

# iPLUG Project Factsheet



 Horizon Europe – Grant Agreement No. 101069770

 Main Results & Conclusions: WP2 & WP3

## WP2: Medium-Voltage Multiport Converters (MV-MPC)

 **Objective:** Develop and validate MV multiport converter topologies for medium-voltage distribution networks, focusing on the Enhanced Soft Open Point (ESOP) application.

### Key Results:

- Evaluated multiple topologies (non-isolated, isolated, partially isolated) meeting ESOP requirements: bidirectional & decoupled power flow, fault tolerance, and scalable voltage.
- Selected a **partially-isolated topology** combining the advantages of isolated and non-isolated designs.
- Built a **lab-scale prototype** and validated its operation under normal and fault scenarios.
- Achieved robust performance through **Control Hardware-in-the-Loop (CHIL)** validation and experiments, confirming dynamic performance and fault-ride-through capability.

## WP3: Low-Voltage Multiport Converters (LV-MPC)

 **Objective:** Develop LV MPCs for residential & distribution networks, integrating renewable energy sources (RES), energy storage systems (ESS), and electric vehicles (EVs).

### Key Results:

- Introduced **innovative single-stage, non-isolated multiport Y-converter topologies** (symmetric & asymmetric) for LV applications.
- Developed and experimentally validated prototypes showing improved efficiency, compactness, and bidirectional power flow.
- Proposed a **non-linear sliding-mode controller (Loss-Free Resistor)** enhancing dynamic response and stability.
- Carried out **multi-objective optimization**, showing MPCs outperform conventional two-port solutions in efficiency and power density.
- Demonstrated compliance with LVRT & FRT standards, ensuring stable and resilient grid integration.

## Summary

MPCs — at both MV and LV — offer flexible, efficient, and robust solutions to enhance capacity, control, and reliability in modern distribution networks. They enable seamless integration of RES, ESS, and EVs while maintaining power quality and fault tolerance.

