BASF’s Catalysts Division: The Global Leader in Catalysis

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President
Catalysts Division

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Catalysts – a strategic fit for BASF

BASF Group third party sales 2013

- Performance Products: 21%
- Agricultural Solutions: 7%
- Chemicals: 23%
- Functional Materials & Solutions: 23%
- Oil & Gas: 20%
- Other: 6%

Total: €74 billion

thereof Catalysts: 8%
1 | BASF a market leader in catalysts

2 | Strategy for growth in core business units

3 | Emerging opportunity in Battery Materials
BASF has strongest portfolio in the industry – catalysts, materials, services

Mobile Emissions Catalysts

Emissions-control catalysts for cars, trucks, motorcycles

Chemical Catalysts

Chemical and polyolefin catalysts plus adsorbents

Refinery Catalysts

FCC* catalysts and additives for oil refining

Battery Materials

Current and next-generation battery materials development

Precious Metal Services

Full-loop metals distribution, financial services, recycling

New Business Development

New “white space” ventures in areas such as clean air and catalytic coatings

* FCC - Fluid catalytic cracking catalysts
Global megatrends drive catalysts demand

We create chemistry for a sustainable future

Air quality
- Mobile emissions regulations
- Fuel & environmental regulations

Process efficiency
- Shift in desired industrial output
- Raw material change

Energy efficiency
- Clean and efficient use of crude oil, natural gas, coal and feedstock

Innovation and technology are the keys to success in the catalysts market
BASF – The # 1 global catalysts solutions provider
Strong catalysts portfolio – leveraging BASF’s leading technology position

Total sales 2013 in € billion

Underlying sales 2013 in € billion w/o “Precious & Base Metal Services” and precious metals

- Mobile Emissions Catalysts
  - 2.3

- Precious & Base Metal Services
  - 2.4

- Chemical Catalysts
  - 0.6

- Refinery Catalysts
  - 0.3

Total sales 2013: €5.7* billion

Underlying sales 2013: €2.3* billion

* Including €0.1 billion in other sales
Balanced sales base

Sales 2013 by region*

- Europe: 30%
- North America: 35%
- South America, Africa, Middle East: 11%
- Asia: 24%
- Other: 4%

€2.3 billion

Sales 2013 by industry*

- Transportation: 55%
- Chemicals: 27%
- Refinery: 14%
- Other: 4%

€2.3 billion

* Excludes “Precious & Base Metal Services” and precious metals
Global manufacturing footprint, with close customer proximity

Significant increase in capex to ~€300 million in 2014
Strong R&D platform

Key facts

- Global R&D presence
- ~€150 million in catalysis R&D spend in 2013 (~7% of sales*)
- Focus on innovation, aligning regional capabilities to local market needs
- >1,100 catalyst experts globally
- Supported by >10,500 scientists in BASF Research Verbund

* Excludes “Precious & Base Metal Services” and precious metals
Sales and profitability development by business

Underlying sales
in € billion
w/o “Precious & Base Metal Services” and precious metals

Sales of “Precious & Base Metal Services”
in € billion

EBITDA Indexed

EBITDA margin: ~2%

* 2012 figures restated, reflecting accounting changes due to IFRS 10/11
BASF’s Catalysts division – driving above market growth

Catalysts sales
in € billion

Sales growth targets

- Achieve catalysts solutions sales of ~€2.8 billion by 2015
- Deliver sales growth above global catalysts market through 2015
- BASF’s strategic relevant catalysts market expected to grow at ~6% p.a. between 2010 and 2015

* Previously €3.0 billion; adjustment reflects restatement of €0.2 billion related to IFRS changes
Mobile Emissions Catalysts

1 | BASF a market leader in catalysts

2 | Strategy for growth in core business units

3 | Emerging opportunity in Battery Materials
Growth drivers for Mobile Emissions Catalysts

- Global tightening of environmental regulations
  - in established and emerging markets
  - driving heavy-duty diesel market CAGR of 21% through 2015

- Accelerated shift of vehicle manufacturing to BRIC countries
  - Chinese automotive sales projected to deliver 11% CAGR through 2015

- Tightening fuel economy, CO₂ regulations

- Ongoing powertrain changes
  - Requires continuous development of new catalytic solutions
# Emissions catalysts market – regulation remains primary demand driver

## Announced Regulations

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<tr>
<th>Country</th>
<th>Light Duty</th>
<th>Heavy Duty</th>
<th>Motorcycle</th>
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## Future Regulations

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BASF – leading mobile emissions catalysts provider

Mobile Emissions Catalysts SRM*

in € billion

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<tr>
<th>Year</th>
<th>Light-duty</th>
<th>Heavy-duty diesel</th>
<th>Motorcycles</th>
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<tr>
<td>2012</td>
<td>2</td>
<td>2.1</td>
<td>2.1</td>
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<td>2015</td>
<td>4</td>
<td>3.7</td>
<td>5.8</td>
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CAGR 2012-2015 11%

* Strategic relevant market excluding precious metal
What makes BASF the Mobile Emissions Catalysts market leader?

Key factors:

- **Technology leadership** – matching innovation focus with regulation maturity
- **Proximity to the customer** – local manufacturing, technical services and R&D presence in both established and emerging regions around the globe
- **Focus on high growth market** – heavy-duty diesel vehicles
- **Leveraging BASF’s inroads** – excellent customer relations in global automotive markets
### Bringing great products to market
Provider of choice for innovative technology solutions

<table>
<thead>
<tr>
<th>Four-Way Conversion Catalyst (FWC™)</th>
<th>Lean NOx Trap + Multifunctional Catalyzed Soot Filter (LNT+CS4F™)</th>
<th>Selective Catalytic Reduction on filter (SCRoF™)</th>
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<tr>
<td>▪ Single component, removes particulate matter, carbon monoxide, hydrocarbons and nitrogen oxides from gasoline-engine exhaust</td>
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<tr>
<td>▪ Removes particulate matter, carbon monoxide, hydrocarbons and nitrogen oxides from diesel-engine exhaust with fewer components</td>
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<tr>
<td>▪ Controls nitrogen oxides and particulate matter</td>
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<td>▪ Superior durability; maintains performance while saving systems space and weight</td>
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The most powerful patent portfolio in the sector
Technology leadership
Innovation leader in environmental technology

Global emissions catalysts patents (2009 – 2013)

Number of patents
BASF is a market leader in China

>30 million catalysts manufactured at integrated Shanghai emissions catalysts and R&D hub since 2005

~€60 million invested in Shanghai-based operations to date, with additional investments to follow

Project to double production capacity in Shanghai to be completed in 2014

Estimated annual production of 33 million passenger cars in China by 2020

Proximity to the customer
Leveraging local presence and capabilities in China
Proximity to the customer
Expansions in high-growth mobile emissions catalysts regions

**Brazil growing at 7% CAGR 2012 – 15**
- #2 catalysts supplier
- Ongoing capacity expansions at Indaiatuba, Brazil, production site (2010-2013)

**India growing at 13% CAGR**
- #1 catalysts supplier
- Manufacturing capacity expansion at Chennai, India, production site (2009, 2011)
- New Chennai production site being built to address growing demand (2014-15)

- ~€35 million in capacity expansions since 2006
- > €80 million incremental investment planned through 2016
Proximity to the customer
New plant in Poland to meet growth from Euro 6 & Euro VI

Market growth and regulation support establishment of new production hub in Środa Śląska

- BASF’s largest emissions catalysts manufacturing facility globally
- More than doubles regional production capacity in Europe
- Phase 1 production launched Q1 2014; full project completion in 2016
- Excellent access to German and East European customers (canners) & substrate suppliers
- Investment of ~€ 90 million initially, ramping up to €150 million by 2016
Focus on high-growth market
Heavy-duty diesel vehicles

BASF’s current technologies and business

- Leading edge technologies for new on-road and off-road regulations
- Cost effective state-of-the art technologies for emerging markets
- On-road market: significant new business already awarded to BASF
- Off-road market: Gold Certification status at Caterpillar – the # 1 player in off-road

Targets

- Increase market share in on-road market
- Secure leading share with top customers in emerging off-road market (largest opportunity in China, not currently regulated)
Leveraging BASF’s inroads
Excellent customer relations with all major OEMs

BASF is competitively advantaged across the automotive value chain

- Addresses all major global and local OEMs
- Market approach coordinated by a “Global Automotive Steering Committee”
- Provides integrated, leading-edge solutions
- Brings greater value and technology to market faster

Adding value as one company
1 | BASF a market leader in catalysts

2 | Strategy for growth in core business units

3 | Emerging opportunity in Battery Materials
Growth drivers for Chemical Catalysts

- **Technology**
  - Demand for better process economics
  - New chemical processes or routes

- **Raw material change for chemical production**
  - Increasing use of natural gas, coal and biomass as alternative feedstocks
  - Heavier crude oil feedstocks

- **Global economic expansion**
  - Chemical growth in Asia and Middle East
  - Increasing energy demand
  - Strong growth in polyolefin consumption

- **Regulations**
  - Legislative requirements drive demand for new environmental solutions in US and EU
BASF – global leader with solutions along the chemical value chain

Chemical Catalysts SRM*
in € billion

CAGR 2012-2015 6%

~4.7
5% p.a.

~5.6

Polyolefins

~3% p.a.

Adsorbents

7% p.a.

Chemical catalysts

* Strategic relevant market
What makes BASF the Chemical Catalysts market leader?

Key factors:

- **BASF innovation network** – catalytic process innovator and chemical industry benchmark
- **Strong technology position** – most comprehensive product & technology portfolio serving large variety of high-growth applications
- **Technical expertise** – broad know-how of catalysts and processes
- **Strategic partnering** – strong relations with process licensors and innovative customers
- **Market position** – excellent position in major growth markets and segments
Strong technology position and reach
Broadest product portfolio

- **Regional expansion** – Targeted growth in Asia; planned new manufacturing hub in Shanghai (2016)
- **Operational excellence** – Continuous process efficiency & productivity-driven cost reductions
- **Expansion in high growth markets** – including zeolites, base metal catalysts
- **Value creating acquisitions** – CRI styrene catalysts (2012)
- **Product Innovation** – continuous R&D expenditure (~5% of sales) for new and improved products

R&D pipeline and targeted investments will further improve BASF’s leading technology position in Chemical Catalysts
Bringing great products to market
R&D expertise provides sustainable competitive advantages

**Climate gas catalyst**
- BASF technology eliminates nitrous oxide emissions up to 100%

**Emission control zeolites**
- BASF zeolite technology enables high-quality diesel NOx abatement catalysts, allowing cost-effective regulatory compliance

**Bio-renewables**
- Ethylene from ethanol catalyst for downstream renewables (green glycol)
- Process & catalyst for producing bio propylene glycol (PG) from glycerin
Strategic partnering
Strong relations with process licensors and innovative customers

- Innovative technologies to produce olefins and alcohols
- Adding value to coal-based value chains in China

- BASF catalysts support Sasol’s ability to convert gas into low-sulfur diesel, naphtha and LPG

- Tailored manufacturing, supply and technical service relationships with mix of industry leaders

~ 25% of R&D funding supports long-term partnership projects
1 | BASF a market leader in catalysts

2 | Strategy for growth in core business units

3 | Emerging opportunity in Battery Materials
Growth drivers for Refinery Catalysts

- **Continuing shift in refined product mix**
  - Drives high growth in petro and diesel fluid catalytic cracking (FCC) catalysts

- **Access to tight oil delivering new challenges and opportunities**
  - Short-term focus in North America, mid- to long-term in other regions

- **Declining feedstock quality globally**

- **Tightening environmental and fuel quality regulations**

- **Increasing global fuel demand**
  - Accelerated growth in Middle East through 2016 and Asia continuing beyond 2025
BASF is #2 globally in FCC catalysts and additives

**FCC Refinery Catalysts market**

*in € billion

<table>
<thead>
<tr>
<th>Region</th>
<th>2012</th>
<th>2015</th>
<th>CAGR 2012-2015</th>
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<tbody>
<tr>
<td>Europe</td>
<td>~1.5</td>
<td>~1.6</td>
<td>3%</td>
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<tr>
<td>North America</td>
<td>1</td>
<td>-1% p.a.</td>
<td></td>
</tr>
<tr>
<td>South America, Africa &amp; ME</td>
<td>0% p.a.</td>
<td>1% p.a.</td>
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<tr>
<td>Asia Pacific</td>
<td>0</td>
<td>8% p.a.</td>
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**Key success factors**

- A global leader in FCC catalysts
- Leading-edge refining solutions
- Superior performance in Gas Oil catalysts
- Proprietary Distributed Matrix Structure (DMS) technology
- Strong technical sales force
- Reliable supply with short lead times
- Strong innovation pipeline

* FCC is one component of the SRM – BASF is not currently present in hydroprocessing technology.
Technical expertise
R&D expertise provides sustainable competitive advantages

Low Rare Earth Phinesse™ Catalyst
- Vacuum Gas Oil FCC catalysts with raw material flexibility
- Provides equivalent yields to market leading BASF NaphthaMax® III with 50% less Rare Earth

Flexible Innovation: AEGIS™ Catalyst
- Resid market solution, allows refiners to adjust zeolite-to-matrix (Z/M) ratio to calibrate yield selectivity
- Provides exceptional metals tolerance and bottoms-upgrading capability
1 | BASF a market leader in catalysts

2 | Strategy for growth in core business units

3 | Emerging opportunity in Battery Materials
Market leader in precious metals (PM) management and sourcing services

Total sales 2013 in € billion

- Mobile Emissions Catalysts: 2.3
- Precious and Base Metal Services: 2.4
- Chemical Catalysts: 0.6
- Refinery Catalysts: 0.3

Total: €5.7* billion

PM distribution – Supply chain management, risk management for BASF and key customers

PM processing – Refining and recovery services, including auto catalysts recycling

Financial expertise – Trading and hedging of Platinum Group Metals (PGMs)

Manufacturing – Precious metals salts and solutions for industrial applications driven by technology

“Full loop” portfolio leveraging robust capabilities in trading, refining, manufacturing & catalysis

* Including €0.1 billion in other sales
Leveraging precious metals market insight

**Supply Insight**
Direct visibility into platinum group metals (PGM) market supply
- Mine supply
- Secondary supply
- Trading flows
- PGM supply chain finance / management

**Future Insight**
Unparalleled market insight into evolving R&D trends

**Demand Insight**
Direct visibility into PGM market demand
- Automotive demand
- Chemical demand
- Investor demand
- LPPM Fixing trading flows

**Supply / Demand Forecast**

**24-Hour Global Trading Team**

- Enable industrial business
- Trading & hedging expertise
- Price risk management

- Strategic positioning
- Access to multiple liquidity pools
BASF provides 24/7 access to PGM market liquidity

- BASF Trading Offices
- BASF Refining & Production Facilities and JVs
- Major Primary PGM Producers
- Exchanges / Key Bullion Centers

Locations:
- London, UK
- Cinderford, UK
- Lincoln Park, US
- Seneca, US
- Huntsville, US
- Iselin, US
- CME / NYMEX, US
- Indaiatuba, Brazil
- Port Elizabeth, South Africa
- Sydney, Australia
- New Dehli, India
- Nienburg, Germany
- Środa Śląska, Poland
- Moscow, Russia
- Tokyo, Japan
- TOCOM, Japan
- Seoul, Korea
- SGE, Korea
- Shanghai, China
- Huntsville, US
- Zurich, Switzerland
- Zug, Switzerland
- Rome, Italy
Focus on high-growth and sustainable metals recycling market

**Targets**
spent automotive recycling

#1 global catalyst recycler

First mover in China

**Key Success Factors**

- **High metal velocity** – Faster settlement times
- **Expertise in assay analysis** – Fast, accurate, and transparent assay results
- **Integrated trading platform** – Financial services including price risk management
- **Global footprint** – Commercial collection points in all regions
- **Innovation** – New BASF technology to optimize metals recovery yields
1 | BASF a market leader in catalysts

2 | Strategy for growth in core business units

3 | Emerging opportunity in Battery Materials
Battery technologies are key enabler for growing electric vehicle market

- Future of electromobility depends on batteries with higher energy density, greater power, lower cost
- Innovative solutions from the chemical industry will drive battery market growth
- Battery materials such as cathodes and electrolytes are vital to performance, cost and safety of batteries

Total global battery market potential: >€20 billion by 2020
Enabling technology: Battery Materials
Driving the future of electromobility

Business potential 2020
- Strategic relevant market: >€5 billion globally (~€4 billion in Asia Pacific)
- Sales potential BASF: >€500 million globally (~€350 million in Asia Pacific)

BASF activities
- Start of business unit “Battery Materials” in 2012
- Several technology-driven acquisitions undertaken
- Three-digit million euro invest for R&D and production
- R&D network with universities / industrial partners

BASF’s technology roadmap- Battery materials for today and tomorrow

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<td>Li-ion</td>
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<td>HE/HV Li-ion</td>
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<td>Li-S</td>
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Driving range (km)*

- From Li-ion to Lithium-sulfur

*BASF Catalysts, May 2014
* Driving range (km) of an electric car (with a 100kg battery)
BASF’s battery materials portfolio
Comprehensive today, further strengthened

Lithium ion technology

Electrolytes
(production; R&D)

Anode active materials
(R&D)

Cathode active materials
(production; R&D)
- Nickel Cobalt Manganese NCM
- Lithium Iron Phosphate LFP

BASF has a broad battery materials portfolio today, and continues to invest

- NiMH technology: License business, NiMH battery materials
- LiS technology: Investment of $50 million in Sion Power (R&D)
- BASF/Toda Kogyo: In negotiations to establish JV in Japan
NCM production

Largest NCM production plant of the US (2.4 kt): Elyria

Electrolyte production

Production capacity: Suzhou, China
Further capacity: Louisiana, US

Application labs, research centers

Further application labs: US, China, Germany
Research centers: US, Germany

Rochester Hills, US
Elyria, US
Beachwood, US
Independence, US
Baton Rouge, US
Ludwigshafen, Germany
Seoul, Korea
Suzhou, China
Tokyo, Japan
Amagasaki, Japan

Sales Office
Production
R&D/Application Technology Center
EV market on strong growth track
Significant opportunity for materials providers

Battery demand e-mobility market
in GWh (Lithium-ion batteries)

- Total e-mobility market* will increase more than fivefold from 2012 to 2015
- Electrified (LiB) passenger car sales in 2013: ~400,000 units
- Launches of new electrified vehicles announced by major OEMs (including Daimler, BMW, Volkswagen) will drive battery demand
- Forecast for electrified passenger cars sold in 2015: >1 million units**

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* The e-mobility market includes EVs, PHEVs, Hybrids, buses, e-cycles and commercial vehicles.

** Source: Bloomberg and BASF estimates
Key operational and financial targets

- Extend our position as the global leader in catalysis and establish leadership position in battery materials market

- Continue to grow profitably above global catalysts market rates

- Achieve total Catalysts division sales, excluding metals*, of ~€2.8 billion** by 2015 with increased profitability

- Solidify our leadership position in technology

* Excludes ‘Precious & Base Metal Services’ and precious metal  
**Previously €3.0 billion; adjustment reflects restatement related to IFRS changes