

AURA Technologie GmbH



Innovation Forum 2022
Recycling Region Harz

What market are we in?

- To comply with the European regulations for sulfur limits in transportation fuels refineries employ HDS (Hydrodesulfurization) units
- Core of the HDS units are Molybdenum-containing catalysts that need to be replaced every 12 to 18 months
- Molybdenum represents a high value industrial metal that Aura focus on to keep in the circular economy by combination of thermal and chemical processes: either raw materials for the production of new Molybdenum containing catalysts are produced or valuable additives for the production of specialty steels (non-corrosive) are provided to the steel-sector
- Hereafter basic principles applied to our business are detailed by an example of a selected customer partnership ("Customer X")

What do we offer?

1. Long-term strategic partnership for a constantly increasing sustainability
2. Important contribution to Customer X's efforts to reduce Carbon Footprint and secondary life cycles
3. European based solution according to European standards
4. Constant improvement through technology-driven recycling approach
5. Best Available Technique (BAT) for enhance Catalyst Recycling and Carbon footprint reduction
6. Value creation
7. Reduce waste

How do we succeed?

Circular Economic

Instead of

Linear Economic

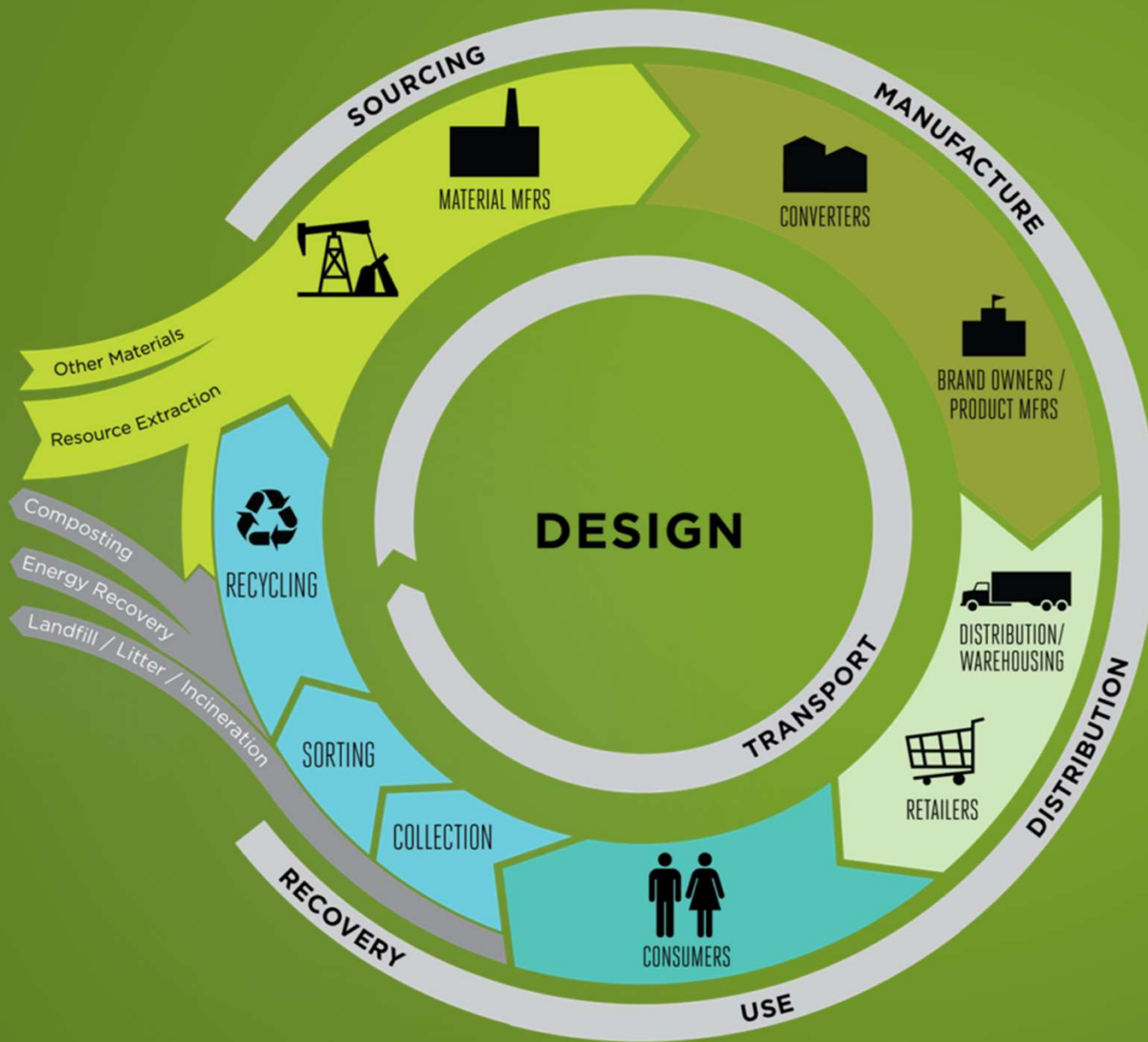
Molybdenum – Linear Economy (Disadvantages)



LINEAR ECONOMY

- Lost value of materials
- Scarcity of Resources
- Unstable supply
- Volatile prices/logistics
- Waste generation
- Environmental degradation
- Greenhouse Gas (GHG) emissions
- Climate Change

AURA CONCEPT – Molybdenum Circular Life Cycle (Advantages)



- Maintaining the value of resources in the economy as long as possible
- Reducing GHG emission, waste generation and other environmental impacts
- Improving security of supply
- Increasing competitiveness
- EU based complete process require less logistics

WE save Molybdenum Ore



Thanks to the partnership with AURA over the past 12 years, Customer X:

- avoided landfilling of 13.000 t of waste, and therefore also
- avoided extraction, transportation and use of more than 900.000 tons of Molybdenum ore

WE save CO₂

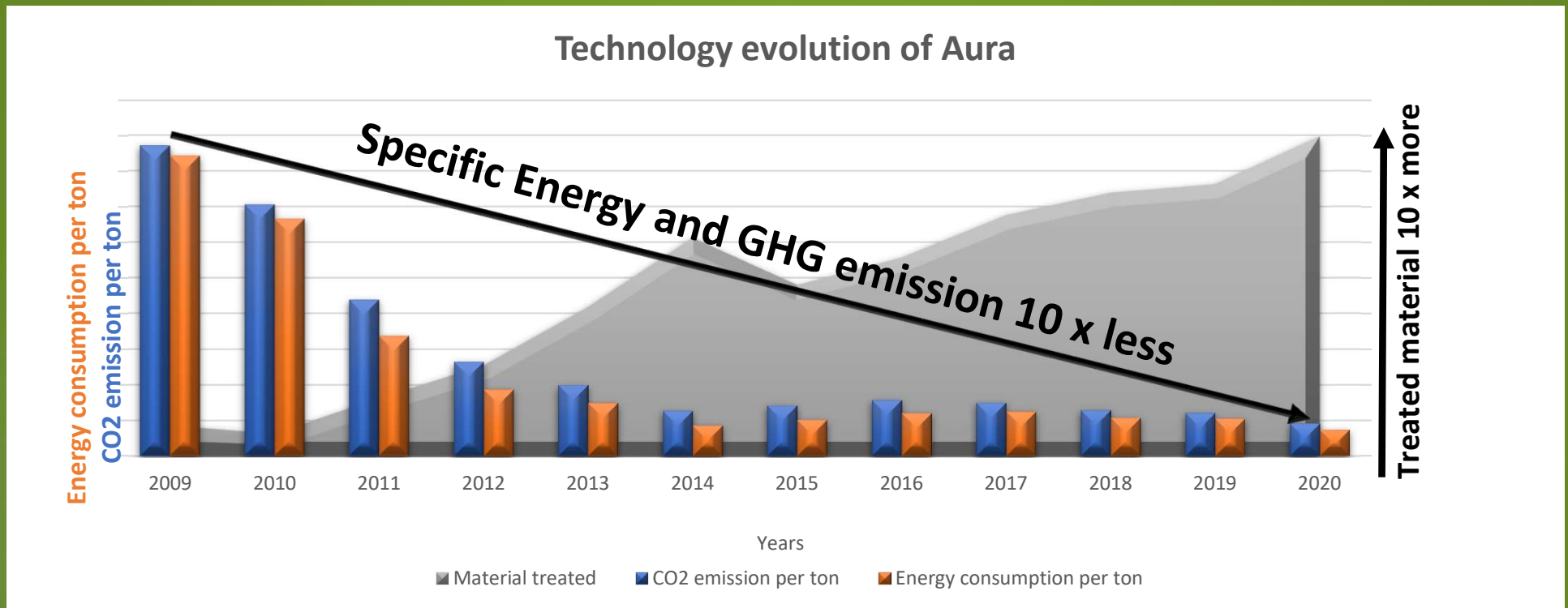
Compared to the procurement of primary molybdenum units, the recycling of Customer X' spent catalysts saved approximately 5.700 t of CO₂. 5.700 t CO₂ represent e.g.

- travelling 52,8 mio. km with a VW Polo car, equaling 1.318 circumnavigations of the world
- 831 circumnavigations of the world by plane (one seat)
- 1.629 beech trees (each beech tree compensates 3,5 t of CO₂ during a 100-year life span). This represents an area of 109.000 m² beech forest.

Customer X also avoided 900.000 t of molybdenum ore mining.

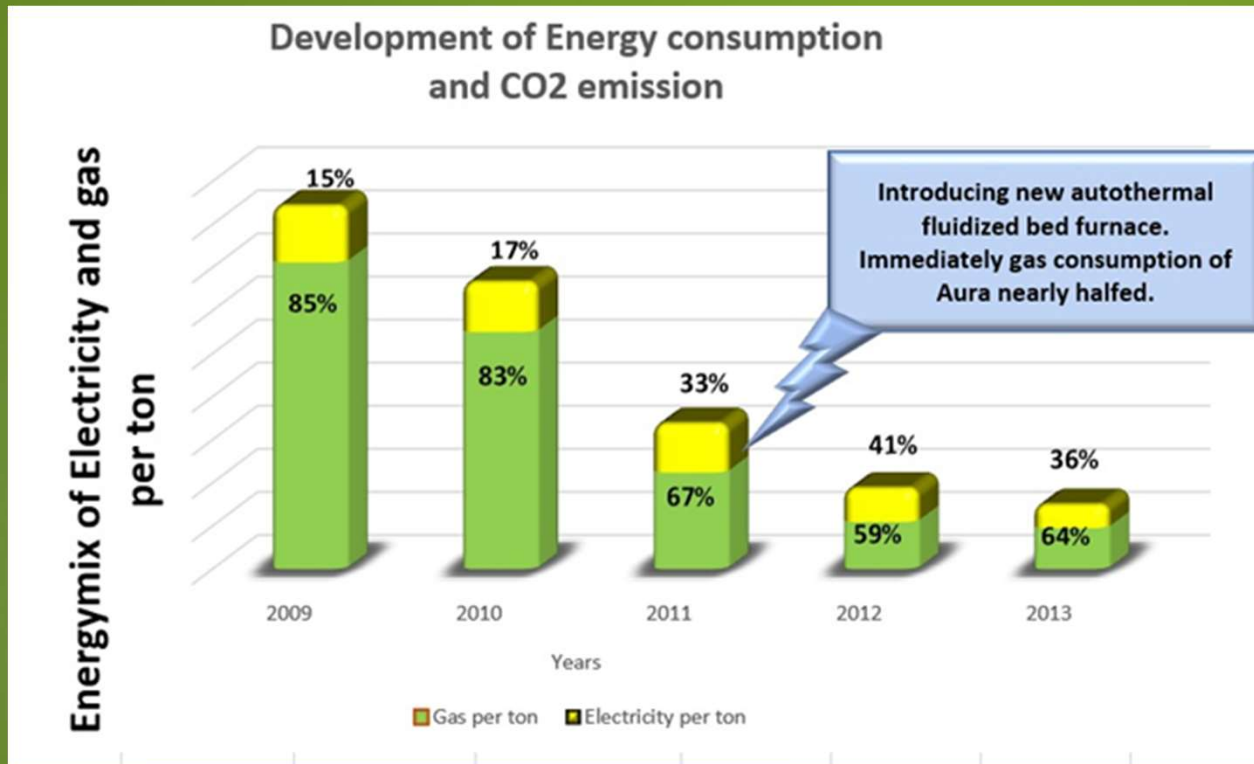
- The mere transport of this material e.g. from Shanghai to Hamburg would need 44,7 ships of the size of the “Ever Given” containership (which blocked the Suez Canal back in March 2021) and consume approx. 288.500 t Diesel, emitting 1,18 mio t CO₂
- 44.7 “Ever Given” containerships have the length of 17,89 km!

Fluidized bed technology – Best Available Technique



- BAT leads to environmental improvement
- We save approx. 25% more CO₂ than other alternatives due to our technology-driven approach.

Fluidized bed technology – Environmental Improvement



- In 2011, AURA introduced the patented autothermal process for catalyst treatment
- Besides substantially reducing our energy consumption, the energy mix
 - ✓ now depends much less on gas
 - ✓ includes more “green energy” given Germany's energy policy

WE transform residues into value-added products

BAT for Recovery of metal from spent industrial catalysts and residues

- Full Compliant with all legal, environmental, efficiency and technical European requirements
- Complete recovery of valuable metals from industrial residues in Helbra (Germany):
 - ✓ Input: hazardous waste
 - ✓ Output: value-added, saleable and non-dangerous products
- High flexibility in selection and variation of production steps
- Manufacturing by means of closed-loop-recycling



WE save Resources - Technology applied for Sustainability

All our products are based on recycling activities, therefore saving resources

Our Products	Value Proposition	Applications
Molybdenum Oxide	High Mo concentration	<ul style="list-style-type: none"> ➤ Catalyst manufacturing ➤ Nutrition ➤ Pigments production
Calcium Molybdate	Medium Mo concentration	<ul style="list-style-type: none"> ➤ Manufacturing of high purity Mo chemicals
Mo/W/V concentrates	Alternative to mining	<ul style="list-style-type: none"> ➤ Alloy addition for specialty steels (FeMo, FeW, FeV steels) ➤ Batteries ➤ Aerospace
Calcium sulfate	Solidification and stabilization	<ul style="list-style-type: none"> ➤ Building industry
Cobalt concentrates	Alternative to mining	<ul style="list-style-type: none"> ➤ Batteries ➤ Catalyst manufacturing



WE create value for our strategic partners

➤ Environmental Value:

- ✓ We save more CO₂ than any other potential recycling alternative
- ✓ We offer a local European closed-loop which requires less logistics

➤ Economic Value:

- ✓ We achieve an important economic improvement compared to traditional waste management alternatives
- ✓ Transparent payment terms according to changing market conditions
- ✓ Competitive, reliable and adapting to constantly changing market conditions

➤ Strategic Value:

Long-term strategic partnership allows to create environmental and economic value through close collaboration, like the drums return service which leads to:

- ✓ Environmental improvement: around 90% drums waste reduction
- ✓ Economic Value: around 80% drums cost reduction

AURA - an ideal strategic service provider

- We present state-of-the-art proven technology complying with all European legal, environmental, efficiency and technical requirements
- We offer 20 years of experience in spent catalyst recycling
- We reduce your environmental and Carbon footprint more than any other available recovery or treatment alternative
- We successfully built a proven track record over more than 10 years:
 - ✓ More than **13.000 tons of spent HDS** catalyst processed for Customer X
 - ✓ **Competitive and reliable** in constantly changing market environment (Upside/Downside)
 - ✓ **Our strategic long-term mindset enhances:**
 - **Flexible and solution-driven approaches in any given moment**
 - **Constant value creation for our partner**
- Excellent legal/documental compliance regarding waste management service. We assume responsibility for a gapless and fully transparent traceability of entire compliance requirements over years

WE contribute as corporate citizen



- Charity to school & kindergarden
- Tree Donation to the National Park of the Harz
- Charity run sponsoring
- Sponsoring footballclub



WE offer a perspective to the young generation



- Professional Training
- Practical trainings for students and pupils
- Member of the Umweltallianz Sachsen-Anhalt
- Corporation with university

