Chemistry powers Sustainability

Standards: Enabler of Sustainability
David Green – BASF Admixture Systems | May 2017
We are active in diverse industries and markets:

- Transportation
- Construction
- Agriculture
- Health & Nutrition
- Consumer Goods
- Electronics
- Energy & Resources
We create chemistry for a sustainable future.

- We add value as one company.
- We innovate to make our customers more successful.
- We drive sustainable solutions.
- We form the best team.
Sustainability at BASF
What we stand for

Together with our partners we drive sustainable solutions to improve quality of life. Innovation, continuous improvements and responsible action along the value chains ensure most efficient resource use and our long-term business success.
Verbund site Ludwigshafen: at a glance

The largest integrated chemical complex in the world

<table>
<thead>
<tr>
<th>Headquarters</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees BASF SE</td>
<td>35,972*</td>
</tr>
<tr>
<td>Site area</td>
<td>10 km²</td>
</tr>
<tr>
<td>Sales products</td>
<td>about 8.5 million metric tons p.a.</td>
</tr>
<tr>
<td>Road</td>
<td>106 km</td>
</tr>
<tr>
<td>Rail</td>
<td>230 km</td>
</tr>
<tr>
<td>Site traffic</td>
<td>2,100 trucks daily</td>
</tr>
<tr>
<td>Shipment</td>
<td>100,000 containers p.a.</td>
</tr>
<tr>
<td>Pipeline system</td>
<td>about 2,850 km</td>
</tr>
<tr>
<td>Production facilities</td>
<td>110 production facilities with around 200 production plants</td>
</tr>
</tbody>
</table>

* As of December 31, 2015
Ludwigshafen site: a comparison

Verbund site Ludwigshafen – Manhattan, New York City, USA
The Verbund:
adding value as one company through the efficient integration of our resources

Production Verbund
- more cost-effective, safer and environmentally preferable production
- Saving energy by means of efficient processes
- Avoiding long transport routes

Technology Verbund
- one company unit for Engineering and Operational Excellence
- strengthening BASF’s global network

Customer Verbund
- Working closely with customers
- Interlinking markets and technologies

Employee Verbund
- success as one company
- networking among employees
- employees share their expertise

Knowledge Verbund
World population
9.6 bn people in 2050
By 2050, 66% of the population will live in urban areas
In 2030, middle class growth is expected to reach a level of 4.9 bn people total.
By 2020, transportation will increase to nearly 1.2 billion cars
Challenges

- Sustainability is a very broad topic and a moving target
- New approaches, initiatives and desires for sustainable solutions are almost daily initiatives.
- New sustainability standards are needed for clarity, transparency, consistency, comparability.
- Replacing experience and knowledge in the workforce
- Collaborative solutions
Sustainable Construction
evaluating impacts

- Resource consumption
- Energy use
- Emissions
- Waste reduction
- Recycled material
- Durability
- Resilience
- Cost of Ownership
- End-of-Life
- Human and environmental health
- Transparency
- Performance

LCA  EPD  Material Transparency
**Applied Sustainability**: Our tools offer pragmatic answers to address challenges

<table>
<thead>
<tr>
<th>Big Picture</th>
<th>Position Finder</th>
<th>Hot Spot Mapping</th>
<th>Value Chain Dynamics</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td>Assessment of an organization’s sustainability performance</td>
<td>Identification of the sustainability issues of a value chain</td>
<td>Assessment of sustainability positioning and momentum of players along value chain</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Zooming In</th>
<th>Sustainable Solution Steering®</th>
<th>Opportunity Finding</th>
<th>Sustainability Pyramid</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2.png" alt="Image" /></td>
<td>Overview of a product portfolio’s contribution to specific value chain sustainability needs</td>
<td>Systematic analysis of value chain to reveal hot spots and business opportunities</td>
<td>Visualization of sustainability initiatives according to their differentiation potential</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Deep Dive</th>
<th>Eco-Efficiency Analysis</th>
<th>Eco-Efficiency Manager</th>
<th>Life Cycle Assessment</th>
<th>Life Cycle Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td>Quantitative analysis of both economic and environmental impacts of products and processes over the entire life cycle</td>
<td>Customized, easy-to-use online Eco-Efficiency calculator for the assessment of life cycle costs and environmental impact</td>
<td>Quantitative analysis of environmental impacts of product and processes over the entire life cycle</td>
<td>Inventory of all relevant in- and output flows occurring during production (cradle-to-gate)</td>
</tr>
</tbody>
</table>
Sustainable Solutions
Standards and Guidelines

- **ISO 14044:2006** – Environmental management – Life cycle assessment - Requirements and guidelines
- **ISO 14025** - Environmental labels and declarations – Type III environmental declarations
- **EN 15804, ISO 21930** - Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- **BSI Standards Publication PD CEN/TR 15941:2010** - Sustainability of construction works – Environmental product declarations – Methodology for selection and use of generic data
- **ISO 14045:2012** - Environmental management - Eco-efficiency assessment of product systems
- **ISO 14046:2016** - Environmental management - Water footprint –
- **PAS 2050:2011** - Specification for the assessment of the life cycle greenhouse gas emissions of goods and services
- Guidance for the implementation of the EU Product Environmental Footprint (PEF)
- Joint Research Centre – European Platform on Life Cycle Assessment
- Guidance for Accounting & Reporting Corporate GHG Emissions in the Chemical Sector Value Chain.
- IBU Communications Manual on Sustainability, Eco-balance and EPD
- Methodologies for EEA/LCA tools – CML, ReCiPe, EU PEF, TRACI, NSF Protocol P352 Part A
- Product Category Rules for Concrete Products– Carbon Leadership Forum, ASTM,
Standards and Guidelines

- Align concepts and real-world applications
- Supports in meeting technical, regulatory, safety, societal, market needs
- Provides credibility
- Delivers transparency
- Generates consistency
- Promotes openness, balance and consensus
- Supports global innovation
- Knowledge
Moving Forward

- New innovations require new and innovative standards
- Active involvement in standards development
- Holistic thinking
- Moving beyond the initial customer
- Product development for the circular economy
- Integration
- Learning never ends
BASF
We create chemistry
BASF – a growth industry

Agriculture   Health & nutrition   Energy & resources   Construction & housing   Consumer goods   Transportation   Electrical & electronics

Chemistry as enabler to meet current and future needs

~10bn people by 2050

70% of the world population will live in cities by 2050

50% more primary energy consumption by 2050

30% more food needed by 2050
a. **Challenges** – Making educated decisions that support a sustainable future for the entire value chain.

- Sustainability is not an easily defined term and incorporates numerous facets. In addition, for many, sustainability is an emotional term. This makes the development of standards and objective guidelines difficult to create, both at a global level and regional level. Although this is not a new topic, understanding and applying the topic is new to many. Today, some of the issues of high concern are healthier products, environmentally preferable solutions, transparency, labeling, leadership. With alternative pathways to differing definitions for sustainable solutions, the results are confusing, misunderstood, misrepresented, result in poor decision making and generate multiple pathways to compliance. The sustainability arena is dynamic with new ideas, innovations and alternative solutions being delivered on a regular basis. The available data can vary between databases and not all analyses are developed based on the same protocols. There is also the continuous desire to refine and improve existing standards and practices to provide more detailed and scientifically sound results.

a. **Standards Issues** – The onslaught of “expert” consultants in areas without standards or guidelines, i.e. evaluation of substances at the user level (hazard, risk, exposure). The development of standards is understandably lengthy, sometimes complex which can and does slow down innovation – or reduces the opportunity for aligned results.
Evaluating our product portfolio

- **Substantial sustainability contribution in the value chain**
- **Meets basic sustainability standards on the market**
- **Specific sustainability issue which are being actively addressed**
- **Significant sustainability concern identified and action plan in development**

We will increase the Accelerators and develop action plans for Challenged solutions.