

**WHY THIS MATTERS**

## Aluminum lowers cost only if the joint holds.

Aluminum costs up to **7-9 times** less than copper and can reduce cable theft risk. But replacing copper is not straightforward since materials behave differently. The key commercial risk is the joint connection, where creep (deformation) temperature cycling, and maintenance complexity can threaten a **10-year** service life and erase the expected savings.

*The business case depends on a connection that stays tight over time.*



Example connector candidates and bi-metallic interfaces reviewed for aluminum cables and busbar connections.

**HOW IT WORKS**

## Deformation risk is designed out at the joint.

Creep in aluminum joints happens slowly over time when the joint is exposed to heat and pressure. At around **100 °C** and **30 MPa**, aluminum may deform by about **1.5%** after **5 years**, equal to roughly 0.15 mm in a 10 mm profile.

To avoid this, the joint should be designed to keep stress below 30 MPa. Thermal expansion can help compensate part of the movement, while a spring washer helps maintain the required clamping force over time.



Preliminary Results: Two bi-metallic connector types identified, connector specifically designed for aluminum cables and copper connections, significant economic importance.

**WHAT THIS PROJECT DELIVERS**

## From material choice to connection instructions.

The project defines safe aluminum connector designs by setting stress limits below **30 MPa** and linking torque to long-term clamping force.

Accelerated tests are underway, with **3 months simulating 10 years** of charging station use. Results will provide **design guidelines** and evidence to support the shift from copper to aluminum.

**WHO IT IS FOR**

## For OEM, installation, and service teams.

The work is relevant for charger OEMs, manufacturing teams, installers, field service organizations, suppliers, and subcontractors.

Any move **from copper to aluminum** changes connector selection, assembly torque, maintenance practices, and long-term risk management.

**PROJECT SNAPSHOT**

<b>Lead</b> Prof. Juha Varis	<b>Focus</b> Al busbars joints	<b>Timeline</b> 2025-2026	<b>Partner</b> Kempower	<b>Primary output</b> Design rules, instructions and test results
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