BASF in Antwerp: Chemical Verbund production in the heart of Europe

Bernd Brian
Member of the Management Committee BASF Antwerpen N.V.
Investor Visit, June 27, 2018
Cautionary note regarding forward-looking statements

This presentation contains forward-looking statements. These statements are based on current estimates and projections of the Board of Executive Directors and currently available information. Forward-looking statements are not guarantees of the future developments and results outlined therein. These are dependent on a number of factors; they involve various risks and uncertainties; and they are based on assumptions that may not prove to be accurate. Such risk factors include those discussed in the Opportunities and Risks Report from page 111 to 118 of the BASF Report 2017. BASF does not assume any obligation to update the forward-looking statements contained in this presentation above and beyond the legal requirements.
Agenda

1 | BASF’s Antwerp site at a glance

2 | Leveraging Verbund advantages

3 | Positioned for further growth
BASF’s Verbund site Antwerp…

... is the second-largest Verbund site of BASF

... has competitive advantages through unique Verbund site integration

... is continuously improving cost structures by technological and operational excellence

... has lean and reliable logistics

... supplies into growth markets
Global Verbund sites of BASF
Antwerp is BASF’s second-largest Verbund site
BASF in Antwerp
Ideally located in the heart of Europe

June 2018 | BASF Investor Visit Antwerp
The Benelux chemical cluster

BASF in Antwerp: Suppliers and customers at arm’s length
**BASF Verbund site Antwerp at a glance**

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Sales</td>
<td>€6.3 billion in 2017 (including group internal sales)</td>
</tr>
<tr>
<td>Site area</td>
<td>6 km²</td>
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<tr>
<td>Production facilities</td>
<td>more than 50 production plants (including third-party plants)</td>
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<tr>
<td>Investments*</td>
<td>~€160 million p.a.</td>
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<td>Sales volumes</td>
<td>8.4 million metric tons</td>
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<tr>
<td>Volume handled</td>
<td>16.9 million metric tons</td>
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<tr>
<td>Employees BASF</td>
<td>~3,100</td>
</tr>
</tbody>
</table>
Safety first
Maintain focus on safe behavior

LTI frequency rate*

Good safety track record versus industry benchmarks

* Lost Time Injuries (LTI) per 1 million hours worked
** As from 2005, based on data from Fund of Occupational Accidents
*** VIBNA: Association of Industrial Companies in Northern Antwerp
**** As from 2011, including Styrolution Belgium N.V. and EuroChem Antwerpen N.V.
Antwerp’s contribution to BASF segments
Involved in BASF’s core chemical activities
Antwerp’s contribution to BASF segments

Key products

**Chemicals**
- Petrochemicals
  - Ethylene
  - Propylene
  - Benzene
  - Acrylic acid
- Monomers
  - MDI
  - Ammonia
  - Caprolactam
- Intermediates
  - Amines
  - Formaldehyde

**Performance Products**
- Care Chemicals
  - Superabsorbents
  - Surfactants

**Functional Materials & Solutions**
- Performance Materials
  - Polyether polyols

**Agricultural Solutions**
- Functional Materials & Solutions

**Oil & Gas**
Agenda

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We add value as one company
Verbund generates >€1 billion global cost savings p.a.*
A competitive advantage of BASF

80% of the entire energy demand from exothermic processes; reduction of 1 million metric tons of CO₂

Logistics savings
>€600 million p.a.
Combi terminal saves 150,000 truck loads (equaling 30,000 metric tons of CO₂ p.a.)

Infrastructure savings
>€100 million p.a.
Shared use of on-site facilities (e.g. fire department, security, waste water treatment)

BASF Antwerp

People, Customers, Technology, Production

Energy savings
>€300 million p.a.

* Savings include only tangible synergies.
Verbund Simulation
Verbund means efficiency and flexibility – if steered intelligently

Verbund simulator enables
▪ Optimized operations
▪ Efficient utilization of assets
▪ Management of value chains

Through intelligent steering
▪ Digitalization (digital plant)
▪ Data analytics (cross-functional and high-value plant availability)
▪ Synergies and market opportunities
Verbund of energy-producing and energy-consuming processes reduces net energy demand
Continuously improving logistics: costs, reliability, lead time, sustainability
BASF Antwerp – Infrastructure Verbund
Effective use of common infrastructure

Cost savings through joint use of infrastructure and utilities
Most of the cracker output in Antwerp is used for downstream value generation.

Cracker products:
- Ethylene
- Propylene
- Butadiene
- Raffinates
- Benzene

Value chains of the BASF Verbund

Merchant Market
Verbund site Antwerp – Key value chains
Creating synergies along the value chain

<table>
<thead>
<tr>
<th>Steam cracker</th>
<th>Ethylene</th>
<th>Ethylene oxide</th>
<th>Ethylene glycol</th>
<th>Surfactants</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Propylene</td>
<td>Acrylic acid</td>
<td>Acrylates</td>
<td>Pure acrylic acid</td>
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<td></td>
<td>Benzene</td>
<td>Nitrobenzene</td>
<td>Aniline</td>
<td>MDI</td>
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<td>Nitric acid</td>
<td>Hydrogen</td>
<td>Formaldehyde</td>
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<td>Phosgene</td>
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MDI – Key value chain
Integrated world-scale plant

MDI
(Methylene diphenyl diisocyanate)

Polyether polyols

Rigid and microcellular polyurethane foams

MDI is mainly used captively; further value capture by BASF polyurethane systems
MDI – Product applications
Supplying into growth markets

Key facts

- MDI demand expected to grow above GDP (2015-2020)
- Growth driven by:
  - Increasing demand for energy efficiency
  - Increasing standard of living (e.g. footwear, furniture, performance textiles)
  - Transportation and construction
Acrylic acid – Key value chain
Value chain contributes significantly to cash flow

Each value chain step represents a potential merchant market outlet
Acrylic acid – Technology
Leveraging the BASF Technology Verbund

Focused R&D to continuously improve acrylic acid process

- Highly selective and efficient process catalysts
- Proprietary technology for new process
  - Higher yield
  - Lower energy consumption
  - Lower investment costs
- In addition, four radically new processes being investigated in research; one based on renewable raw materials
Key facts

- Acrylic acid demand expected to grow above GDP (2015-2020)
- Growth driven by emerging markets; rising middle class leads to increased demand for diapers, coatings and paints, adhesives, construction, textiles

About 2/3 of BASF’s acrylic acid is used captively
Acrylic acid – Cost excellence
Leading technology strengthens profitability

**Acrylic acid production technology benchmark**
Industry average costs = 100; normalized

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<tr>
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<th>BASF new process</th>
<th>BASF classic process</th>
<th>Industry average</th>
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**Key facts**

- Lower production cost than industry average
- Efficiency gains:
  - Run-time extension
  - Higher throughput
  - Lower energy consumption
- Proprietary technology, new process protected by 280 active patent families
- 4 out of 6 production sites already equipped: Ludwigshafen, Antwerp, Nanjing and Camaçari (Brazil)

BASF with best-in-class acrylic acid process

Source: BASF estimate | BASF Investor Visit Antwerp | June 2018 | Source: BASF estimate
BASF Antwerp – Hydrogen peroxide-based propylene oxide plant
First world-scale HPPO plant*

Propylene oxide production without any by-products, except water
Butadiene extraction plant
Successful start-up in September 2014

Key facts
- Production capacity of 155,000 metric tons p.a.
- Securing BASF’s internal supply of butadiene in Europe
- Taking advantage of merchant market opportunities

Strengthening of Antwerp Verbund site
Steam cracker flexibilization

Revamp of the cracker

Key facts

- High feedstock flexibility will be achieved
- Addition of LPG storage capacity to unload very large gas carriers

Strengthening of Antwerp Verbund site
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► BASF’s Verbund site Antwerp is positioned for further growth