

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

Final Presentation Edmonton Seminar

*Presentation on behalf of:*



**30 May 2008**

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Stage 1

Development of the cluster alternatives

Benchmarking of the international clusters

Stage 2

Strategically imperative products

Cluster attributes and key performance criteria

Cluster land use and logistics

Cluster marketing strategy

Conclusions and next steps

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## Study Background and the purpose of this Presentation

- Key government groups in Alberta – the Alberta provincial government, the City of Edmonton and Alberta’s Industrial Heartland Association) **are focused on developing a value added downstream industry** based on oil sands to produce petroleum products and petrochemicals, rather than simply selling the processed oil.
- Kline & Company was engaged to provide an **objective view of Alberta’s potential** for the building a world class chemical cluster in Greater Edmonton and **develop the cluster alternatives and integrated strategy.**
- This report is a **final presentation of the Study results** and it consists of two major blocks:
  - An overview of the **key findings of the Stage 1** already presented to the various stakeholders earlier in the course of the Study
  - Presentation of the **results and findings of Stage 2**
- Together, the above blocks will provide a **full overview of the results and findings of the Study** and outline the next step in developing the world class chemical cluster in Greater Edmonton

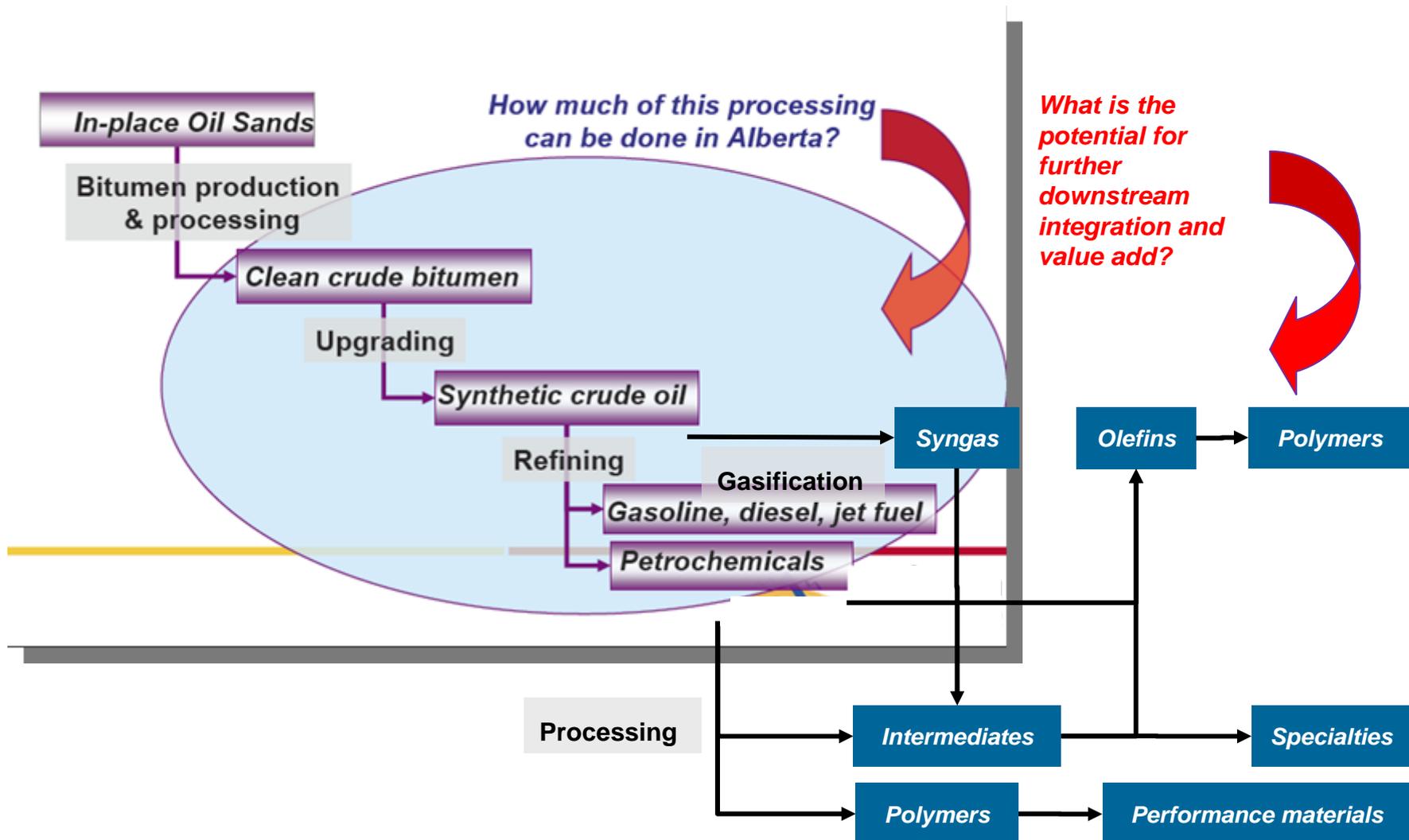
## Project Goals were formulated to address the major issues - Stage 1

- ➔ **Develop world-class eco-industrial chemical cluster alternatives for the Greater Edmonton Area**
- ➔ **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**

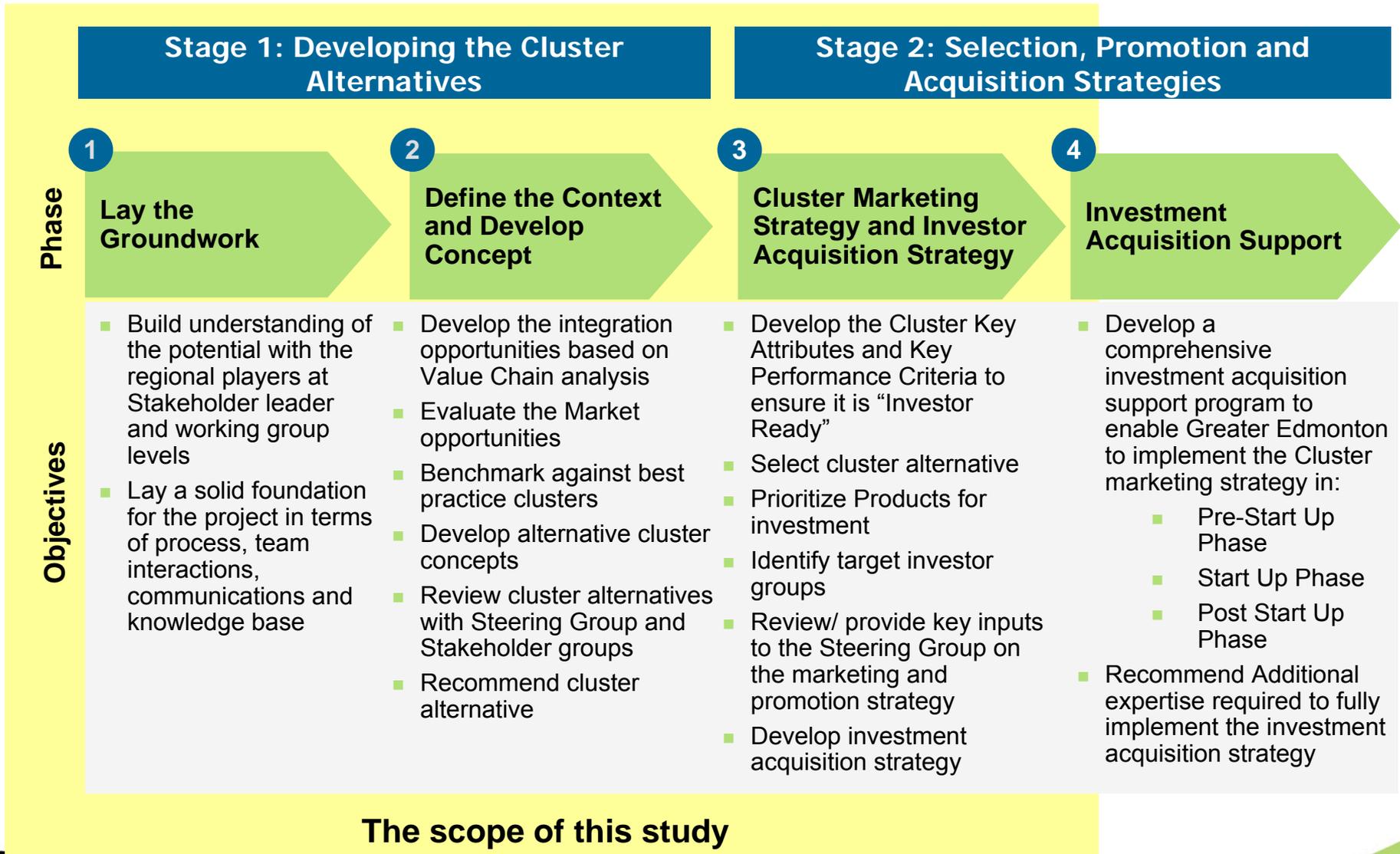
## Project Goals were formulated to address the major issues - Stage 2

- Select the most attractive investment projects which will enable Greater Edmonton to trigger the development of the cluster as soon as practicable
- Develop appropriate marketing and investor acquisition strategies for Greater Edmonton
- Develop a targeted investor acquisition strategy (e.g – incentives)
- Develop the basis for an integrated cluster development strategy – what does the cluster need to become “Investor Ready”
- Recommend a coordinated, integrated cluster development strategy for Greater Edmonton
- Evaluate the strategic and economic impact of the cluster development, 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



## Phase 3: Developing the Promotion and Acquisition Strategies

3

### Cluster Marketing Strategy and Investor Acquisition Strategy

#### Objective

- Develop the Cluster Key Attributes and Key Performance Criteria
- Select cluster alternative and establish product priorities
- Identify target investor groups
- Review/ provide key inputs on Cluster marketing strategy
- Develop investor acquisition strategy

} Focus of this presentation

#### Key Tasks

- Develop the Cluster Concept
  - Key Attributes and Key Performance Criteria
  - Develop the Cluster "Site Plan"
- Select the appropriate cluster alternative
- Establish product priorities for investment acquisition
- Develop a prioritized target investor list
- Review the marketing and promotional strategies for the region
- Formulate the investor acquisition strategy together with the Steering Group
  - Approach to potential investors
  - Develop business cases
- Develop/ review strategies to obtain buy-in from authorities to support the promotion and acquisition strategies

#### Deliverables

- Cluster "Investor ready" Inventory of Key Attributes and KPC's
- Government's "Recipe for Success"
- Selected cluster alternative
- Product investment priority list
- Investor database
- Promotional "content" review
- Promotional strategy review
- Qualified business cases for each product
- Prioritized investor acquisition strategy and schedule

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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**

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

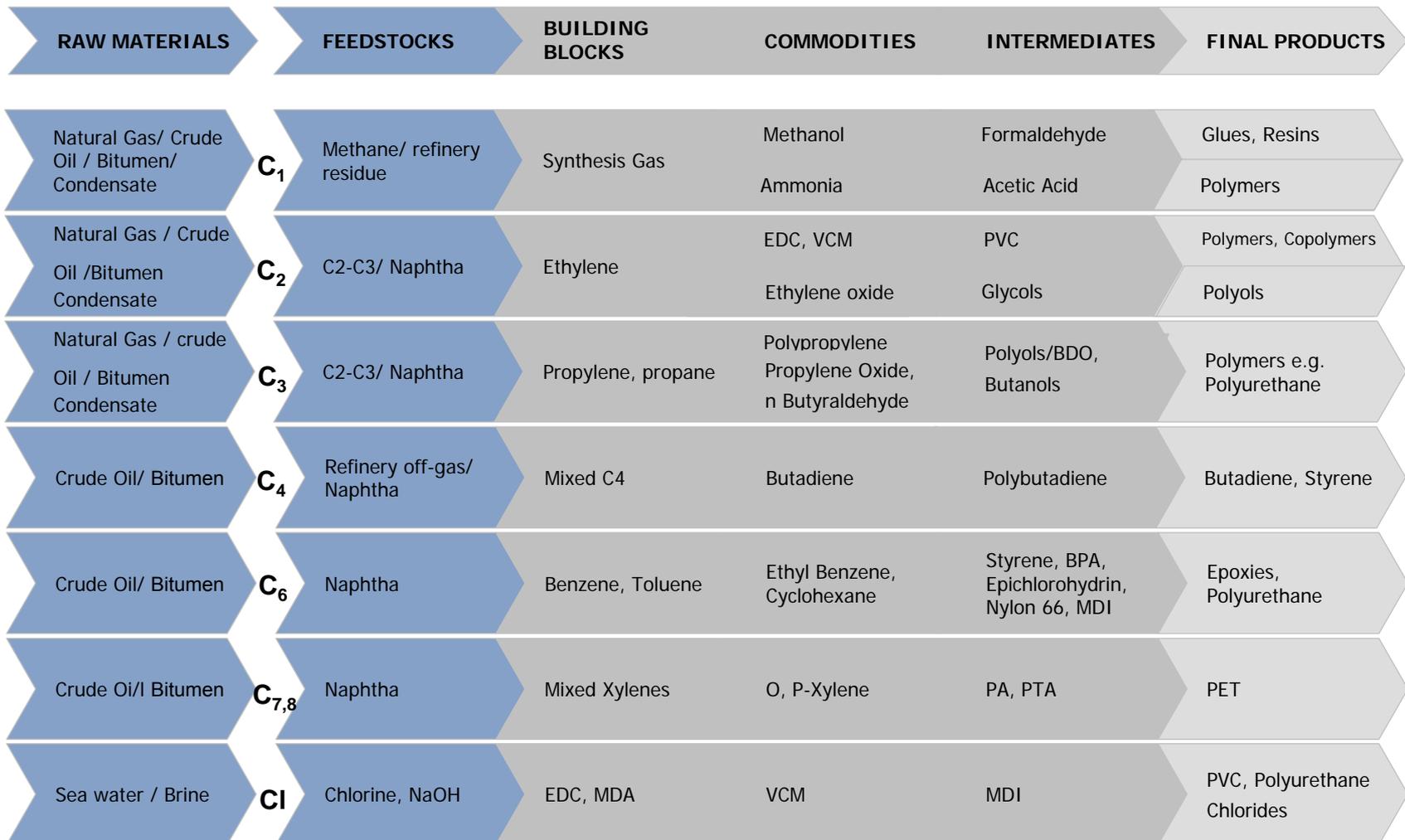
**This is the underlying opportunity**

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

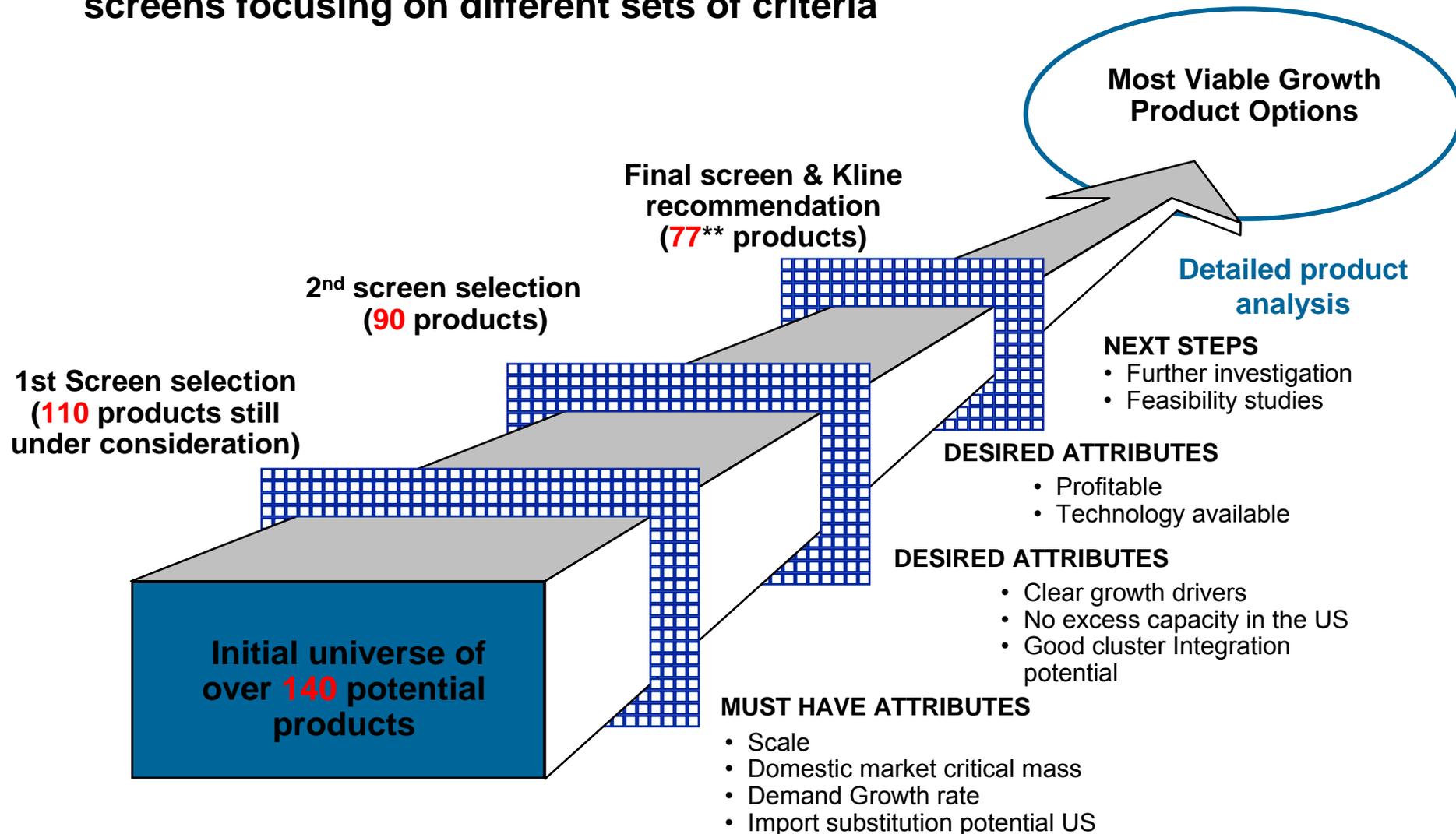
- **Additional refinery capacity** will be added in Alberta, serving **export markets**
- **Pipeline infrastructure will be expanded** to include **clean products** and possibly olefins
- **Upgrader and refinery off-gases** will become increasingly important sources of **petrochemical feedstock**
- **Gasoil 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 at 77 products from initial 140 after three consecutive screens focusing on different sets of criteria



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

# The Screening process resulted in 77 products available for cluster development in Greater Edmonton

RAW MATERIALS	FEEDSTOCKS	BUILDING BLOCKS	COMMODITIES	INTERMEDIATES	FINAL PRODUCTS	
Natural Gas/ Crude Oil / Condensate	C <sub>1</sub> Methane/ refinery residue	1	2	6	6	15
Natural Gas / Crude Oil / Condensate	C <sub>2</sub> C2-C3/ Naphtha	1	1	5	5	12
Natural Gas / crude Oil / Condensate	C <sub>3</sub> C2-C3/ Naphtha	1	1	7	5	14
Crude Oil	C <sub>4</sub> Refinery off-gas/ Naphtha	2	1	5	5	13
Crude Oil	C <sub>6</sub> Naphtha	1	3	8	4	16
Crude Oil	C <sub>7,8</sub> Naphtha	1	2	2	2	7

\*Of 77 chemicals selected, 17 are already made in Alberta

Excludes N and CI Value Chains

**Total: 77\***

## The Scale and Value of the Alternative Chemical Clusters is World Class

Value chain	# products	Capex (US\$bn)	Production (Kta)	Sales value (US\$bn/a)
C1	15	4.5	3,500	2.5
C2	12	3.6	2,700	3.5
C3	14	4.2	3,100	5.0
C4	13	3.1	2,400	4.0
C6	16	5.2	4,100	7.8
C7,8	7	2.6	2,200	2.2
<b>Total</b>	<b>77</b>	<b>23.2</b>	<b>18,000</b>	<b>25.0</b>

- Estimate based typical capex for 1 world scale plant for each product, USGC adjusted to Alberta project cost
- Estimate based on current sales prices delivered USA
- Excluding investments in utilities, sites services and general infrastructure

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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**

## Interviews were used to obtain the views and inputs of the regional Stakeholders in Alberta

- Over **90% of stakeholders are confident** that the fundamentals to develop a world-class petrochemical cluster in Alberta are present
- Enhancing the confidence of potential investors will require a **strong message** with regards to:
  - Tackling the shortage of skilled labour
  - High cost of projects
  - Approach to the further development of Alberta's infrastructure and energy supply network
- The concept of a World-class Eco-Industrial Chemical Cluster needs to be **better defined and communicated.**
- **The dilemma** of reduction in greenhouse gas emissions and large scale industrial expansion needs to be tackled (uncertainty increases investment risk)

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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

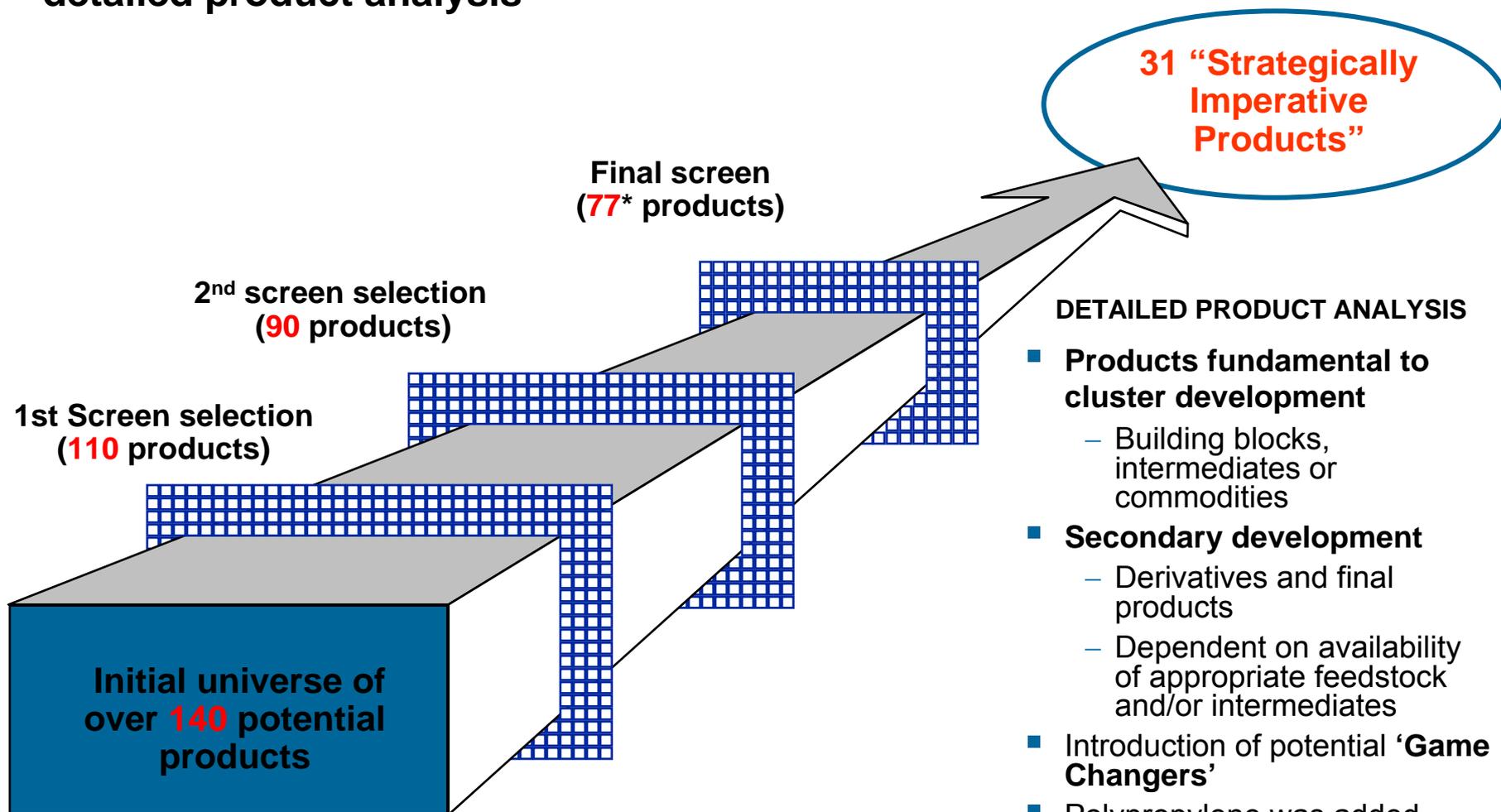
### Feedstock

- **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)

We selected 31 strategically imperative products from 77 through detailed product analysis



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

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

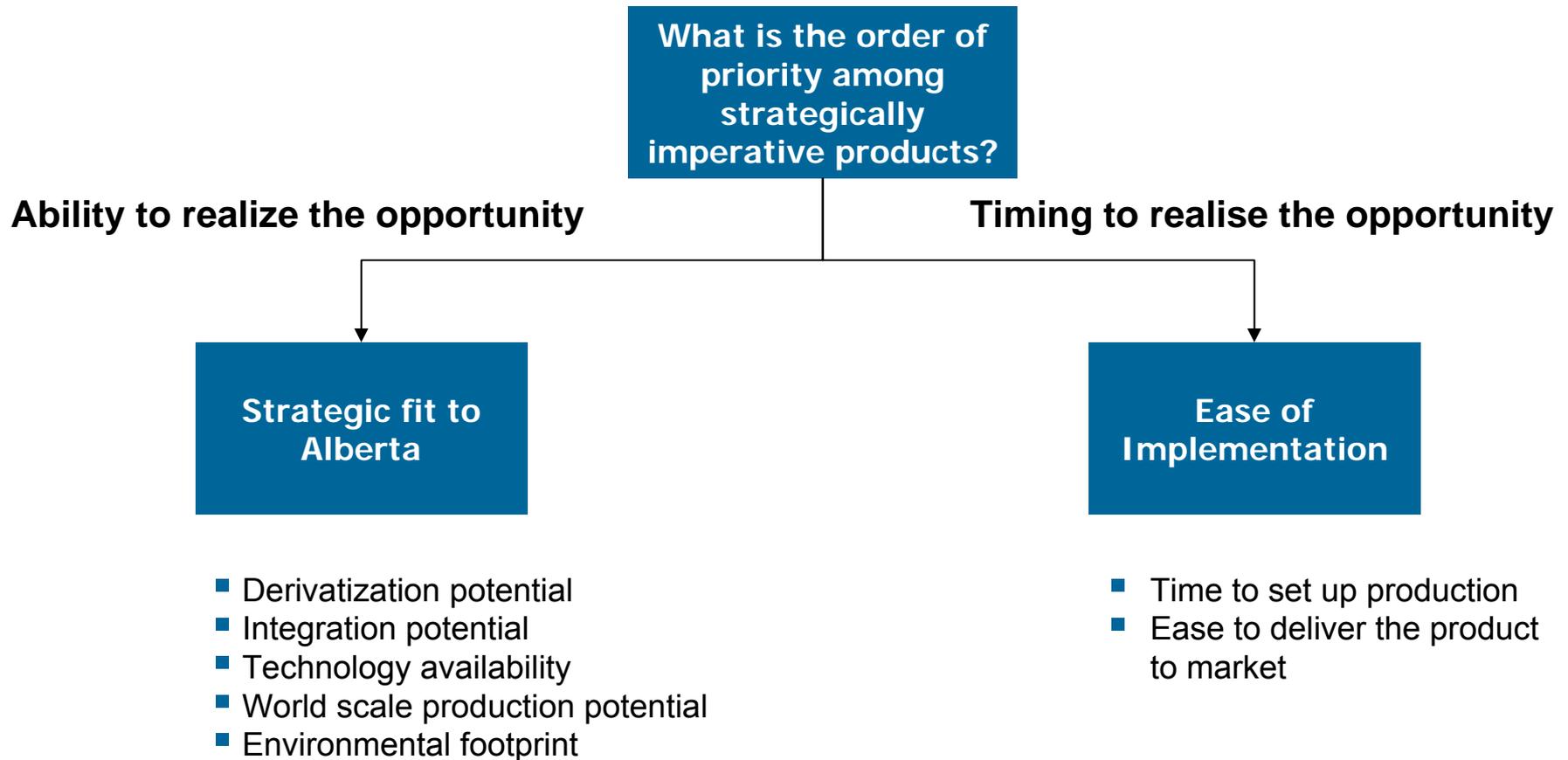
RAW MATERIALS	FEEDSTOCKS	BUILDING BLOCKS	COMMODITIES	INTERMEDIATES	FINAL PRODUCTS	
Natural Gas/ Crude Oil /Bitumen/ Condensate	<b>C<sub>1</sub></b> Methane/ refinery residue	Syn Gas	Methanol Ammonia	Acetic Acid Urea, AN	VAM UAN	7
Natural Gas / Crude Oil / Bitumen/ Condensate	<b>C<sub>2</sub></b> C2-C3/ 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

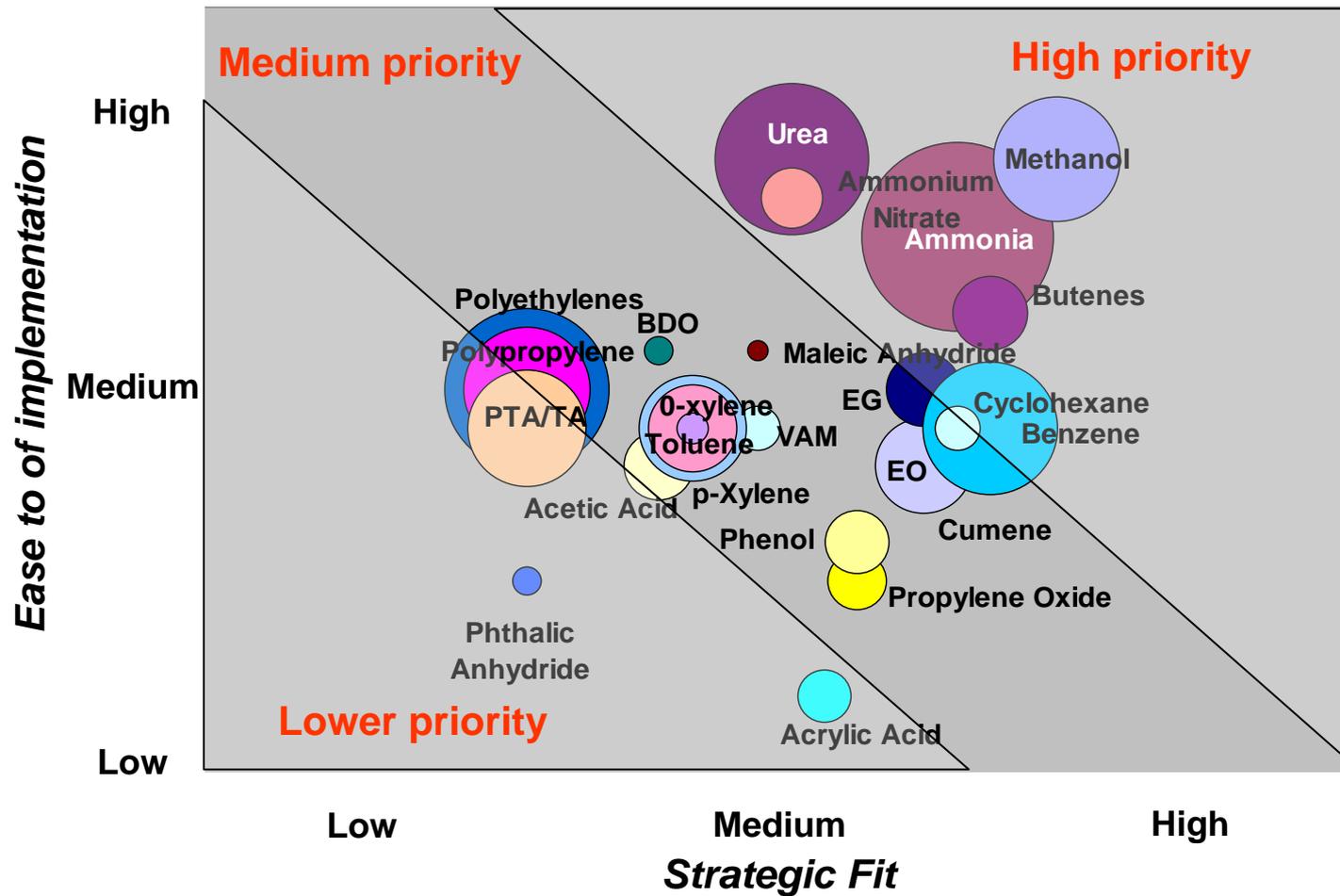
\*\* Includes LDPE, LLDPE and HDPE

**Total: 31\***

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

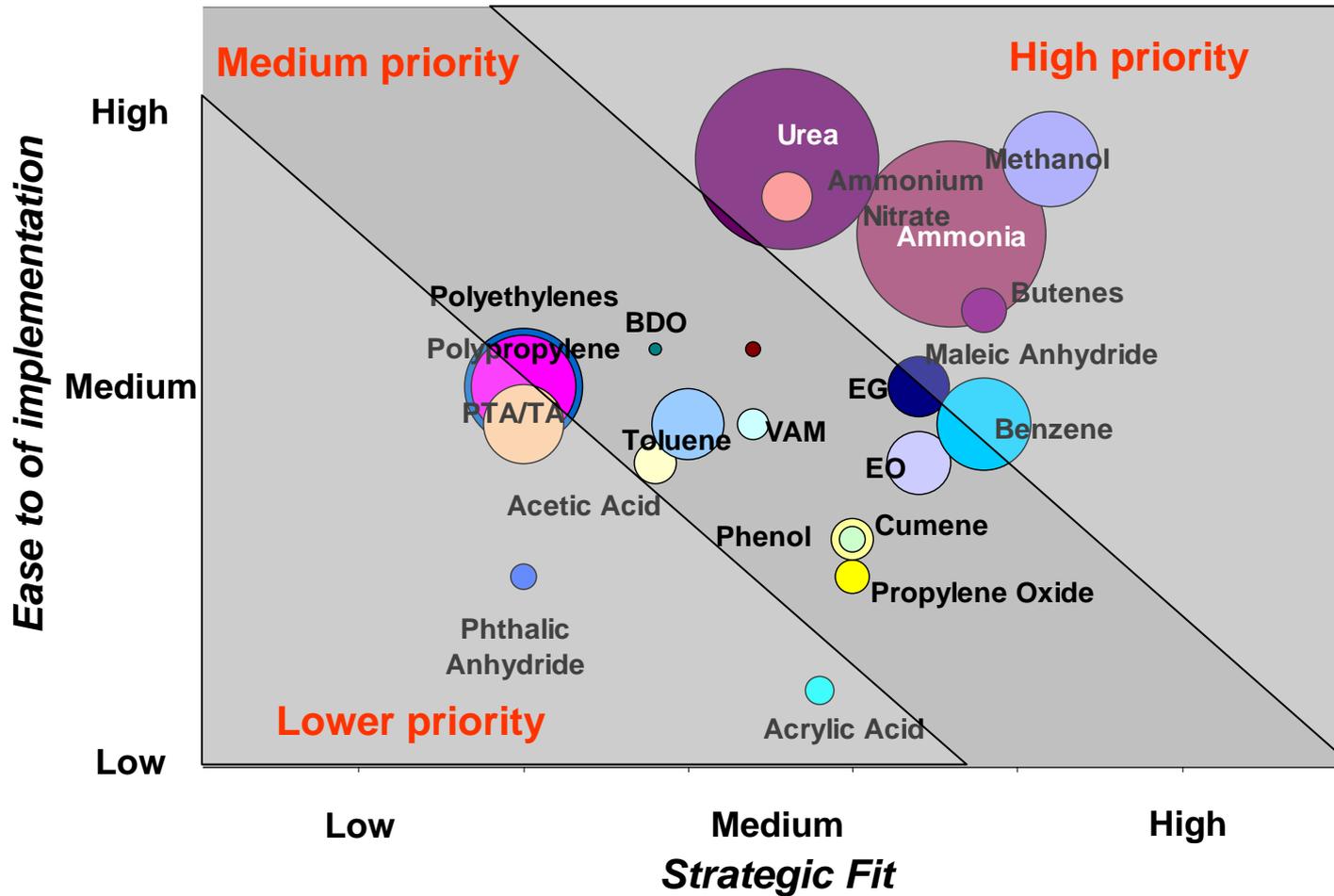


# Prioritisation of strategically imperative products: North American context



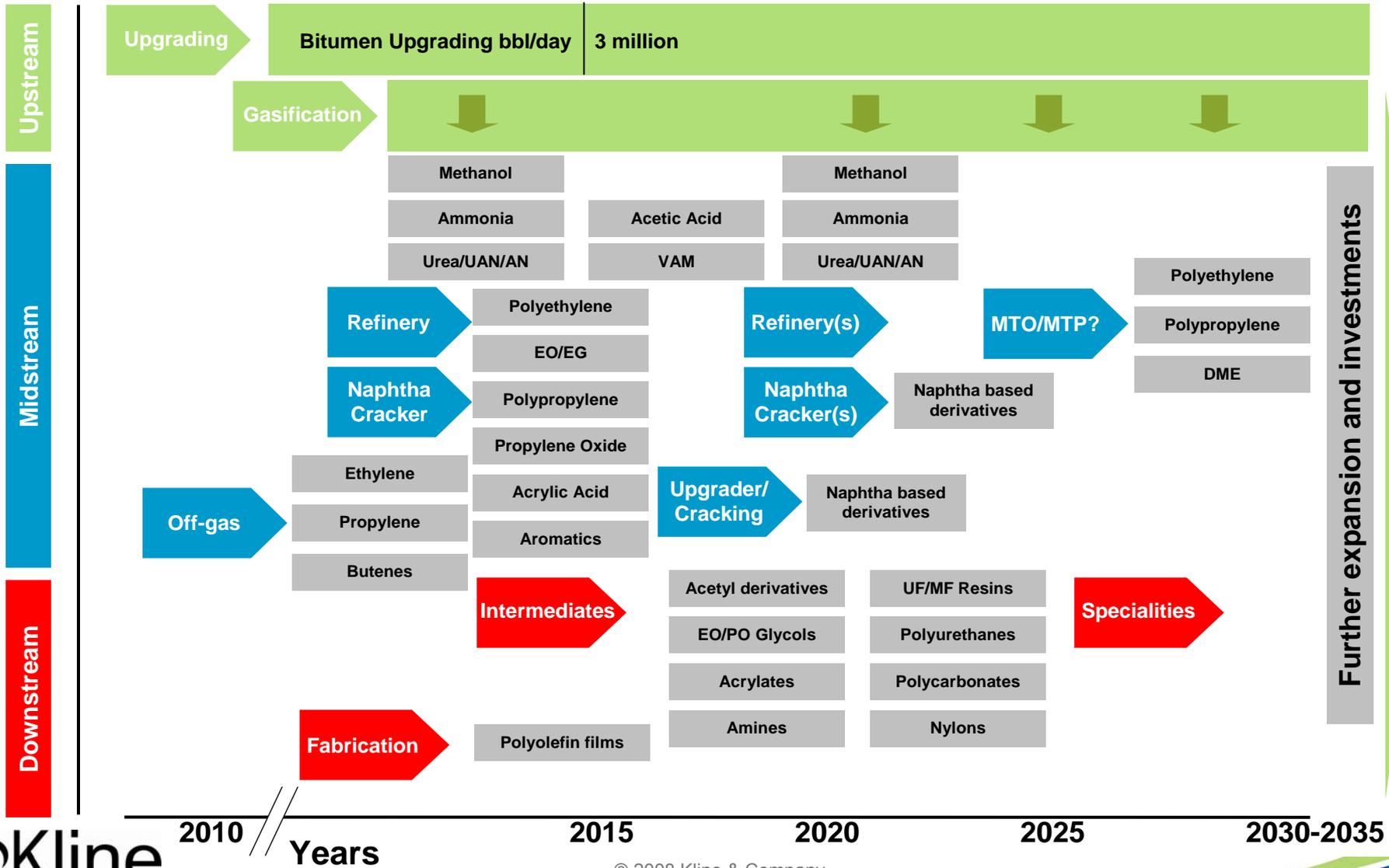
Bubbles proportional to estimated market size, 2007

# Prioritisation of strategically imperative products: Global context



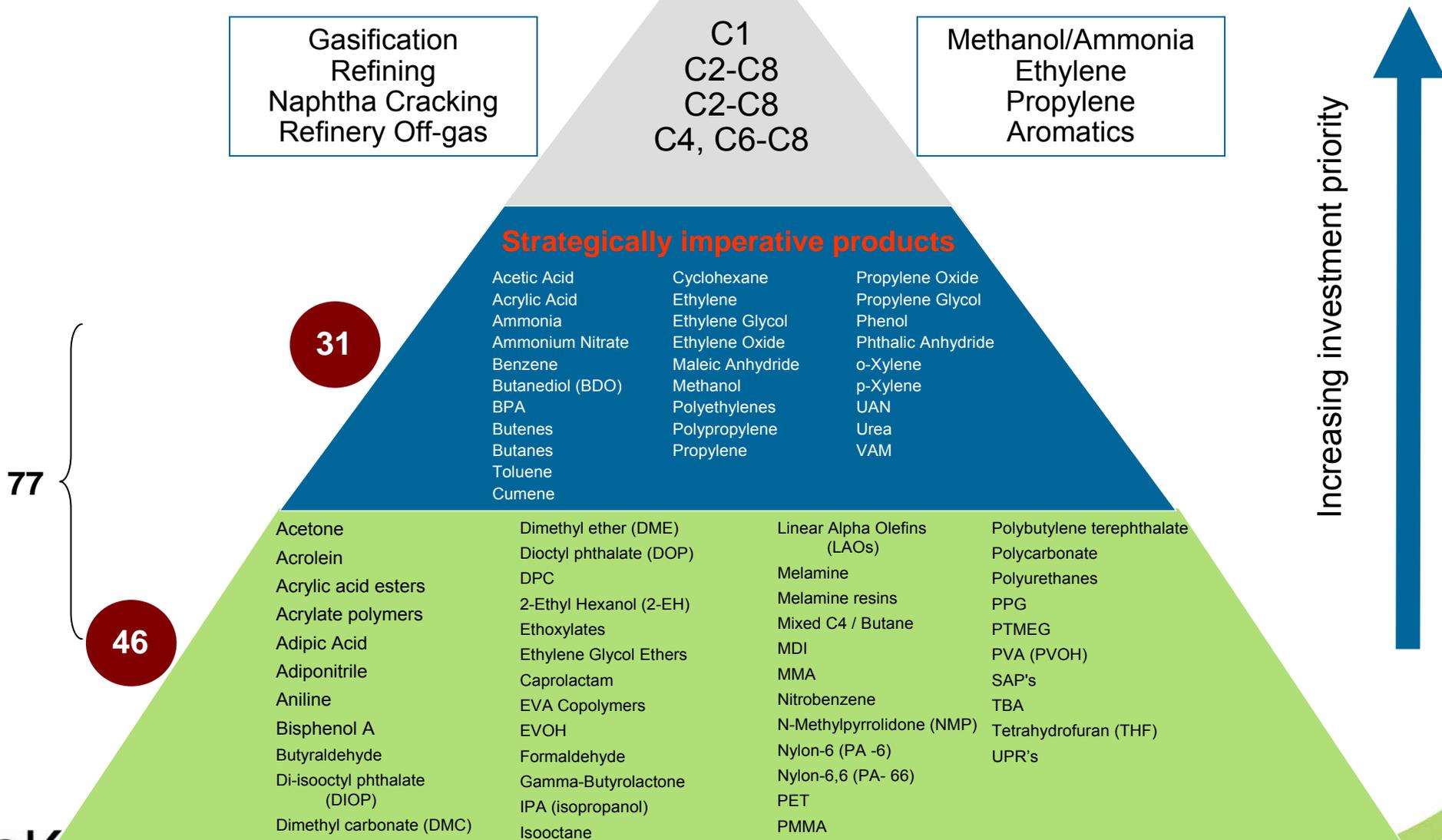
Bubbles proportional to estimated market size, 2007

# 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



77

# The GEA has a unique opportunity to develop a leading petrochemical cluster based on Upgrader bottoms gasification

## Increasing availability of Upgrader Bottoms

### Outlook

### Conversion to Coke

### Direct Gasification

### Future

Increasing NG prices leading to uncompetitive GEA petrochemical industry and potential closures

Mounting concerns on oversupply of coke and lack of realisable value. Unacceptable environmental development

- Power generation
- Increasing Coke Oversupply
- Stranded Coke Negative Value
- Bottoms Negative Value
- Risk of Upgrader closure

- Source of lowest Syngas cost
- Feedstock for Methanol and Ammonia
- Capture downstream added value
- Integration within clusters and other value chains

Ability to transform the GEA into one of the leading global petrochemical clusters independent of oil and NG feedstock supply

Management of stranded Upgrader bottoms to lever integration value. Solution to environmental aspects

A 25+ year opportunity for the GEA

## The Economic Rationale for Investment in the Strategically Imperative Products in the GEA was examined in detail

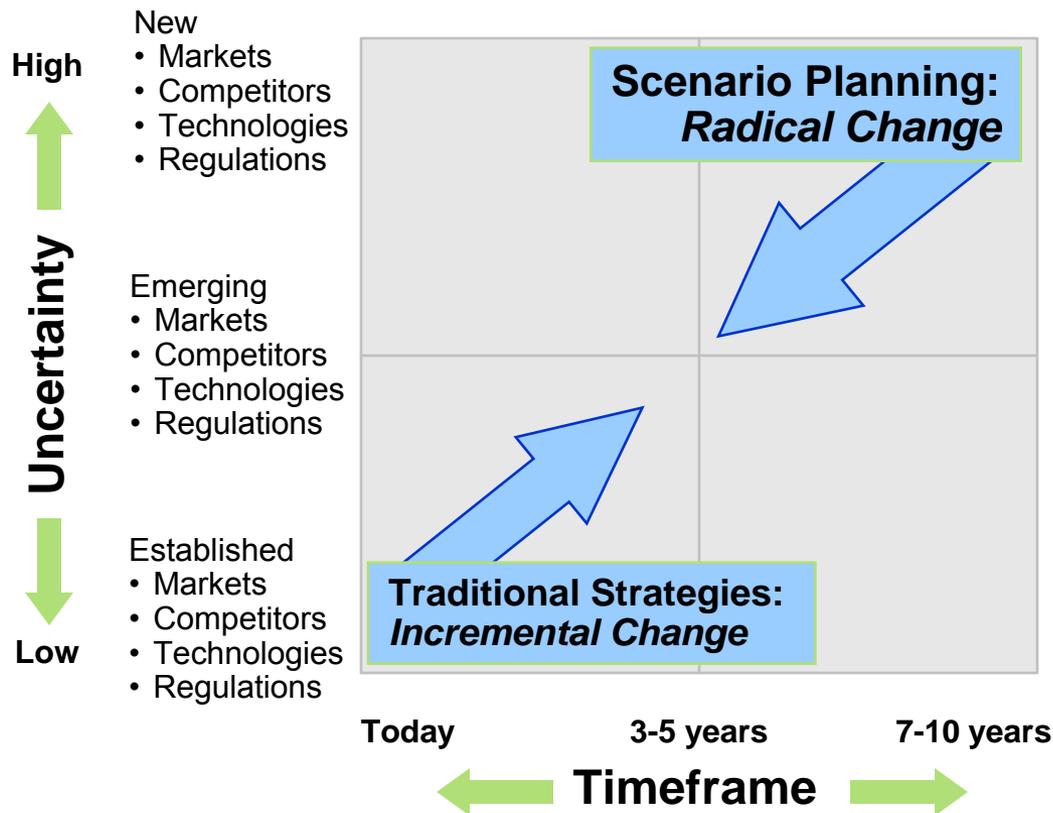
- Key global players expect **access to advantaged feedstock** as one of the major drivers behind their **location decisions**.
- We need to demonstrate that **Alberta's economics based on upgrader bottoms as a source of feedstock is better** than production based on other feedstock types.
- We have 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

# Scenarios shift strategic thinking from incremental change to radical change

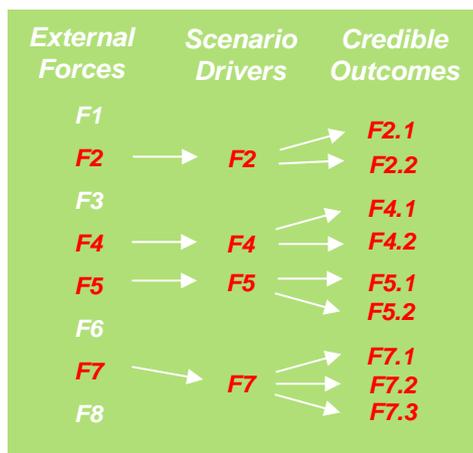


- What will the world be like in 2015+?
- What will our customers and their customers demand?
- What platforms, products, technology, and infrastructure will be required?
- Where are we threatened and how can we benefit?

# Scenarios are now more sophisticated, reflecting the reality of multiple forces at play

## Filter Multiple External Forces

Which external forces are critical to describing alternative future worlds?

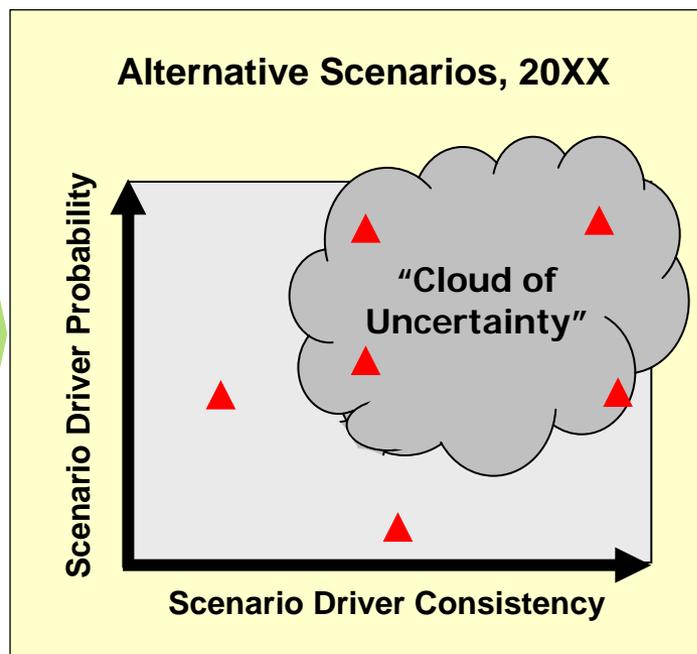


Trends Common to All Scenarios

F1 F3 F6 F8

## Develop Discrete Scenarios

What combinations of scenario drivers/driver outcomes best describe the future?



## Assess the Implications

How might these alternative futures shape our strategy?

### Implications

- For industry attractiveness
- For product/market opportunities
- For our competitive position
- For business models
- For strategic options

## 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

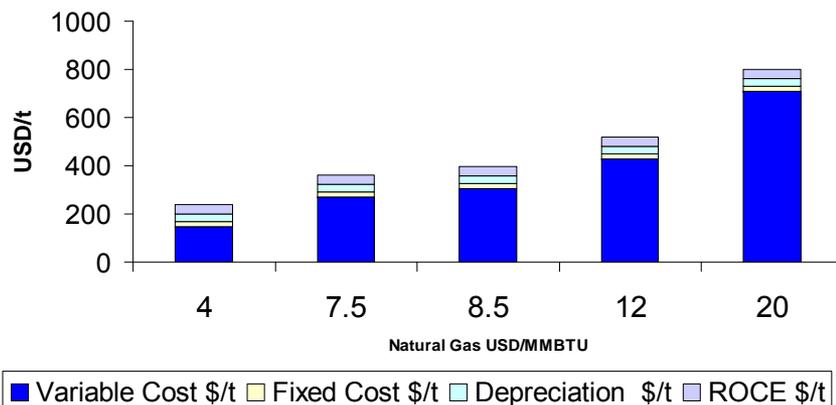
Scenarios
Natural gas price levels: \$4 – 20 / MMBtu
Upgrader bottom price levels: \$0 – 40 per tonne
Coal and Petroleum Coke price levels: \$0 – 60/ST
Capital: 80 - 150% world scale
Locations: USGC, Caribbean, Middle East, Russia



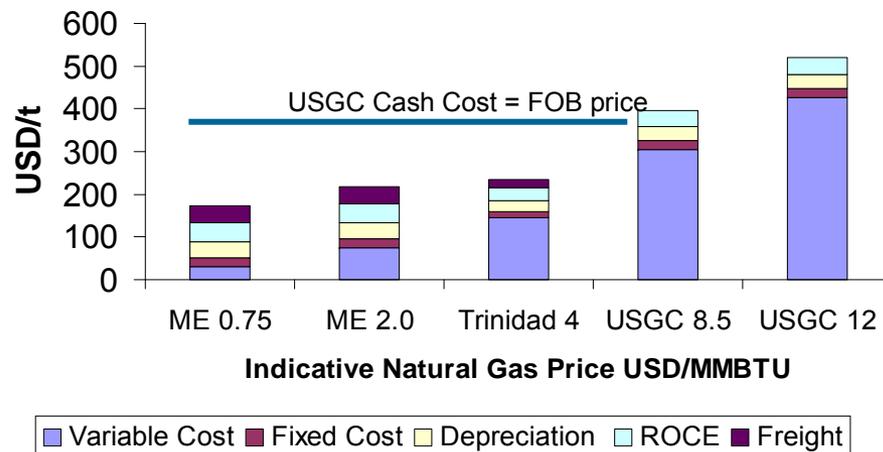
Key Sensitivities
Natural gas prices: will natural gas prices remain at a high enough level such that gasification-based economics are sufficiently advantaged?
Capital investment levels: will escalating capital investment costs make the investment unprofitable?
Product pricing: will product pricing remain 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**

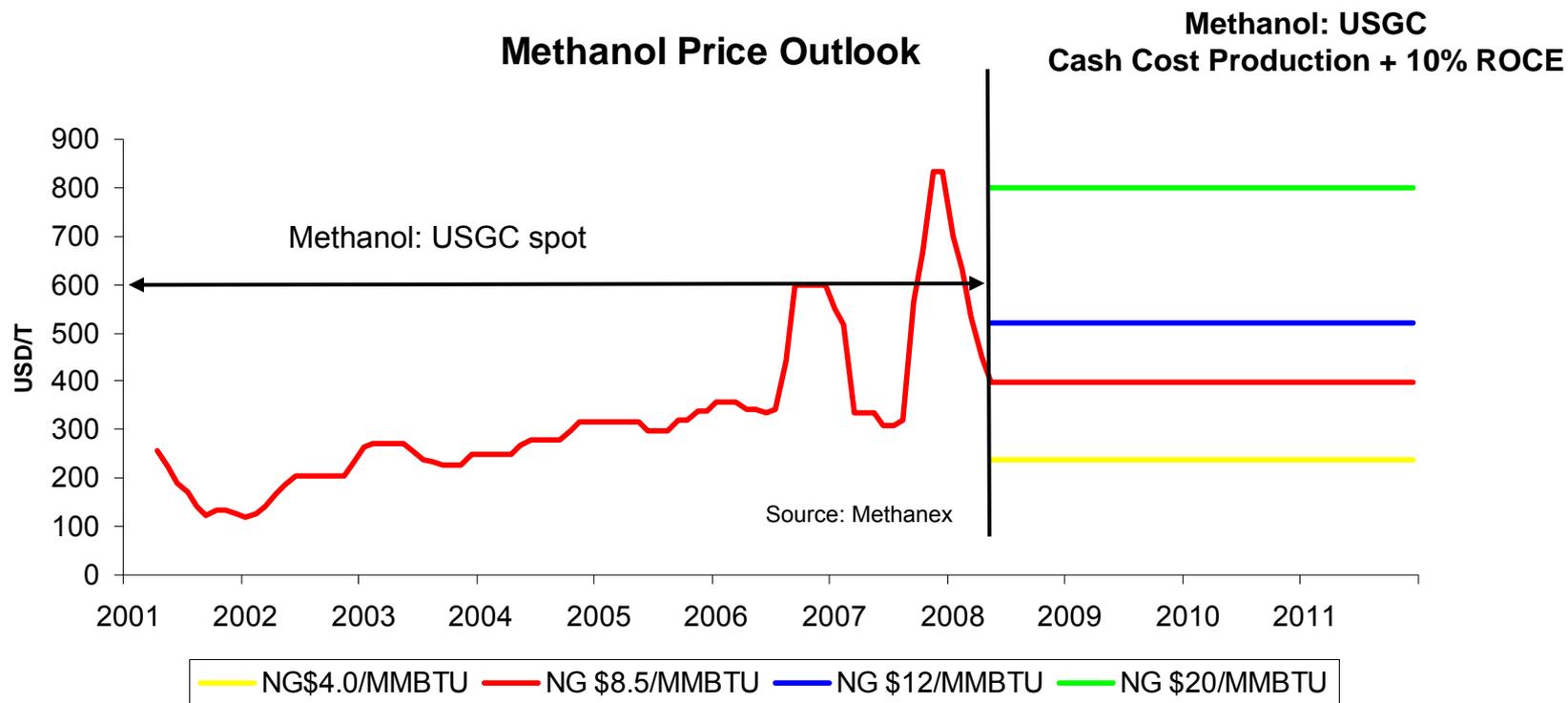


**Methanol Regional Cost Structure**



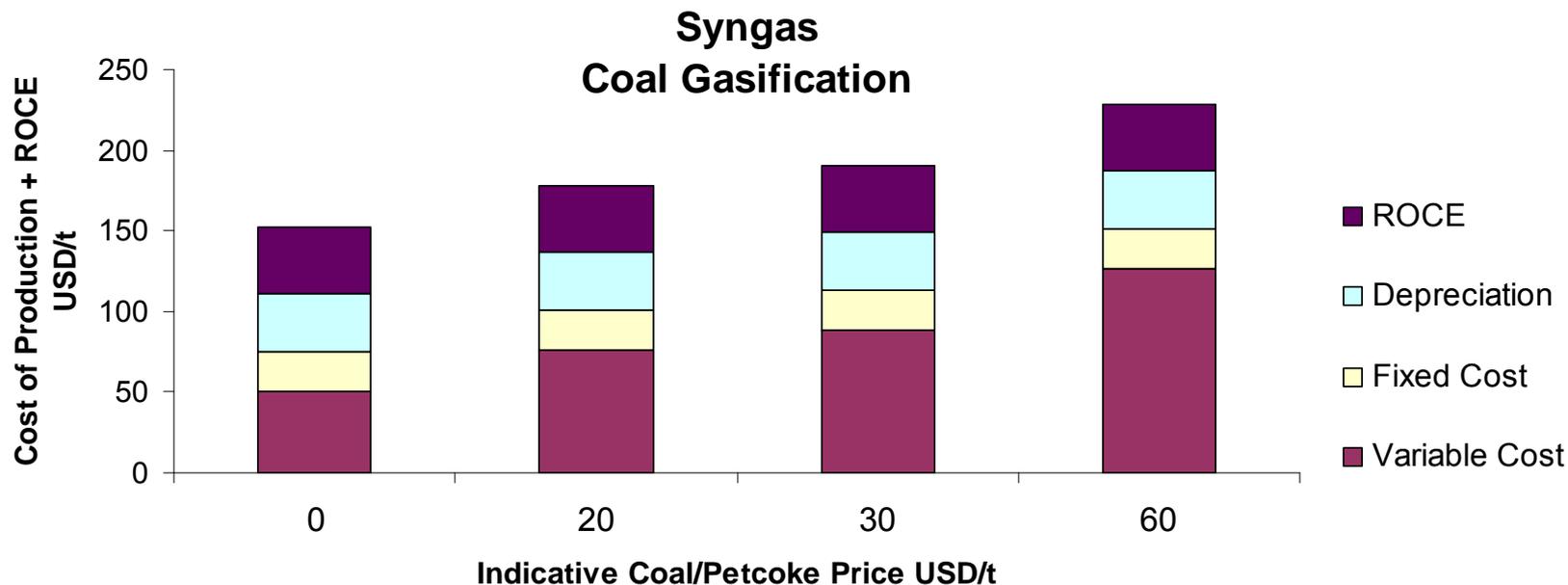
- Variable cost component essentially drives overall cost of production
- Global business based on stranded natural gas developments
  - Key locations: Trinidad, Chile, Middle East, New Zealand
  - US ‘high cost, natural gas’ plants setting overall pricing mechanism
  - USGC Cost of Production = FOB 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

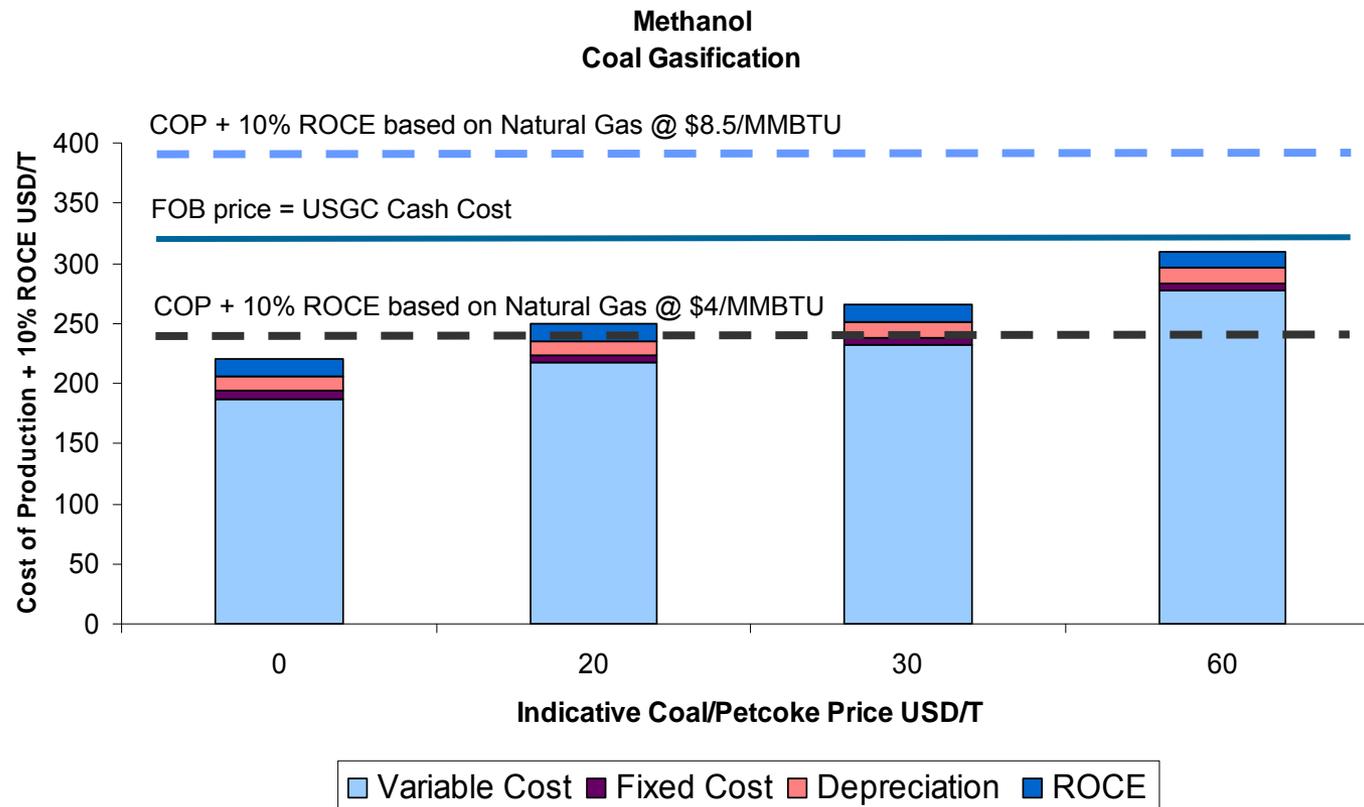
### Coal Gasification

- 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

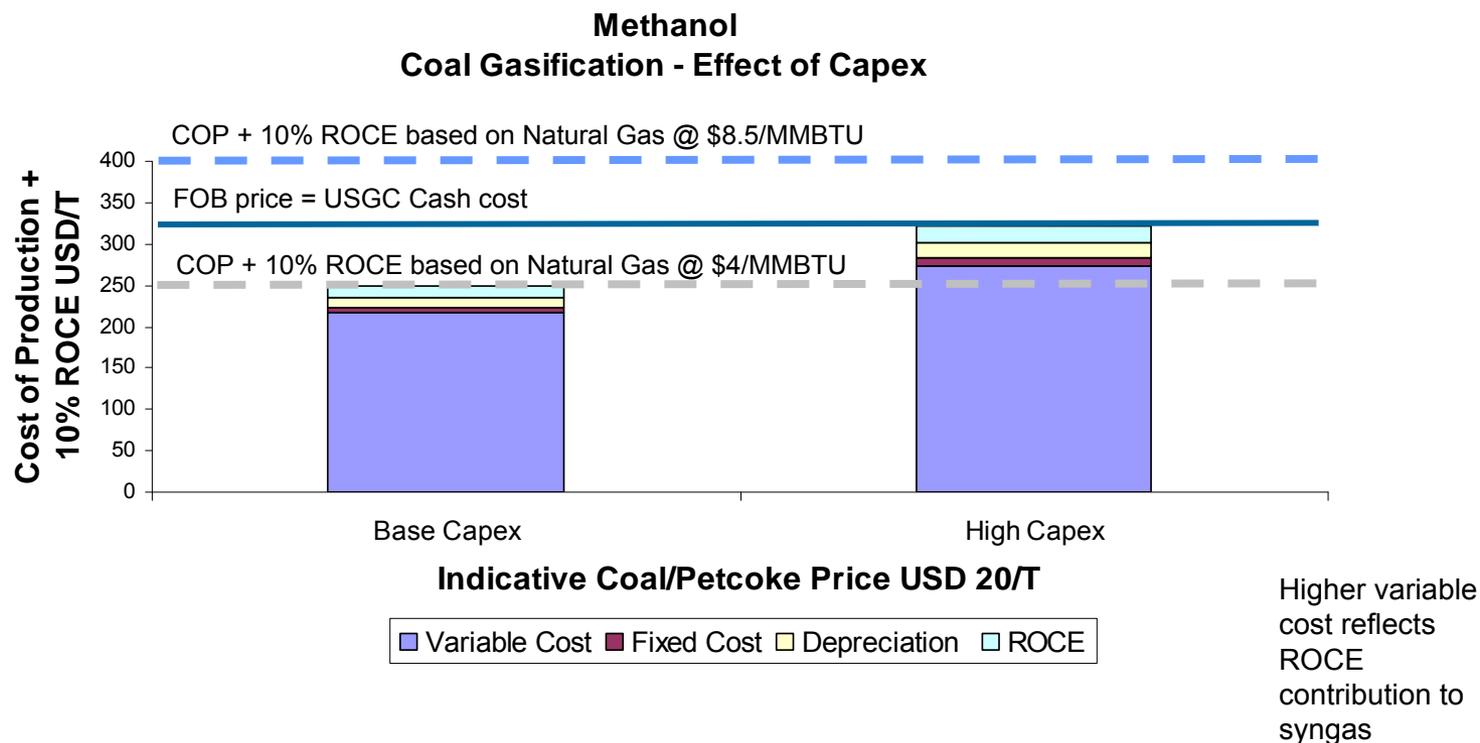
- Feedstock is upgrader bottoms
- Feedstock consumption per kg of syngas produced in POX is higher as compared to feedstock consumption in gasification
- Sulphur is removed early in the process thereby reducing very high investment in corrosion resistant equipment throughout the plant
  - \$0.206 million 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

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



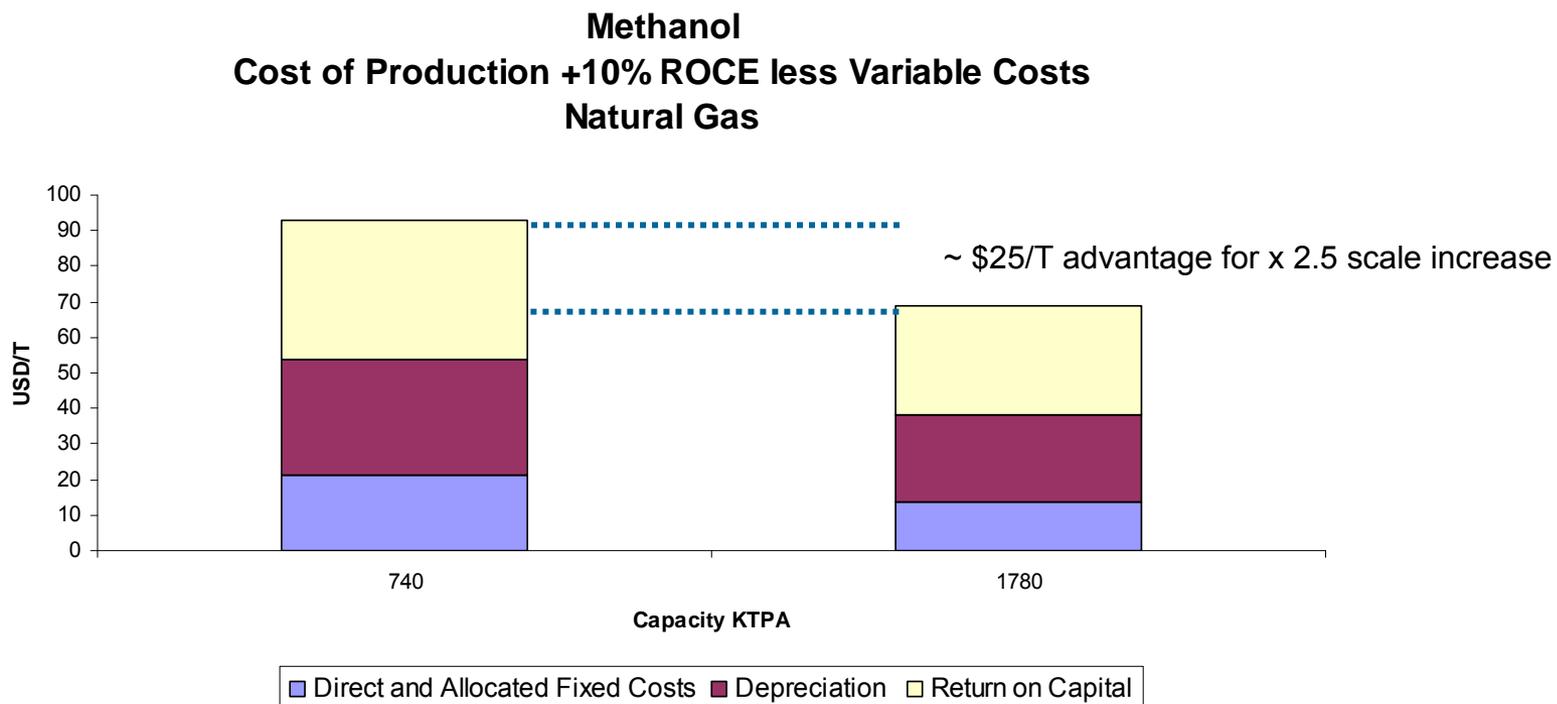
- Long term coal and petroleum coke prices are forecast to remain essentially flat with regional and quality variations
  - Albertan sources may be considered as stranded with limited markets; prices of order \$20-30/T

## 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

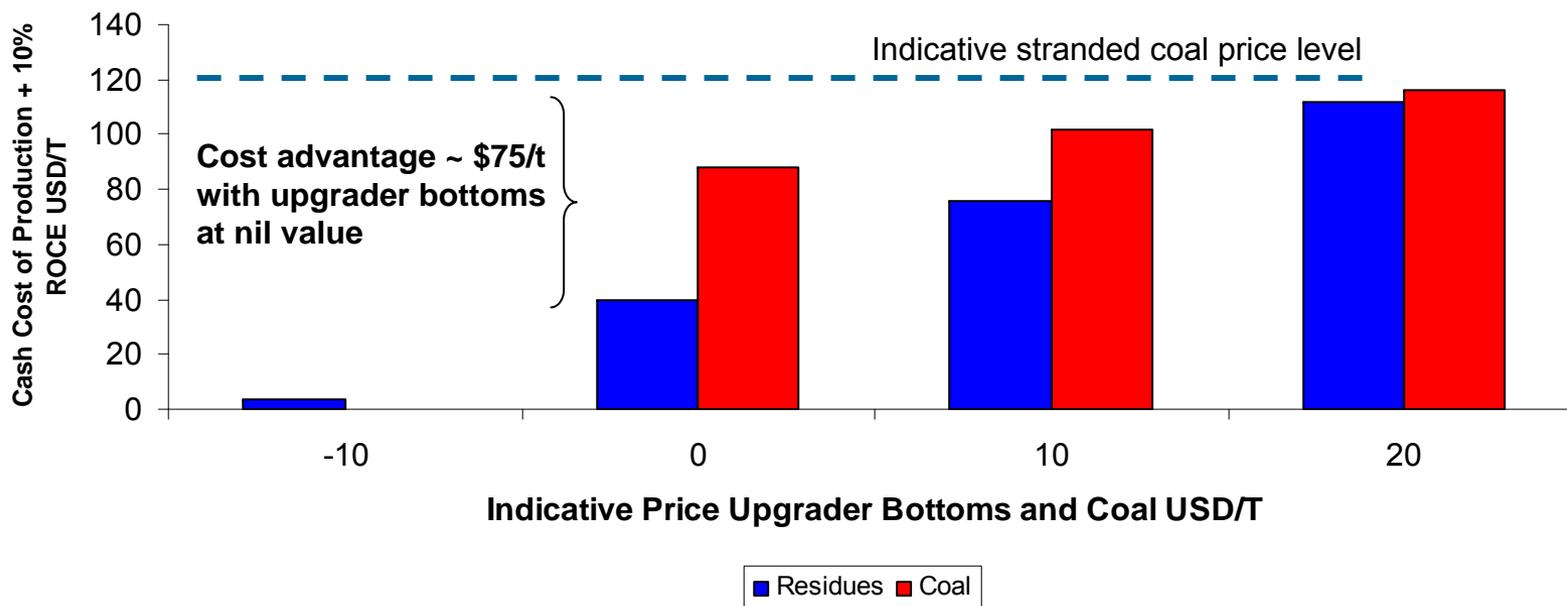
## Scale advantage is driving producers towards Mega Methanol plants of 5,000-10,000 tpd methanol with subsequent improvement in return



- Availability of appropriate feedstock and stranded economics brings the opportunity to develop methanol-to-olefins and entry into polyolefins and dimethyl ether markets (DME) together with additional opportunities across the C2 and C3 value chains

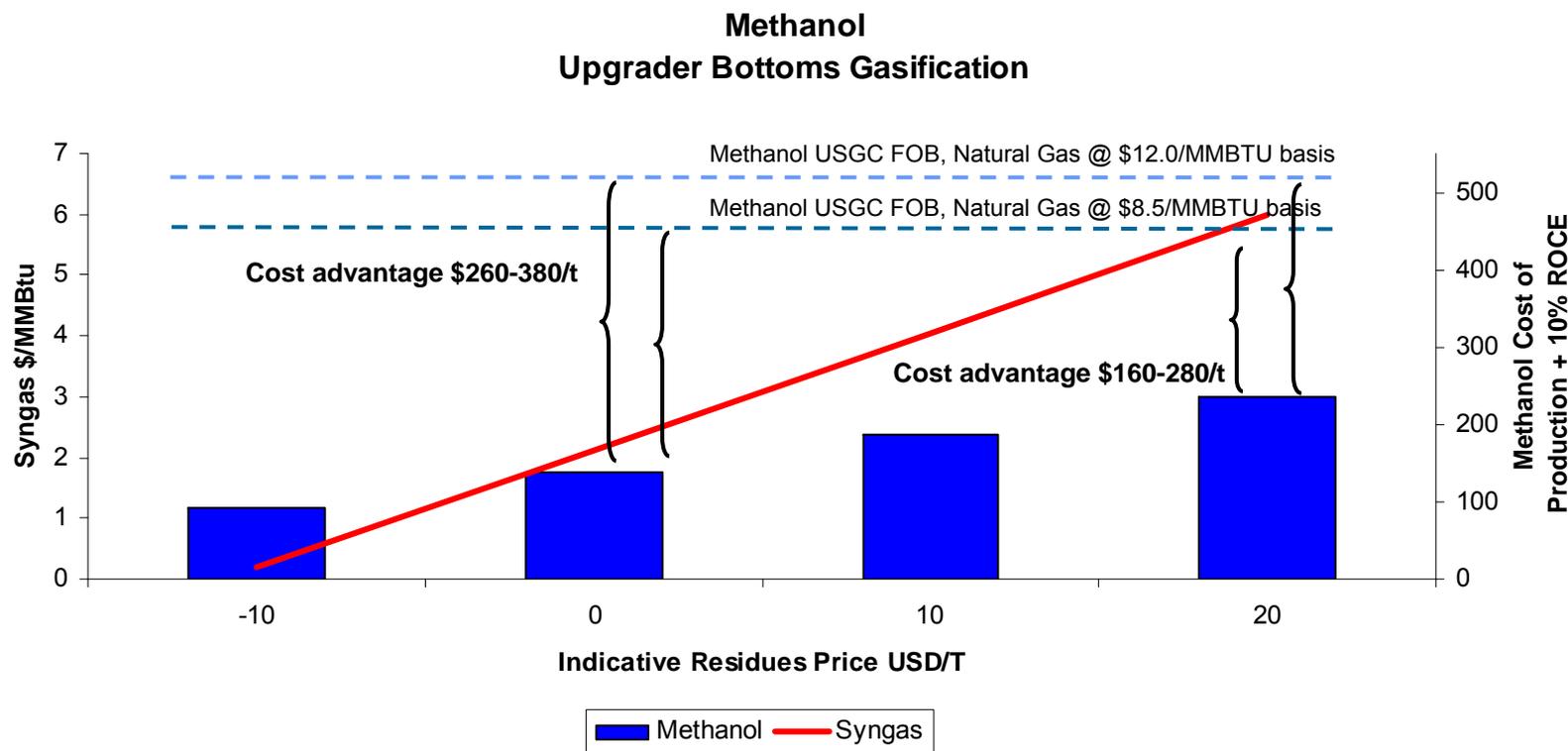
## Syngas from gasification of stranded upgrader bottoms will be highly competitive given no alternative value

### Comparison of Syngas Economics Residues Bottoms and Coal



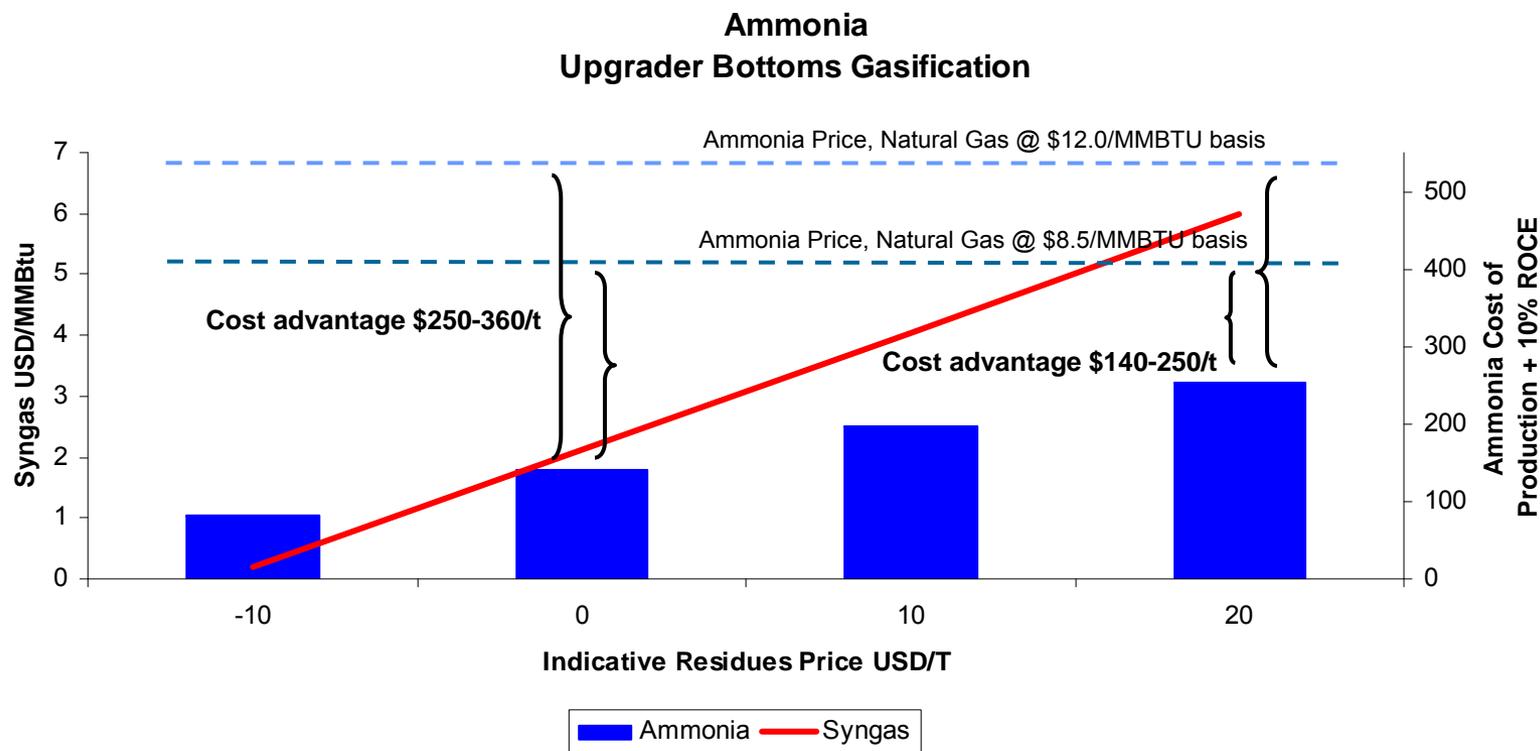
- Stranded location with no alternate option suggests a nil or negative value for Upgrader bottoms
- Gasification of Upgrader bottoms (liquids) is less capital intense than coal or petroleum coke gasification (solids) but is still considerable
- Economics are capex dependent but there are a number of 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

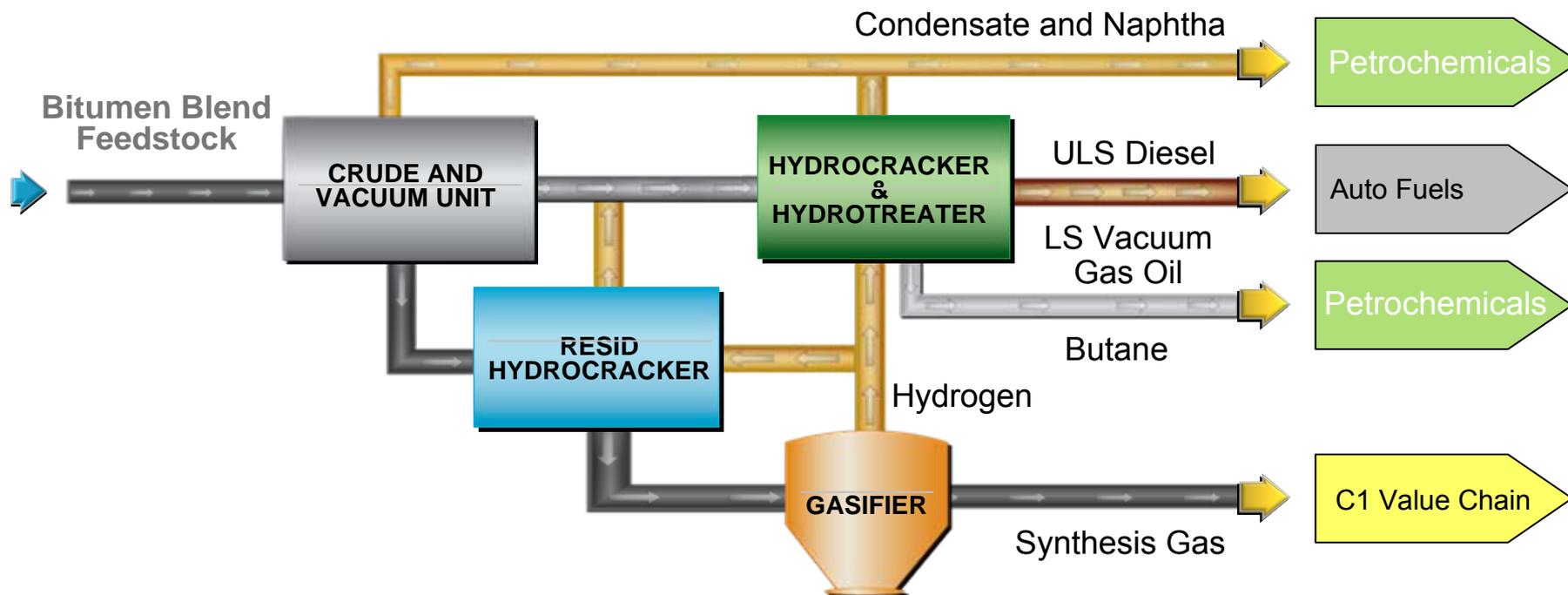
## Upgrader bottoms gasification gives leading economics



- 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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Background and objectives of the study

## Summary Stage 1

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Strategically imperative products

## Stage 2

**Cluster attributes and key performance criteria**

Cluster land use and logistics

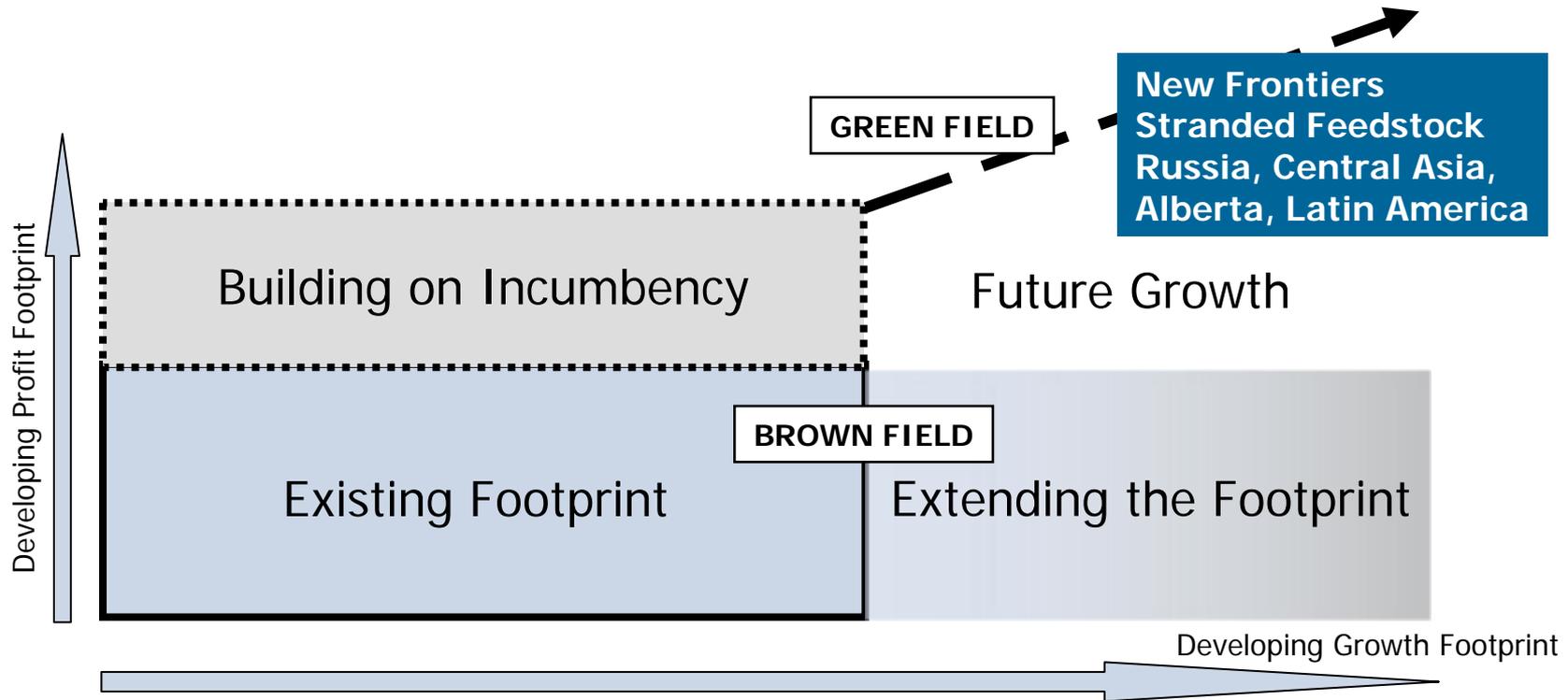
Cluster marketing strategy

Conclusions and next steps

## 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

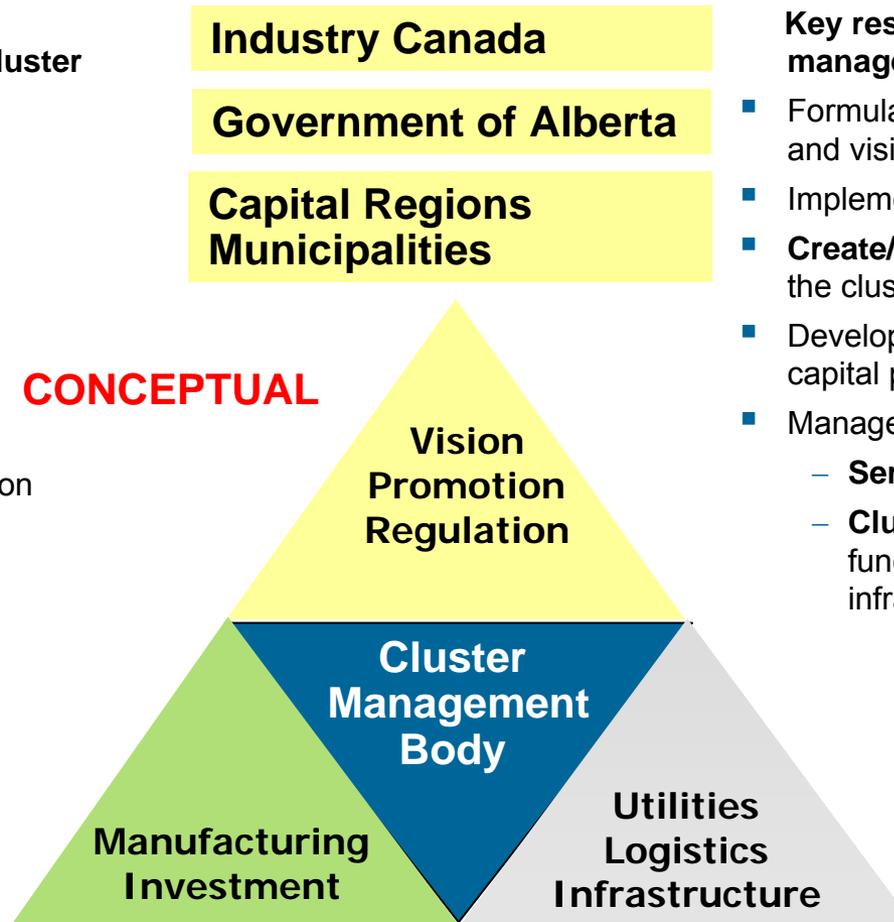
- ***Availability of competitive feedstock and raw materials***
  - To achieve 1<sup>st</sup> quartile or leading economics
    - Pricing structure and mechanisms re Upgrader bottoms
- ***Integration of suppliers and other clusters***
  - To maximize operational efficiency and reduce logistics
    - 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

**CONCEPTUAL**



### 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

Manufacturing Investment

Utilities Logistics Infrastructure

Service providers

Port Alberta?

Province of Alberta

Capital Regions Municipalities

## Central and local government will play an important role in numerous aspects of cluster management **CONCEPTUAL**

### Industry Canada:

- Disincentives for the exportation of the feedstock to encourage downstream development
- Investor advice and assistance mechanism in place
- Fiscal Incentives
- Financial incentives for the investors
- Funding/budget for investments into chemical infrastructure
- Visa regimes for foreign workers etc

**National level**

### Alberta Energy, Alberta Finance and Enterprise, Alberta Trade and Industry, Alberta Environment

- Fiscal Incentives
- Training support and education
- Public infrastructure development (Rail and Road, Water, Pipelines, Upgraded "greenfield" sites)

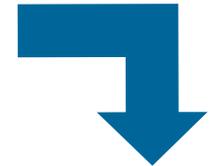
**Province level**

### City of Edmonton, Alberta Industrial Heartland, Edmonton Economic Development corporation, 24 Municipalities

- Municipal fiscal incentives
- Local public services:
  - Wastewater treatment
  - Solid waste handling
- Transport and social infrastructure:
  - Community (educational institutions, hospitals, recreational facilities)
  - Industrial (greenfield sites "investor ready", water, pipelines)
  - Investor support (purchase/leasing of land, environmental permits, investment finance)

**Municipal /Regional level**

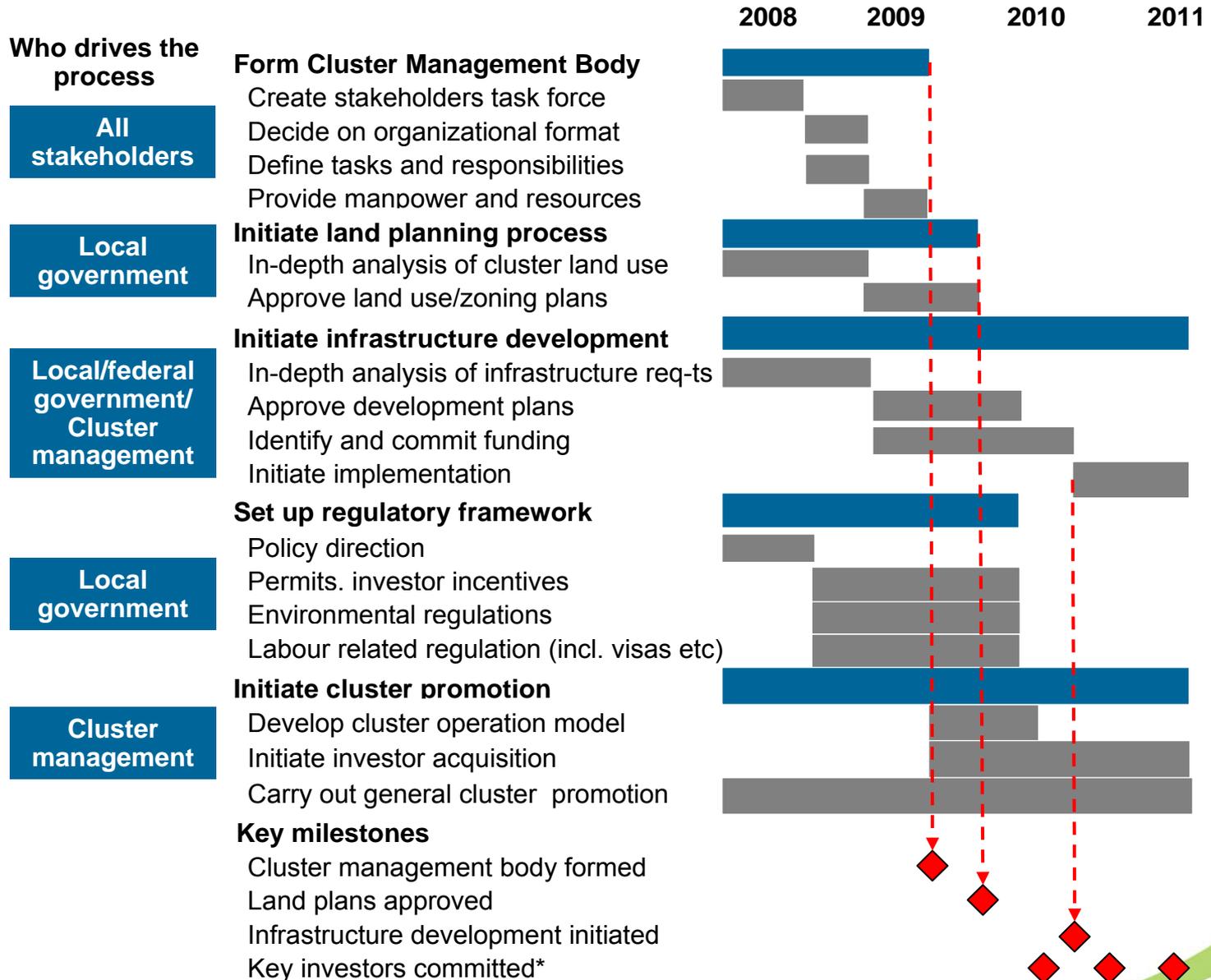
**Cluster Management Body: PPP or other form**



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

**June 2008**  
Cluster  
concept  
developed

Next  
steps



# Contents

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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

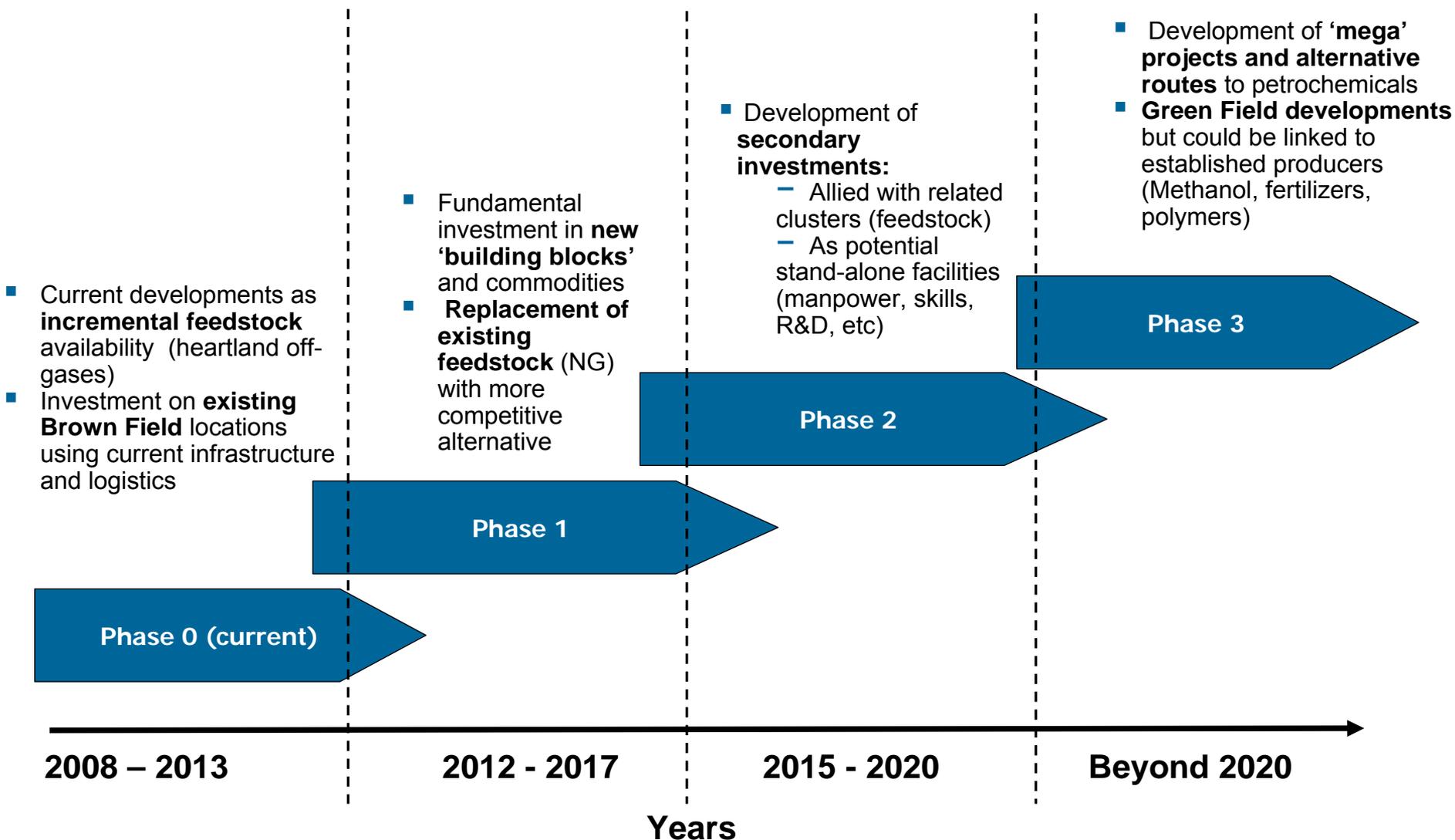
#### Location of the investment

- 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

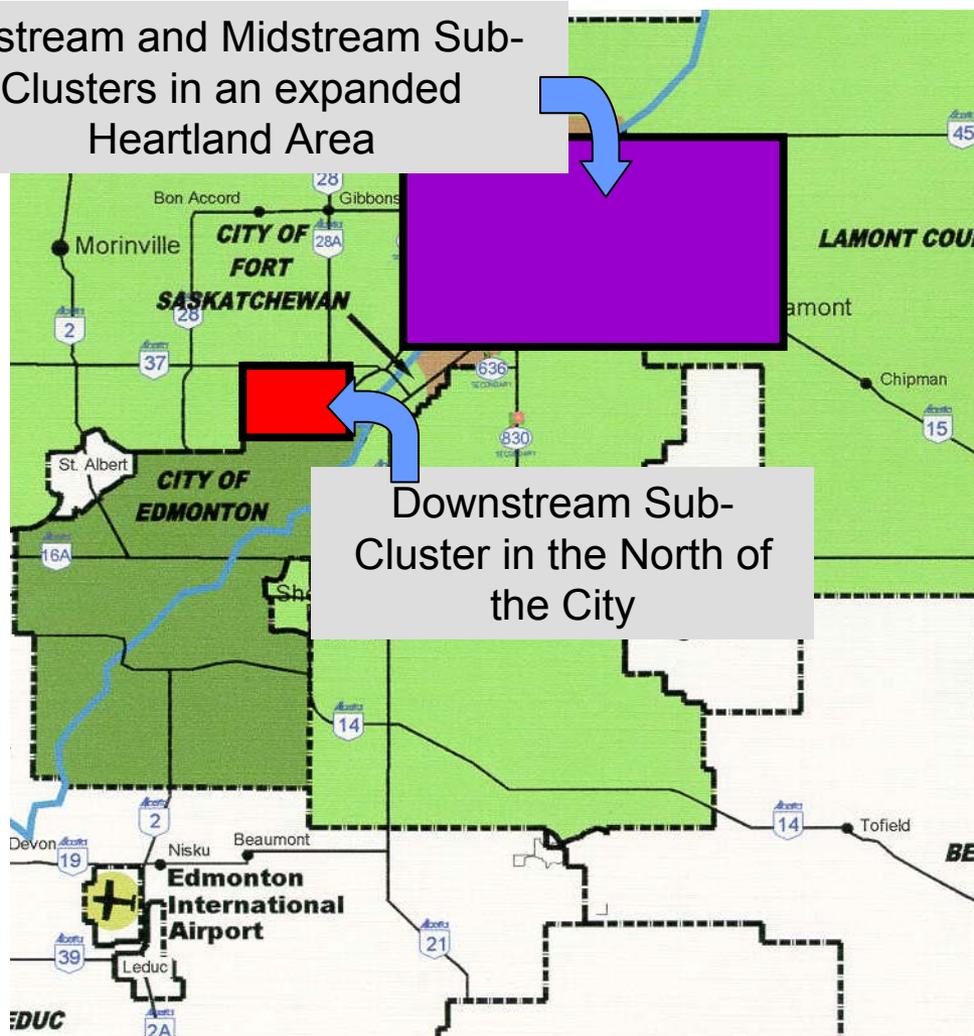
## Investments are considered in the following timeframe\*



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

**CONCEPTUAL**

Upstream and Midstream Sub-Clusters in an expanded Heartland Area

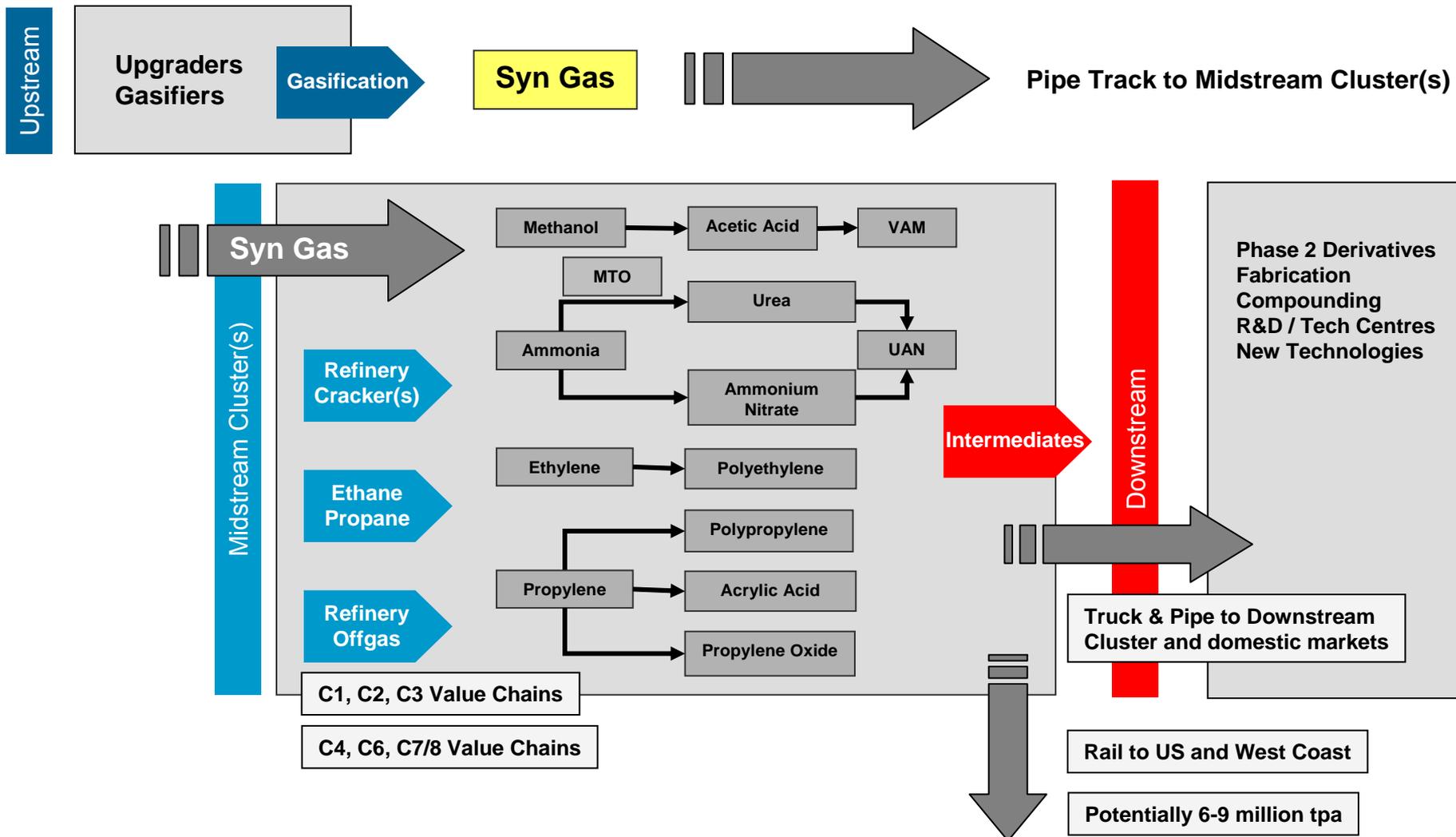


Downstream Sub-Cluster in the North of the City

### Key Issues to Consider:

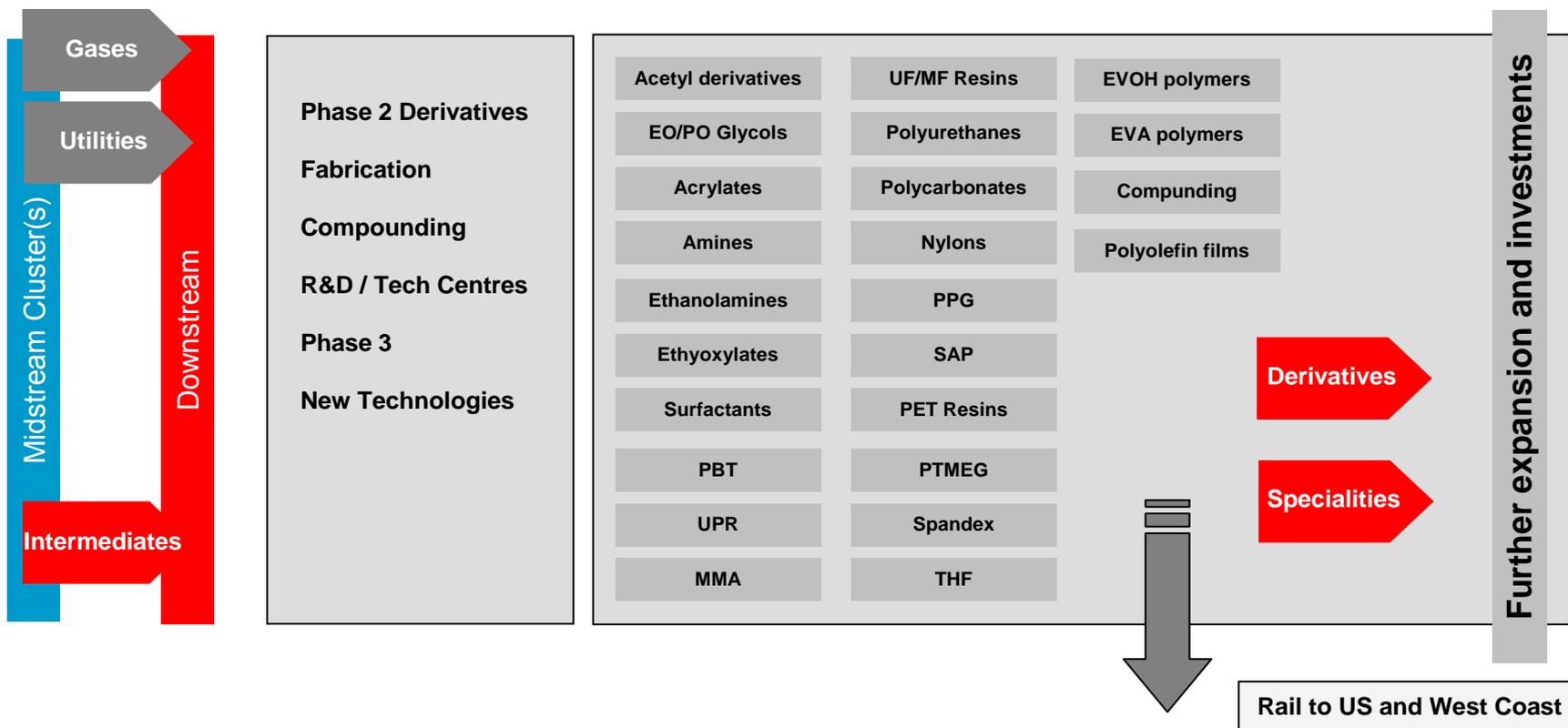
- Allocation of a designated industrial park area for chemical plants
- Development of a cluster logistics infrastructure
- Development of the export logistics infrastructure
- Development of a integrated utilities and services infrastructure
- Provision for linkage to the Downstream cluster and other 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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## There are two major elements of marketing strategy to be implemented in parallel



- Consists of **high level messages** to be sent through various channels
- aimed **at generating visibility and awareness** of the cluster among various groups of stakeholders:
  - *Broad range of potential investors*
  - *Industry associations*
  - *National and supranational institutions*

### Very targeted approach:

- Focused on the identified group of investors
- Tailor made business cases
- Content is in line with the investors' strategic intentions and investment interests

## Our overall approach to developing a marketing strategy for the future cluster in Alberta will be based on a sequence of steps

### *Understand the investors of the future cluster*

- Define **target investors** based on the strategically imperative products
- Analyse their **declared and perceived strategies**

### *Create targets on how we want the future cluster to be perceived*

- Analyse **marketing strategies of the leading clusters worldwide** to understand how they formulate their messages
- Derive “best practices” in cluster promotion
- Formulate **“unique selling points” for Alberta** and the message that we want to send to the potential and existing investors

### *Choose appropriate marketing channel*

- **Choose appropriate media**, systems and content for communication and interaction with investors:
  - Website
  - Brochures
  - Participation in the industry events
  - Press strategies
  - Direct approach to the target investor groups

### *Initiate target investors acquisition*

- **Develop rules of engagement and “packages”** for each group of investors:
  - Business cases for specific investors
  - Plan sequence of meetings/ approach

### *Support Strategy Implementation*

- Develop **organisational capabilities** in Alberta to support the implementation of the marketing strategy
- Plan resource allocation and timing of activities

## We have analysed numerous world class clusters to derive best practices in cluster promotion

### – European clusters:

- Antwerp, Belgium
- Rotterdam, The Netherlands
- Tarragona, Spain
- Chemsite, Germany
- Leuna, Germany

### – Asian clusters:

- Nanjing, China
- Jurong Island, Singapore
- Daesan, South Korea
- Mab Ta Phut, Thailand
- Shanghai Chemical Industry Park, China

### – Middle Eastern Clusters:

- Al Jubail, Saudi Arabia
- Ras Laffan, Qatar



### ■ We have looked into the following **channels of cluster promotion**:

- Websites
- Brochures
- Participations in the industry events
- Press strategies
- Direct approach to the target investor groups

### ■ We will analyse all the **promotional materials** at two levels:

- Format
- Content

## There are several approaches to cluster promotion strategy

### Based on the level of visibility

- **Active promotion**, characterised by:
  - High visibility across all the channels
  - Significant amount of information presented
  - High level of details
  - Noticeable presence in the industry media
 OR
- **Passive promotion**, characterised by:
  - Lower visibility
  - Scarce information presented
  - Relevant contacts are not clear

### Based on content

- **Highly detailed information** on all the aspects of cluster operation and external environment
- OR
- Low level of detail, **high impact data** (key selling points) with contact details for further information

### Passive strategy

*is mainly pursued by:*

- **Already well established clusters**
- *Clusters with orientation mostly towards internal market*
- *Clusters focused on a very narrow group of investors targeted directly*

### Promotional strategies

- **Cluster promotion integrated into the higher level government/regional presentation** (German clusters – “Invest in Germany”) OR
- **Cluster specific promotion** carried by the operator, governing body or a company playing a leading role in the cluster

### Based on the level of stakeholder presentation

## National level strategy of cluster promotion is comprehensive but the danger is in information overload

### Advantages:

- Allows investors to get an **in-depth understanding** of what is on offer
- Emphasises **strong support and commitment from the regulators**
- It creates the impression that there is a **concerted effort** by different levels of the stakeholders to promote the clusters
- Core material will remain the same for different type of industry events – **versatile** promotion material

### Challenges:

- Lack of focus: can be ***overwhelming*** for potential investors, risk of losing their attention
- Combination of different level of stakeholders creates **several contact points** and ***requires a lot of coordination*** among the promoting bodies

### ■ Main messages/features:

- Highlighting the **competitive advantage of the country/region** in general before moving on to the specific chemical site
- In some cases the intention is to **promote multiple sites** and, potentially, networks of clusters within the same region/country
- Investor is often presented with a **large number of contact points** depending on location, stage of investment readiness and issues at hand

## Individual promotion strategy is exclusively focused on a specific cluster or a site within a cluster

### Advantages:

- Clear focus on the cluster
- Direct access to detailed information on cluster relevant data: land use, operators, service providers and infrastructure
- There is one contact point for all the cluster related issues
- Once produced, this promotional materials can be used in the same format for different type of industry events – versatile promotion material

### Challenges:

- Requires a **strong operator** to serve as a **single contact point** to address all the investor requirements and needs
- Need to ensure that the **regional context and the commitments of the respective authorities** are communicated

### ■ Main messages/features:

- Illustration of the **cluster location** in relation to the feedstock and markets
- Land use and internal **infrastructure** (a lot of emphasis on the quality and availability of the infrastructure)
- **Operators, utilities, service providers and products** manufactured on site, and potential developments within the cluster
- Demonstrating the **existing and potential synergies** to attract investors' interest
- **Financial incentives** and investor support initiatives/services are strong selling points

This fundamental logic of cluster existence should be reflected in the promotional strategy

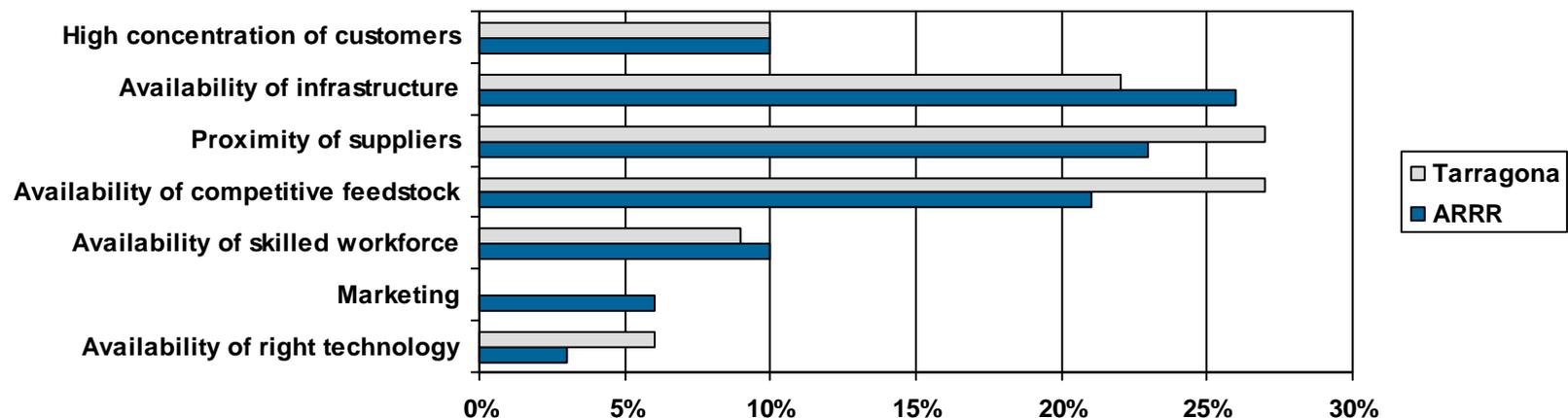
### Cluster formation logic



## Despite the difference in cluster's focus, there are common messages used by all the major clusters in their promotion

- There are **common messages** in all the promotional materials of the clusters that we studied:
  - **Synergies** generated within the cluster
  - **Infrastructure** development (including transport, pipelines, IT infrastructure and utilities)
  - **Availability of the raw material/feedstock**
  - Benefits of the **location** and it's positioning towards the attractive markets
  - **Labour** availability and intellectual capital
  - **Support from the central/local government** and supra-national institutions (i.e. the EU) – in the form of investor support services, subsidies, cash grants, tax incentives, land usage etc.)
- **What is on top of investors' agenda?** – Case study\* from ARRR (Antwerp/Rotterdam/Rhine/Rhur) and Tarragona (based on the interview with 27 executives from each cluster)

### Declared benefits of chemical clusters by participating producers in ARRR and Tarragona

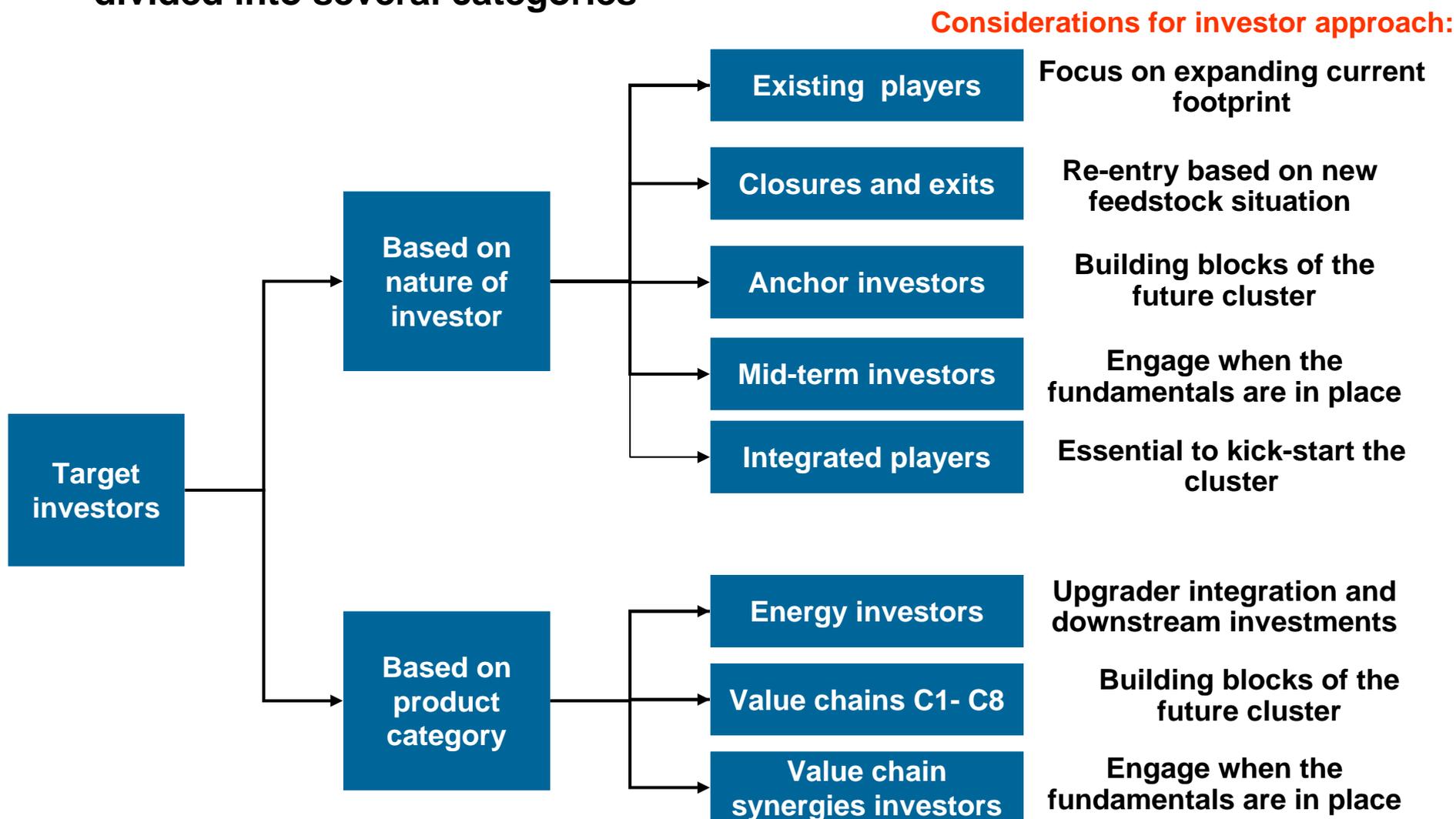


\*Source: EPCA Think Tank (2007), *A Paradigm Shift: Supply Chain Collaboration and Competition in and Between Europe's Chemical Clusters*, EPCA: Brussels

## Combination of internal resources and external expertise will ensure effective implementation of the Promotion strategy

Strategy	Pros	Cons/Challenges
<i><b>Do- it- alone</b></i>	<ul style="list-style-type: none"> <li>■ Full control over the content and quality of the promotional materials</li> <li>■ Ownership of know-how used in producing material</li> <li>■ Building in-house expertise in cluster promotion</li> </ul>	<ul style="list-style-type: none"> <li>■ Significant expense coming from:               <ul style="list-style-type: none"> <li>– large number of people defining and driving the strategy</li> <li>– involvement of highly qualified specialists and industry experts</li> </ul> </li> </ul>
<i><b>Use existing national/provincial/regional promotion vehicles</b></i>	<ul style="list-style-type: none"> <li>■ No need to invest extra resources into staffing</li> <li>■ Re-use of elaborated messages around Alberta's advantages</li> </ul>	<ul style="list-style-type: none"> <li>■ Lack of focus on the cluster shadowed by the repetition of high level messages about regional and national promotion in general</li> </ul>
<i><b>Use external consultants</b></i>	<ul style="list-style-type: none"> <li>■ Immediate access to expert advice on content and format of promotional strategy</li> <li>■ Access to the industry network</li> </ul>	<ul style="list-style-type: none"> <li>■ Committed Internal resources needed to control and manage interaction with the consultants</li> <li>■ Internal knowledge building is not as intensive</li> </ul>
<i><b>Combination of internal resources with involvement of external consultants</b></i>	<ul style="list-style-type: none"> <li>■ Provides a <b>good balance</b> by using mostly internal resources and attracting external advice where expert knowledge is required</li> </ul>	<ul style="list-style-type: none"> <li>■ <b>Committed Internal resources</b> needed to control and manage interaction with the consultants</li> <li>■ Fair amount of qualified resources needs to be available in-house</li> </ul>

## Investor acquisition strategy: universe of potential investors can be divided into several categories



## 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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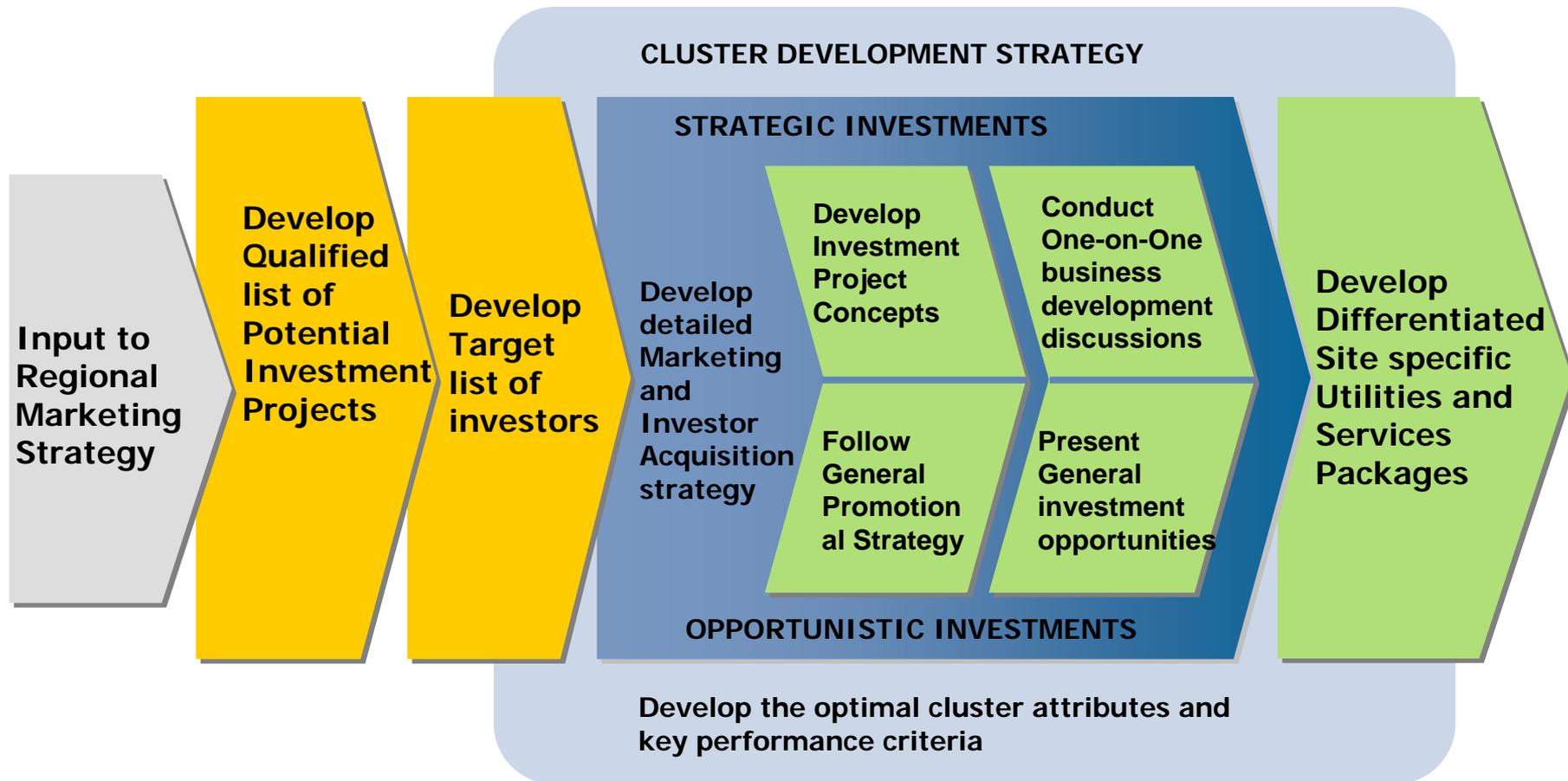
Cluster marketing strategy

Conclusions and next steps

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

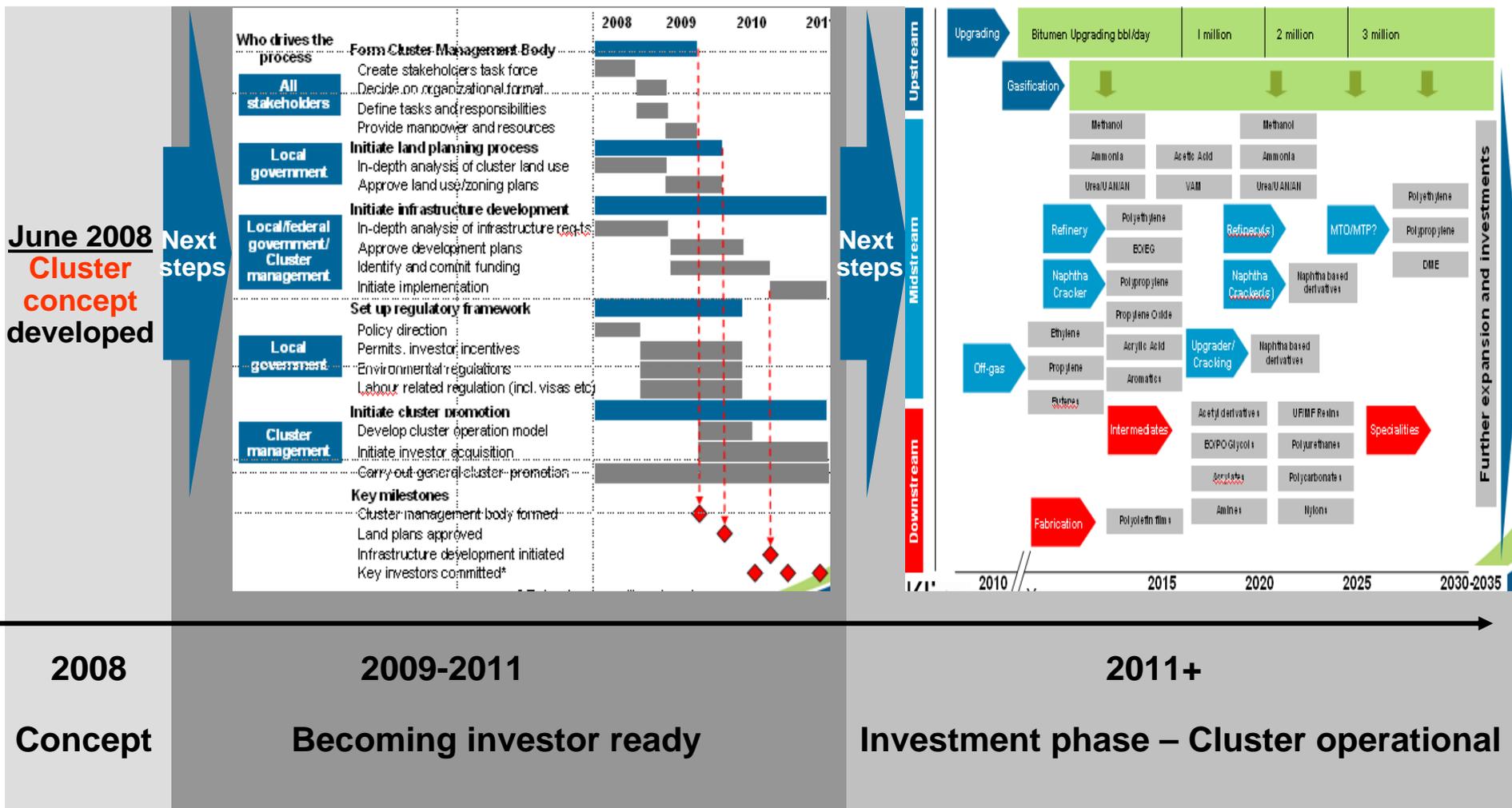
- Secure **Competitive Feedstock** supply
- **Designated/Zoned Land** for cluster development
- **Regional infrastructure** connecting to local, regional and international markets
- Competitive **regional utilities** and **services**
- **Targeted Investment Acquisition** for strategically imperative 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

# This study has provided key inputs into the Integrated cluster development strategy



**NEXT STEP: DETAILED INTEGRATED SITE MARKETING AND INVESTOR ACQUISITION STRATEGY**

# Putting it all together: charting the way forward



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