Industrial bioeconomy –
examples of the chemical industry
Global Bioeconomy Summit, Berlin
Carsten Sieden
Why renewable feedstock?

1. Competitiveness: product with a certain performance not accessible or at higher cost or market demand

2. Sustainability: Saving of fossil resources and climate protection
   Vision 2050: a world in which nine billion people can live well, and within the planet’s resources

3. Opportunities: Customer / consumer demand and regulations

4. Raw materials: diversification of the raw material base

Four main drivers are influencing BASFs renewable-based portfolio.
Different approaches to a renewable-based portfolio

**Products only accessible from renewables, e.g.**
- Oleochemicals
- Furandicarboxylic Acid
- Enzymes
- Schizophyllan (Biopolymer)

**RRM-based drop-ins, e.g.**
- 1,4-Butanediol
- Succinic acid
- Vitamin B2
- Beta-carotin

**Biomass balance products, e.g.**
- Polyurethanes
- Polyamides
- Acronal Dispersions
- Polystyrol
BASF purchases a broad range of renewable raw materials

<table>
<thead>
<tr>
<th>Oils &amp; Fats</th>
<th>Grains</th>
<th>Sugar</th>
<th>Wood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural oils</td>
<td>Starches</td>
<td>Raw sugar</td>
<td>Ligninsulfonate</td>
</tr>
<tr>
<td>Fish oil</td>
<td>Modified Starches</td>
<td>White sugar</td>
<td>Cellulose-Derivatives</td>
</tr>
<tr>
<td>Castor oil</td>
<td>Dextrose</td>
<td>Ethanol</td>
<td>Gum Rosin</td>
</tr>
<tr>
<td>Sebacic acid</td>
<td>Maltodextrin</td>
<td>Itaconic acid</td>
<td>Tackifier</td>
</tr>
<tr>
<td>Fatty acids</td>
<td>Gluconates</td>
<td>Citric acid</td>
<td>Furfural</td>
</tr>
<tr>
<td>Fatty alcohols</td>
<td>Glycerin</td>
<td></td>
<td>Tall oil sterols</td>
</tr>
<tr>
<td>Glycerin</td>
<td>Stearates</td>
<td></td>
<td>TOFA</td>
</tr>
</tbody>
</table>

~ 5% of BASF’s total raw material purchase are renewables.
Growing demand, renewable raw materials not per se sustainable
Palm and palm kernel oil

- Wide-spread use in personal care and food applications
- Unique chemical properties make substitution unfeasible to date
- Supply chain complexity challenges traceability
- Plantations cause deforestation and related issues of concern

Palm is an example for the sustainability dilemma of renewables.
How do we work on our journey to Sustainable Palm?

Collaborate

Collaboration: one of the first members of the Roundtable on Sustainable Palm Oil (RSPO) and member of the High Carbon Stock Approach Steering Group.

Co-create for sustainability

Co-Creation: engagement in smallholder inclusion with our partners.

Drive physical transformation

Physical transformation: certified sites worldwide enable the shift towards sustainable palm.

More: on.basf.com/palm-dialog or Twitter: @BASF_palm
Examples for bio-based portfolio

Joint venture BASF and Corbion

- bio-based succinic acid (Succinity®) as platform chemical
- Production start Montmeló, Spain Q1 2014

Joint venture BASF and Avantium

- Furandicarboxylic acid (FDCA) from renewable feedstock for polyethylene furanoate and more
- FDCA-production planned at BASF’s Verbund site Antwerp, Belgium

Patented process of Genomatica

- 1,4-Butanediol based on sugar
- Commercial volumes available since end 2013

ecovio® - bio-based and compostable

- Consists of the compostable BASF polymer ecoflex® and polylactic acid derived from corn
- Applications: fruit & vegetable bags, mulch films, packaging
Biomass Balance: groundbreaking way of deriving products from renewable raw materials
Product examples for biomass balance products

- **HySorb® Biomass Balanced** – Sustainable superabsorber for baby diapers
- **Glasurit® automotive refinish products**
- **Flexible films for new packaging made of Ultramid®**
- **Construction elements containing BASF’s Elastopir® systems**
- **Acronal® binders for interior paints**
For the use of renewable raw materials at BASF 4 different value drivers are crucial:

- Competitiveness
- Sustainability
- Business Opportunity
- Diversification of raw materials base

Renewable Raw Materials are not per se sustainable.

BASF offers bio-based materials as well as biomass balanced materials.
We create chemistry