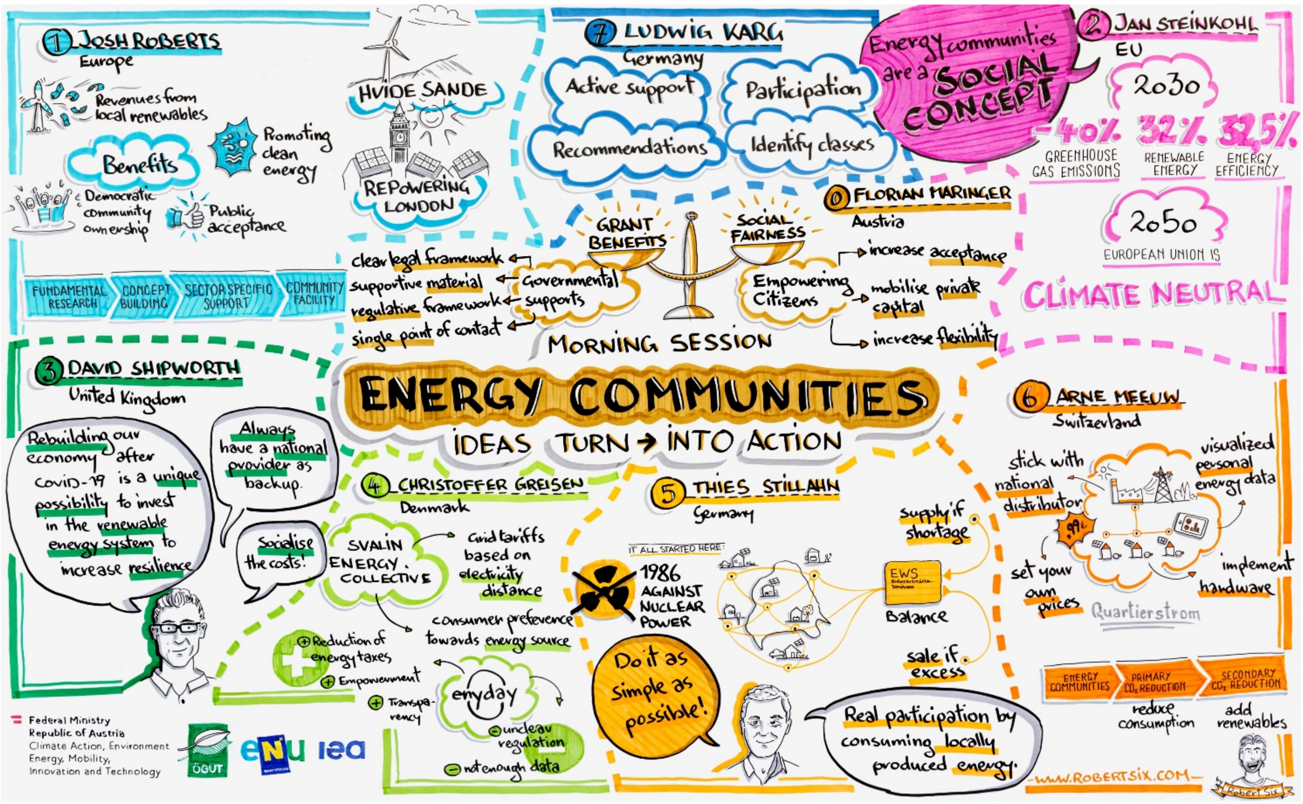
ENERGY COMMUNITIES

SUMMARY REPORT



A webinar organised under the auspices of the

IEA Experts' Group on R&D Priority Setting and Evaluation (EGRD)

Thursday, April 23rd 2020 09:45 – 12:00 (CEST)

Hosted by the Austrian Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology in cooperation with Klima- und Energiefonds, Standortagentur Tirol and Energie Tirol.

Executive Summary

Introduction

On 23 April 2020 delegates to the IEA Experts' Group on R&D Priority Setting (EGRD) organized an online meeting to gain further knowledge of the research and innovation needs associated to energy communities. The aim of the half-day webinar was to provide insights into energy communities and their opportunities and challenges arising from current market and regulatory regimes. The event was hosted by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK).

Rationale and Background

The transition to a sustainable energy system with large shares of renewable energy sources is radical and requires innovative ways of designing, organising and operating the whole system to divert from the traditional centralised system with the notion that citizens are passive consumers of the energy generated. The rapid development and uptake of renewable technologies and distributed energy over recent decades, facilitated by supportive technological and social innovations, as well as growing government efforts with climate change initiatives and policies to promote clean energy, is now rapidly altering the electricity industry landscape worldwide[1].

It is expected that the ratio of distributed energy capacity deployment compared to new centralized generation might reach 5:1 globally by 2024[2]. The overlapping role of energy consumers and producers results in prosumers, but it remains an open playing field with ownership models and enabling framework conditions that they face as an impact of such energy communities. The emergence of "energy communities" reflects the individual community energy needs, their desires and engagements in addressing social, environmental, and economic opportunities and challenges in local energy production and use.

In relation to energy communities there are two official EU level definitions; "Renewable energy communities" or "Citizen energy communities". This is stated in the EU's "Clean Energy Package (CEP)", which will be implemented over the next few years. These definitions of energy communities describe a way to organise collective cooperation of an energy related activity around specific ownership, governance and a non-commercial purpose (as opposed to traditional market actors). After a period of largely uncritical acceptance of the idea of energy communities, critical approaches view communities as much more complex with potentially problematic relations between communities and other institutions, with different meanings and as sites of contestation, difference, tension, and distinction.[3] [4]

The aim of the webinar is to provide insights in energy community examples of the electricity sector, the opportunities and challenges they pose for current market and regulatory arrangements, and how they might be further facilitated. In this workshop, we will focus on two fundamental questions, which we will address through stakeholder inputs in the morning session which IEA EGRD committed.

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[1] Typology of future clean energy communities: An exploratory structure, opportunities, and challenges. Energy Research & Social Science 35 (2018) 94–107

[2] Navigant Research, Installed Distributed Energy Resources Capacity is Expected to Total $1.9 Trillion in Investment from 2015 to 2024, J. Eng. (2016)

[3] Aiken, G.T.; Middlemiss, L.; Sallu, S.; Hauxwell-Baldwin, R. Researching climate change and community in neoliberal contexts: An emerging critical approach. WIREs Clim. Chang. (2017) 8, 1–14.

[4] Bristow, G.; Cowell, R.; Munday, M. Windfalls for whom? The evolving notion of 'community' in community benefit provisions from wind farms. Geoforum (2012) 43, 1108–1120

Issues Addressed

How do Renewable Energy Communities (RECs) contribute to a sustainable energy system?

- What characterizes a renewable energy community (ownership structure, governance and purpose)?
- What are the pros and cons of RECs in fostering the energy transition?
- What is the business model of energy communities, not least regarding access to financing instruments or partnership schemes?
- How do RECs influence the electricity system with respect to security and climate protection?

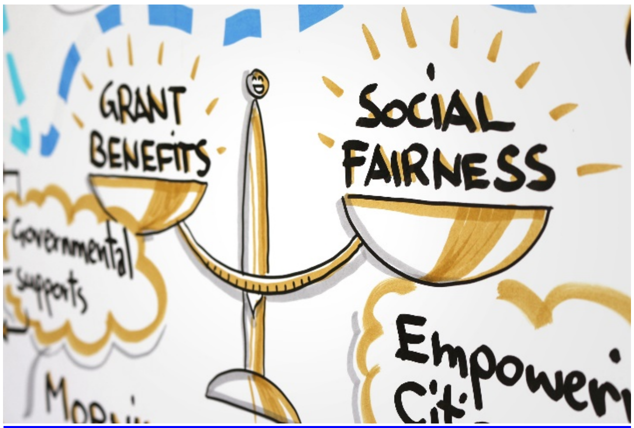
What are the unknowns of RECs - technical, political, social and economic?

- Which aspects are addressed by ongoing R&D projects with respect to REC?
- How can R&D support the further implementation of REC?
- Which role do RECs play in large-scale energy labs/show case regions?

Welcoming Session and Keynotes on Energy Communities

The workshop was opened by Michael Hübner (BMK) and Hemma Bieser, from the organising committee of the Mission Innovation Austria Week. They started the day by providing a brief overview of the agenda as well as upcoming online events on energy communities. Besides the webinar hosted by the EGRD in the morning, the afternoon session was hosted by Bridge 2020 and ERA Net – Smart Energy Systems and included an additional ten presentations of energy communities examples from all over Europe.

The morning session, which was attended by more than 300 participants from 28 countries, was opened by Florian Maringer (BMK), who talked about the purpose of the concept of "energy communities" to increase the acceptance of citizens for renewable energy projects, to mobilise private capital for the energy transition and to increase the flexibility in the market. Following the EU directives, the Austrian government currently is working on creating a legal framework, which is adaptable, responsive and provides clear definitions. Accompanying measures such as supportive materials or an entity serving as a single point of contact should help to avoid or manage conflicts.



The chair of EGRD Birte Holst Jørgensen, Technical University of Denmark introduced EGRD in general and the webinar in particular. Attention was drawn to past workshops with a strong content connection e.g. `Future Energy Market Designs: Research and Innovation Needs´, ´The Role of Storage in Energy System Flexibility´, ´RD&D Needs for Energy System Climate Preparedness and Resilience´. Another point highlighted by her was the focus areas of the EGRDs' work programme 2020-2022, including R&D policy setting and the linkage to governmental policy objectives, methods and approaches for evaluation the impact and benefits from energy-relevant R&D activities and the understanding of emerging and systemic R&D topics.

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For REScoop.eu, the European federation of renewable energy cooperatives, an energy community is not created simply by involving local citizens in some type of technological innovation in the energy sector. It is the commitment to social innovation that defines an energy community as a distinct market actor apart from other traditional commercial energy companies. Josh Roberts addressed in his keynote the opportunities and challenges that arise from renewable energy cooperatives and gave recommendations for research & development to support the implementation of energy communities.

Among other things, energy communities should be defined as non-commercial market actors and market barriers should be reduced. Local opposition to renewable energy projects (especially the case of wind turbines) decreases when citizens are given the opportunity to invest in and co-own the production installations. This is especially true when local citizens are involved from the very start of the project, a democratic community ownership in the words of Roberts. Stakeholder involvement and direct citizen participation foster social acceptance for renewable energy where citizens not only share in the profits, they also have access to clean energy at a fair price. Sector-specific support for energy communities and the promotion of inclusion (gender aspects, low-income households etc.) also play an important role.

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The energy policy context and the provisions regarding Energy Communities at European level were the subject of the presentation by Jan Steinkohl (European Commission). Despite the emerging nature of the energy community concept, several Member States as well as the EU have taken an attempt to develop regulatory frames for energy communities' operations. On the EU level, the energy community concept is defined in the Renewable Energy Directive (REDII) and the Internal Electricity Market Directive (IEMD). Steinkohl provided a brief overview of relevant articles in the directives, namely Art.16 of the Directive on the Internal Market for Electricity on "Citizen Energy Communities" (CEC) and Art.22 of the Directive on the promotion of the use of energy from renewable sources on "Renewable Energy Communities" (REC). Referring to Art.2 on definitions, he stressed the point that Energy Communities should be understood as a social rather than a technical concept.

Local communities take with them a huge and often neglected potential for the development of social innovation initiatives that can foster a radical transformation towards renewables. The reason for this disregard has to be mainly found in how current research and policies approaches dealing with this transformation are mostly based on a principle of technological substitution and modification of individual behaviour around technologies. Both REC and CEC require open and voluntary participation in the entity. The necessary framework conditions to implement them include enabling all customers to participate and using tools that promote access to information and finance.

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Observations and key messages of the key note presentations
• Energy Communities are a social rather than a technical concept.

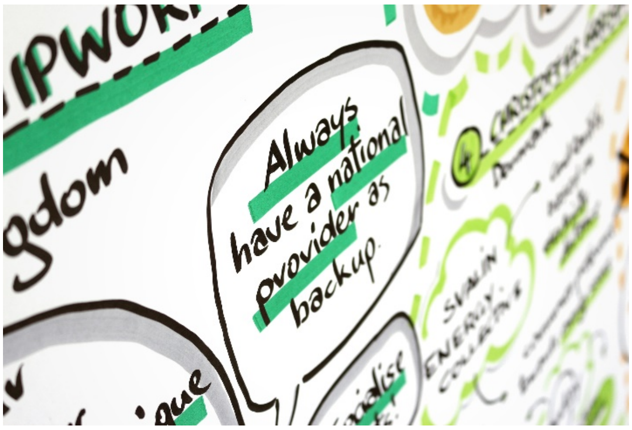
- The benefits of Energy Communities are in promoting clean energy, supporting democratic community ownership, mobilising private capital, and increasing public acceptance of local projects.
- Energy Communities should include an element of fairness, between people who can afford and those who choose or simply cannot take part. Incentives should therefore be linked to the benefit they generate.

National Implementations of Energy Communities

UK & International implementation of energy communities: drivers & barriers
David Shipworth, UCL Energy Institute, UK

Within the UK government funded project EnergyREV, a project to provide academic evaluation of smart local energy concepts, energy communities are much broader than just looking at the physically functioning of the grid but also to look at important questions around policies and governments, social benefits and other multi-vector aspects of whole systems. According to Shipworth, a central challenge in this area is that there are benefits that flow to the physics and engineering at the grid systems, there are benefits that flow to individuals through transactions and markets, and there are benefits that potentially flow to wider society through economic and social value. One of the challenges is that this stack of benefits is misaligned and that any discussion we have needs to make sure that in designing systems we should align values across all three of layers by considering the design of ICT, hardware systems and data architectures.

According to Shipworth, we should start thinking about policy objectives and outcomes, then we drive that through regulatory change, which then motivates business model development and ultimately drives behavior. Shipworth explained that community energy potentially has the capacity to deliver a lot of value and now could be a critical time to be discussing this in the context of post COVID-19 economic stimulus packages. There is a unique opportunity now to shape the way we invest in infrastructures and, if made right, there could be a lot of benefits for the energy systems.



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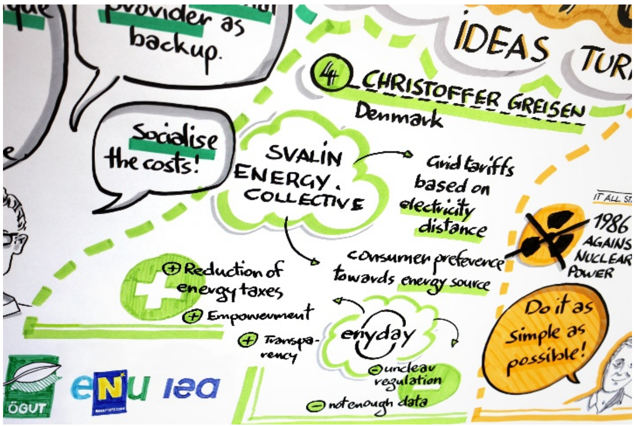
Implementation of energy communities – drivers, barriers, best practices
Christoffer Greisen, DTU Electrical Engineering, DK

Christoffer Greisen started his presentation by introducing the Svalin energy community, a community dwelling with a peer-to-peer trading system and the Delestrøm test case, a project driven by the energy company Norlys. The model used in Svalin is to unlock consumer preferences for using renewable energy and their willingness to pay for that and at the same time also embrace those consumers whose preferences are for low energy prices. In the case of Delestrøm, a digital grid was established on top of the existing infrastructure, with about 100 test customers. The aim of this example was to explore how a local energy community could benefit the area, change the consumption pattern, and understand if a strong local benefit would help engage customers.

The manifold drivers, Greisen mentioned, are a reduction of energy taxes, empowered guilds and owners associations, transparency and the feeling of local ownership, and the delivery of flexibility services. Barriers can be found still in an unclear and uncertain regulation, a lack of real-time data need to do instant operations, or the need of more collaboration among companies to scale up the solution. Clear recommendations were provided in the sense that well established organisation forms (guilds, associations, cooperatives) should be used to develop solutions that can also be activated in the existing building stock.



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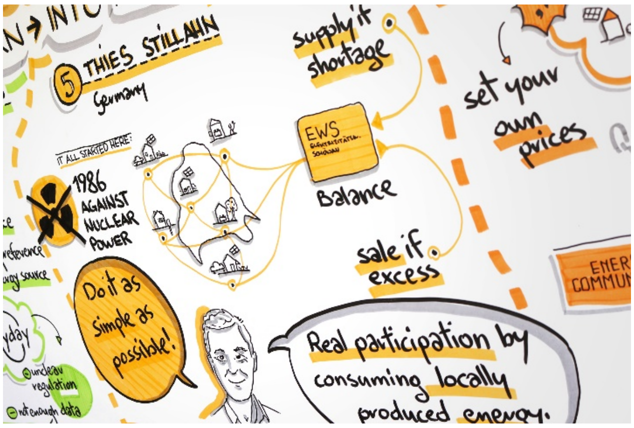
The EWS Schönau energy community showcase
Thies Stillahn, Elektrizitätswerke Schönau, DE

Schönau is a small village in the middle of the Black Forest. As described by Stillahn, everyone knows everyone in the village. This has contributed considerably to the sense of community and thus the possibility of mobilizing a large proportion of the villagers to participate in the community initiative. Elektrizitätswerke Schönau eG (EWS) is an energy cooperative founded by a citizens movement that calls for an end to electricity generated from nuclear energy following the Chernobyl disaster. Since 1997, the local electricity network has been officially in the hands of the cooperative. The registered office is located in Schönau (Baden-Württemberg). The cooperative currently has more than 7.872 members. The cooperative is open to natural persons, partnerships and legally private and public persons, but subject to a number of conditions of affinity and the purchase of shares (min. 5 shares or € 500,) and the signing of an unconditional declaration of accession and approved by the Council (discretionary authority to refuse certain applications).

As a benefit, dividends are consistently issued by EWS Schönau, ranging from 2% to 3.5% of the profit. Although the dividend could be higher, the proposal to increase the amount is consistently rejected by the majority of the members. They want capital to be reinvested in new production facilities and technologies. Stillahn also mentioned the observation, that members of the cooperative share a common interest in contributing to the energy transition. Every year they could meet again, exchange ideas and discuss the energy transition.



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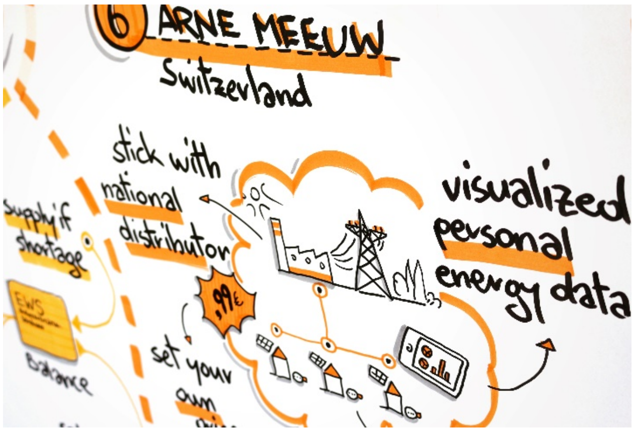
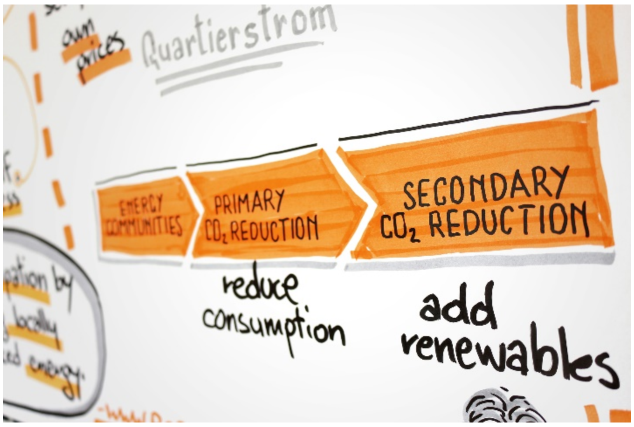
Exnaton and the learnings from the project "Quartierstrom"
Arne Meeuw, Exnaton, CH

The final presentaition of this session was provided by Arne Meeuw, co-founder and CTO lead developer of Exnaton, a students' spin-off of Quartierstrom. The presentation was about the Swiss research project "Quartierstrom", which connects households to form an energy community. The pilot project in Walenstadt was carried out in cooperation with the local energy provider and included a total of 37 participants (28 photovoltaic systems, 8 battery storage systems). At the time of the project start, no smart meters were available, which made the deployment of 75 Raspberry Pis smart performance indicators (PIs) as smart meters necessary. The project team established a distributed platform based on blockchain technology and settled every 15 minutes. Participants were provided a web application visualising their real-time energy data within the community and allowing them to set price options on both the selling (minimum price) and buying (maximum price) side.

Meeuw emphasized that scalable solutions to be rolled-out to a big number of participants require readily available, easy to get and apply hardware and software solutions. Blockchain turned out to be a good software solution to build a bottom-up energy community, however, scalable database technology could also serve as a standard. The user motivation and satisfaction have been reportedly high, with users intensively engaging with the application provided by the team.





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Taskforce on Energy Communities

Ludwig Karg, B.A.U.M. Consult, DE

The morning session was concluded by the presentation of the European Task Force on Energy Communities by Ludwig Karg (B.A.U.M. Consult), who is working on an overview of the state of affairs in various EU countries and tries to show how the development of these can be further facilitated. In his presentation, Karg explained how these approaches can be accommodated within the EU provisions for renewable and citizen's energy communities and what the role of approaches outside the EU regulation is.

Within the taskforce, knowledge on energy communities is created and actively exchanged by participating members. As a result, a categorisation of Energy Communities has been undertaken, leading to the 10 classes. The most important aspects for classification are the participation and organizational structure, the ownership structure, the activities carried out with regards to energy and the main purpose of the energy community.

No	Name	LEC Taskforce
class 1	Collective generation and trading of electricity	all types of territorial or commercial groupings of generators – whether active on the market or under feed-in mechanisms (often called Virtual Power Plants)
class 2	Generation-Consumption Communities	certified sourcing of electricity in a closed group of generators and consumers - not necessarily in proximity but including local or regional energy markets
class 3	Collective residential & industrial self-consumption	generation, storage and consumption in residential cases with multiple dwellings; includes Tenant-Power (Mieterstrom) - models
class 4	Energy positive districts	districts with residential and business entities operating their energy supply systems under their own regime
class 5	Energy islands	real islands or parts of the distribution system that can be operated standalone (e.g. cellular system as in SINTEG, holonic model as in PolyEnergyNet)
class 6	Municipal utilities	existing organizations for energy production, supply and grid operation under citizens' control – directly (e.g. cooperative) or indirectly (e.g. controlled by local government)
class 7	Financial aggregation and investment	a "community" of investors joins to scale the amount of or manage the investment in generation systems (without further involvement in organisation etc.)
class 8	Cooperative Financing of Energy Efficiency	citizens jointly investing in efficiency means of SMEs and municipalities, possibly in their own region (e.g. contracting / ESCO, crowd-funding
class 9	Collective service providers	all types of commercial groupings of energy services (e.g. grouping of EV charging stations, aggregation of demand side management services)
Class 10	Digital supply and demand response systems	all types of digitally controlled energy systems (e.g. implemented with blockchain), these days possibly operated as a sandbox-model

Figure 1. Classes of Energy Communities (BRIDGE)

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Summary and Discussion

Discussions on Renewable Energy Community (REC) have been active especially after its inclusion in the EU Renewable Directive (REDII) on December 11 2018 after which Member states should prepare national transpositions by June 30 2021. Citizen Energy Community (CEC) concept was proposed in the EU Internal Electricity Market Directive (IEMD) in parallel on June 5 2019 and national transpositions should be ready by December 31 2020.These two concepts have overlapping characteristics in local renewable power supply, however, differences are found in the geographical coverage, energy sources, etc.

The workshop presentations covered definitions and categories of energy communities, their roles in local energy transition, national implementations and some showcases. According to the experts, the challenges lie in the upscaling of individual pilot projects, as they are not yet out of the demonstration stage. One of the key tasks for the future is also to align different values in separate levels, such as economic and social values, through political and regulatory measures and incentives. It is necessary to investigate how the costs of infrastructure and the risks of local inequalities can be socialised and, on the other hand, how the formation of ghettos can be avoided. For future R&D activities the development of models for the provision of real-time data is mentioned among other things.

The experts agree on the involvement and acceptance of local stakeholders – this is crucial for overcoming barriers and for the success of the Energy Community. The best practice examples described show that energy communities can promote the use of renewable energy sources also in existing buildings and thus reduce CO_2 emissions. Furthermore, the involvement of communities and their participants in the electricity market can have a positive impact on grid stabilization and flexibility management

EU directives (REDII-REC, IEMD-CEC) and national implementation requests provide a basic framework and political incentive for facilitating energy communities. New services would produce system benefits through new business opportunities by local providers such as aggregation and flexibility supply, system adequacy. Finance mechanism is important part of incentive to encourage private capital involvement.

Remaining challenges of detailed rules are governance, membership, metering and tariffs, inclusion of non-energy service, proximity and its definition (REC only), remote cooperation (CEC only), code structure revision, etc.

REC and CEC emergence would have strong impact on traditional distributers due to potential competition from new distributors. The system can be designed in a competitive way (e.g. bidding) and/or in a co-existence manner. In addition, Peer-to-Peer (P2P) as direct transaction between producers, consumers and prosumers could bypass traditional distribution system operators (DSOs). The non-electric distribution service (e.g. gas, heat, ICT) can be integrated in local system, sometimes with sector-coupling opportunities.

Pragmatic distribution standards and legislations need to be provided in multiple layers, including hardware, software, data architecture and policy & regulation.

Public/citizen participation may be considered a public good, especially if demonstrated successfully in replicating experiences among regions.

ICT is the one of key technologies embedded in REC and CEC concepts and a prerequisite for an energy community. Interaction with the surrounding distribution system, production, consumption and eventually EVs and storage is of high importance for the aggregator and micro-grid archetypes. Consequently, the introduction and spread of smart meters is of critical importance for both archetypes. Local balancing with short term and high-resolution demand prediction and aggregation has huge benefit, coupled with supply side asset management. This technology is crucial in particular when flexibility trading market is open to outside of energy communities. Security concern should be resolved because some data can be open to third parties to provide new services.

Secure data handling and protection is also of importance for participants of energy communities, since there will be an exchange of a significant amount of data related to energy consumption and production.

There are opportunities in social science R&D, because local community behaviour, governance, potential societal impacts evaluations are important issues to realized energy community diffusion in the future.

Observations and key messages of national best practices
• Community energy is characterised by local multiple-benefits value generation, asset ownership and governance. It is the most socially reconstructive model: challenging incumbents and empowering consumers. • Benefits of Energy Communities are reduced energy taxes, more citizen empowerment and participation, and increased transparency. • Barriers can be found in unclear national regulation, a lack of data, data security, no clear pathway to scale, and distributional impacts. • Active involvement and participation of local stakeholders are of major importance for overcoming barriers and for the success of Energy Communities. • ICT plays a key role in realising the REC and CEC concepts. • Distributional impacts are the single most challenge we face. Solutions could be a pay-per-use structure (e.g. kWh/km) to nationalising the transmission network as a social good. • Governments should in a post COVID-19 economic recovery effort take advantage of the unique opportunities which Energy Communities offer in terms of socially and economically robust investments in the renewable energy systems. • Governments should support more R&D in: - facilitate learnings from energy communities across different countries in terms of organisational and legal models, key ICT technologies and market design. - the use of artificial intelligence (AI) and big data for short term predictive markets (to align the market behaviour with energy flows in the grid).