

Let Smart
Surface

TACTOTEK

IMSE® Environmental Performance





We want to make technology invisible and seamlessly integrated. We're here to disrupt structures – turning conventional mechanics into smart, natural and interactive surfaces.

An aerial photograph showing a winding asphalt road cutting through a dense, lush green forest. The trees are tall and coniferous, creating a textured canopy. The road has white lane markings and a small dark car is visible in the lower right section. The overall scene is serene and emphasizes nature.

We believe that improved customer experiences should not come at the expense of the environment.

TACTOTEK

Verified IMSE Sustainability

DRIVES MOMENTUM

**70% REDUCTION IN SIZE & WEIGHT,
REDUCED MATERIAL USE**

**SUBSTANTIALLY LESS LOGISTICS &
MANUFACTURING LOCATIONS**

**UPTO 90% REDUCTION IN TOXIC WASTE
WITH IMSE MANUFACTURING**

**80% REDUCTION IN MANUFACTURING
TOOLING**

**Reduce
Greenhouse
Gas Emissions
by 60%
with IMSE**

RECYCLED & BIOBASED PLASTICS

100% RECYCLED SILVER

100% RECYCLABLE**

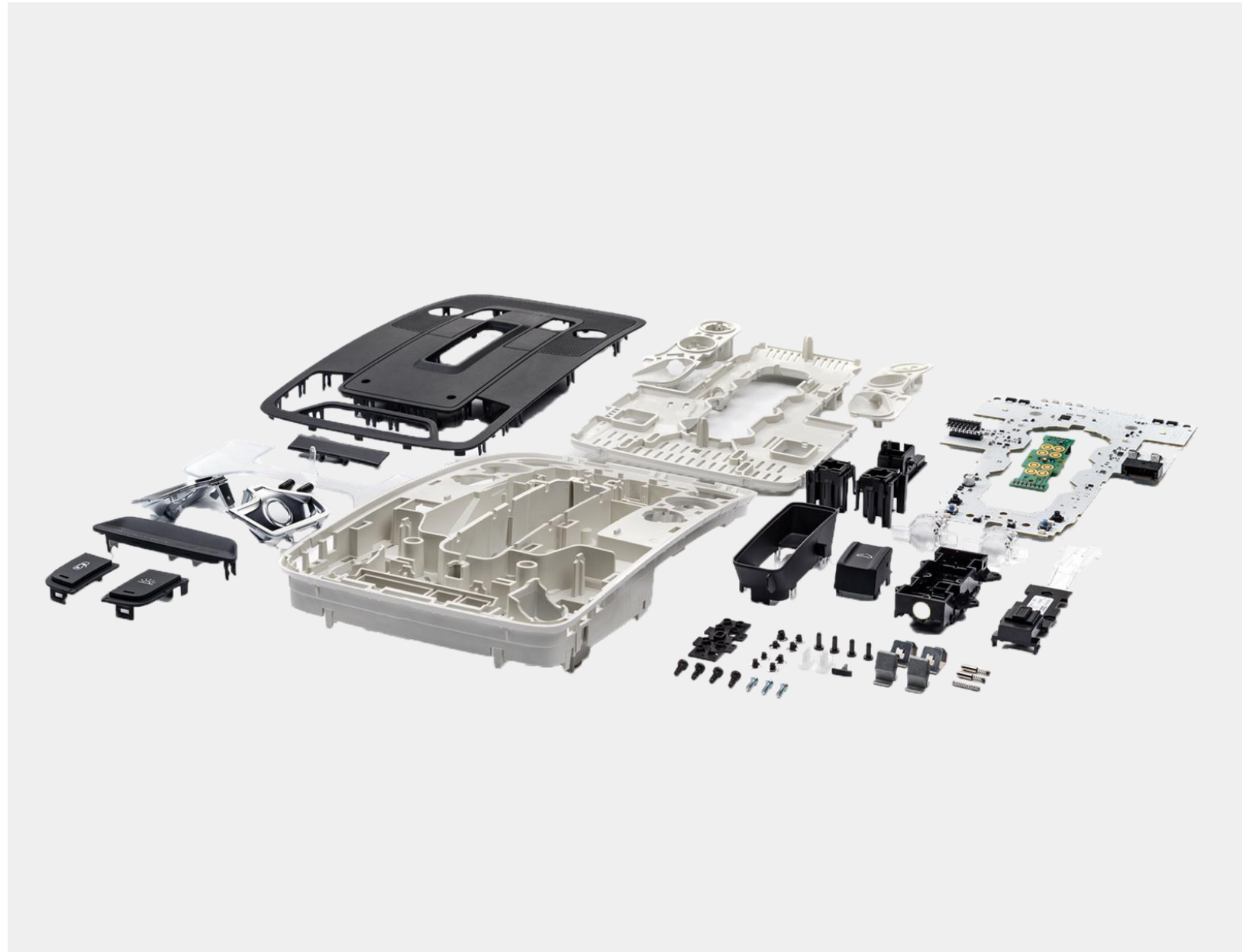
**TARGET: UP TO 100% CLOSE LOOP IN
MATERIALS**

**VERIFIED LIFETIME SAVINGS* IN
AUTOMOTIVE WITH 5 TYPICAL IMSE PARTS >
2 Mt CO₂eq*****

Today: Components in a Box

Conventional Electronics

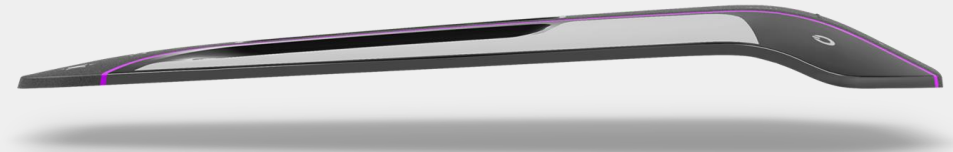
- 64 parts + PCBA
- Costly assembly
- 45mm assembly depth
- 650 grams



The Future of Electronics

IMSE—Seamless smart molded structure

- 1 molded part + small PCBA/internal PCBA
- Fewer parts to design, less tooling, less inventory, minimal assembly
- 3mm molded material thickness, 90% less
- 150 grams, up to 70% less plastics
- CO₂eq, up to 60% less cradle-to-gate emissions



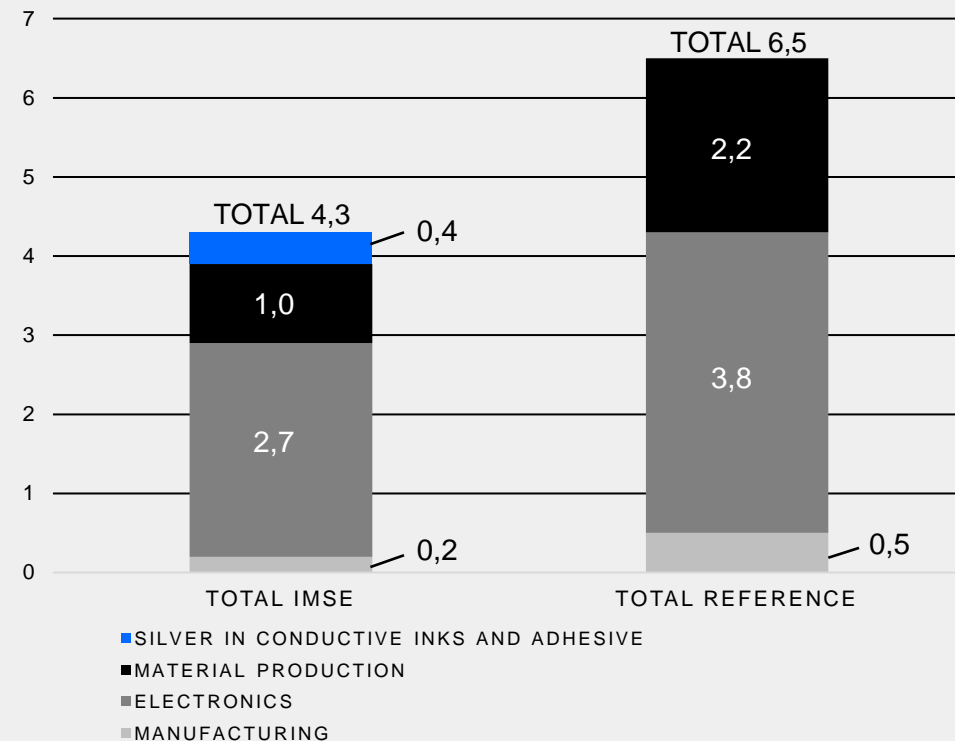
Comparison

Screening LCA and environmental impacts of injection molded structural electronics by VTT

- kgCO₂e = carbon dioxide equivalent kilograms. Globally used unit for greenhouse gas emissions
- Manufacturing covers thermoforming (only IMSE), injection moulding and electronics assembly line. Printing and cutting excluded (IMSE)
- Electronic parts cover circuit boards, solder paste and electronic components, silver in printed conductors and LEDs (IMSE)
- Material production cover plastic raw materials, encapsulant materials (IMSE), solvent and adhesive materials (IMSE), connecting metal parts (Reference) and extrusion of polycarbonate film (assumed production technology for polycarbonate in IMSE)

IMSE and Reference global warming potentials, in kg CO₂eq.

Life cycle stages stacked. Functional unit: one piece of car control panel



Home Appliance LCA



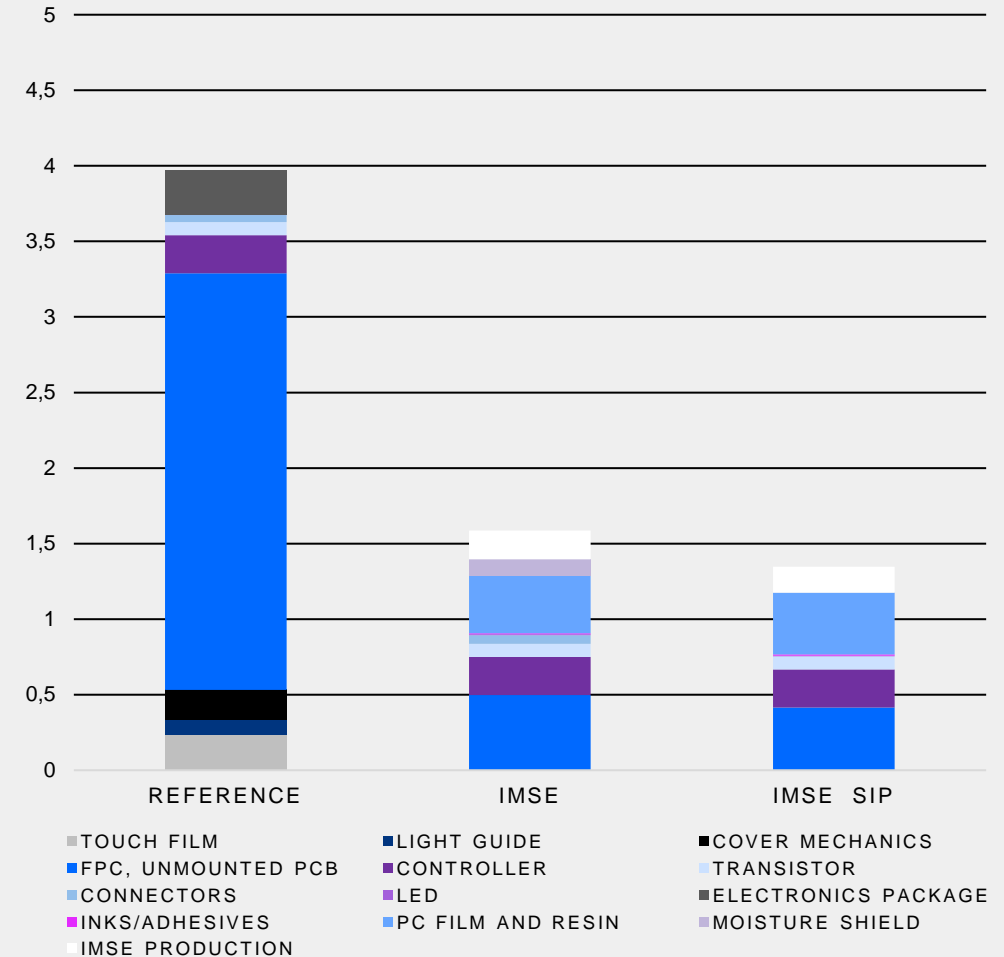
Reference Control Panel Area

Consumer Electronics Control Panel LCA – Conventional vs IMSE vs IMSE SiP

- Greenhouse Gas emissions reduction for IMSE was 56% and 62% for an IMSE SiP control panel
- The most significant factor for GHG emissions is control panel production
 - IMSE solutions can reduce the size of the PCB significantly; with SiP even greater reductions are achieved

LCA study conducted by 2-0 LCA Consultants, Dr. Ivan Muñoz

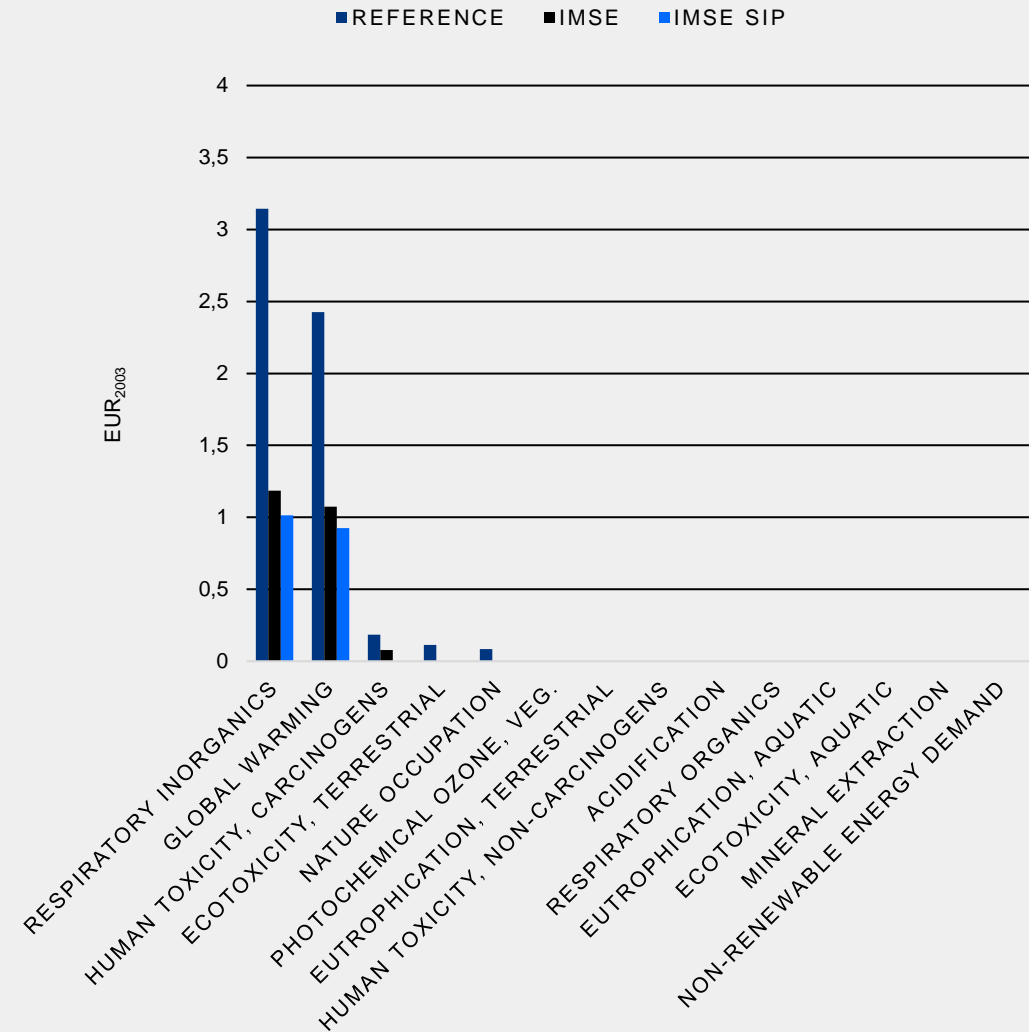
GHG emissions for control panel production in kg CO₂eq.



Consumer Electronics Control Panel LCA – Conventional vs IMSE vs IMSE SiP

- IMSE and IMSE SiP perform significantly better in all impact categories
- LCA conducted according to ISO standards, peer review to be done
- Sensitivity analysis indicate the results are robust

Monetarized impact assessment results in EUR₂₀₀₃



Efficient material recovery and novel technologies

- Recycling of IMSE production waste and IMSE parts enables the circularization of certain material streams
- Current recycling and material recovery technologies enable the efficient and economically viable extraction of silver and other precious metals, such as gold, from IMSE films and other manufacturing waste
- With pyrolysis, a chemical recycling technology, the recovery of plastic monomers and precious metal is economically viable from IMSE parts, too

New technology requires new solutions for sustainability:

- TactoTek is further building it's recycling ecosystem
- Material verification focuses on biobased and recycled materials
- New LCA study with 2-.0 LCA Consultants



Start building
smarter surfaces for
a smarter future

TACTOTEK

TACTOTEK.COM