Sustainability
New Products
Sneak peek at INEOS

INEOS at a glance

- **Turnover**: $47 billion
- **Employees**: 15,000
- **Production**: 60 million tonnes
- **Heritage**:
  - AMOCO, BASF, BAYER, BOREALIS, BP, DEGUSSA, DOW, ENICHEM, ERDOLCHEMIE, HOECHST, ICI, INOVENE, LANXESS, MONSANTO, NORSK HYDRO, AND SOLVAY.
- **Sites**: 51 manufacturing plants in 11 countries

Growth through strategic partnerships

- JV with PetroChina for refining and trading
- Former JV with BASF (now fully owned) for the styrene/PS chain
- Proposed JV with Solvay for the chlorine/PVC chain

Entrepreneurial & Innovative

INOVYN™
Our polyolefins licensing successes

Our polyolefins licensing successes

The new leading licensor of polyolefins technology

More than 20 million tonnes of polyolefins capacity awarded since 2005
Our polyolefins technologies

**Innovene™ G**
Clean loop gas phase
Swing LLDPE/HDPE

- Superior mLL and HAO LL products
- Unique C4-C6-C8 comonomer versatility
- Clean Loop Process
- High reliability / Low Maintenance

**Innovene™ S**
Bimodal slurry loops
HDPE/Bimodal HDPE

- Superior bimodal HDPE products
- Unique swing monomodal/bimodal/Cr operations
- Quick transitions
- No wax generation

**Innovene™ PP**
Plug flow gas phase
PP (homo, RCP, ICP)

- Superior ICP’s
- Highest product consistency
- Unique plug flow process
- Short transitions
Our future….

« The challenge of our age must be to decouple human progress from resource use & environmental deterioration »

© KMPG: expect the unexpected, building business value in a changing world, 2012
Our future… with polyolefins

- Light weight & durable
- Recycling solutions
- Energy recovering
Polyolefins end-use application

- Packaging: 40.1%
- Building & Construction: 26.4%
- Automotive: 5.6%
- Electrical & Electronic: 7%
- Others: 20.4%
Trends in polyethylene

Metallocene LLDPE

2 x AAGR of LLDPE

Based on Nexant POPS data

Bimodal HDPE

1.5 x AAGR of HDPE

Based on Nexant POPS and Townsend Solutions data
### Innoven™ G Product Coverage

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Film</strong></td>
<td>LL C4</td>
<td>●</td>
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<tr>
<td></td>
<td>LL C6</td>
<td>●</td>
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<tr>
<td></td>
<td>LL C8</td>
<td>●</td>
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<tr>
<td></td>
<td>mLL C6 or C8</td>
<td>●</td>
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<tr>
<td></td>
<td>HDPE</td>
<td>●</td>
</tr>
<tr>
<td><strong>Blow Molding</strong></td>
<td>Medium Mw Cr</td>
<td>●</td>
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<td></td>
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<td>●</td>
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<td><strong>Injection Molding</strong></td>
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<td></td>
<td>HDPE</td>
<td>●</td>
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<tr>
<td><strong>Pipe &amp; Conduits</strong></td>
<td>Non pressure</td>
<td>●</td>
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<tr>
<td></td>
<td>PE80</td>
<td>●</td>
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<tr>
<td><strong>Textile</strong></td>
<td>Monofilament</td>
<td>●</td>
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<td></td>
<td>Tape</td>
<td>●</td>
</tr>
<tr>
<td><strong>Rotomolding</strong></td>
<td>MDPE</td>
<td>●</td>
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<tr>
<td></td>
<td>mMDPE</td>
<td>●</td>
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<tr>
<td><strong>Others</strong></td>
<td>W&amp;C</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td>Geomembrane</td>
<td>●</td>
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<tr>
<td></td>
<td>Extrusion coating</td>
<td>●</td>
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- **Commercial**
- **New/improved and delivered**
- **Development**

- Extension of mLL grade slate
- New Cr catalyst
- Extended offer
- New Cr catalyst
- ISO certified black PE80
- Improved tenacity
- Metallocene & Ziegler
HPLL™ metalloocene product line

2007
HPLL™ metalloocene product line

Density (kg/m³)

MI2.16 (g 10/min)

Film

Extrusion coating

Injection

Roto

2015

2015
HPLL™, a unique metallocene product

Conventional Ziegler
Broad MWD
Comonomer decreases with Mw

Conventional Metallocone
Very narrow MWD
Comonomer evenly distributed

INEOS HPLL™
Narrow MWD
Comonomer increases with Mw

LCB
Reverse Comonomer Distribution
HPLL™, a unique metallocene product

Best processability
Best ESCR
Best optics
High impact
Excellent sealability
**HPLL™**, downgauging in film applications

**Formulation**:
- Monolayer 50µm
- 95% mLLDPE + 5% LDPE

**Better processability with HPLL™**
- Bubble stability comparable to conventional LLDPE
- HPLL™ was run at 20% higher output

**Higher stiffness**: Best balance of mechanical, optical and sealing properties available now with unmatched processability and lower energy costs

**Outstanding Optics**:

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<th>HPLL™ formulation</th>
<th>Competitive mPE formulation</th>
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<td>Secant Modulus</td>
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<tr>
<td>Dart impact</td>
<td></td>
</tr>
<tr>
<td>Haze (%)</td>
<td>9.7</td>
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<tr>
<td>Gloss (%)</td>
<td>66</td>
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**Mono**
HPLL™, low SIT film based on mVLDPE

- HPLL™ @ 912 kg/m³ matches solution 902 kg/m³ ULDPE’s
- is very close to metallocene plastomers
- but is exhibiting better mechanical properties

Extra low SIT film
still with superior processability and toughness
HPLL™, enhanced extrusion coating

- Lower seal temperature - broader processing window
- Tougher seal - higher seal integrity
- Highly increased ESCR

Broader processing window and better package integrity & ESCR still with superior processability

INEOS pilot coating line, line speed = 250 m/min, sealing time = 0.5 s

6 mm thickness specimen, 1 mm depth notch, 3 Mpa, 40 °C, 2 %, arkipal N100
Innovene™ S Product Coverage

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- **Commercial**
- **New/improved**
- **Development**

LL C4
INcrease™
High processability
INcrease™
INcrease™
High stiffness, ESCR & swell

High ESCR
INcrease™
Low sag PE100
PE100RC

High tenacity

Roto C6
Trends in pressure pipes market

1987: INEOS invented the 1st generation of PE100

PE63

PE80

PE100

PE100RC

Low Sag PE100

12.5 m

2010
PE100 requires sand bed protection.

PE100RC is designed for alternative installation techniques.

Sand protection might represent up to 50% of the total cost!
INpipe™100SR a new PE100RC reference

INEOS’ INpipe™100SR No break!!

Innovene™ S is a solution provider for all piping systems including PE100RC, today’s most performing HDPE grade
Bimodal Blow Moulding

Blow moulding

Monomodal

Bimodal
ZBM58-30HS, a new reference

Superior ESCR and processability multiplying opportunities for downgauging
Première platforms

Innovene™ G
Clean loop gas phase
Swing LLDPE/HDPE

Innovene™ S
Bimodal slurry loops
HDPE/Bimodal HDPE

Bimodal HDPE
mLLDPE / mVLDPE
for all market segments
Solutions for the new millenium

INEOS Technologies

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