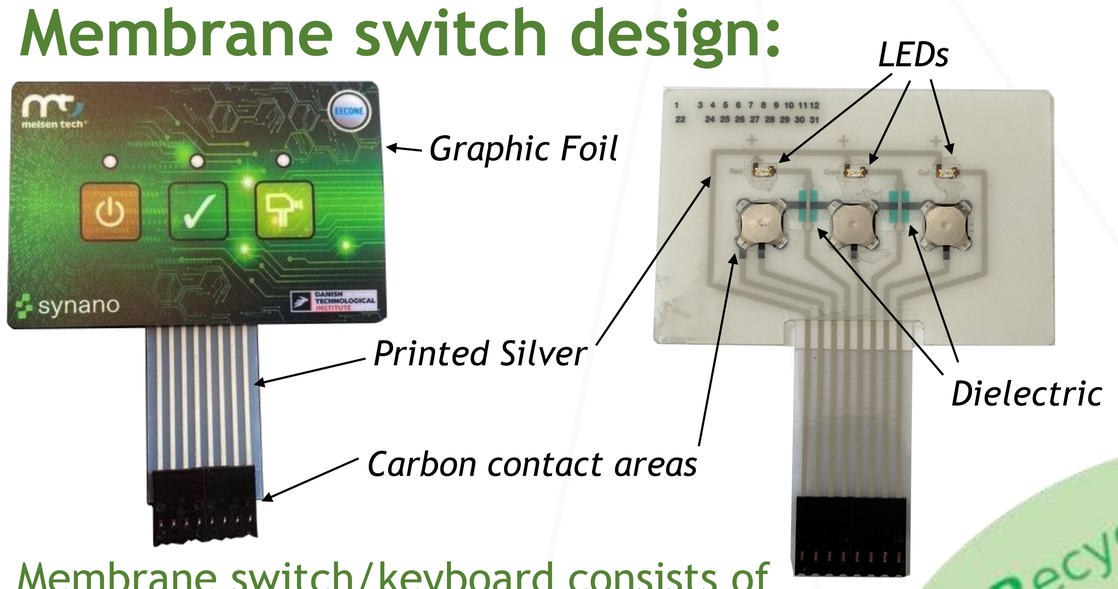
UC-03: Membrane switches improved via the 6R strategy

***Objective**: To provide the large and growing market of membrane switches for digital interfaces with practical alternatives with minimal e-waste generation and reduced environmental footprint.*

Membrane switch design:



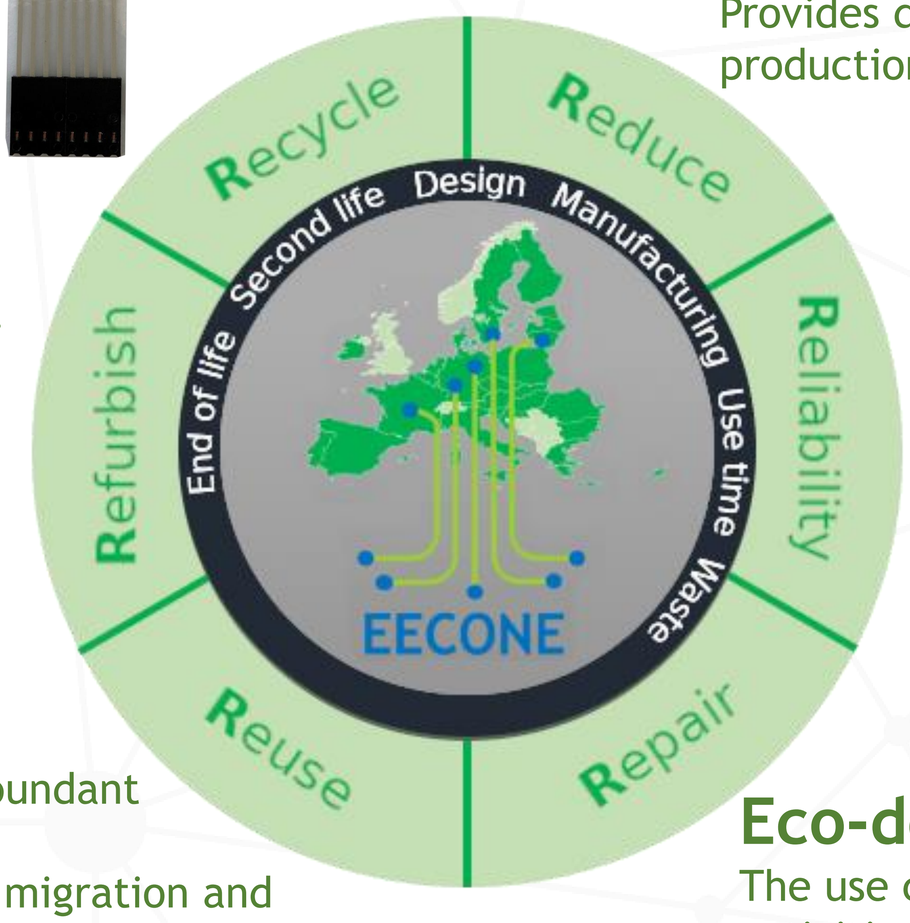
Membrane switch/keyboard consists of a PE circuit using screen-printed silver, dielectric, and carbon materials on a poly(ethylene terephthalate) (PET) foil. Light emitting diodes (LEDs) are mounted on top, and the entire foil is laminated with several plastic layers, including the front graphic foil. Screen printing is the standard method used for membrane switch production.

Methodology:

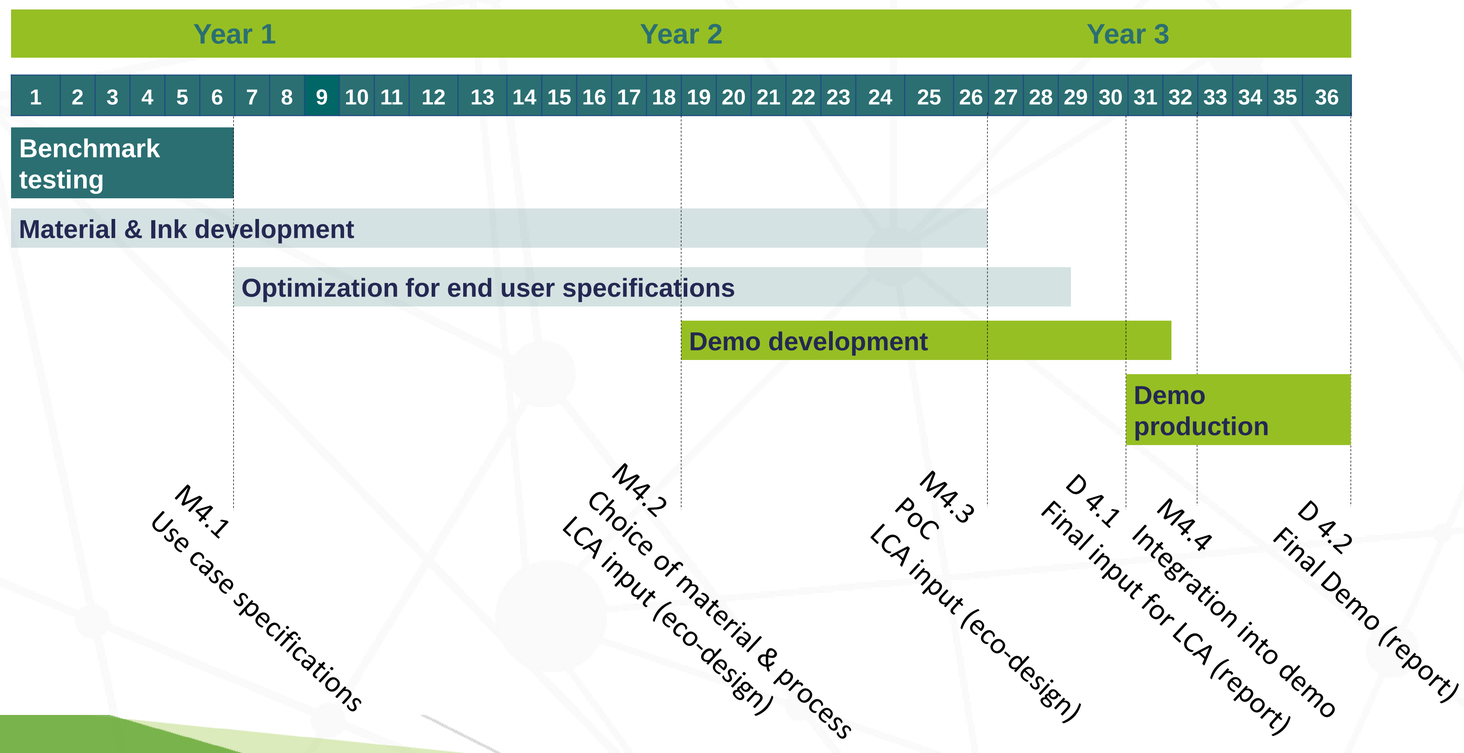
Printing with inks consisting of earth-abundant elements:

- Copper (<10 μΩ·cm) – Reduced silver migration and lower environmental footprint in extraction.
- Carbon (<2.5 μΩ·cm) – Based on sustainable materials and improves robustness.

Develop printing processes for both traditional PET substrates and new sustainable alternatives.



Timeline:



DTI (UC-03 Leader):

Development of accelerated aging standards, copper-based inks and printing methods.
Development of upscaling and pilot scale testing.

Melsen Tech:

Industrial production of membrane switches (>50 years experience to customers around the world).
Provides designs, specifications, benchmarking, production, and validation for the use case.

SYNANO BV:

Development of carbon-based conductive inks developed with sustainable materials.

Tasks:

UC 03 is focused in WP4 with strong ties to task 4.1 (low environmental impact mat.), task 4.2 (reduced mat. use and waste), and to task 4.4 (enhanced lifetime).

Eco-design:

The use case and associated development activities will provide input for the eco-design tool development (WP3 - Task 3.2) and the result (WP3 – Task 3.3) is integrated into the optimization process aiming to reduce material use and waste (WP4 – Task 4.2).

Expected Results:

Demonstrator for membrane switch with minimum e-waste footprint and low environmental footprint.

Eco-designed electronics based on new inks, substrates, and printing methods.

Evaluation of the recycling prospect of the individual parts of the PE system → Reduction of e-waste.

Improved robustness of the product → Decreases the replacement rate.

It is anticipated that the project will extend its lifetime by 20% resulting in a 20% decrease in e-waste.

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