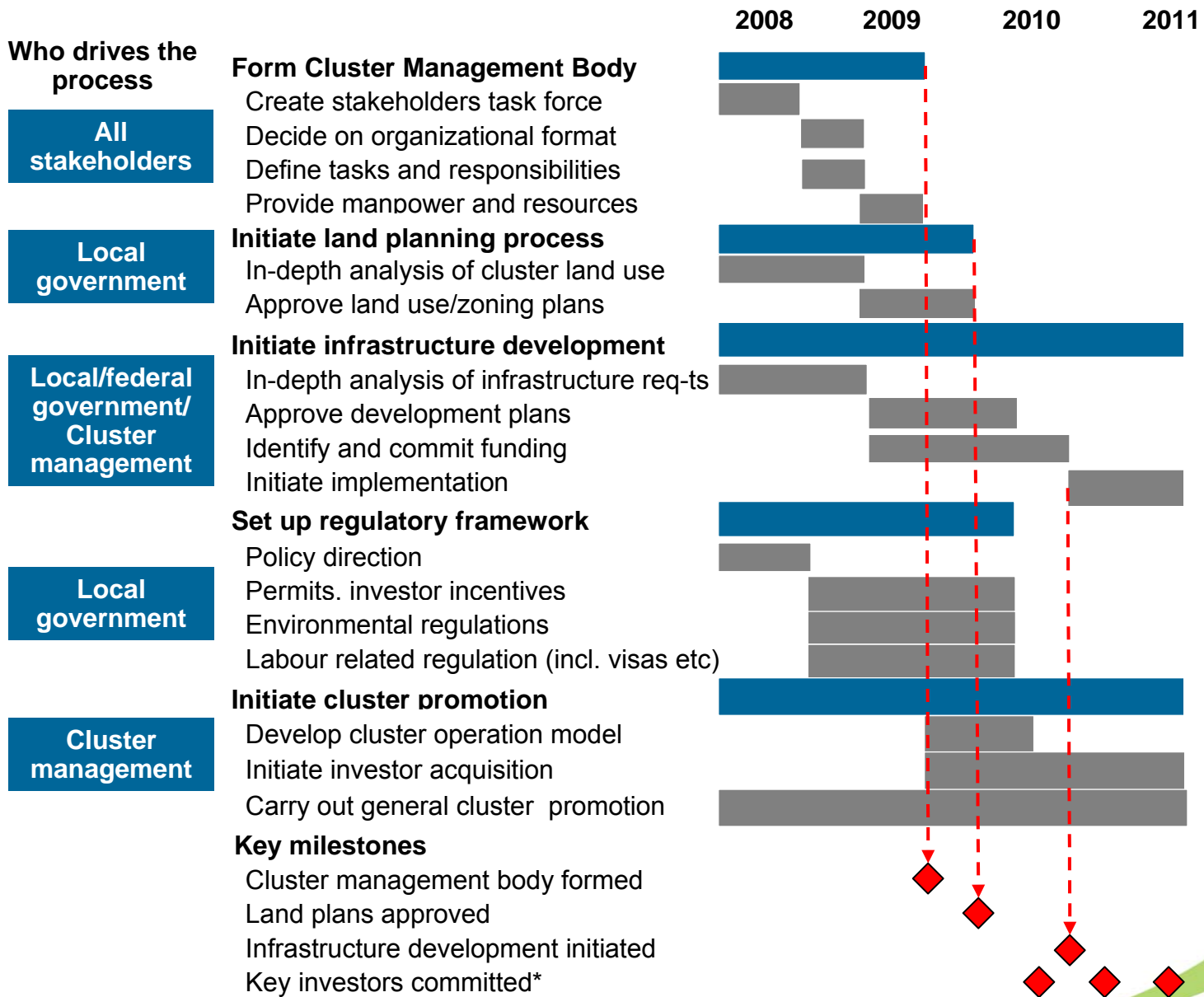
Province of Alberta

Capital Regions  
Municipalities

# A number of activities need to be initiated to make the cluster investor ready

**June 2008**  
Cluster  
concept  
developed

Next  
steps



# Contents

	Background and objectives of the study
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	Benchmarking of the international clusters
Stage 2	Cluster attributes and key performance criteria
	<b>Cluster land use and logistics</b>
	Cluster marketing strategy
	Conclusions and next steps

## Land Use and Infrastructure Scenarios

### Key Assumptions:

- Development will be phased over **25+ years**
- Investments need to be **co-ordinated**
- **Success** of initial investments will **influence further investment**
- Availability of cost **competitive feedstock** is paramount: volumes, long term pricing agreements
- Appropriate **cluster leadership in place** to encourage/support inward investment

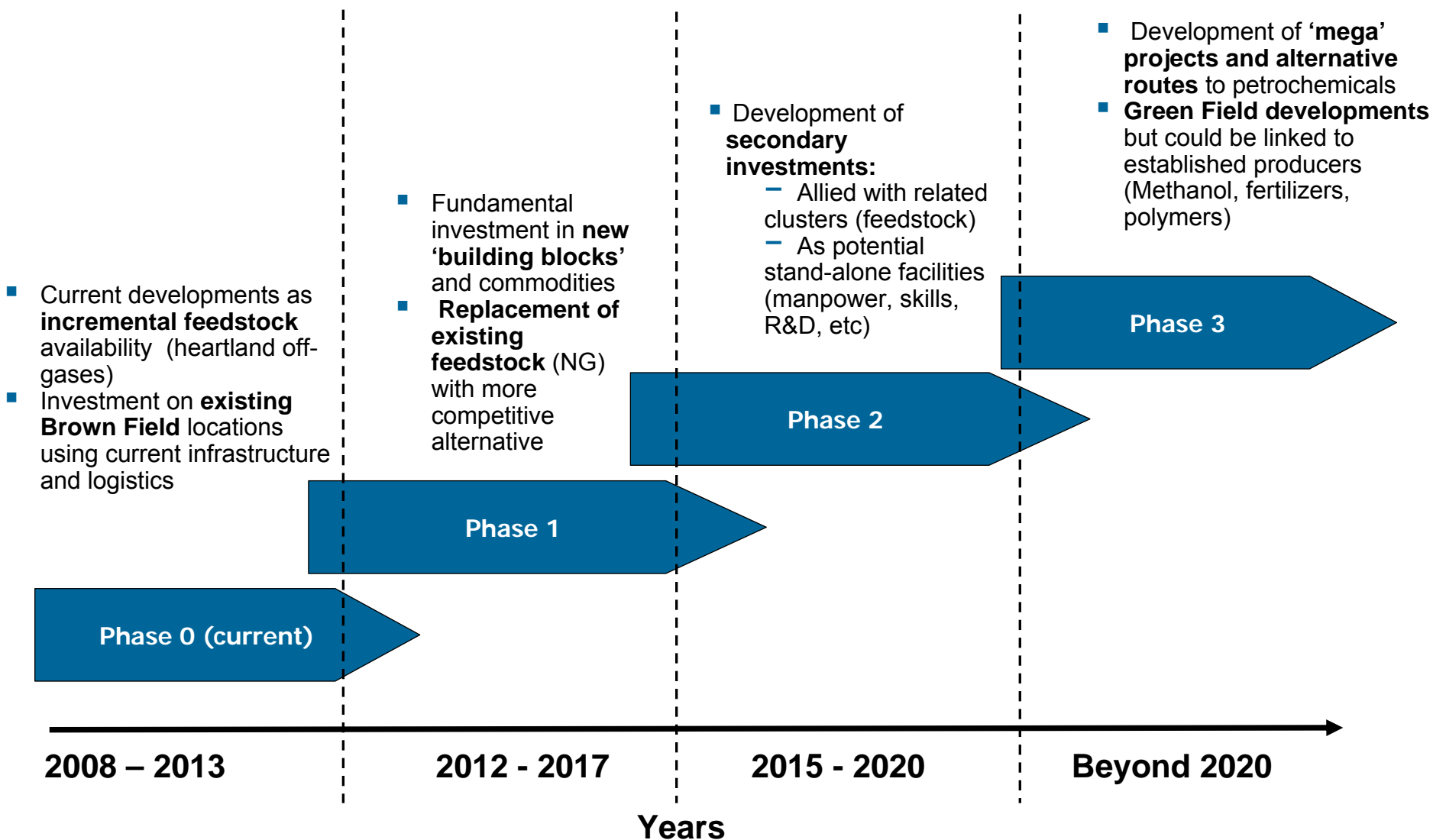
#### Location of the investment

- Integration into the current Upgrader area (**upstream**)
- Integration and development with the current refining and petrochemical area (**midstream**)
- Development currently not integrated into upgrading/ refining/ petrochemicals (**downstream**)

#### Infrastructure requirements

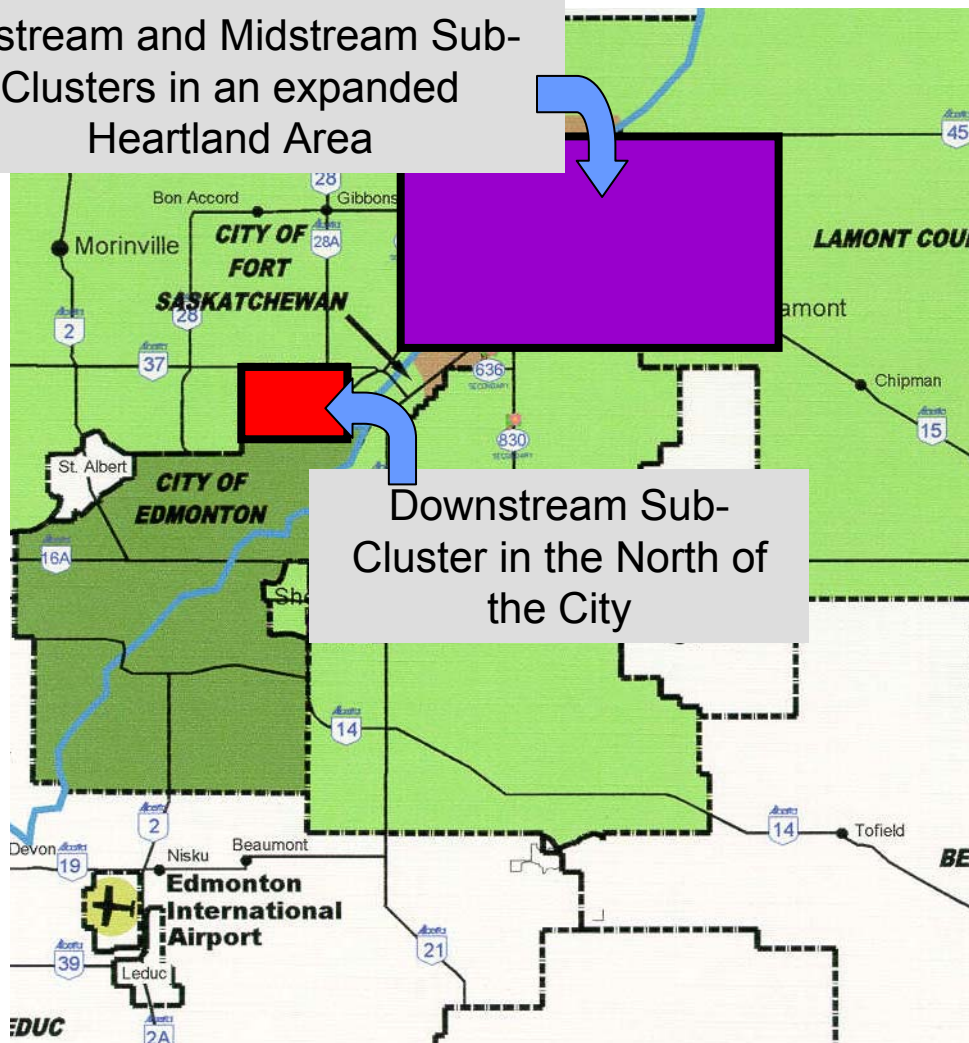
- **Logistics:** Majority of movements will be rail orientated
  - To US and west coast for export
  - Mainly solids (polymers, fertilizers), some liquids (methanol, ammonia, etc)
  - Increasing **local demand** for intermediates and finished products over time
- **Other:** Significant demand for utilities and power (oxygen, hydrogen, nitrogen, water)
  - Need to move CO<sub>2</sub> for EOR
  - Waste management

## Investments are considered with the following timeframe\*



## The Heartland Area will be home to the Upstream and Midstream Sub-Clusters

Upstream and Midstream Sub-Clusters in an expanded Heartland Area

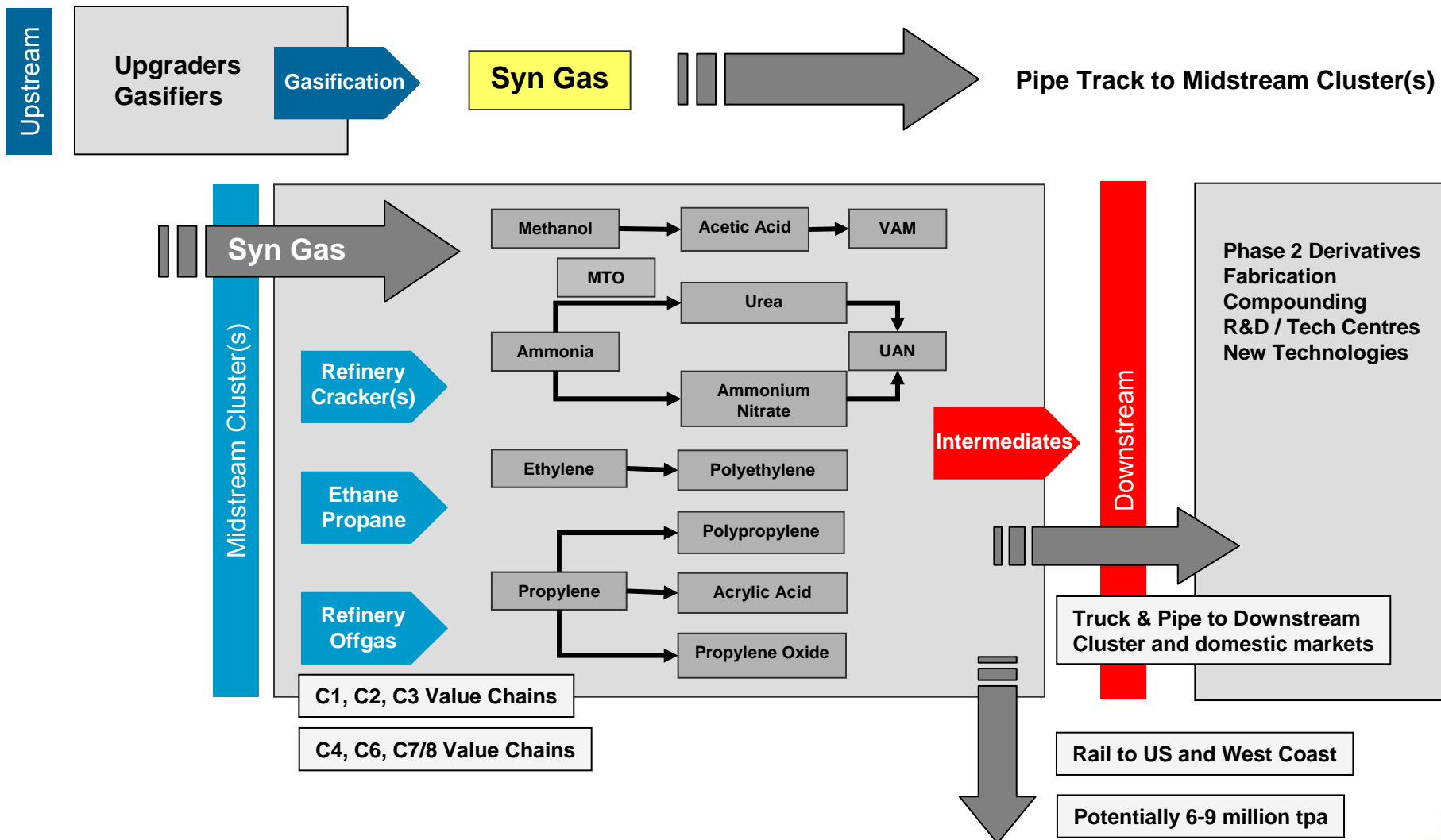


Downstream Sub-Cluster in the North of the City

### Key Issues to Consider:

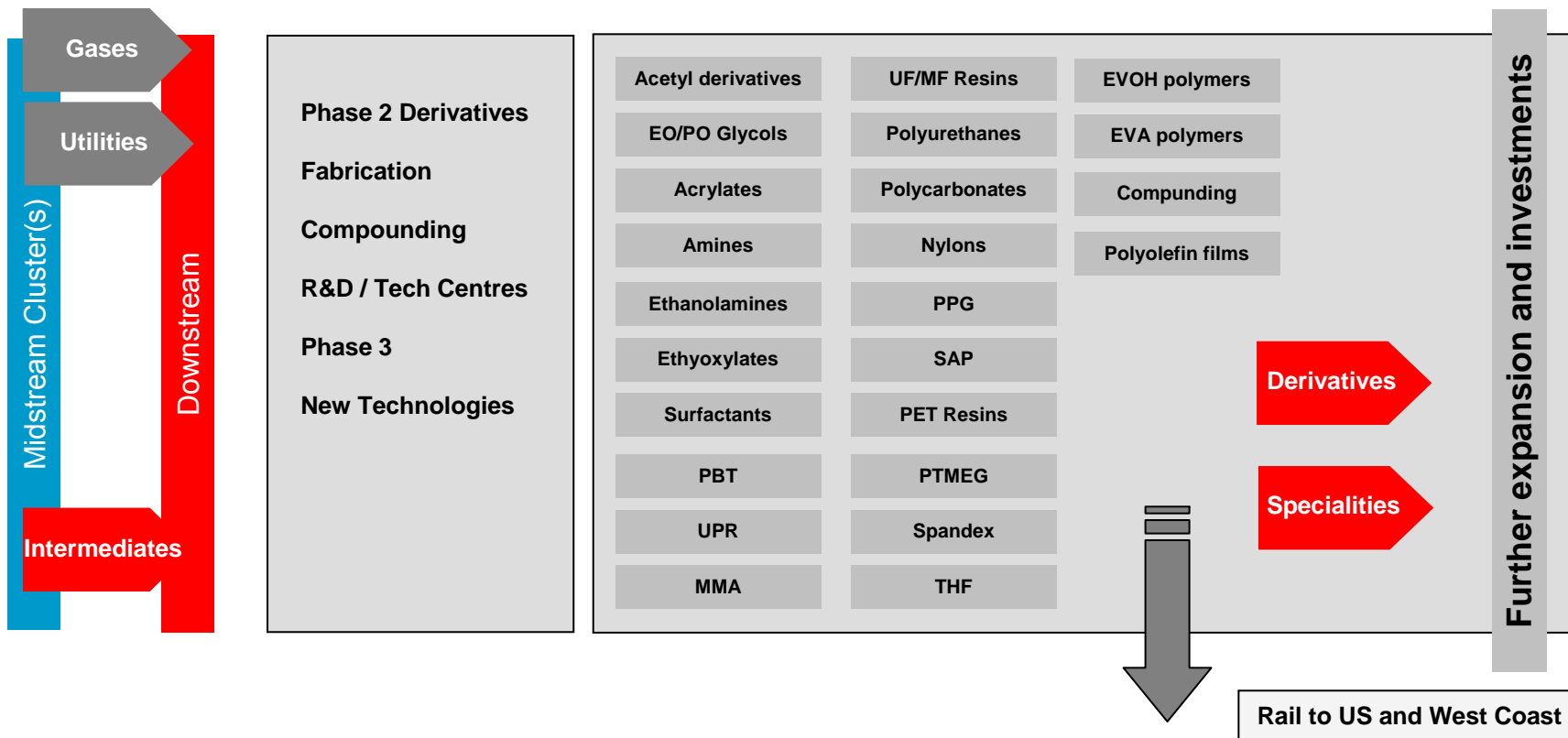
- Allocation of a designated industrial park area for chemical plants
- Development of a cluster logistics infrastructure
- Development of the export logistics infrastructure
- Development of a integrated utilities and services infrastructure
- Provision for linkage to the Downstream cluster and other future industry clusters
- Future public infrastructure expansion
- Building the long range community development around the cluster evolution

The Midstream sub-cluster(s) will become the centre for petrochemicals. Upstream will be focus for feed preparation and Downstream added-value.



# The Downstream cluster will focus on added-value, intermediates and associated developments including new technology

Investment timing is a function of availability of intermediates and other feedstocks



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**Cluster marketing strategy**

Conclusions and next steps

## Some target investors operate across several value chains

Investor group	Strategic drivers						Players
Upgraders	Downstream integration						Various
Refiners	Maximizing refinery / petrochemical interface / synergies Enhancing chemical portfolio Regional growth						Shell Imperial Oil PetroCanada
Gas Separation	Downstream integration						Williams Aux Sable
Chemicals	Competitive feedstock access and market access Global positioning / regional portfolio extension / technology capability						
	C1	C2	C3	C4	C6	C7/8	
	BP Agrium Yara, Terra Mosaic Methanex Celanese Eastman DuPont	Nova Shell Dow LyondellBasell CPChem MEGlobal Ineos	BASF  Dow LyondellBasell	BASF Hexion ISP Lanxess	BASF Shell Dow ExxonMobil ConocoPhillips Sunoco Ineos	BP Shell Invista CPChem ConocoPhillips Eastman	
Global plays	A new regional entry						Reliance, Sasol, Total

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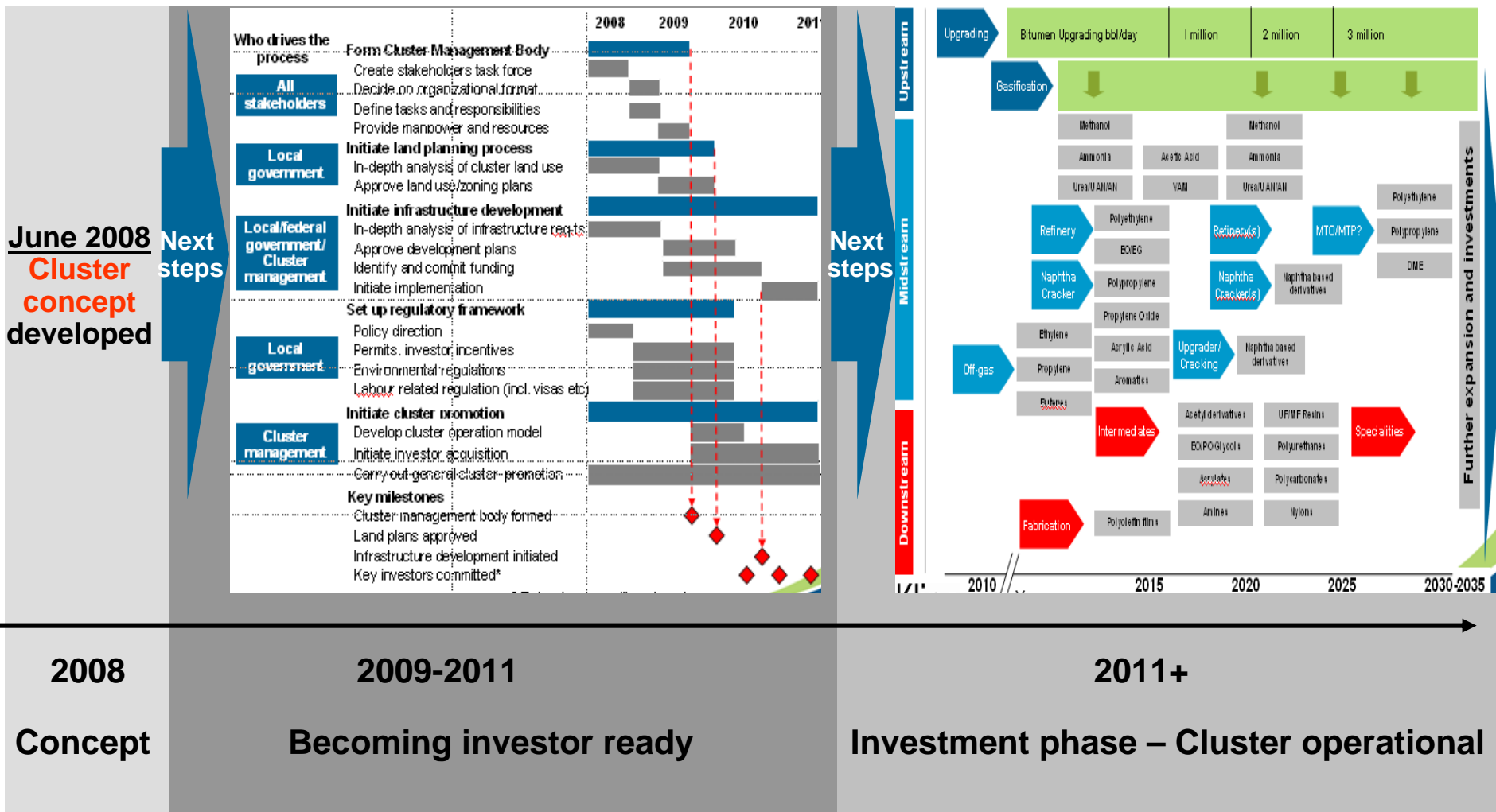
Cluster marketing strategy

Conclusions and next steps

## What are the specific critical issues that need to be considered to develop a World-Class Cluster?

- Secure **Competitive Feedstock** supply
- **Designated/Zoned Land** for cluster development
- **Regional infrastructure** connecting to local, regional and international markets
- Competitive **regional utilities** and **services**
- **Targeted Investment Acquisition** for strategically imperative products and downstream products
- **Cluster site development** and chemical **industry specific infrastructure**
- Efficient **Permitting** Procedures
- **Cluster coordination/leadership** for development and investment attraction
- **Trigger** mechanism to **kick-start** the cluster development

# Putting it all together: charting the way forward



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