Agri meets chemicals

The biorefinery as a platform for building a bio-economy

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Sustainable Business Development
Brandowners want Biochemicals

“The Coca-Cola Company

“we convert all plastic bottles into the 100% renewable, bio plastic equivalent, by 2020”

IKEA

“all plastic materials used in home furnishing products should be 100% renewable and/or recyclable by 2020”

TOYOTA

“20% of plastics in each of our vehicles must be from bio-based sources by 2020”

LEGO

“we invest 1 Billion DKK for implementation of sustainable materials”

AkzoNobel

“20% of revenue by 2020 should come from products that are more sustainable, e.g. using renewable raw materials”
Mazda: Fuel economy of our customers can be improved through decreased car bodyweight.

Lubriplate: Biodegradability helps our users to save costs on disposal and cleaning.

Coca Cola: We want materials that are less expensive – and more price stable – than volatile, fossil-based resources.

Nestlé: Bioplastics can help increasing the shelf life of our products, thus quality.

Danone: PLA cups have less leakage than Polystyrene.

BASF: Customers increasingly know from what materials their products are made and what their environmental impact is. They want better alternatives.
Biochemicals for all purposes

Plant constituents

- Proteins
- Sugars
- Oils & Lipids
- Ligno cellulose

Biorefinery

Packaging & disposables

Consumer goods

Personal care

Automotive

Building & construction

Textiles

Paints, lubricants, waxes

Food additives
Industrial Biotechnology: connects agribusiness & chemicals

Biotech enables a whole new approach to agriculture using Bugs for Business
Bio-tech transforms Agribusiness

Linking agri to chemicals.
Accelerating a circular economy.
Towards a biobased economy

Earth’s resources are finite, human ingenuity and solar energy are infinite.
Key F&A players are investing

- Coca-Cola partners with Liquid Light
- Cargill acquires OPX-biotechnologies
- Cargill invests in Genomatica
- Tereos and Avantium partner for PEF production
- Wilmar partners with Elevance in biochemical refinery in Indonesia
- Sime Darby takes a stake in Verdezyne
- ADM invests in Rennovia for biochemicals production
- Corbion announces investment in PLA plant
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Strong presence F&A companies in biobased supply chains
Chemicals derived from cane, beet, corn, tapioca, and wheat through fermentation are the primary focus on this study.
Oil prices were stable up to 2000 after which it increased dramatically; white sugar prices have been volatile but increased more gradually.

Development of white sugar and crude oil prices (monthly averages, $ / barrel, $ / ton)

Source: FO Licht, EIA, Deloitte Analysis
Oil price Sugar price ratio ($/GJ)

Brent Crude ($/GJ) / London #5 ($/GJ)
Average production costs over the past 5 years vary with strong positions for the US, Brazil, Thailand and the Netherlands.

Global supply curve of sugar (average 2008/09 – 2012/13)

Note: Production costs of raw sugar converted to w.s.e. multiplying by 1.087 (polarisation constant) and adding refining costs of $65/ton, raw sugar volume converted to w.s.e. by dividing volume by 1.087; Note 2: Production costs for beet and cane include for both land and factory costs for labour, capital (incl. a.o. land rent and depreciation), input (incl. a.o. seeds, fertilizer, chemicals, and energy), and factory by-product revenue.

Source: LMC International Sugar & HFS report 2014, UNICA Harvest Reports 09/10 – 12/13, Deloitte Analysis
Brazil and Thailand increased production mostly by increasing acreage and/or crop yield, whereas production in the Netherlands is under quota.

\[
\text{Total production (min ton w.s.e.)} = \text{Cultivation area (min ha)} \times \text{Crop yield (ton crop / ha)} \times \text{Sugar yield (ton w.s.e. / ton crop)}
\]

* Figures include all cane and sugar produced, no adjustment for ethanol production has been made.

Source: LMC International Sugar & HFS report 2014, Deloitte Analysis
Since 2000 the production costs in Brazil have increased significantly more than in the Netherlands, resulting in a higher price level.

Production costs (USD / ton w.s.e., 1980-2013)

Brazil – Cane

Netherlands – Beets

Thailand – Cane

EU – Beets

Note: cost levels same as previously defined
Source: LMC International Sugar & HFS report 2014, Deloitte Analysis

% = CAGR 2000-2013
Once quota are released, it is expected that volumes in the EU and in the NL will increase while prices will converge to global market price levels

Potential scenario for sugar beet volume in the EU and in the Netherlands

Once quota are lifted, volume of beets will increase...

- Once quota are lifted, it is expected that more farmers will choose to grow sugar beet, as prices and earnings have been higher for sugar beet than for wheat and coarse grains in the EU
- This will potentially increase the acreage in the EU (in NL this could move from currently 73,000 ha to 120,000 ha (former acreage of sugar beet)
- Simultaneously, it can be expected that yield will continue to increase from the current 14 ton sugar/ha to c 18 ton sugar/ha around 2020

...which will lead to excess volumes in sugar...

- As a result, production of sugar in North-Western Europe can grow by 5 million tons in 2020 (with a proportional share in NL)
- As consumption is not likely to change significantly in the EU, it is possible that this volume will reduce imports by up to 1 mln ton and replace countries with high production costs
- It is expected that in the EU an excess volume of 2-4 mln ton of sugar can be supplied to either the fermentation industry or sold on the global sugar market

...however, impact on global market will be limited

- The current volume sold on the world market is 55-60 mln ton annually, of which the majority (~25 mln ton) is sold by Brazil
- An additional volume from the EU of 2-4 mln ton is unlikely to have a significant impact on the price developments in the global sugar market
- However price levels in the EU are likely to move towards the price levels of the global sugar market (with premiums/cuts for transportation costs and or semi-finished product)
Opportunities for forward integration

Chemicals companies have much higher return expectations than farmers

Farm income can be improved by partially shifting production to chemicals

This suggests downstream opportunities for farmers (co-operatives)

### Biomass

<table>
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<th>Return in EUR / ha</th>
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<tr>
<td>Food</td>
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<tr>
<td>Biochemicals</td>
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Rabobank is experienced in making Agri Feedstocks Bankable

**Agri feedstocks have their challenges**
- Seasonal production/Weather risk
- Poor security of supply
- Non homogeneous feedstock
- Volatile prices; no price hedging
- Many small scale suppliers
- Complex logistics

**but these can be overcome**
- Buffer stocks
- Pre-processing
- Diversification of sourcing
- Revenue dependent pricing, rebates
- Co-operative structures
- Specialized fuel management companies

This is an area that offers opportunities to both Wholesale & Rural and Retail
Is there enough biomass?

Energy demand require 30 times more land than chemicals
Summary

• Agriculture to take center stage in post oil era
• Brand owners want better, cheaper & renewable products
• Bio-chemicals do not adversely affect food security
• Sugar platform is leading the biochemicals value chain
• EU has a strong feedstock position with Sugarbeet strong
• Merger of Agri & Chemicals can rejuvenate agriculture and play a major role in the sustainable re-industrialisation of Europe
Time for Questions

Rabobank is committed to

ENTER A NEW, GREENER WORLD OF INFINITE POSSIBILITIES