

NOVA Chemicals and BP Petrochemicals Catalyst Development Collaboration

Advanced Zeigler-Natta and Single-Site Catalysts for Gas-Phase PE Processes

Flex PO 2004 Conference

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NOVA Chemicals

Agenda

1. NOVA Chemicals
2. NOVA Chemicals - BP Petrochemicals Collaboration
3. Zeigler-Natta Catalyst Development
4. Single-Site Catalyst Development
5. Summary

NOVA Chemicals

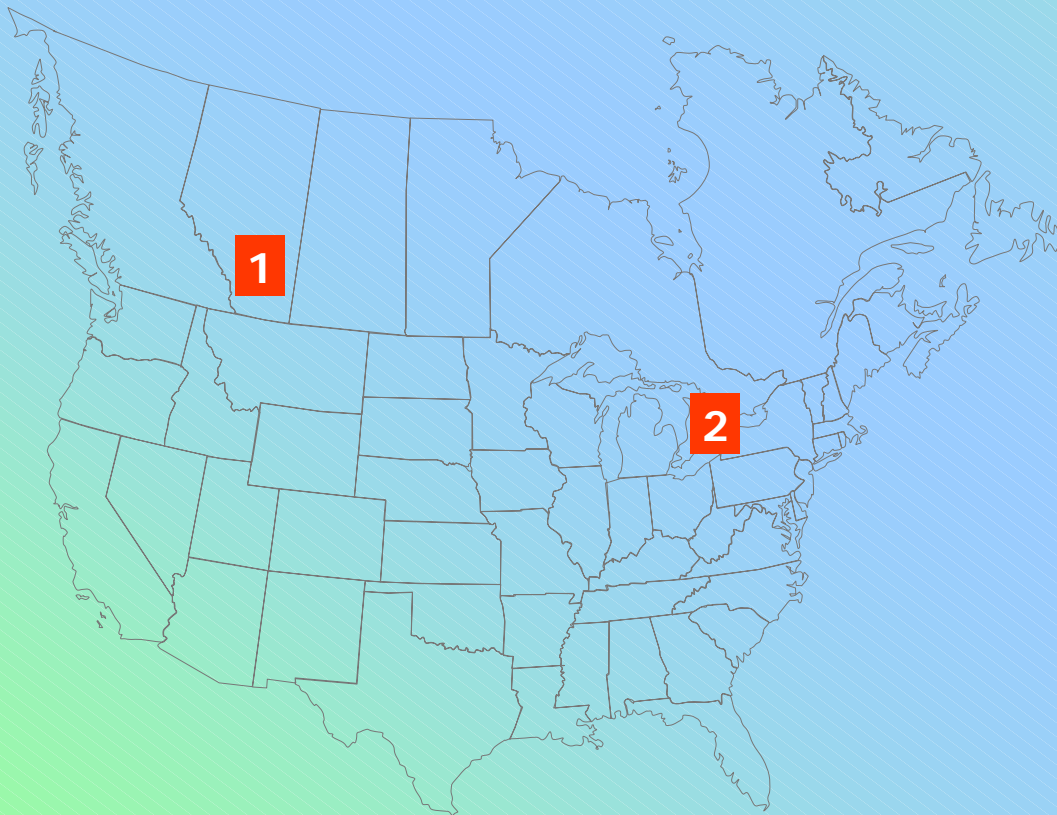
- A Commodity Chemical Company
- 2003 Revenue of \$3.9B US
- Competitive Advantage
 - Low-cost producer
 - World-scale manufacturing sites
 - Access to low-cost feedstock
 - Astute technologists

NOVA Chemicals – Major Products

	Capacity (KT/Y)	Ranking in World
Ethylene	2950	11
PE	1660	11
<hr/>		
SM	1200	4
PS	1600	4

Two World Class Complexes

Olefins / Polyolefins



1

Joffre

4.9 B lbs. (2.2 Mt) Ethylene
2.1 B lbs. (1.0 Mt) Polyethylene

2

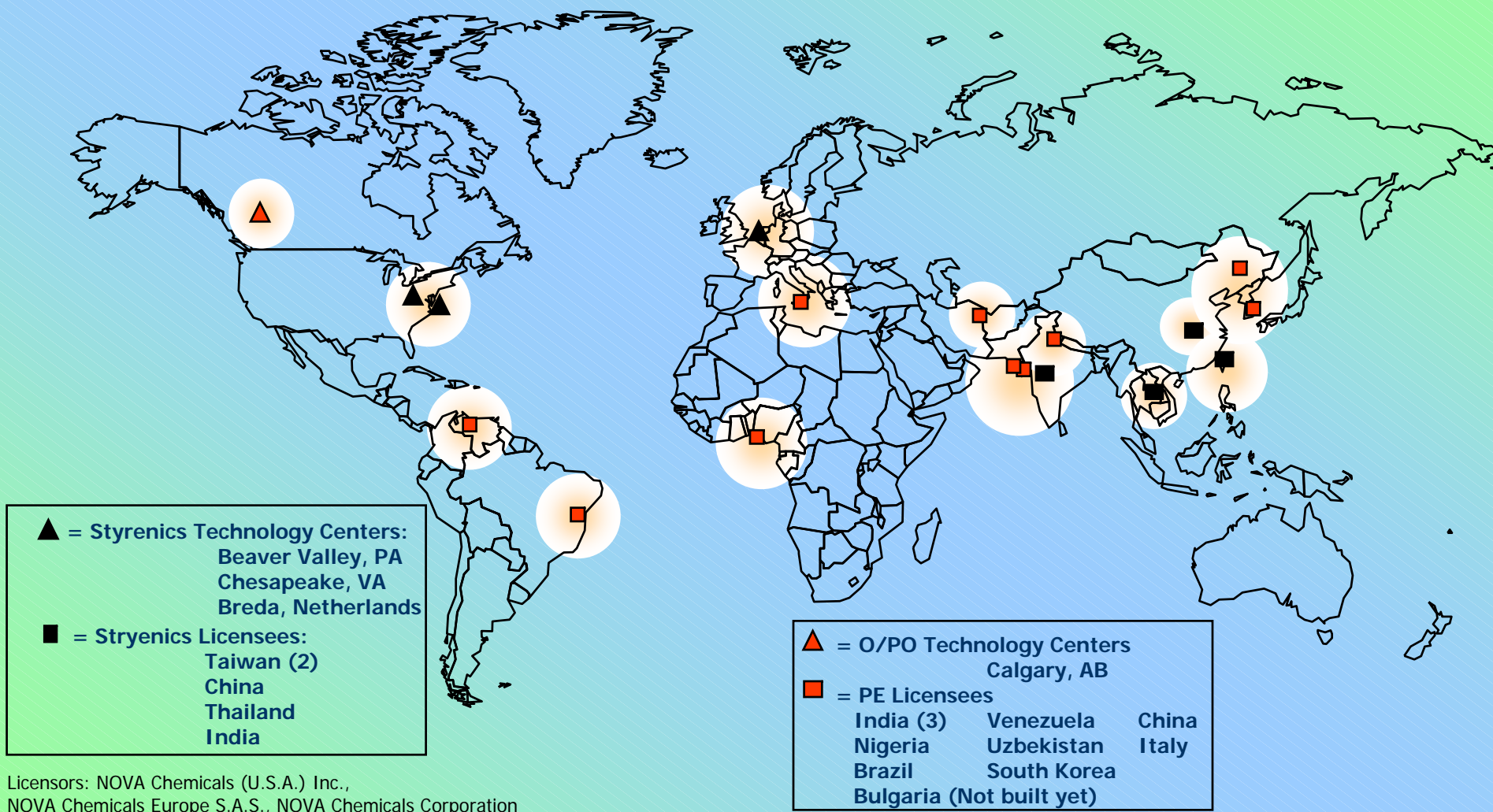
Sarnia

1.6 B lbs. (0.7 Mt) Ethylene
1.5 B lbs. (0.7 Mt) Polyethylene
3.7B lbs. (1.7 Mt) Co-Products

NOVA Chemicals Licensing

- **NOVA Chemicals is a world leader in licensing proprietary technologies for olefins, polyolefins.**
- **SCLAIRTECH™ licensed worldwide with installed capacity more than 2000 kT/y**
- **World leading technology for cracker furnace tube coking-prevention**
- **Advanced Z/N and single-site polyethylene catalysts for gas-phase polyethylene platforms, in collaboration with BP**

Technology Installations & Licensees



NOVA Technical Centers Calgary, Alberta, Canada

A World-class Research Facility (NRTC)

- 213 research scientists, engineers, technologists
- 120M sq. ft. of prime research space
- Piloting capabilities for all our processes
- Detailed product/process characterization equipment
- Leading edge modeling/simulation capabilities

Separate Product Development Center (NCTC)

- Full PE Technical Support Organization
- 60 Technical staff
- Commercial-scale processing lines for various applications



NOVA Chemicals - BP Petrochemicals Catalyst Collaboration



BP Petrochemicals

A global Petrochemicals Company producing olefins, polyolefins, aromatics and various commodity chemicals.

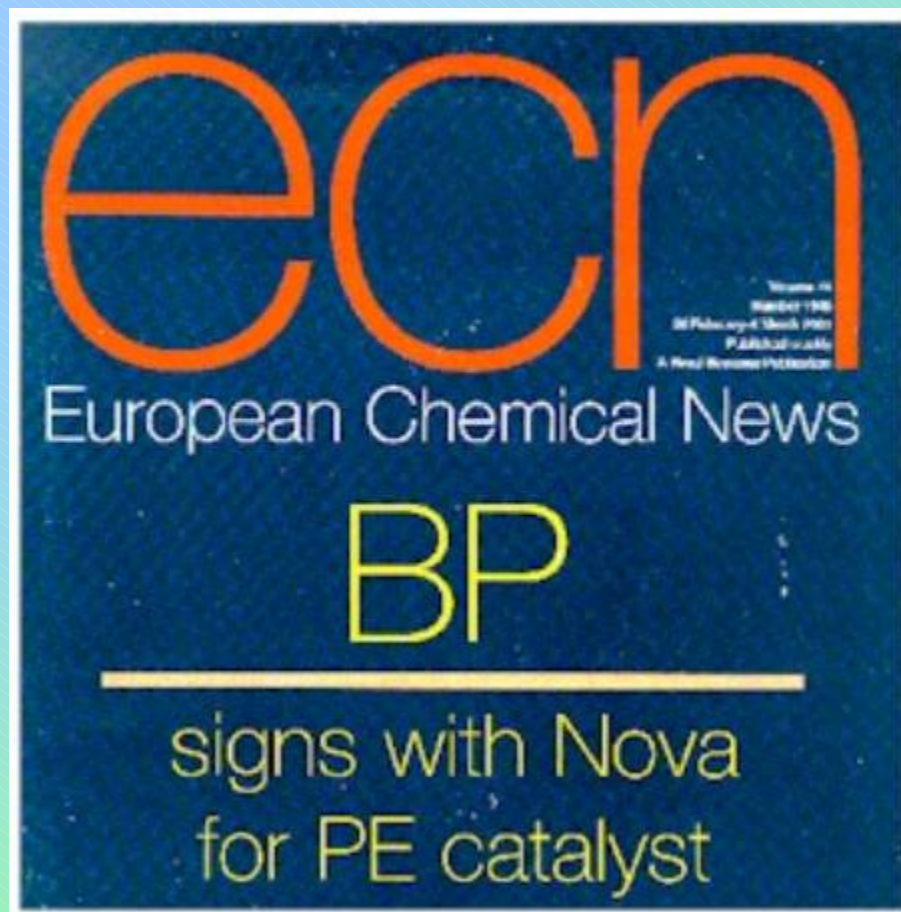
The Polyethylene production in Europe is @ 1500 kT/year.

BP Petrochemicals uses its proprietary Innovene™ technology, which is licensed worldwide to 25 operators with capacity of 5 million tons/year.

Supports world-class research efforts for the development of new technologies related to BP's businesses.

- For PE business, research programs dedicated to catalyst, process and product development.
- Catalyst developments in Ziegler-Natta, Single-site, Chromium and late transition metal technologies.

NOVA Chemicals/BP Petrochemicals Z-N Catalyst Collaboration Announced February 19, 2001



NOVA Chemicals and BP Petrochemicals

Joint Development Program

- Joint deployment of R&D Capabilities and Resources
- Further Development and Exploitation of Technology
- Combined Patent Estate and Research Strength of two companies
- Complimentary for all gas phase polyethylene plants

Ziegler-Natta Program Initiated 1Q2001

Single-site Program Initiated 3Q2002

Strict firewalls, protocols and procedures are in place to protect proprietary information

NOVA Chemicals and BP Petrochemicals

Commercial PE Business Success

NOVACAT™ Catalysts

- Operating successfully at NOVA Chemicals' Joffre, Alberta, Canada plant for past three years making LLC4 and LLC6 products - Full Conversion to NOVACAT in 2004
- Operating successfully at BP Chemicals' Grangemouth, UK plant for past two years making LLC6 products - Full Conversion to NOVACAT™ in 2005.

Single-site

- Next Commercial trial with Innovene™ PE planned in 4Q04
- Commercial trial on NOVA Chemicals' gas-phase PE assets planned in 2005

NOVA Chemicals and BP Petrochemicals

Joint Catalyst Licensing Effort

- Technology and Catalyst available to third-parties via License and Purchase Agreements
- NA Customer using routinely on gas-phase asset
- Other Catalyst and Polymer Evaluations underway globally
- Arrangement announced with Grace Davison Catalysts for Long-Term commitment of Z-N supply to Licensees

BP Marketing Efforts to Innovene Licensees

NOVA Marketing to all other gas-phase platforms

NOVA – BP – Grace Arrangement

Long-Term Supply of NOVACAT T Catalysts

- BP-NOVA-Grace Arrangement announced March 2004

Grace Davison Catalysts

- A leading global supplier of polyolefin catalyst and silica products
- Extensive research and manufacturing sites
- Significant knowledge and expertise in Catalyst Manufacturing

Winning Combination of:

***NOVA & BP Catalyst Technology, Gas-phase development
and commercial platforms***

Grace - Premiere supplier of Polyolefin Catalysts

NOVACAT™ Catalysts

Catalysts and PE Products

NOVACAT™ Catalysts

	LLDPE C6 High strength	LLDPE C6 General Purpose	LLDPE C4 General Purpose	HDPE General Purpose
NOVACAT™ S	Principal product target	Likely extension	Not envisaged	Not envisaged
NOVACAT™ T	Likely extension	Principal product target	Likely extension	Not envisaged
NOVACAT™ K	Not envisaged	Likely extension	Principal product target	Principal product target

Key :  Principal product target
 Likely extension
 Not envisaged

NOVACAT S

- High Strength Hexene LLDPE Products

NOVACAT T

- Hexene LLDPE and Butene LLDPE Products

NOVACAT K

- Butene LLDPE and HDPE Products

NOVACAT™ Catalyst Advantages

All NOVACAT™ Catalysts

Low Resin Stickiness

Excellent Particle Morphology

Excellent Conveyability

High Production Rates

Excellent Product Properties

Low Hexane Extractables

Excellent Optical Properties

Low Level of Alkyls Required

Robust Performance!

NOVACAT™ K vs. NOVACAT™ T

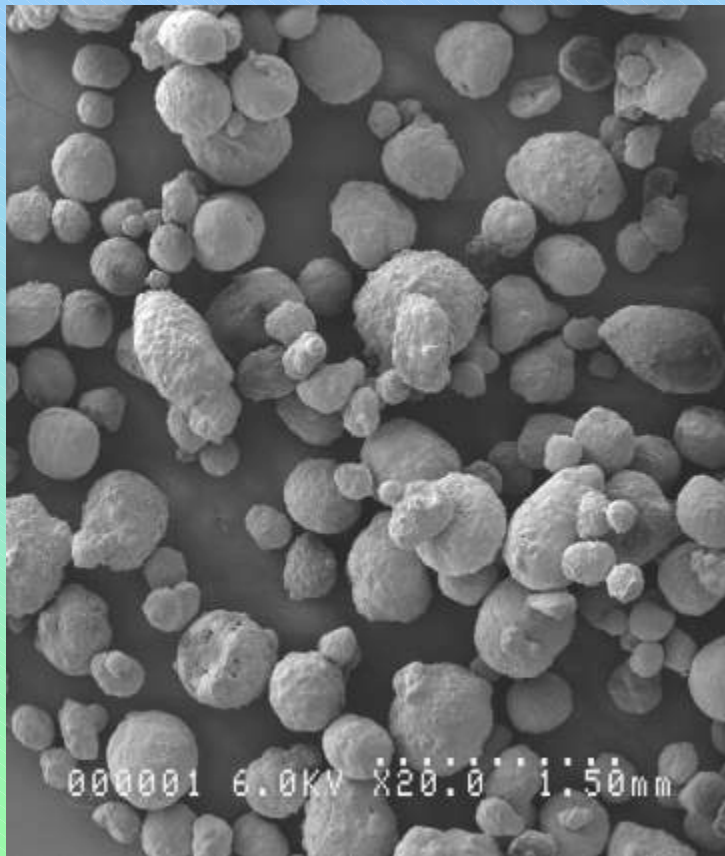
Significant Increase in Catalyst Productivity

Decreased Comonomer and Hydrogen Requirements

NOVACAT™ S vs. NOVACAT™ T

High Strength C6 Film at costs similar to General Purpose C6 Film

SEM Picture of Resins Made with NOVACAT™ T 0.918 Density 1 MI Resin



- **Good Morphology**
- **Controlled particle growth
(resin retains round shape)**
- **Low fragmentation**
- **No Fines (0% < 120um)**

Product Performance

Butene Copolymers

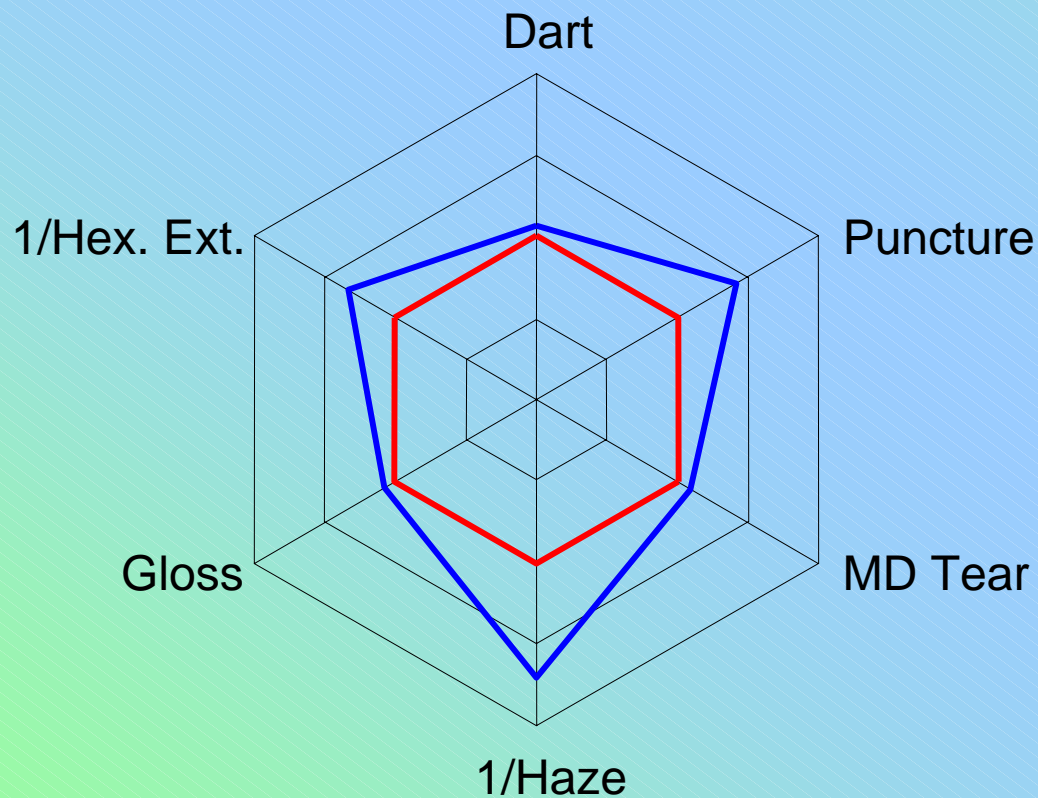
- **Excellent physical properties**
- **Good opticals, low extractables**
- **Less blocking**
- **Superior processability**

Hexene Copolymers

- **Excellent dart impact, tear, and puncture performance**
- **Haze 13% to 26% lower than commercial product**
- **Gloss 6% to 26% higher than commercial product**
- **Low Hexane Extractables**
- **Industry leading “Super Strength” Hexene copolymers**

Butene Film

2 MI, 0.918 Density

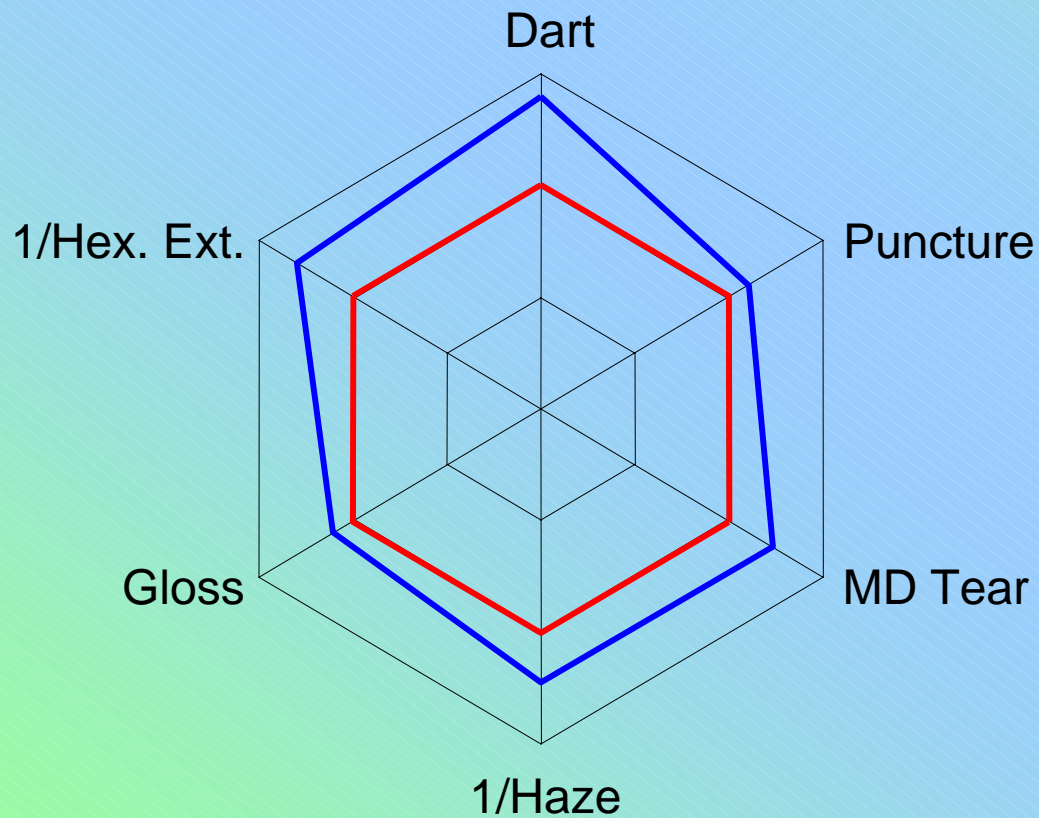


Lower H.E.'s
Lower Haze
Lower Blocking
Superior Processability

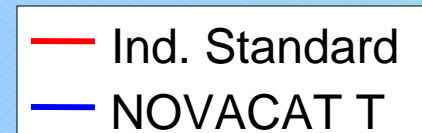
— Ind. Standard
— NOVACAT

Hexene Film

1 MI, 0.918 Density

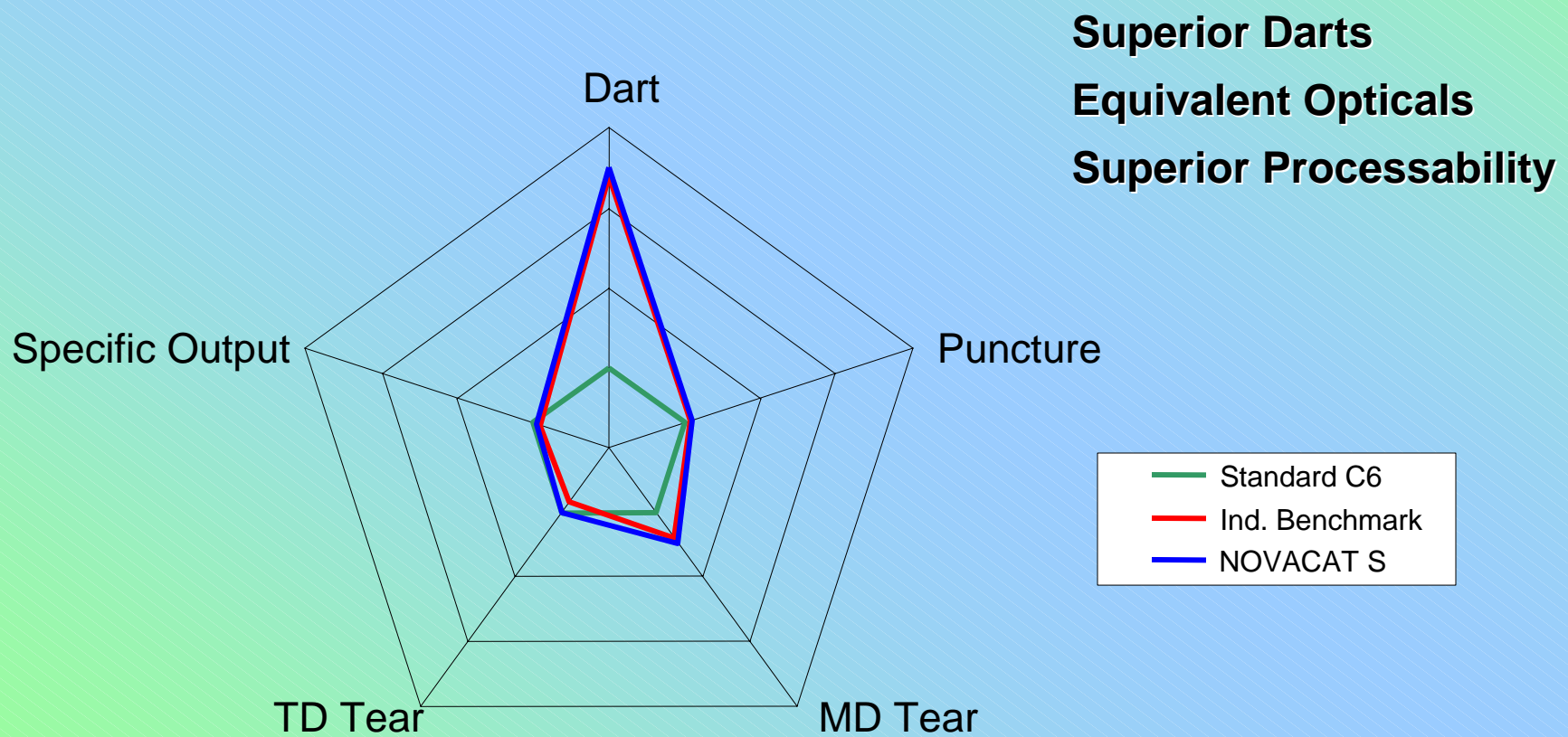


Lower H.E.'s
Better Opticals
Better Physicals



High Dart Impact Hexene Film

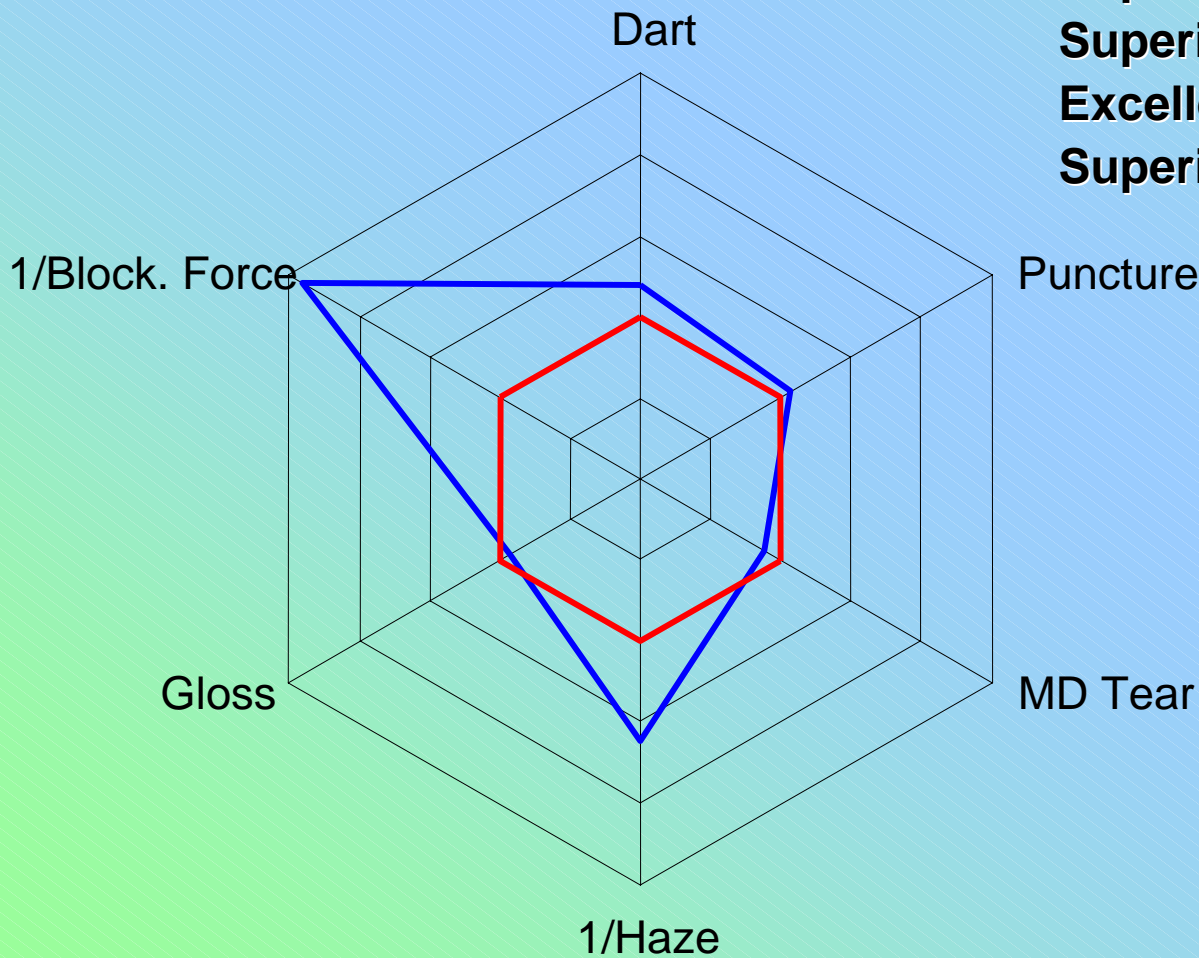
0.8 MI, 0.919 Density



Hexene Cast Film

3 MI, 0.919 Density

Superior (less) Blocking force
Superior Opticals
Excellent Physicals
Superior granular powder flowability



— Ind. Standard
— NOVACAT T

Single-site Catalysts

Historical Perspective


1995 -1999	Dow BP Joint Development Agreement
1999	Commercial Trial at PT Peni (HPLL)
2001	Commercial Trial at Chevron Phillips (HPLL)
2001	BP acquired broad rights to operate the metallocene Technology following Dow-BP settlement
2002	BP/NOVA Commercial & Joint Development Agreement
2003 – 2004	Development and scale up of HPLL-P catalyst

Innovene™ Metallocene Technology



**CONSTRAINED
GEOMETRY
CATALYSTS**

HPLL Technology
1995- 2002

 **NOVA** Chemicals
BP chemicals- Nova Chemicals
JDA (3Q02)

**HPLL- P
Technology**

HPLL-P Process and Operability Features

- Very good operation stability
- Very low level of agglomerates, no sheeting
Campaigns agglomerate free
- Very good powder flowability
- Access to a broad range of density and MI

HPLL-P Product Performance - Key Features

Excellent Product Processability

- No PPA required for any grades in the European market

Enhanced optical properties over commercial single-site resins

Fully Competitive performance for mechanicals

Full compliance with both US and European food contact regulations

Single-Site Catalysts - Path Forward

- **Commercial demonstration of HPLL-P Technology on a BP Innovene™ PE asset planned for Q404**
- **Commercial demonstration of HPLL-P technology on a NOVA gas-phase asset in 2005**
- **Explore the full capability of the HPLL-P technology**
 - **Broaden the grade slate: extrusion coating, rotomolding...**
- **With combination of HPLL-P and NOVA single site Technology, Develop Second-generation single-site catalysts**

Single-Site Catalysts Conclusion

- **Strong commitment from BP Chemicals and NOVA Chemicals to advance and commercialize Single-Site Catalyst Technology**
- **HPLL-P developed over the 2 past years**
- **HPLL-P exhibits unique features giving significant product performance leads**
- **HPLL-P in scale up phase to Innovene commercial reactor**

Summary: NOVA-BP Collaboration

Enhanced Technology Development

- **Broader Portfolio of Technologies**
- **Lower Cost through Sharing Resources**

Commercial Success in NOVA & BP PE Businesses

- **Excellent Product Acceptance in Marketplace**
- **Single-site Commercial Trials Planned**

Significant Licensing Opportunities

- **In all gas-phase platforms**
- **Industry excited to have catalyst supply options**
- **Market-leaders evaluating the technology**

Summary: NOVACAT™ Catalysts

Produce broad range of butene and hexene copolymers

- good opticals, low extractables and excellent physicals

Production of high dart hexene products with better dart impact, processability, and economics

- Super Strength resins
- Low-cost catalyst formulation

Improved operating-envelope through enhanced particle morphology and lower stickiness

- Allows for higher production rates
- Enables the production of lower density and higher melt index LLDPE resins

Summary: Single-Site Catalysts

HPLL-P Single-site Catalyst for:

- **General Purpose and Performance Films**
 - **Market Leading Properties**
- **Economics Equal or Better than Z-N**
- **Commercial Demonstrations in 2004 and 2005**

Broad Capability of Enhanced Applications with HPLL-P

Second-generation Single-site Catalyst Development Underway

Acknowledgements

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END OF PRESENTATION

THANK-YOU