

D.T2.1.1

# REPORT ON MEASURES AND PROPOSALS FOR MICROGRIDS AND ENERGY COMMUNITIES

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ALPGRIDS Policy Document

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Short Description
<p>The document summarizes the specific measures proposed by B.A.U.M. Consult GmbH (PP7), Rothmoser GmbH &amp; Co. KG (PP8), and Prof. Dr. Simon Schramm from Hochschule München University of Applied Sciences (member of Alpgrids Sounding Board) to public authorities in charge of energy plans, both at local and regional level. The energy plans were previously selected and analysed by the partner. The measures reported can be already integrated in the energy plan or just proposed to the public decision maker in view of next coming plan updates. Measures are supported by a preliminary qualitative and quantitative analysis estimating their potential impacts, associated costs and recommendations for the implementation.</p>

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# CONTENTS

1	CONTEXT ANALYSIS: LOCAL, REGIONAL AND NATIONAL LEVEL .....	7
2	RECOMMENDATIONS FOR FURTHER DEVELOPMENT OF THE DISTRICT OF EBERSBERG'S	
	Eberberg's ENERGY USE PLAN .....	9
2.1	Tenants and neighbourhood energy communities .....	9
2.2	Continuous data assessment and adaptation of the energy use plan.....	10
2.3	Optimised development of the charging infrastructure for electrically powered vehicles	11
2.4	Making biogas use more flexible.....	11
2.5	Development of wind power use .....	12

# 1 CONTEXT ANALYSIS: LOCAL, REGIONAL AND NATIONAL LEVEL

The German Alpgrids pilot is situated within the City of Grafing, District of Ebersberg, Bavaria. Within Alpgrids, the Rothmoser GmbH & Co. KG has planned a microgrid pilot consisting of a tenant electricity supply scheme in a new residential building which includes electric vehicle charging points.

Grafing is a city in a semi-rural environment 30 km east of Munich. With around 13,600 inhabitants and around 6,100 grid connection points, Grafing has a total yearly consumption of electric energy of approximately 24 GWh. Out of this, 10 GWh are produced locally. This results in a self-sufficiency rate at city level of around 40%.

Rothmoser is a family-owned local distribution grid operator (DSO), combined heat and power (CHP) plant operator, district heating grid and electricity distribution grid operator with 11 employees. Rothmoser owns and operates six public charging points for electric vehicles.

Initially, Rothmoser has planned a pilot microgrid project in the District of Schönblick which was described in the ALPGRIDS deliverable DT1.2.1<sup>1</sup>. This was given up because Germany still fails to appropriately transpose the EU Renewable Energy Directive (EE-RL) into German law. In Art. 22 this directive guarantees the possibility of energy sharing for all EU citizens, but as of end 2021, this option is not foreseen in German law. Especially the cooperation of energy communities and DSO is not defined yet. Moreover, legislation in Germany does not support the exchange of energy between prosumers to avoid grid strain, especially when both prosumers do not share the same house connection. See details in 2.1.

The national legal context is decisive for the implementation of microgrids. The framework for the relevant national legislation is provided by the two EU directives addressing, respectively, renewable energy communities (notion defined in, and used by, the Directive on the promotion of the use of energy from renewable sources (Renewable Energy Directive 2018/2001/EU<sup>2</sup>) and citizen energy communities (notion defined in, and used by, the Directive on common rules for the internal market for electricity (EU) 2019/944<sup>3</sup>) leave it to member states to allow such energy communities to own and operate their part of the grid or not.

Actions at regional and local context are restricted by the national context and this concerns, among others, microgrid deployment. The District of Ebersberg has published an Energienutzungsplan (Energy Use Plan)<sup>4</sup> in 2015. A digitalised version is about to be produced by the regional energy agency Energieagentur-Eberberg-München<sup>5</sup>. The Energienutzungsplan includes local plans for each community, including the City of Grafing.

<sup>1</sup> <https://www.alpine-space.org/projects/alpgrids/en/project-results/wp-t1-creating-a-common-and-shared-understanding-of-microgrids/dt1.2.1-pilot-project-plans>

<sup>2</sup> [https://ec.europa.eu/energy/topics/renewable-energy/renewable-energy-directive/overview\\_en](https://ec.europa.eu/energy/topics/renewable-energy/renewable-energy-directive/overview_en);  
text of the directive: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L2001>

<sup>3</sup> [https://ec.europa.eu/energy/topics/markets-and-consumers/market-legislation/electricity-market-design\\_en](https://ec.europa.eu/energy/topics/markets-and-consumers/market-legislation/electricity-market-design_en);  
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<sup>4</sup> <https://www.energieagentur-ebe-m.de/data/dokumente/konzepte%20ebe%20m/enp-landkreis-ebe-gesamt.pdf>

<sup>5</sup> <https://www.energieagentur-ebe-m.de/>

The regional energy agency is involved in the Alpgrids projects via the Sounding Board, where its managing director Dr. Willie Stiehler is a member. The Alpgrids project was taken as an opportunity to analyse the Energy Use Plan with regard to the deployment of microgrids. This was done by the Alpgrid partners B.A.U.M. Consult GmbH and Rothmoser GmbH & Co. KG together with Prof. Dr.-ing. Simon Schramm from the München University of Applied Sciences, another member of the Alpgrids Sounding Board, and discussed with Dr. Willie Stiehler.

The recommendations for the further development of the District of Ebersberg's Energy Use Plan are presented in Chap. 2. Various options for taking account of them have been considered. At present, the national legal context is expected to change within 2022 as the new German federal government has promised to fully implement the two mentioned EU directives. This will considerably affect the scope for including energy communities and microgrids in the District's Energy Use Plan.

The Alpgrids partners and Sounding Board members involved regionally will search a way of further developing the Energy Use Plan, starting with the City of Grafing. If possible before the end of the Alpgrids project, results of these efforts will be communicated making use of the communication channels offered by the project.



## 2 RECOMMENDATIONS FOR FURTHER DEVELOPMENT OF THE DISTRICT OF EBERSBERG'S Eberberg's ENERGY USE PLAN

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### 2.1 Tenants and neighbourhood energy communities

Sharing renewable electricity in apartment buildings, neighbourhoods and districts allows, for example, to better utilise available roof space for photovoltaic systems, to generate more cheap and locally available electricity from renewable sources and to allow more people to benefit from cheap electricity. It is advantageous that generation and consumption are balanced between more generation plants and consumers and that the energy storage systems required for this balancing can be designed smaller.

Urban development in the district of Ebersberg is characterised by densification. Many multi-family houses are being built, where the use of roof surfaces for energy generation from renewable sources would be important in order to achieve the district's expansion targets for the use of renewable energies. Especially in social housing, tenant electricity models would also help to reduce energy costs and thus promote broad acceptance of the energy transition.

The EU Directive on the promotion of the use of energy from renewable sources of 18 December 2018 requires that "a legal framework be put in place to enable self-suppliers to generate, store, consume and sell electricity without disproportionate burdens". For example, citizens living in flats should be able to benefit from consumer empowerment to the same extent as households in detached houses". The EU directive with common rules for the internal electricity market of 5 June 2019 demands something similar. These demands have not yet been effectively taken into account in German law, but it can be expected that the necessary legal changes will be made in the course of the current legislative period (2021-2025) of the Bundestag (federal parliament). This is supported by various passages in the coalition agreement of the new federal government, in particular the following passages:

- "In order to ensure an economically efficient, socially acceptable implementation of the climate protection targets, in particular oriented towards the tons of CO<sub>2</sub> saved, we rely on precisely fitting and technology-open measures consisting of optimisation of the building envelope, technical systems for the generation and supply of renewable energy at the building and neighbourhood solutions." (2996-2999)
- "We will simplify and strengthen the promotion of tenant electricity and neighbourhood concepts as part of the amendment of the tax, levy and apportionment system." (1879-1882)

At the level of the district, the establishment of renewable energy / citizen energy communities, as defined in the above-mentioned EU directives, should be supported, among other things by providing communal roof and other areas and advice on the establishment, set-up and operation. Currently, the implementation of tenant electricity models is still rare due to technical, legal and billing hurdles. The Ebersberg Munich Energy Agency should build up the necessary expertise to be able to advise interested parties.

## 2.2 Continuous data assessment and adaptation of the energy use plan

Energy use plans are usually prepared at long intervals due to the time and effort involved in their preparation. Often, an energy assessment of the current state is carried out by means of a balance sheet consideration of annual energy quantities. However, the future energy system will be determined by a very large proportion of fluctuating electrical energy generation from photovoltaic and wind power plants. For the development towards this energy system, the planning of the necessary infrastructure and the setting of incentives for the actors involved, a temporal resolution according to calendar years is too coarse and the consideration of energy quantities ignores an essential feature of the future energy supply.

Most components of the infrastructure of the future energy system, photovoltaic and wind power plants, electrical and other grids, electrolyzers and energy storage systems, are characterised by the maximum power that can be produced, absorbed or transmitted. Since the use of these components is predominantly associated with investment costs and hardly with operating costs, it is essentially the maximum output that determines the costs, not the energy generated, transmitted, stored or consumed. In the future, the value of a kilowatt hour will fluctuate considerably more and on very short time scales, as it will no longer be determined only by demand, but also by a very strongly fluctuating supply, as well as by the possibilities of spatial and temporal balancing between supply and demand given by grids and storage, and communication infrastructure and energy markets impacting on their operation. If these balancing options are not sufficiently available, the only option left is to shut down photovoltaic and wind power plants, i. e. to operate them below the currently possible maximum output.

Both for the creation and continuous further development of energy utilisation plans and for the operation of the energy system, data platforms are required at various levels that map all the essential power flows at the respective level down to energy cells, for example from the size of individual towns, as well as within the energy cells (generation plants, flexible and other consumers, grids and energy storage systems).

Such a mapping is already being done for the entire German energy system to some extent by <https://energy-charts.info>. The data collected at short intervals allow a quasi-continuous recording and representation of the energy flows. Their analysis allows conclusions to be drawn about the relevance of various generation and other plants. This serves as a data-based decision-making and progress control, e. g. for the expansion of generation systems or for energy saving targets, improves transparency and increases the acceptance of expansion measures.

The data collected allows the energy system to be modelled, which represents a digital twin of the real system, so to speak, which enables its optimal operation and allows expansion options and their associated consequences to be mapped and recognised at various levels down to that of an individual energy cell.

## 2.3 Optimised development of the charging infrastructure for electrically powered vehicles

Electricity generation from photovoltaic systems is currently one of the cheapest forms of electricity generation from new plants, along with that from wind turbines, and still has considerable potential for further cost reductions. This means that it can be expected to become the dominant form of electricity generation in the district and that cheap electricity will be available in large quantities, especially during the day.

Electric vehicles should therefore not be charged primarily at night, but increasingly during the day, i. e. in the case of electric cars not at home, but at the workplace. Accordingly, photovoltaic systems should be installed on office and commercial buildings and above car parks. In addition, employers in particular should be motivated to provide charging infrastructure with suitable charging controls that adapt the charging power to the current locally available electrical energy. In this way, the energy supply from local photovoltaic and wind power plants can be used comprehensively instead of transferring it to higher-level grids with losses or shutting down the plants.

The charging power of the individual charging points does not necessarily have to be matched to the maximum charging power of the vehicle batteries. Due to the long parking times, for example, connections with an output of less than 11 kW are also far sufficient to fully charge the vehicle battery. For billing, simplified systems should be offered that, for example, directly use the ID of the vehicle via the (existing) powerline communication for identification and billing, thus simplifying both registration and billing.

In this way, electric vehicles become a flexible load, as they will be increasingly needed in the future for the provision of system services, in order to bring electrical energy generation (from predominantly volatile renewable energies) and consumption into harmony at any moment. Charging electric vehicles at the employer's premises can contribute to this.

The possibility of charging at the employer's premises also supports those employees who live in rented accommodation and do not have their own charging facilities at home. This will improve the acceptance among the population for the conversion of the transport sector to e-mobility.

## 2.4 Making biogas use more flexible

Biogas plants can be used for flexible electricity and heat generation by controlling the substrate feed and intermediate storage of the gas produced. If they are equipped with sufficiently large heat storage tanks, they can be operated purely on electricity demand and balance out fluctuating demand and generation from photovoltaic and wind power plants.

The flexibilisation of a biogas plant is accompanied by an increase in the maximum output, usually to double, occasionally to four times, the original maximum output, whereby the supply of substrate essentially remains the same, but is distributed slightly differently in terms of time. Thus, there is almost no change in overall biogas production and little change in the logistics of the substrate. This should be taken into account when assessing building applications for flexibilisation of biogas plants in the district, and flexibilisation should be facilitated.

## 2.5 Development of wind power use

Wind power represents an important energy source for the generation mix of the future. In our latitudes, photovoltaic systems have much higher yields in the summer months than in winter, while wind energy systems have higher yields in winter. The electrical energy consumption as well as the heat demand for building heating is higher in winter than in summer. From these correlations alone it can be deduced that an energy mix of solar and wind power can reduce the need for seasonal storage. Energy storage is always accompanied by losses of usable energy, which is why direct energy use is always to be preferred. Studies have shown that a ratio of approximately  $P_{\text{Wind}} = P_{\text{PV}}$  is suitable for minimising the seasonal storage requirement.

In the future, it will not only be the amount of energy provided that will be important, but also the time at which it is provided, which is why the use of wind power also makes a lot of sense in southern Germany, despite the known low average wind speed. The latest developments in wind turbine technology have led to the fact that good yields can also be generated for southern German wind conditions, given the appropriate turbine dimensions. The acceptance within the population depends on the understanding of the necessity of this energy production, as well as on possible participations in the plant yields, which is why it should be ensured that the added value can essentially be "skimmed off" by a large part of those affected.