Aurubis
16-11-2017
The Mental Shift
Aurubis Belgium
100 Years of Experience in Copper Production and Processing
History of Aurubis Belgium

The Aurubis Group celebrated its 150th birthday last year!
Aurubis Belgium: Company Profile

» Demerged from Umicore in 2005 and creation of Cumerio.
» Renamed in Aurubis Belgium in 2009 after the acquisition of Cumerio by NA.
» Aurubis Belgium consist out of two sites:
  » Brussels: Commercial Services and Group Competence Centres
  » Olen: Operations, HR and Finance
» Today Aurubis Belgium employs about 570 employees; and our workforce has grown with 4% per year in the last 5 years.
» Aurubis Belgium is one of the top 30 Belgian companies ranked according to turnover and represents about 1% of Belgium’s GDP. We invest more than 10 million € per year in our Belgian facilities.
» Aurubis Belgium has subsidiaries in Switzerland, Hong Kong, Finland, Russia, Sweden, Netherlands, Italy and USA.
» We are operating in a wide “Open Innovation” Network, including many Top Universities. Our RDI-research work is being recognized by funding of the EC and the Flemish authorities.
Copper – the material of modern life

High electrical conductivity
- Electric motors
- Cable and wires
- Microchips
- Transformers

High thermal conductivity
- Air conditioners
- Heat exchangers
- Kitchen appliances
- Brake pads

High durability
- Sanitary installations
- Pipelines
- Roofs and facades
- Coins
Aurubis is a world leader in the copper value chain

<table>
<thead>
<tr>
<th></th>
<th>FY 2015/16</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom concentrate</td>
<td>2,156,000 t</td>
<td>No. 1 worldwide</td>
</tr>
<tr>
<td>processing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper scrap processing</td>
<td>253,000 t</td>
<td>No. 1 worldwide</td>
</tr>
<tr>
<td>Cathode production</td>
<td>1,084,000 t</td>
<td>No. 4 worldwide</td>
</tr>
<tr>
<td>Rod production</td>
<td>758,000 t</td>
<td>No. 1 worldwide</td>
</tr>
<tr>
<td>Shape production</td>
<td>172,000 t</td>
<td>No. 1 in Europe</td>
</tr>
<tr>
<td>Strip production</td>
<td>218,000 t</td>
<td>No. 1 worldwide</td>
</tr>
<tr>
<td>Sulfuric acid production</td>
<td>2,068,000 t</td>
<td></td>
</tr>
<tr>
<td>Gold production</td>
<td>42 t</td>
<td></td>
</tr>
<tr>
<td>Silver production</td>
<td>961 t</td>
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Aurubis has a service and sales network in more than 20 countries (Europe, Asia and North America).
Aurubis Belgium: an integrated copper producer

**Integrated copper processor**

- **Mines and recycling markets**
- **Copper production**
  - Primary Copper: Sulphuric Acid, Iron silicate
- **Copper processing**
  - Recycling / Precious Metals: Cathodes, Precious Metals, Other metals
  - Copper Products: Flat rolled products, Shapes, Wire Rod, Other semi-finished products

- **Processors and end users**
Business model largely independent of copper price

Aurubis business model

Mines and secondary markets → Copper Production → Copper Processing

Copper price

TC/RC

Profit

Costs

Premium

Sur-charge

Costs

Profit

Profit Aurubis

Aurubis sales

Premium + Sur-charge

Copper price
Aurubis Belgium Flowsheet

**Typical data in kton**

- **In**: 400KT
- **Out**: 400KT
- **100 % Cu**: 350
- **90**: 230
- **18+12**: 50
- **70**: 200
- **50**: 200
- **10**: 50

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**In**: 100 % Cu

**Out**: 100 % Cu
Aurubis Belgium Flowsheet

Typical data in kton

In
AUR BE Logistics
Out

400KT

100 % Cu

90

70

50

10

200

200

2

50

350

100 % Cu

90

400KT

18+12

100 % Cu
**Major trends that are important for Aurubis’ business**

<table>
<thead>
<tr>
<th>Trend</th>
<th>Implications</th>
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<tbody>
<tr>
<td><strong>Rising Copper Demand</strong></td>
<td>Global expansion of copper production capacity.</td>
</tr>
<tr>
<td>Global refined copper demand will increase, compensating for substitution effects</td>
<td></td>
</tr>
<tr>
<td><strong>Multipolar Business World</strong></td>
<td>Demand for global delivery and international production platforms.</td>
</tr>
<tr>
<td>Emerging countries (especially China) will outpace Western countries</td>
<td></td>
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<tr>
<td><strong>More Complex Materials</strong></td>
<td>Requires extensive production know-how, innovative technologies and customized solutions for suppliers</td>
</tr>
<tr>
<td>Rising no. of elements and decreasing metal content in primary and secondary raw materials</td>
<td></td>
</tr>
<tr>
<td><strong>Increasing Recycling Efforts</strong></td>
<td>Recycling capacity and capability with high recycling standards and customized solutions for suppliers</td>
</tr>
<tr>
<td>Volume and complexity of recycling materials will rise</td>
<td></td>
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<tr>
<td><strong>Growing Sustainability Ambitions</strong></td>
<td>Sustainable activities balancing economy, environment and people.</td>
</tr>
<tr>
<td>Shifting customer values towards sustainability</td>
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Aurubis Belgium: Our Journey to Zero accidents

LTIFR
Aurubis Belgium
Logistics
Aurubis Belgium Logistics is a benchmark by location, infrastructure and organisation

» Olen’s great location
  » 50 km from Antwerp Port
  » 120 km from Rotterdam Port
  » 60 km from Genk Railway Terminal
  » 5 km from main highways

» Olen’s organization
  » One department
  » Highly integrated
  » Exchange of knowledge

» Olen’s tri-modal infrastructure
  » Access via road
  » Internal railway connection (Connection to line Antwerp – Aachen)
  » Kanaal Bocholt-Herentals (Connection to Antwerp via Albertkanaal)

Head of Logistics

Planning Import & Export
Desk administration
Product planning and selection
Internal Logistics
Each year we transport around 800,000mt of material.
Our usage of Olens Tri-modality

**RAIL**

20%

- Anodes from Pirdop by rail

**ROAD**

75%

- Rod by truck all over Europe

- Blister from overseas via container

**WATER**

5%

- Anodes via barge from overseas

- Rod by train to Eastern Europe
The past showed a modal shift by transport companies

» Outsourcing the fleet
  » Lower personnel costs

» Intelligent systems
  » Information flows
  » Reports
  » Fast communication
  » Low empty kilometres

» Modal shift
  » Truck to train
  » Truck to shortsea

» Squeezing the lemon
The current reality

- Road congestions
  - Less km/day covered
  - Same volume to be covered
- Bigger distances to cover
  - General move to eastern-Europe
- Lack of (skilled) drivers
  - High personnel costs
- Restrictive laws by governments
  - Taxes
  - Less operational time
The future needs a mental shift of the industry

» “Driverless” transport
  » Material carrier as starting point
  » Raising tons or volume per driver
  » Investment in infrastructure

» Giving up the link between driver and information
  » Payment terms and transfer of ownership

» Following the path of the regulations

» Logistics as enabler
  » Intelligent placed hubs, warehouses, big volumes, steady lanes,…
  » Collaboration instead of providing services
All Supply Chain Solutions brought forward must meet five key criteria

**RELIABLE**
- Guaranteed for long time
- Well-known and established partners
- All kinds of risk to be avoided

**FLEXIBLE**
- Quick response to peak volumes
- Multi-functional

**SUSTAINABLE**
- Long term cooperations
- Set-up of a direct link
- Using standards
- Focus on big flows

**ENVIRONMENTAL FRIENDLY**
- Reduced impact on environment
- Reduced impact on neighborhood

**USER FRIENDLY**
- Lean
- Minimal impact on workload for all parties involved

“We do not simply transport from A to B but we take the whole supply chain in consideration for each decision. Therefore we strive for the multi-purpose use of each investment in order to guarantee the most cost-effective solution for the total material flow.”
Container Project
An New Way of Handling Container Transport
The transport of all inbound and outbound containers between Aurubis Belgium and the Port of Antwerp + the handling of containers after arrival with Aurubis Belgium.
Numbers of the current flows

50%–50% split inbound-outbound

+100% container with Rod in 4 years

10,000 containers/year

fluctuating volumes

maximum 108 containers/day

average 39 containers/day
Problem statements

1. High impact on workload and number of FTE’s
   A. Individual processing
   B. Limited to openingshours

2. High impact on environment and neighbourhood
   A. CO² emission
   B. Impact on local roads

3. High total cost of transport
   A. Low volume and high labour costs per transport unit

4. Lack of capacity
   A. Congestion
   B. Transport legislation
Solutions for a shift away from road transport: Rail and Water

1. RAIL
   - Centralisation of containers in port of Antwerp
   - 1 dedicated train to Olen, 54 containers per train
   - 1 roundtrip per day

2. WATER
   - Barges with max 24 containers per barge (max 16 full)
     A. Direct to the terminals in the port and/or centralisation in Antwerp
        - 7 barges in roundtrips
     B. Centralisation at inland terminal
        - 2 barges in roundtrips
        - 4 boxes and one pusher in roundtrips

* Beneficial on workload and FTE’s
* Very limited impact on carbon footprint
* Higher transport cost (+15%/container)
Partner choice based on the five key criteria for supply chain solutions

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<tr>
<th></th>
<th>INLAND</th>
<th>ANTWERP</th>
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<tbody>
<tr>
<td>Reliable</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Flexible</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Sustainable</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Environmental friendly</td>
<td>=</td>
<td>=</td>
</tr>
<tr>
<td>User friendly</td>
<td>(+)</td>
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No final decision made yet but we are in favour of a certain option…
» Building complete new terminal next to our existing quay
  » 7000m² - room for 250 containers
  » Moving loading operations
  » Efficient workload planning

» PPS (???)
Creating future opportunities...

» Loading and unloading multimodal boxtrailerbodies directly from trains
  » For transport to UK, Italy, Spain, Austria
  » +30% of our truck transport = 2000 trucks

» Easy, cheap and reliable transport AND storage capacity in case of intercompany flows

» Swap bodies via barges