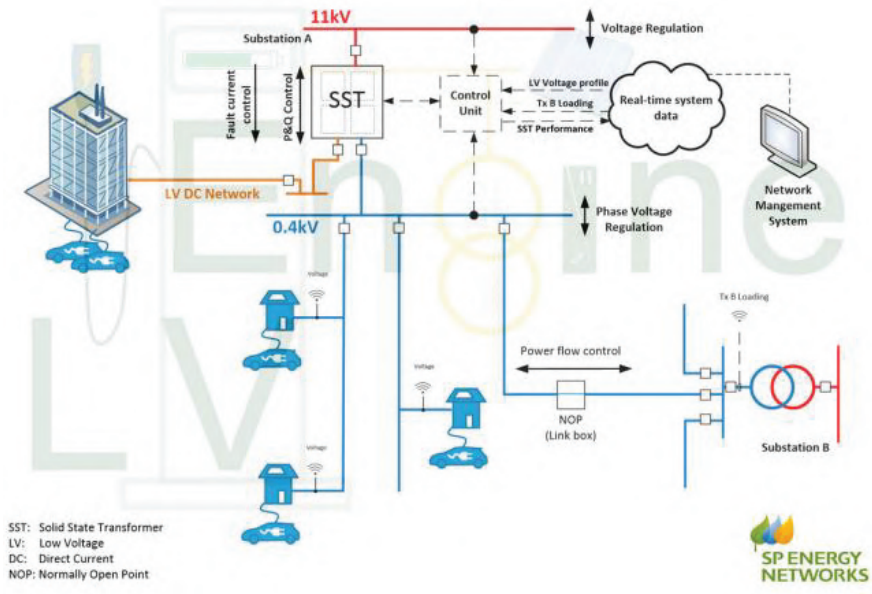
Grid Modernization (SPEN) Case Study

Using Smart Transformers to Accelerate Decarbonization of the Grid

GRIDBRIDGE

Scottish Power's LV Engine project demonstrates how Smart Transformers can be deployed to extend existing infrastructure assets supporting the uptake of low carbon technologies like wind, solar and electric vehicles.

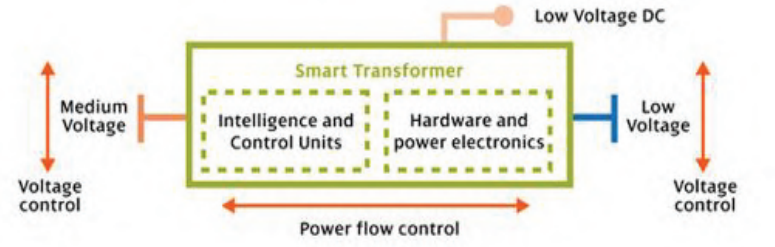


Scottish Power's LV Engine flagship project is an ambitious innovation program to accelerate the decarbonization of the UK electric grid while continuing to maximize use of its existing grid infrastructure investment. The program launched in 2018 and through a competitive bidding

process Scottish Power selected ERMCO as its development and manufacturing partner for a next generation Smart Transformer that will serve as the cornerstone of successful program delivery. A key project objective is to demonstrate how smart transformers can be integrated with existing grid infrastructure to permit the on-boarding of low carbon technologies like wind turbines and electrical vehicles as well as the provision of low voltage DC power at scale.

The Role of the Smart Transformer

Central to the project's design is the deployment of a Smart Transformer (ST) also referred to as a Solid-State transformer (SST) due to the use of power electronic switches. It works as a digitally controlled power electronics converter. The ST provides multiple functionalities over and above the standard voltage conversion of conventional 11kV/0.4KV transformers. Their role is to combine with existing grid power distribution assets to provide the requisite voltage regulation, power flow control and protection needed to manage a significant uptake of distributed energy resources.



Key functionality provided by a Smart Transformer includes:

- Intelligent LV feeder voltage regulation
- Power flow control and transformer load sharing
- Active harmonic filtering
- Reactive power compensation to the 11kV network
- Access to low voltage DC customer supply

Benefits to Customers

The LV Engine project is multi-phase trial program that will be deployed with and extended testing at six different locations across the Scottish Power distribution networks. Once validated the plan is to deploy this capability throughout Great Britain. Successful implementation and wide dissemination of this technology is expected to provide the UK grid with the requisite optimum voltage regulation, power flow control and protection needed to make the LV network flexible, adaptable and ready to support a low carbon future. Importantly the rollout of this innovation is expected to generate substantial ROI by delivering a cost savings to customers of £62m by 2030 and £528m by 2050.