[*PROFITABILITY ANALYSIS OF PV-INSTALLATIONS FOR MULTI- APARTMENT BUILDINGS*]

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Overview

Nowadays the focus of electricity generation is shifted from big conventional power plants towards a decentralized generation based on renewable energy. These initially polititically motivated goals become increasingly important for people in the private sector aswell. Germany poses as the role model in Europe concerning the integration of photovoltaik installations into the system in general, aswell as in multi-apartment buildings. The concept of tenants, being provided with their own solar energy production, is expected to be applicable in Austria and other European cities soon. The goal of this paper is the evaluation of this concepts‘ profitability regarding multiple scenarios of PV-selfconsumption in multi-apartment buildings.

Methods

For this purpose a Matlab-optimization model is implemented to find the optimal dimension of a rooftop PV-installation for a multi-apartment building holding ten apartements. To be able to study different goals, two basic optimization-approaches are conducted - minimal cost- and maximum autarky approach. In order to be more sensitive, these completely opposite approaches are merged via multi-objective optimization. The optimal installed PV-peak capacity can then be found either as the sum of optimal results calculated for every single apartment or as the optimal result for the whole building, which is then considered as total load. The building considered as total load represents a future scenario, which ensures, that synergy-effects, existing between single load profiles, are taken into account. Then, the Matlab-model is expanded with a battery storage, whose optimal storage capacity will also be calculated, to further reduce electricity purchase from the grid.

Results

The results show the impact of different underlying conditions, like electricity prices, rate of return, prices for surplus electricity, on the optimal dimensioning of PV-installations and storages. The two most important szenarios to be considered differ in electricity prices, taken from Germany and Austria. Results show, that the cost-reduction potential for each apartment, when implementing PV installations, turns out to be significant with german electricity prices. Calculation with austrian electricity prices, on the contrary, shows, that cost reduction potentials do barely exist, because of lower variable costs in the electricity bill. The maximum autarky approach leads to maximal possible PV-peak capacity installations, which are just limited by the available rooftop area. The minimal cost approach, in contrary, leads to smaller PV-peak capacity installations, depending on the available prices for surplus electricity and variable electricity prices. In the case of an additional implementation of charging stations for electric cars, the optimal PV-peak capacity to be installed is shifted upwards, depending on the correlation of loadprofiles and sunhours. Further more the results show, that with increasing weighted average cost of capital, less PV-peak capacity is installed and profitability declines. When implementing a battery storage, the optimal storage capacity calculated with german electricity prices turns out to be higher than with austrian ones, which is again because of the variable electricity-price cost difference. The implementation of storages can lead to notable reductions of purchased electricity volumes (down to about 35%).

Conclusions

For the future penetration of such a concept, the legal basis has to be provided for different business models to be developed. These business models should aim at pushing electricity trade between tenants to be sure that synergy effects are taken into account.

References