ENERGY COMMUNITIES IN INDUSTRY – ANALYSIS OF THE EXCHANGE POTENTIAL BASED ON MEASURED LOAD PROFILES

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Summary

In the industrial sector there is a huge energy exchange potential available. This exchange potential reaches from excess heat to surplus power generated by production units like photovoltaics, fossil-based engines or steam turbines. Within the project InduGrid measured load profiles are evaluated and the shifting potential carried out is compared to the potential found in literature. The measured load profiles are analysed by different statistical and mathematical methods.

Motivation and Objective

An enabler for energy communities in industry will be the directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources. Within a single industry, there is a high potential to reduce the peak demand by 19 % to 50 %. By applying demand side management the potential within a region is reaching from 3 to 9 % [1], [2], [3], [4]. In addition, storages play an important role within energy communities. If excess heat produced cannot be used at the same time it can be stored in high temperature storages [5]. Based on this evaluation questions like 'Which companies fit best to form an energy community?', 'Who is going to coordinate the production/transmission and storage of energy in the community?' and 'What are the (economical) benefits of such a community?' should be answered within the project InduGrid.

Methodology

By secondary research the technological, economic and legal boundary conditions are investigated and translated into a mathematical optimization model. This model is used for an energy exchange platform. Companies which join the platform can find matching companies and the algorithms will calculate the exchange potential as well as the costs and benefits caused by the exchange. By field tests in three test beds (Ennshafen, Hagenberg and Wels) the platform and its outcome are proved.

For the first analysis of the load profiles a storage with infinity capacity as well as infinity charge and discharge capacity is used. If the load is higher than a certain threshold the energy exceeding this threshold is stored in a storage unit. If the load drops below the threshold the storage is discharged either until it is empty or until the load rises above the threshold again.

Results

For the analysis of company 1 the threshold was set to 450 kW. In Figure 1 the load profile for an exemplary week is given. The original load profile (light blue) as well as the shifted load profile (dark blue) is shown. It can be seen that the state of charge SOC (grey) is raising when the load is above the threshold and the peaks are shaved. By applying this method in total 30.8 MWh could be shifted in the first eight month of 2019. Extrapolated the potential for a whole year it would be 46.2 MWh. The load profiles for an exemplary week is shown in Figure 1 and for an exemplary day in Figure 2.

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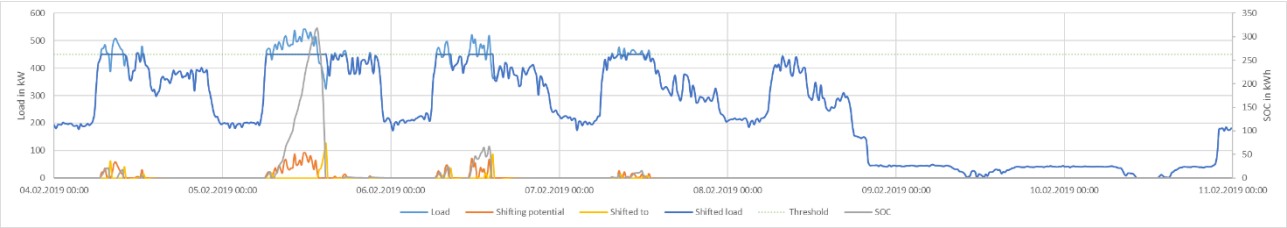

Figure 1: Load profile, shifted load and SOC for company 1 for an exemplary week of the year 2019

Figure 2 shows one day out of the week shown in Figure 1 in detail.

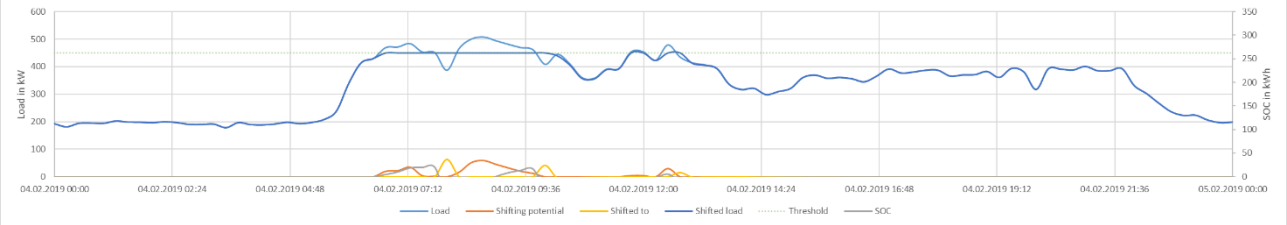

Figure 2: Load profile, shifted load and SOC for company 1 for an exemplary day of the year 2019

Conclusions and Outlook

As the first results show there is possibility to shift 46.2 MWh in one year if a storage unit is used. In case an energy community exists, this energy could be provided by the partners or shifted to the partners.

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