16. Symposium Energieinnovation 2020

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EnInnov2020

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ENERGY FOR FUTURE – Wege zur Klimaneutralität

Der aktuelle Klimabericht der Weltwetterorganisation (WMO) weist für die Jahre von 2015 bis 2019 nach vorläufigen Berechnungen die heißeste Fünfjahresperiode seit Beginn der Messungen vor rund 150 Jahren aus. Die durchschnittliche Temperatur habe in diesem Zeitraum bereits um 1,1 Grad über jener der vorindustriellen Zeit gelegen. Die durch den fortschreitenden Klimawandel verursachten Auswirkungen (Gletscherschwund, Anstieg des Meeresspiegels, Umweltkatastrophen uvm.) werden dabei immer unmittelbarer für die Menschen spürbar. Eine vor allem von der jungen Generation initiierte und getragene weltweite Bewegung fordert entsprechende Maßnahmen ein, was durch zahlreiche Kundgebungen und Aktionen weltweit zum Ausdruck gebracht wird. Der

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ATLANTIS Electricity Model

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VALUE OF PV AND RENEWABLE ENERGY COMMUNITIES IN SELECTED EUROPEAN COUNTRIES

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Overview

Renewable energy communities (REC), have been introduced in some countries to enable the collective self-consumption of renewable energy. The “clean energy for all Europeans package” makes the collective use of self-generated renewable energy possible all over Europe. This study investigates on the value of PV in selected countries and the benefits of REC. The countries differ in PV irradiance, electricity consumption patterns as well as in grid tariff design. Within the project PV-Prosumers4Grid, the optimal investments in PV and batteries (battery energy storage systems) for individual investments are evaluated, as well as for community investments.

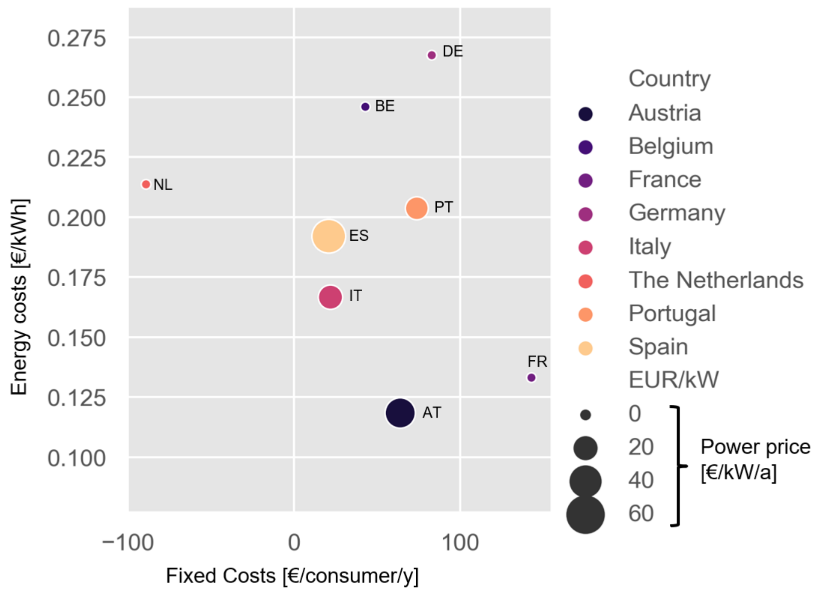

Figure 1: Residential electricity costs for selected countries

A snapshot of residential electricity costs is depicted in Figure 1**Fehler! Verweisquelle konnte nicht gefunden werden.**. E.g. in Germany, some consumers pay twice as much per kWh electrical energy compared to consumers in Austria. France has high annual fix-costs whereas in the Netherlands a “social bonus” even leads to negative fix costs. In 4 countries power tariffs are in place.

Methods

In order to evaluate the monetary benefits of PV, we calculate the electricity costs for a group of consumers in the scenario “grid consumption” and compare it with the costs of optimal PV investments in “No community”. Further cost reduction is possible in the scenario “Community”, where collective PV consumption is enabled and a reduced energy price is applied for exchanging energy within the community.

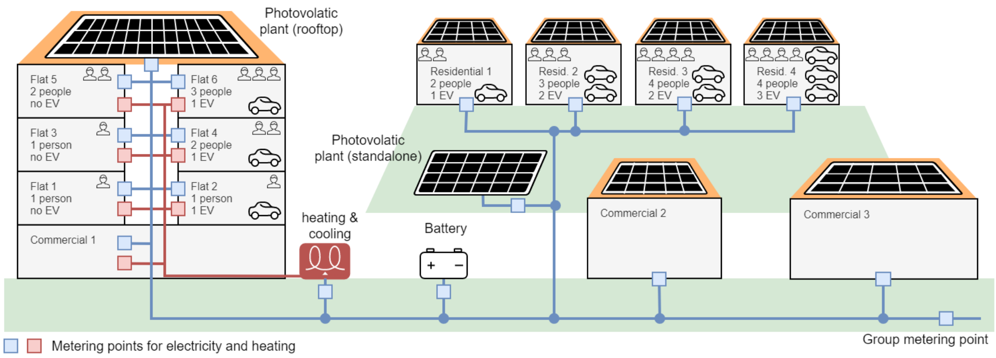

Figure 1: Setup of a renewable energy community - the „European village“

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The setting of the simulation is a “European village” (Figure 2) where we picture the average housing situation of Europeans in terms of people per household [1] together with the average car distribution in Europe [1]. With the Load Profile Generator [5] we generate a synthetic high-resolution electricity and hot-water load profile based on the number of people per household. Sector coupling is assumed for heating (air-heat-pumps) and individual transportation (Electric vehicles).

Results

Due to the high solar irradiance (1200-1500 full-load hours) in the southern countries, as well as a high correlation from PV generation with cooling demand, investments in PV lead to a high cost reduction. High energy costs (€/kWh) in Germany, Belgium and the Netherlands cause cost reductions from 15 % to 20 %. In Austria and France, the cost reductions are between 5 % to 10 % due to the quite cheap energy costs. The community approach leads to a further cost reduction to up to 6 %.

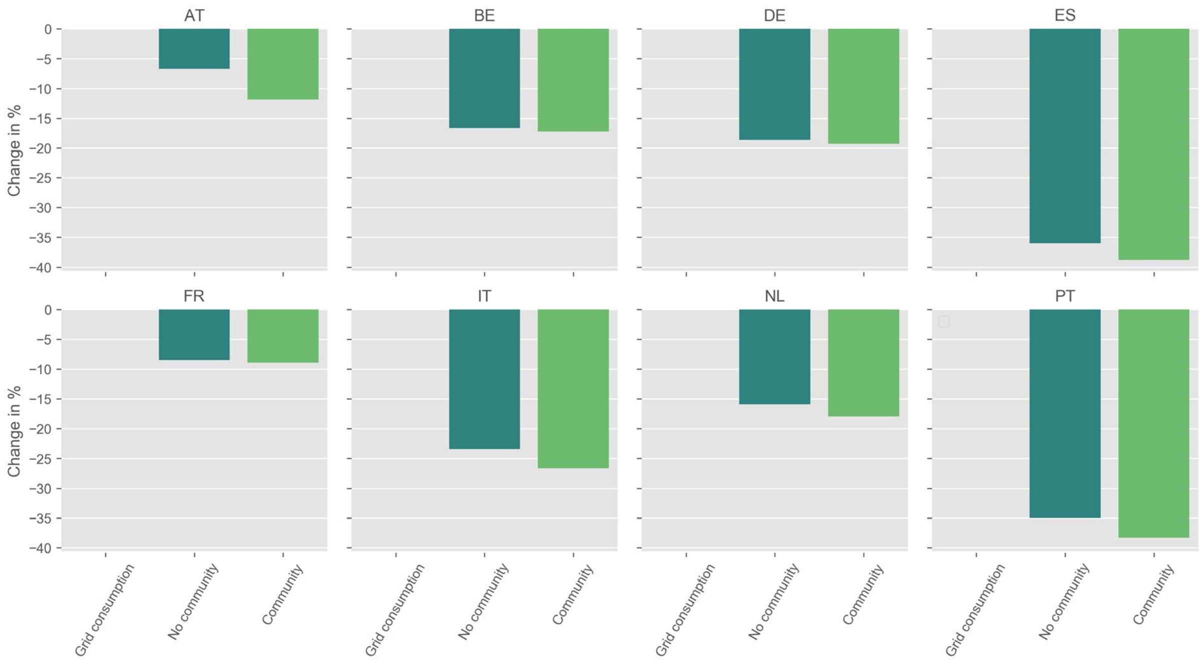

Figure 2: Change in total costs (compared to Grid Consumption) Conclusions

Conclusion

- The benefits of RECs depend mostly on the costs for exchanging energy within the community. If no costs would apply, the cost reductions were much higher.
- Since most PV systems are not perfectly dimensioned to suit the individual demand, the cost reduction for REC in real life applications are usually much higher.
- Renewable energy communities make PV more profitable, reducing the need of subsidies, due to lower investment costs due to community investments and more beneficial due to increased self-consumption.
- The real (non-monetary) benefits are that RECs give access to PV to everyone who is not able to install a PV system in case of building restrictions or rooftop limitations.

References

[1] Eurostat, 2018. Housing statistics and passenger cars in the European Union [WWW Documents], URL https://ec.europa.eu/eurostat/statistics-explained/index.php/Housing_statistics and https://ec.europa.eu/eurostat/statistics-explained/index.php/Passenger_cars_in_the_EU (accessed 11.12.18).

[2] Pflugradt, N. Load Profile Generator, URL https://www.loadprofilegenerator.de (accessed 06.03.19).