

# Impacts of community energy trading on low voltage distribution networks

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## Abstract-

The wide spread of distributed energy resources (DERs) enabled the transformation of the passive consumer to an active prosumer. One of the promising approaches for optimal management of DERs and maximizing benefits for the community and prosumers is community energy trading (CET). CET gives the prosumers the flexibility and freedom to trade electricity within the neighborhood and maximize their economic benefits besides maximizing local consumption of renewable energy sources generation. Despite the economic benefits of CET for individuals and the whole community, it could cause impacts on the low voltage distribution network (LV DN). Therefore, there is a need for a comprehensive evaluation of the potential impacts of CET on LV DN. This study compared CET with the home energy management system (HEMS) regarding community operation costs and interaction with the retailer. Furthermore, this paper focused on assessing the impacts of CET between prosumers on the phase unbalance of LV DN. Moreover, the impacts on transformer loading, lines loading, and voltage deviations are assessed. Compared to the corresponding HEMS scenarios, the results demonstrate that CET reduces the community electricity cost by up to 31%. CET resulted in better self-consumption by reducing the exports to the retailer by 93% and better self-sufficiency by covering up to 54% of energy demand by community DERs. However, CET resulted in increasing the community peak demand, accordingly, higher impacts on the LV DN. The transformer is lightly loaded in all scenarios. CET resulted in limit violations in some lines, whereas most are lightly loaded. The voltage magnitude and voltage unbalance exceeded the acceptable limits at some nodes of the LV DN.

**Index Terms-** Local electricity market, energy community trading, energy community, transactive energy, distributed energy resources, electric vehicle, energy storage.

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