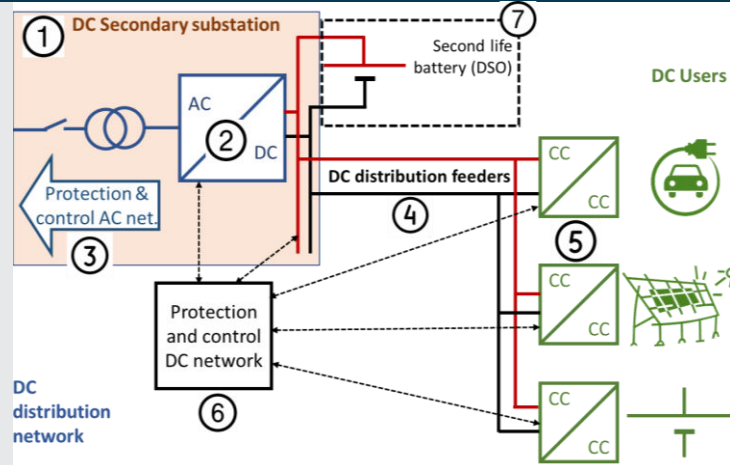


SUCCESS CASE 3.2024

# ASTRA-CC

DEVELOPMENTS FOR A  
REALISTIC PUBLIC DC  
NETWORK

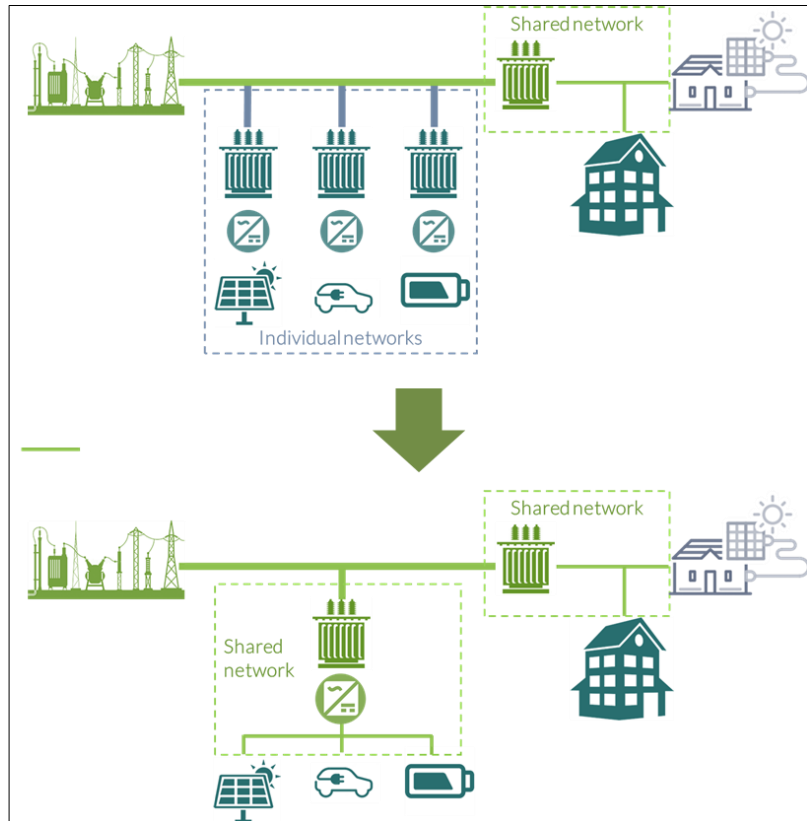


## THE CHALLENGE

The **ASTRA-CC Project** developed by i-DE explores the conditions for the creation of **direct current (DC) networks** with an operation **equivalent to the low (LV) and medium voltage (MV) alternating current (AC) network**. To this end, i-DE started from a situation in which current networks penalize the connections of medium power direct current loads (tens or hundreds of kW) to the MV grid.

The following objectives were identified:

- Fostering the **creation of employment** across the value chain (extensive and long-term approach).
- Designing systems for a fair energy transition, **removing barriers for small facilities and rural areas**.
- **Fostering circular economy**, creating a new market for batteries, extending the battery life with a first-life cycle and a second-life in distribution networks.
- **Saving costs** for renewable and storage facilities.
- **Optimizing cost sharing**, between public networks and users by means of service aggregation.



*i-DE's concept for the development of a DC network (bottom) as an alternative to the AC network (top).*

## THE SOLUTION

The developed solution consists in a public network designed to allow:

- Simple, plug&play connection.
- Service and cost sharing among users and the Distribution System Operator (DSO).

The general objectives included the research of technologies, equipment and control systems that allow the development of an **electrical network architecture for public DC networks**.

## TECHNOLOGICAL OBJECTIVES

The technological objectives of ASTRA-CC were:

1. Designing a new DC secondary substation.
2. Researching new AC/DC multipurpose converters that allowed shared use between the distribution network and its users.
3. Researching new functionalities for power electronics applied to the AC distribution network.
4. Designing new DC distribution networks in LV.
5. Researching DC/DC converters to integrate the different loads that work with DC in the network, e.g., photovoltaic modules, storage systems, and electrical vehicles, including vehicle-to-grid (V2G) technology.
6. Investigating the architecture of a public DC network that combines and coordinates the previous elements and coordinates the protection and control of the network.
7. Researching new circular economy batteries, with a first life in renewables and a second life in distribution networks.

## WAY FORWARD

**The success of public DC networks will depend, mainly, on the ability to demonstrate that it has relevant and provable economic advantages for the connection of renewables and storage** to the grid, so the necessary regulation can be developed. Other aspects, such as improvements in the quality of supply through voltage control or fault management, greater control of flexibility or improvements in the circular economy, are complementary, but they would hardly justify the deployment of DC networks which comes at a higher cost than that of AC networks.

ASTRA-CC focuses on an economic niche in which the costs could be justified as a first step towards a deployment of DC public networks, which could become a complement to the AC networks, without expecting to replace them.