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BRAZERO – Brass Streams for Optimal Use and Zero loss

- State-of-the-Art
- Project P2025-03599
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Participants in BRAZERO

NORDIC BRASS GUSUM

ESBE

isiflo

IMI Hydronic Engineering

MLVI Merikarvian LVI-Tuote Oy

LK Systems

HELA LAIHO INDUSTRIES

FM Mattsson

Mattsson Metal

viega

Boverket

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Background: why BRAZERO project?

Brass alloys
Primarily copper and zinc, with additional elements added to tailor properties such as machinability, corrosion resistance or strength.

Lead Usage and Regulations
Lead was traditionally added to brass for better machinability, but new EU regulations require lead-free brass in drinking water products by 2032

Challenges of Transition
A transition to lead-free alloys pose numerous challenges, including alloy composition, machinability, corrosion resistance, and balancing recyclability with performance requirements

➔ BRAZERO aims to enable a well managed and economically viable transition to lead-free brass landscape in Sweden

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Legislation and Regulatory Drivers

EU Drinking Water Directive
The directive limits lead leaching and mandates approved materials for contact with drinking water with a transition period until 2032.
Some European countries have a shorter transition.

REACH and RoHS Regulations
REACH classifies lead as high concern; RoHS restricts lead in electronics with uncertain exemptions post-2027

Occupational Health Standards
Tighter exposure limits for lead in workplaces drive companies to eliminate lead for worker safety

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Market Size and Current Situation

Swedish Brass Industry Overview – a circular value chain
Sweden produces around 20,000 tons of brass annually and employs about 2,000 people, focusing on plumbing and heating products.
Sweden's brass industry recycles 95% of scrap, creating a highly circular value chain
Lead-free brass accounts for only 5–10% of Swedish production

Installed Brass Components
Approximately 160 million brass components are installed in Swedish drinking water systems, most of them made of leaded brass, affecting future scrap material streams

Brass scrap flows
Scrap from production (e.g. machining) sent back to material producer and end-of-life scarp.

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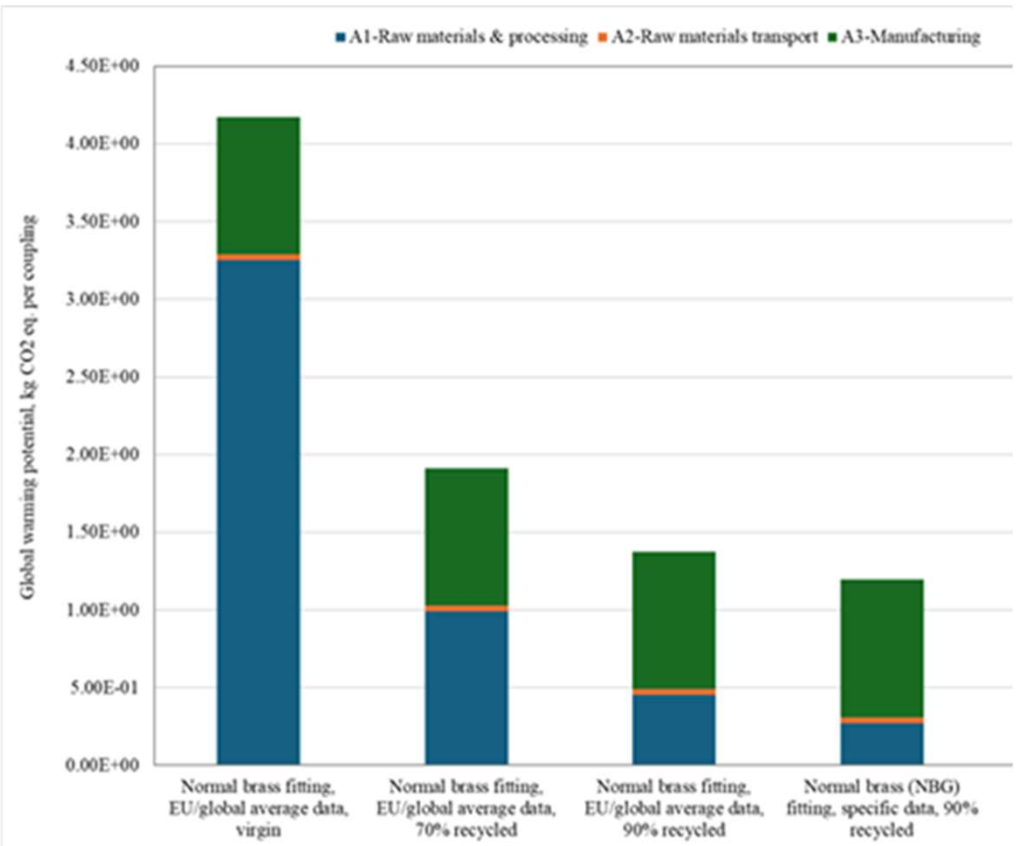
Climate impact, environmental data



- **Climate impact of brass** is mainly driven by raw material source and recycled content, rather than alloy composition

- **Recyclability varies by alloy**
  Si-containing brasses must be handled separately, reducing scrap value and increasing production complexity

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Available lead-free brass alloys

Market overview
Several lead-free brass alloys are commercially available, but they vary widely in machinability, corrosion resistance, and compatibility with existing recycling streams
Very few of them are approved for EU drinking water distribution

Nordic constraints
Nordic water quality requires dezincification-resistant (DZR) alloys, excluding several common EU-approved lead-free alternatives

Alloy families
Lead-free options include ceramic-modified brasses (e.g. AquaNordic®), bismuth brasses, silicon brasses, and magnesium-alloyed brasses.

Alloy	Denomination/ Composition	Technology	4MS-list	EUPL	Recycling in current streams
CW510L	CuZn42	Binary brass	Yes	Yes	Yes
CW511L	CuZn38As	As	Yes	No	Yes
Envirobrass I	C89510	1%Bi – 0.5%Se		No	No
BZ3N	C6802	Bi		No	No
CW724R	CuZn21Si3P	Si	Yes	Yes	No
SnECO	CuZn20Si3Sn0.5P	Si-Sn	?	No	No
CW726R	CuZn36Si1P	Si	Yes?	No	No?
CC246E	CuSi4Zn9MnP	Silicon bronze	Yes	Yes	No
eZeebrass	CuZn41Mg	Mg	Yes	No	Yes?
CW511L AquaNordic®	CuZn38As	Ceramic particles	Yes	No	Yes
CW727R	CuZn35Sn1P	Sn-P	Yes	No	Yes
CC771S	CuZn38AsSb-C		Yes	Yes	Yes
CB771S AquaNordic®	CuZn38AsSb-C	Ceramic particles	Yes	Yes	Yes
CC768S	CuZn21Si3P-C	Si	Yes	Yes	No
CC761S	CuZn16Si4-C	Si	Yes	No	No
-	CuZn38Bi1Al-C	Bi	Yes	No	No
-	CuSi3Zn12FeMnP	Mn	Yes	No	?

No alloy available today is fully satisfactory

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Research around Lead-free Brass Alloys

Emerging Research Themes
Recent research explores microalloying, alternatives like graphite incorporation and advanced process control

Machinability in focus
Development focus on machinability, which depends strongly on alloy composition, machining conditions, tool geometry, and coatings. Machine learning methods are used to optimize machining

Corrosion resistance
Corrosion resistance, especially against dezincification, is governed by both alloying elements (e.g. As, Sb, Sn, P) and microstructure; refined grain structures and phase distribution significantly improve performance.

Data-Driven Optimization
Computational alloy design tools increasingly support optimization of composition, microstructure and processing (heat treatments).

Element	Typical content (%)	Technical function	Risk/Challenge
Cu	58-77		
Zn	10-35		
Pb	0-3,5	Improve machining Casting	Toxic substance
As	(0,02-0,15) 0,02-0,05	Corrosion Inhibitor	Only protects alpha-phase Toxic substance but present at very low concentrations.
Si	0-3,5	Mechanical properties Chip breaking	Kappa-phase and gamma phase sensitive for corrosion.
Sn	0,2-1	Corrosion, erosion, Strenght	Higher concentration, formation of gamma-phase negativefrom corrosion perspective
Sb	>0,2	Corrosion inhibitor	Higher concentration, cracks
Al	>0,2	Corrosion (marine applications)	Contributes to better corrosion resistance in some cases but also cases when Al decreases the dezincification resistance.
Fe	>0,2	Grain refining	Forms intermetallics with corrosion inhibitors, thus decreased corrosion resistance.
P	>0,2	Corrosion inhibitor Grain refinement	Easily forms intermetallic compounds, poor corrosion inhibitor when Fe is in alloy.
B	>0,2	Grain refining	
Mn	>0,2	Strength	

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Maturity Assessment of the Swedish Industry

Assessment methodology
Seven key dimensions were evaluated for lead-free transition maturity. Deep interviews were performed with 11 companies.

Overall Maturity Score
The average maturity score of 3.02 (on a 5 scale) shows structured progress but not full optimization across companies

Larger company vs Swall entreprises Gap
A 40% maturity gap between larger companies and SMEs.
Many SMEs lack robust techno-economic decision support, leading to delayed or uninformed investment decisions

Collaboration Strength
Value chain collaboration scored highest, highlighting strong cooperation across suppliers and manufacturers

1. **Strategic leadership** - integration in business strategy, investment allocation
2. **Production readiness** - technical capabilities, process control
3. **Material flow management** - scrap handling, separation protocols
4. **Data and traceability** - composition tracking, certification systems
5. **Value chain collaboration** - supplier/customer partnerships
6. **Market position** - product positioning, competitive differentiation
7. **Transition perspective** - organizational attitude, perceived barriers

➔ Need of collaborative efforts beyond isolated technological solutions for industry-wide success

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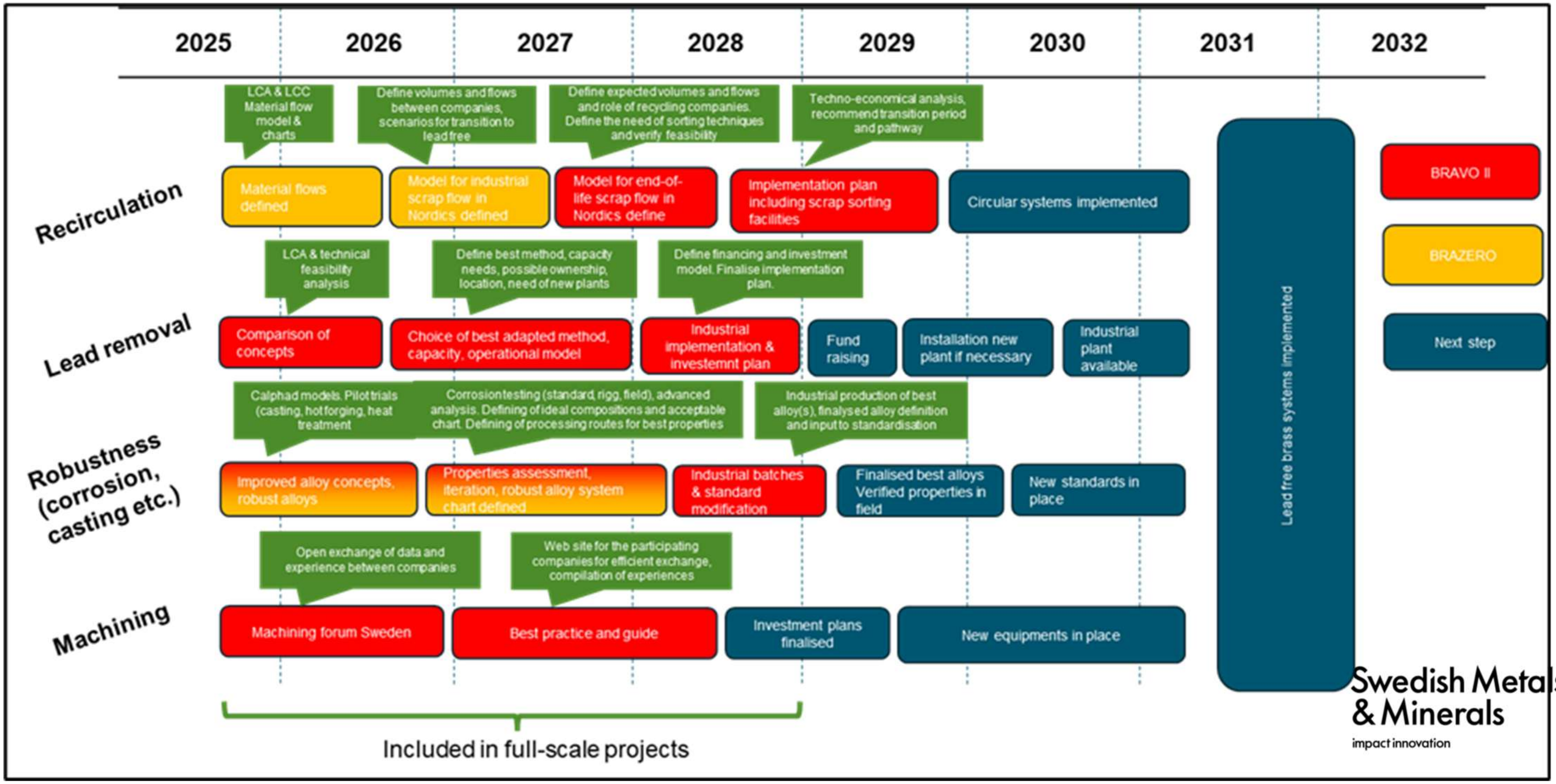
Roadmap for lead free brass implementation



Thank you for your attention!

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