Verbund at its core: New acetylene plant

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Intermediates division
Four product groups serve a wide variety of customers and industries

Sales by location of customer 2017 (sales to 3rd parties)

- South America, Africa, Middle East: 3%
- North America: 17%
- Asia Pacific: 38%
- Europe: 42%

€2,979 million

Sales by first customer industry 2017 (sales to 3rd parties)

- Health & nutrition: 5%
- Consumer goods: 3%
- Energy & resources: 3%
- Agriculture: 1%
- Other: 3%

Chemicals & plastics: 85%

€2,979 million

Amines: 40%*
Butanediol and derivatives: 25%*
Acids and polyalcohols: 20%*
Acetylenics and carbonyl derivatives: 15%*

* Percent of divisional consolidated sales in 2017
The acetylene value chain
Integral part of the BASF Verbund, providing raw materials for a variety of businesses

Natural gas → Acetylene → 1,4-Butanediol → Tetrahydrofuran → PolyTHF® → POM**

Intermediates:
- Methanol → Formaldehyde
- 1,4-Butanediol → Tetrahydrofuran
- PBT*
- gamma-Butyrolactone
- N-Methylpyrrolidone
- Pyrrolidones
- Vinylethers

Applications:
- Thermoplastic PU
- Engineering plastics
- Personal care products
- Other specialties

* Polyethylene terephthalate  ** Polyoxymethylene
The acetylene value chain
These materials are linked to attractive markets and applications

Markets and applications

- Automotive
- Filtration
- Electronics
- Textiles
- Pharmaceuticals
- Cosmetics

POM*
Thermoplastic polyurethane
Engineering plastics
Personal care products
Other specialties

* Polyoxymethylene
Technology leadership
We strive for continuous cost improvements along the entire value chain

1,4-Butanediol cash cost curve, Asia
(average cash costs, 2017)

- More than 80 years of experience in acetylene-based chemistry
- Technological leadership on all steps of the value chain, e.g., acetylene, BDO, PolyTHF®
- Investment in cost-competitive plants
- Strong integration into Verbund
- Continuous R&D efforts to improve processes and incorporate them into existing and new assets
From the old to the new acetylene plant
Consistent implementation of clear rationale

Objective
- Safe and reliable continuation of acetylene production in Ludwigshafen with favorable and long-term sustainable cash cost position

Motivation for project
- Ensure sustainable, safe and reliable operation
- Achieve significantly better cost position
- Utilize downstream capacities at our Ludwigshafen site to the fullest extent possible
- Equip the value chain for future growth of acetylene specialties

Project scope
- Replacement of the existing plant with an extended capacity
- New acetylene plant in Ludwigshafen based on BASF’s proven water quench technology
A truly digital plant
Incorporating elements of digitalization from the design phase on

**Advanced engineering tools**
- Augmented 3D plant modeling
- Increased installation quality
- Superior first pass installation ratio

**Engineering data management**
- Higher resolution plant data
- Consistent data over the plant lifecycle
- Additional quality of process improvements

**Predictive maintenance**
- Performance monitoring of critical assets
- Optimized maintenance scheduling
- Reduced instrument inventories

**Augmented reality in production**
- Workforce efficiency and effectiveness
- Higher asset utilization
- Knowledge transfer and preservation
Replacement of the acetylene plant
An important cornerstone for Ludwigshafen

- Construction was started in the first quarter of 2017
- **Replacement** of an **existing production plant** which has less capacity
- **Startup** expected for **end of 2019**
- Combination of 440 individual plant components
- The **world-scale asset** will have an annual production design capacity of **90,000 metric tons**
- 20 plants utilize acetylene as feedstock
- Deep integration into **Verbund** structure of Ludwigshafen
Key takeaways
The new acetylene plant continues our legacy

- Investments **close to our customers**
- Operation of **optimized assets** and lean business models
- Realization of **synergies** via deep **Verbund** integration
- **Cost competitiveness** through continuous **innovation**