AmsTErdam BiLbao cItizen drivEn smaRt cities

Deliverable 7.2: Functional and operational design of energy data commons

WP7, Task 7.1.4

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0. Executive Summary

The transition of neighbourhoods from using fossil fuels to electricity, increases the demand for electricity and requires households and small businesses to invest in solar panels or wind turbines. It also requires residents to change their behaviour: they have to start using more energy at times when energy from clean sources is available.

This behavioural change is challenging, as not all consumers have the knowledge or motivation to alter the moments at which they use energy. The ATELIER project, experiments with possible ways to support that behavioural change. Energy data commons are one of the ways to do that. Energy data commons are data reservoirs set up by a community of people, such as residents in a neighbourhood. Data commons provide residents with insights into the energy generated from solar and wind sources within their neighbourhood, while also monitoring the neighbourhood's overall energy consumption. As this happens in real-time, the data commons allow residents to see the supply and demand of energy evolve over the day in their neighbourhood, which is information they can use to attune their own energy use to moments when there is a lot of energy from clean sources available. This is expected to serve different valuable purposes: it will help to bring down the total CO2 emissions in the neighbourhood, it will reduce energy costs, but also reduces the burden on the energy grid.

For energy data commons to play this supportive role for residents, however, they first need to be willing to share about the energy use in their own households with their neighbours. As data sharing is a sensitive matter, it is important to involve residents in a reflection on the goals of data sharing and the preconditions that have to be satisfied prior to sharing their energy data with their neighbours. This is the goal of the engagement activities that Waag Futurelab carried out with residents of a neighbourhood in Amsterdam. In this report we describe the results of these activities. We show that residents generally agree that realizing more sustainability is a good purpose for data sharing, but residents do not necessarily agree on the preconditions they would set for data sharing. We describe the various topics they bring forward, and distinguish between groups who are more interested in protecting personal freedom and privacy, and groups who instead are willing to sacrifice some privacy if this will help realize inclusiveness and climate justice in their neighbourhood. By listing the topics, they bring forward and showing how they emerge from different perspectives on data sharing, which are rooted in storylines that emerge from the conversations of residents about data sharing, we show that there are various approaches to establishing energy data commons.

The citizen perspectives and design principles that we describe in this report may be used as input to the technical and social design of energy data commons. The topics brought forwards by the residents are meant to serve as a reference model to inquire further into the specific preferences of residents and get a clearer view on how they want to shape their data common. Eventually, when such enquiries have been done repeatedly, this may lead to creation of one or more value models that can be used as a starting point to create data commons for energy communities and PEDs.

1. Introduction

In the energy transition of Dutch society, 5 million homes must get rid of gas and switch to electricity. In addition, everyone must switch to clean energy, which is generated from sun or wind. The transition of neighbourhoods from using fossil fuels to electricity, increases the demand for electricity and requires households and small businesses to invest in solar panels or wind turbines, and also to change their behaviour: they have to start using more energy at times when energy from clean sources is available.

This behavioural change is challenging, as not all consumers have the knowledge or motivation to alter the moments at which they use energy. The ATELIER project, experiments with the concept of energy data commons, which are data reservoirs set up by a community of people, such as residents in a neighbourhood. Data commons provide on the one hand insight into the energy generated from sun and wind in their neighbourhood, and on the other hand it monitors the energy use of the neighbourhood as a whole. This happens real-time, thus allowing to see the supply and demand of energy evolve over the day, and allowing neighbours to see that and use it to attune their own energy use to moments when there is a lot of energy from clean sources available. This is eventually expected to serve different purposes: it will help to bring down the total CO2 emissions in the neighbourhood, it will reduce energy costs, but also reduces the burden on the energy grid.

The energy grid in the Netherlands is currently designed to accommodate peak times in consumption, while usually only 30% of the capacity is needed. Peak times are expected to increase when medium and small consumers start using more electricity, for example when they switch from gas to electric sources to heat buildings, prepare hot water, cook, and/or charge electric cars. On the other hand, when more people purchase solar panels to generate energy themselves, this will mean that on sunny days the grid also has to process a lot of energy that is coming in. For these reasons, grid operators are asking for a better distribution of energy consumption over time, so that peak loads are reduced and clean energy is used at times when it is available. Energy data commons are a possible way to do that, as it allows residents insight into when energy is generated from clean resources, which allows them to make the choice to use more energy at those times.

For energy data commons to help residents change their behaviour, however, residents first need to be willing to share about the energy use in their own households with their neighbours. As data sharing is a sensitive matter, it is important to involve residents in a reflection on energy data governance; more particularly, about the preconditions they want to see satisfied prior to sharing data about their own energy supply and use in a common with their neighbours. This is the goal of the engagement activities that Waag Futurelab carried out with residents of a neighbourhood in Amsterdam. These citizen perspectives can subsequently become input for the design of energy data commons, as well as for the design of activities supporting inhabitants of neighbourhoods to develop energy data commons themselves – and become more involved as energy citizens.

1.1 The ATELIER project

The ATELIER project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 864374. 8.

ATELIER is part of the European Commission's Horizon 2020 Smart Cities and Communities group of projects and will develop Positive Energy Districts (PEDs) in eight European cities. Coordinated by the City of Amsterdam, the project officially runs from 2019 until 2024 and is a collaboration of thirty partners in eleven countries in Europe. Amsterdam and Bilbao are ATELIER's two Lighthouse Cities that have committed to setting up PEDs, or districts that have a net higher energy production than consumption, integrated into local energy communities and with enormous carbon emission cuts as one main outcome. Bratislava, Budapest, Copenhagen, Krakow, Matosinhos, and Riga are the Fellow Cities that will replicate successful solutions and test PED implementations for feasibility. Together with district users, ATELIER showcases innovative solutions that integrate buildings with smart mobility and energy technologies to create a surplus of energy and balance the local energy system.

ATELIER aims to put **citizens at the centre of its activities** in order to create true citizen-driven PEDs. These activities aimed at the (future) residents of the PEDs, as they are the ones who will be living in the PEDs. Especially the project's Innovation Ateliers are dedicated to strengthening the local innovation ecosystem and thus catalysing conversation between stakeholders at different levels, ranging from industry and investors to local companies and residents. The project thereby takes into account the particular geographic, economic, cultural, and social contexts where PEDs are formed. Citizen and stakeholder engagement plans are included in the project that enhance the development of PEDs in varying districts and cities.

ATELIER's ultimate aim is for more 'positive' cities to arise all over Europe, highlighting the potential of citizens and communities as active players in the energy system (as 'energy citizens' and 'energy communities'). Within Amsterdam several neighbourhoods are interested in becoming a PED. Residents of a neighbourhood called IJburg contacted ATELIER's partner Waag Futurelab, as they had an interest in involving their neighbours in a collaboration with the purpose to help realize a PED.

IJburg is built in the first decade of the 21st century on 6 artificial islands in the IJssellake, in the north of Amsterdam. In 2024 there are 31.700 inhabitants. IJburg has become a diverse and vibrant district featuring a blend of commercial spaces, housing, schools, and recreational areas. Active residents contacted Waag Futurelab in 2023 as they wanted help in bringing neighbours together and supporting them in creating a knowledge base, on which they could build to develop an energy cooperation and eventually invest in technical assets to realize a PED. Waag responded to this request, as it seemed the perfect location for doing citizen science activities to allow people to become aware of their own energy use, and also engage in a reflection on energy data commons.

Waag saw this request as an opportunity to advance the goals of Work Package 7 on Citizen and Stakeholder Engagement, which are:

1. To facilitate participation in the development and deployment of PED services (more particularly; of energy data commons) and technologies, aligning them with the needs, values and realities of the users.
2. To develop general insights on effective and transformative citizen participation and stakeholder engagement in the development of PED technologies and other municipal energy transition interventions, which can inform and help realize the transition towards a PED in other cities across Europe.

1.2 Purpose and Target Group

In ATELIER we are interested in data commons, as they offer insight into energy use in the neighbourhood. Potentially this offers inhabitants of a neighbourhood insight into their own energy use and neighbour's use, as well as into the supply of energy from clean sources such as sun or wind. This insight is a precondition for changing energy behaviour in order to (a) help avoid too high peaks in the energy net, (b) make better use of clean energy sources when they are available, and (c) to potentially reduce energy costs.

Sharing energy data with one's neighbours may however also be a sensitive matter. Hence WP7, task 7.1.4 is about the co-design of energy data commons. The purpose is to engage citizens in a reflection about the management of (potentially) sensitive energy-related data. This input will contribute to a data governance plan and help to identify 'user requirements' for the design of technical devices that will allow neighbours to access this data.

As the WP description says, 'the co-designed result is meant to serve as a reference model to evaluate existing platforms, apps and energy services.' The user requirements and principles that we produce can be taken as a reference point for the design of the actual technical platform of the data common, as well as the organisation of a social collaboration around it.

To serve these project goals of ATELIER, as part of 7.1.4, we are therefore looking to answer the following questions:

- What are goals for sharing of energy data that inhabitants find valuable?
- What are the preconditions for the sharing of energy data that they wish to have respected?
- What user requirements can we formulate on the basis of that for data governance and the technical design of a data common?

These questions will be answered by means of interaction with citizens of the IJburg neighbourhood in Amsterdam. WP7 'Citizen and Stakeholder Engagement' is all about the involvement of citizens and other stakeholders in the formation of PEDs. WP7 consists of several tasks. The current report is a result of the task described under 7.1.4 which is about co-designing energy commons. The way we approached it will also connect to T 7.4 about citizen science, as we will explain below in the method section.

The activities in WP7 link with most other WPs in the project. The closest strategic and operational links are with WP3 (Innovation Ateliers) and WP6 on the development of replication plans. Based on our activities on data commons, we will provide strategies for deploying cocreation processes, which allow to select the most appropriate technical solutions, which fit with the preferences and values of inhabitants regarding data management in a common. This is what T6.4 asks for. Furthermore, we connect to T6.5 as we are exploring the value of methods for citizen engagement in the context of the cocreation of commons, which can be replicated in other contexts. These methods could therefore be a component of an upscaling plan that aims to attune energy data commons to the values and preferences of members of an energy data common.

Furthermore, we relate this deliverable to WP9 on impact and to WP10 on dissemination, communication & exploitation. Through the monthly Steering Committee meetings, WP7 coordinates its activities, ensuring collaboration with all other WPs.

1.3 Contributions of Partners

The following Table 1. depicts the main contributions from project partners in the development of this deliverable.

Partner short name	Contributions	Contribution to this deliverable
Waag Society	Lead of WP7	Main author
TNO	Lead of WP3, the innovation Ateliers	Formal reviewer
UDEUSTO	Main partner representing Bilbao. Lead of Task 7.4 on citizen science	Formal reviewer

Table 1. Contributions of Partners

1.4 Objectives and Expected Impact

WP7 focuses on citizens and local stakeholders as active or passive participants in the energy transition. It considers them primarily as potential users of 'smart' urban solutions and technological innovations, in particular considering the way these solutions fit into the existing social fabric of the neighbourhood. It is clear that the success of implementing PEDs will not only depend on the availability of technical solutions but also on social and behavioural changes. The transition to a PED unavoidably involves a new role for local residents, which is why it is important to involve them in the innovation process. In this way, technology can emerge in tandem with social innovation.

1.4.1 Objectives

The work we did for this deliverable serves the realization of the two objectives that are part of WP7:

1. To facilitate participation in the development and deployment of PED services (e.g., a data common) and technologies, aligning them with the needs, values and realities of the users.
2. To develop general insights on effective and transformative citizen participation and stakeholder engagement in the development of PED technologies and other municipal energy transition interventions, which can inform and help realize the transition towards a PED in other cities across Europe.

The work we did for this deliverable helps to realize both objectives, by involving citizens in a reflective dialogue about the development of energy data commons in their neighbourhood. This facilitated participation in the development and deployment of PED services in a different area of Amsterdam (IJburg), which is not yet a PED, but where citizens want a PED to emerge. Also, the work we did provides a more general insight into how effective citizen engagement can take shape, when considering data commons, and recommendations for the design of energy data commons when developing a PED.

1.4.2 Expected Impact

The work in this WP is expected to contribute to realizing each of the following KPIs:

KPIs (as in deliverable 9.1)

CITIZEN ENGAGEMENT AND PARTICIPATION performance related KPI		
Name	**Unit**	**Description**
Quality of Life	Likert	Improvement of the quality of life for the PED inhabitants
Energy citizenship	Likert	Progress towards energy citizenship
Lifestyles	Likert	Impact on habits and lifestyle towards sustainability
Pulse	Likert	Feeling the pulse - monitoring citizen engagement

Figure 1 Key Performance Indicators (as in deliverable 9.1)

We explain how this deliverable contributes to each of these impacts, bottom up.

Pulse

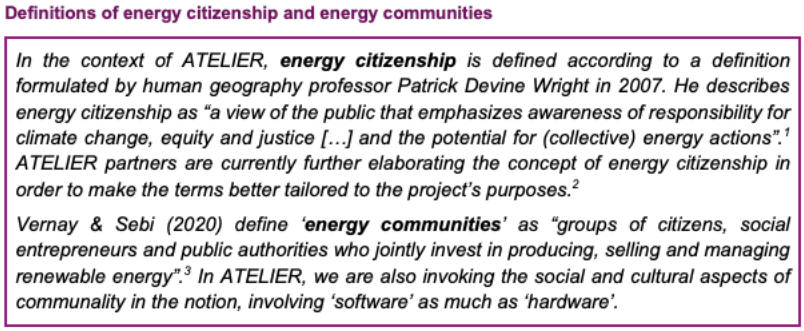
The work in this deliverable contributes to realizing more citizen engagement, as residents of a different area in Amsterdam (IJburg) were involved, which is not one of the designated PED areas. The activities underlying this deliverable contribute to accumulating the number of citizens involved and increasing the number of engagement activities in Amsterdam.

Lifestyles

The work in this deliverable contributes to changing lifestyles, by making people more aware of their own energy use, as well as their dependence on assets such as solar panels, the electricity network, and the energy use of others in the neighbourhood. Based on this, people start to think about the technologies that underlie their energy use and their reflection is enhanced about their own habits, as well as the habits of their neighbours. The deliverable provides stories about people reflecting on their own lifestyle concerning their energy use and the lifestyles of others living nearby. They also converse about whether neighbours should have a say in each other's lifestyles and the potential impact on the collective energy of the neighbourhood.

Energy citizenship

Becoming more aware of one's own energy use, was a lead to also reflect on how citizens can take responsibility and influence how the supply and use of energy is organized in their neighbourhood. The deliverable provides stories on how citizens themselves explore different ways in which they can shape their own role in deciding about their joint management of energy in their neighbourhoods.


Definitions of energy citizenship and energy communities

*In the context of ATELIER, **energy citizenship** is defined according to a definition formulated by human geography professor Patrick Devine Wright in 2007. He describes energy citizenship as "a view of the public that emphasizes awareness of responsibility for climate change, equity and justice […] and the potential for (collective) energy actions".[1] ATELIER partners are currently further elaborating the concept of energy citizenship in order to make the terms better tailored to the project's purposes.[2]*

*Vernay & Sebi (2020) define '**energy communities**' as "groups of citizens, social entrepreneurs and public authorities who jointly invest in producing, selling and managing renewable energy".[3] In ATELIER, we are also invoking the social and cultural aspects of communality in the notion, involving 'software' as much as 'hardware'.*

Figure 2 Definitions of energy citizenship and energy communities

Quality of life

Participants also started to reflect on their quality of life and their need for a continued supply of energy. Furthermore, the gatherings during which residents of IJburg engaged in the workshops were experiences positively. The deliverable brings forward stories of people who experience support from their neighbours when installing the technology, and stories about having fun connecting with others.

1.5 Overall Approach

Objective of the Work Package

The work carried out in this work package was meant to provide input for the technical development of the assets required for a data common. Furthermore, it contributes to the

development of a data governance plan, which focuses on the values that form the goal of the data common and the values that are involved in identifying the preconditions for data sharing.

Ethical Parallel Research

Research that anticipates and evaluates the future impacts of emerging technology on users, is sometimes called 'ethical parallel research'. Ethical parallel research is focused on values and is carried out in parallel to research or development of the technology (Van der Burg 2009; Van Gorp and van der Molen 2011; Flipse et al. 2013). Most often, however, not professional ethicists are involved in the reflection about the value of the (future) technology, but citizens and other stakeholders who had no professional training in ethics and who can therefore be called 'lay ethicists' (Davies et al 2010; Van der Burg 2016).

Ethics vs. Morality

Ethics differs from morality. Morality refers to the values and norms that steer everyday life, and which are taught from parents to children. Sometimes morality is made explicit in rules and principles, but often it remains tacit in people's reactions, emotions, choices and actions. Ethics aims to reflect because they make their values explicit related to an innovative technology and engage in a reflection about these values. This is what ethics is: a systematic reflection about values.

Role of Lay Ethicists

There are reasons to prefer the reflection of 'lay' ethicists to the reflections of professional ethicists. While the reflection of lay ethicists is according to some 'better', because it is sometimes richer and more varied than the reflections of professional ethicists, some of whom are said to focus on just a limited set of values and ethical theories (Kiran et al 2015). But perhaps the more important reason to involve 'lay' ethicists is political in nature. It is often considered problematic that professional ethicists acquire a privileged position in the debate about the value of new technologies; for, as professionals, their viewpoints carry the weight of expert discourse and they are granted visibility and legitimacy which the viewpoints that people who received no previous ethical training lack. This leads to a situation in which not every participant in the moral world has equal power to give shape to the ethical debate about the desirability of a new technology, while eventually they all have to live with the effects of that technology (Felt et al 2008; Van der Burg 2016).

Challenges in Citizen Engagement

In the context of the development of energy data commons, however, residents are supposed to take ownership of the governance of their own energy data. It is therefore important that they themselves reflect on the values that they want to serve with data sharing, and set the preconditions for data sharing. Extra effort should be done to make the debate inclusive and make voices audible that would otherwise not be heard. This is important, if the residents are supposed to take responsibility for how data are shared amongst them, and it also serves to 'increase trust' in data sharing, as no one acquires a privileged role in steering developments in a particular direction.

Ethics is here not carried out by ethical professionals, but by citizens without previous academic training in ethics and who therefore engage in reflections that are sometimes called 'unruly ethics' (Felt et al. 2008), or 'lay ethics' (Davies and MacNaghten 2010; Van der Burg 2016). The purpose of such 'lay' ethical reflection 'parallel' to technology development, is that it aims to engage envisioned end-users in an anticipation of the impacts of a technology on human (social) lives, and enhance reflection about its value. In this sense it fits with calls for

responsible research and innovation, which aims to make technology-development (and research) responsive to the values and needs of envisioned end-users (Burget et al. 2016; Guston et al. 2014; von Schomberg 2011).

Methodology

In the case of this project, residents in a neighbourhood participated in ethical reflection on the future impacts of a tool that would enable them to share data about their energy supply and usage with their neighbours. Having such a conversation about data sharing with inhabitants of a neighbourhood, is however particularly challenging when it comes to energy data. In neighbourhoods there's often a large difference of knowledge and expertise regarding energy use: some know a lot about it, others are quite unaware of the energy that they use, and know little about its sources and how it gets to their homes. This difference of 'energy literacy' complicates the engagement of citizens, as it means that some are quick to develop opinions, whereas others risk to be overruled or marginalized in the conversation, as they lack the knowledge and experience needed to develop preferences regarding the sharing of energy data.

To mitigate this disbalance in (experiential) knowledge about energy that exists in neighbourhoods, we decided to first allow inhabitants to acquire insight into their own energy use and into what it means to share that with neighbours, before engaging with them in an ethical reflection about the value of data sharing and the preconditions that need to be satisfied before doing it. In the ATELIER project we therefore combined the reflections on citizen science activities (which are part of T7.4) and subsequently engage participants in a reflection on the sharing of energy data in a data common (T7.1).

1.6 Deviations to the Plan

Originally the co-design of data commons was meant to engage inhabitants of the PEDs in Amsterdam. This however turned out to be difficult, at first because there were no inhabitants there yet. Afterwards when residents arrived in the PEDs, they did not want to participate because they were busy installing themselves and were quite overwhelmed by the number of requests from ATELIER project partners. In another area in Amsterdam, in the IJburg neighbourhood, however, citizens heard about the project and showed interest in exploring whether to develop their neighbourhood into a PED and they saw the planned reflections about data sharing in a common, as a good way to start those activities.

Given that the ambition of the ATELIER project is also to expand the number of citizens involved in realization of PEDs, beyond the PEDs that are already there, we thought this offered us a good opportunity. Furthermore, doing the work in IJburg serves to realize the objectives of WP7 (described in section 1.5 of this report), which are not exclusively tied to the PED locations in the city of Amsterdam: IJburg offered an opportunity to facilitate participation in the development of PED services, and aligning them with values and needs of potential users; and they allowed us to acquire insight into effective and transformative citizen engagement.

This is the reason why we chose to go along with the request of the residents of IJburg. The results of this research will be transferred to the PED demonstration areas in Bilbao and Amsterdam. Another deviation of the plan described in WP7, was to plan a sequence of activities, which combine the citizen science activities (which are part of T7.4) with the reflections on data commons (which belong in T7.1). We did this because we saw that inhabitants of IJburg did not all have a lot of knowledge about energy. There was a large

difference between the knowledge level of people, which makes it difficult to involve everyone in the dialogue about data sharing. We saw an opportunity in the combination of both task to first support people with citizen science to get insight into their own energy use and the energy use of others in the neighbourhood, before engaging into a reflective dialogue about energy data commons. By combining the two tasks, we allow citizens to first develop awareness of energy use and look at data stemming from different houses which are noted on paper, before engaging in a reflection about their values related to data sharing. We felt this awareness of energy usage was a precondition for the development of preferences regarding data sharing, or a reflection about values. Citizen science allowed to develop that awareness.

1.7 Participants and activities

In total we organized three meetings with activities and dialogue with the inhabitants of IJburg. The meetings had the following content and activities:

1. During the first meeting we did a kick-off, we got to know all participants and asked them to indicate on a map where they live. We gave a presentation to explain the goal of the project, and the sequence of activities. We provided the tools needed to measure energy in their own household: the dongle. And we explained how to install it and monitor energy use. Subsequently, we split up in subgroups and asked everyone to note 'measuring questions': these are questions they could seek an answer to by measuring their energy use with their dongle. These questions were noted on a canvas, and in a personal measuring diary that we provided to everyone. Questions included: what device takes most energy in my house? What is my standby consumption at night? How much energy does my electric car use when it is charging? How much electricity does my water cooker use? We closed off the meeting by wishing everyone a good measuring time at home.

2. During the second meeting, we started out by asking people to share their experiences with the installation of the dongle. Subsequently, we asked people to sit together in subgroups and share the answers they have to the measuring questions. They noted these answers on a canvas and compared the answers across households. Are there things that surprise them in the measurements they did in their own house? Are there surprising differences between their own energy use and the neighbours'? During this second meeting neighbours experience what it is like to share data in an offline manner, by comparing the answers to their measurement questions. We end the meeting by talking about the digital platform where we will collect the data from their individual households together, which will provide insight into their accumulated energy use. We ask for consent to share the data only with the participants in the group.

3. The third meeting starts by a presentation of the digital platform on which we collected the data of various inhabitants of IJburg. This platform shows the peaks and valleys in the energy use of the participants. It also shows the energy supply of those with solar panels. We asked for feedback on this overview: are there surprising elements? What does it mean for them to see this? After this, we start the workshop about values that need to be taken into account when sharing data in a data common.

For the meetings we engaged residents in IJburg. Two inhabitants of IJburg were particularly active and acted as recruiters of participants (ambassadors). They asked neighbours who subsequently spread the word to others residents in the area. Furthermore, Waag Futurelab posted an invitation to participate on the digital platform for the neighbourhood called

HalloIJburg, and spread around posters and flyers in the neighbourhood (in the library, at schools, local supermarket, café's etc.) inviting people to join. Eventually 55 people showed an interest. Of those 55 people, 40 residents actually went to the community library to collect the dongle that we provided to measure energy, and a smaller group also decided to join the meetings.

A number of 15 people joined every meeting (we call this the core group) and during every meeting there were between 3 and 8 extra people present (in total 20 people over the course of the three meetings: 8 women and 12 men) who did not join every time (the variable circle) but who took part nevertheless. In total a number of 34 people joined meetings and also followed the technical instructions needed to make the measurements. We don't know why people who initially showed an interest (by subscribing to the group meetings) eventually did not come. But the people who were part of the flexible circle and who joined only sometimes provided different reasons for not attending to all of the meetings. They gave reasons like: lack of time to join, other commitments, lack of money to invest in solar panels, lack of knowledge about the topic (it is perhaps 'too difficult' for me), don't know whether it is relevant for me as an inhabitant of an apartment building where there is little room to decide for oneself about energy, I have rented a house and decisions about energy are not mine to take. Someone in the core group who joined every time also had his own explanation: 'People in IJburg want to feel free, they come when they feel like it and cannot be forced in any way.'

The core group was composed primarily of men with ages varying between 40 and 80 and one woman (70+). The majority had a higher education (university or applied university), but there were also 4 participants with middle education levels (secondary vocational education). Across these various education levels some people knew a lot about energy, and others did not. The team from Waag Futurelab, as well as the two active inhabitants from IJburg, supported various inhabitants with the installation of their dongle in the P1 meter in order to allow them to measure their own energy use. In the flexible group, 8 more women joined as well as 12 men of varying education levels.

1.8 Focus of this deliverable & outputs for other WPs

In this deliverable, we focus on the data sharing workshop which was part of the third meeting in IJburg. The citizen science activities were described as part of D7.5 on citizen science. It needs to be taken into account, however, that experiences with citizen science preceded the workshops about data commons, and allowed people to become aware of their own energy use and to compare (offline) their own energy use with the use of others, based on the answers to the measurement questions. This awareness was a precondition for development of preferences and values regarding data sharing in a common. The seeds of their own personal reflection on values were already planted during the citizen science measuring activities, which helped them to become familiar enough with each other to be able to express their thoughts openly and freely during the data common workshop.

To enhance reflection about values that residents consider important for the sharing of energy data in a data common, we chose to engage them in smaller groups, and we used cards to be able to give input to their reflective exchange. Cards are regularly used in qualitative research, and are appreciated as a way to engage people (even illiterate ones) in a discussion, especially when they are reluctant to speak or are afraid, they may have nothing to say about the subject (Kitzinger 1994). Cards provide input to reflection and invite a response, even when topics are experienced as shameful or sensitive (Chang et al. 2005; Sutton et al. 2011). Cards are used in a variety of contexts; namely, to stimulate reflection and debate about topics that people do

not usually think about, such as when members of the public are asked to reflect on the design of innovative artefacts (Sealea et al. 2002), or when laymen in science are demanded to explore or assess the value of scientific or technological futures (Davies and Macnaghten 2010; Felt et al. 2014b; https ://playdecide.eu).

As in daily life a lot of the values that people have remain tacit in their actions, emotions, or tacit responses to other people, we developed cards that embody important values (Value Cards). This helps them put their values into words, and develop their own associations with these values. We provided 20 cards with values such as privacy, justice, fairness, knowledge, sustainability etc. The values stem from previous research in other data sharing contexts (Van der Burg et al 2020/2020b). The values on the cards are without explanation, thus allowing participants of the workshop to associate freely about the meaning and content of that value. In this way the cards lead the conversation towards values, while at the same time leaving all participants free to choose the values they prefer and develop their own ideas regarding these values and their meaning for the future governance of energy data in a common. The commons workshops had three rounds:

1. First round, we invited people to reflect on the values in pairs or groups of three, and we asked them to prioritize three values that they would like to have respected when energy data are shared in their neighbourhood.
2. Second round, we joined the pairs of groups of three into larger groups of four or six and asked them to explain their top-three preferences to each other. We asked them to eventually choose three values together (as a group of four).
3. Third round, we joined in the plenary and each group explained their choices to each other.

Figure 3 Selection of Value Cards: inclusion, solidarity, innovation.

The audio of the conversations was recorded and transcribed verbatim and subsequently analysed by two researchers. As we were interested in exploring the values related to the goals of data sharing in a common and the preconditions for sharing data, we conducted the analysis using a grounded theory approach, in which the codes, themes and codebook emerge from the data (Glaser and Strauss 1967; Lingard et al. 2008; Tong et al. 2007). At first, we analysed the transcripts of the groups of participants separately, as we thought this would give insight into how their diverse personal experiences would reveal different meanings and values related to energy data sharing. In the second round, we chose to analyse all groups together

and focused on commonalities and differences in the values and meanings that arise from a comparison between groups. In the first round we linked passages in the transcripts to codes, such as: “data provides an opportunity to learn”, “data can support sustainability”, “data can help more efficient use of energy supplies” or “privacy means no one should interfere in my choices”, “data ownership demands that we get to decide about our data”. Subsequently we ordered the codes under themes, which allowed to acquire insight in their ways of reflecting on the sharing of energy data in a common. We chose themes such as “solidarity within the neighbourhood”, “autonomy and free choice” and “equal effort to realize better energy outcomes in the community”. These eventually provided an ordering to the stories we derived from the input of participants in the workshops.

2 Results

The focus group on values and data commons led to a rich dialogue in every subgroup, as well as during the plenary at the very end of the meeting. During the conversations, people explained to each other how they understand the values that they chose, they questioned each other and invited each other to elaborate their ideas and to question pros and cons of different options. While reading this result section, it is therefore important to realise that it offers a first insight into stories that are still emerging in the conversations of residents, as they are for the very first coming to grips with a possible energy data sharing future; they are looking for the right words, trying out ideas, sometimes pursuing them further, sometimes abandoning them along the way and jumping to new options. The eventual stories and preferences that they end up with at the end of the meeting, and on which we focus in this deliverable, must therefore be regarded as 'work in progress': it provides a first insight into emerging ideas about what matters to the participants in the workshop when considering the data sharing future.

Three main stories emerged from the conversations, which we termed:

- The personal autonomy stories
- The equal effort (or anti-free-rider) story
- The group sovereignty and solidarity story

In the following we will describe the stories and explain the understanding of values that underlies them.

Furthermore, we have developed specific design principles for energy data commons that are based on each community's story and its associated values. These principles take into account the diverse needs and preferences of each group. It's important to note that the design principles are influenced by the specific values and priorities of each group of participants. Our context-sensitive approach ensures that the design principles align with the characteristics and requirements of each group. As a result, the design principles may vary depending on the preferences and values of each community. Additionally, the different groups may not agree on a single set of design principles. The principles focus on functional and operational requirements rather than technical specifics.

2.1 The group personal autonomy story

There are four values that underlie this story and which are prioritized by the storytellers who developed it: ***certainty, efficiency, privacy and autonomy.***

The story starts from the conviction that there needs to be a continues supply of energy. This is what the participants in one subgroup understand the value of certainty to mean in the context of their dialogue about energy data commons. They express a need to be enabled to use energy for the purposes they see fit, such as for cooking and preserving food, washing clothes and crockery, lighting and heating their house or the charging and use of cars and personal digital devices such as computers and phones. To do these things it is necessary to have a continued supply of energy available. If this demands to coordinate energy use with neighbours, then they are willing to take the necessary steps to do that.

'Person A: You just want to make sure that the energy networks normally. That it is constant, that it is managed efficiently, used efficiently. So: few peaks and valleys.'

The group also links the value of efficiency to sustainability. Sharing energy data within the neighbourhood is, according to them, a good way to make energy supply and use more efficient: energy from clean energy sources (sun, wind) is used locally at moments when it is available. This makes the system more efficient and also more sustainable, therefore they take the two values (efficiency and sustainability) to be linked. To serve these two values, it is acceptable to them to share data about their own energy use within the neighbourhood, for it helps to attune their own energy use to the behaviour of others in the neighbourhood and in that way avoid too high peaks, either in the supply or in the use of energy. Realizing more simultaneity in the clean energy supply and energy use, is considered a valuable goal of data sharing in the community, as it contributes to efficiency and sustainability.

While the people developing this story are very open to sharing their data for these purposes, they also want certain preconditions to be respected. Their data need to be treated with care, which means that others should not use data as a basis for criticism of others. The choices people make in their own households about what devices to purchase and how much energy to use, are private and others should not interfere with that. This is important the use of energy can touch on very private information.

'Person A: We want to share data, but confidentially, so to speak. (..) That in the end it is not just thrown on the street, so to speak. (..)

Facilitator: And 'being thrown on the street', what do you mean, for example? What could happen?

Person A: Suppose I have a dialysis machine at home. People say: oh, there's a dialysis machine somewhere. Those kind of things. You just don't want that. Or [they say] why does he have to charge his electric car so often? These are all things that are not necessary at all.

Person B: Yes, no, you don't want to be confronted with that. No.

Facilitator: So, you don't want your neighbours to ask you about your use?

Person C: No, no.

This group is imagining situations to occur in which neighbours could interfere in the energy used in one's own household. They consider this undesirable, as they don't want to have to explain to their neighbours why they are using energy, or how much energy they use, and at what times they use it. Being able to make their own choices autonomously (without meddling of neighbours) is considered a right that should be respected by others. Their trust in data

sharing depends to a large extent on the respect for privacy and personal freedom of choice, which they think ought to be guaranteed. This means that neighbours should not comment on each other's behaviour, but participants also imagine that the system itself could deprive people of energy when their use exceeds a certain level. They consider this undesirable, if the system decides that for you, as the following quotes illustrate.

Person C: That the system shuts you down because you use too much or something. Or that you are obliged to turn things on because it is useful for the system. You must be able to make your own choice, that is important. How we organize our lives is our business and not the business of the energy community

Person B: At the same time, you want to work together, to take each other into account.

Person A: That is again about trust, you contribute to the system, but that you can always make choices within it. (..) It is comparable to buying things. You just want to buy a thing that you need. Not that there's always someone telling you, you can't buy that, because it is made in China or something. In my terms, yes, sorry, I just choose something and that's that.

Person C: Yes. So it may be that [the system says] it is better if you charge your car car now, but you still have the choice to do so, yes or no?

Person A: Yes, I still want to decide for myself. It [the car] needs to be charged now, because I'm going to visit my mother later, so I need the car.

Person B: But for more questionable things, whether it's necessary or not.

Person A: (..) You shouldn't have to explain that either. I actually think so.'

In this group there's also reflection on the value `knowledge' or 'learning' in an energy data common. Especially for one participant in this group this is an important motivator to join an energy data common. She also mentions that 'pleasure' or 'fun' in participating in the group and learning from others is important to her. Eventually the value cards ('knowledge' and 'fun') which she chose were discarded from the final selection of this group, as this did not quite fit with the more general story that was circling around 'certainty', 'efficiency', 'autonomy' and 'privacy', but the value of learning or advising each other does play a role in the conversations of this group too.

Person B: 'Look, (..) you can also compare your own household with that of the neighbours... like: am I doing it right?'

Person A: Learning…I might be less allergic to having someone meddling in my own choices, if there is someone in my group who can tell me, you know….(..). In the house where I live now, there were already solar panels on the roof. I had taken them over [from the previous inhabitant], but they were turned off for an entire year. I didn't notice it. Too bad, missed it all year. (..) If some smart person had seen that and told me immediately, so to speak, when I bought the house; hey, you have solar panels on the roof but I don't see anything coming in. It is nice if someone brings this to my attention.

Person B: 'There should also be some pleasure in doing it. It is also a bit of a challenge (..). So, do you see something in the others' data that you can also learn from? That is also important. (..) You learn from each other.'

Suggestions we derived from the ***personal autonomy story*** about data sharing, was noted in the following table.

1	Data sharing should serve to use available energy more efficiently and keep energy supplies available continuously, whenever people need it.
2	Data need to be kept confidential • Data need to be protected and should not be accessible to everyone • Data cannot end up 'on the street' where everyone can access them
3	Autonomy ought to be respected • Individuals need to be able to make their own choices regarding when, where and how much energy they use • Neighbours need to not interfere in the choices that another person or household makes regarding when to use energy or how much, or regarding what energy providing or using devices to purchase
4	Privacy should be respected • Data anonymization: better to not be able to link energy data to a particular household
	Dilemma: If data are kept private, it is difficult to learn from each other or advise each other. To do that, it is important to link data to people

Table 2. Suggestions derived from the *personal autonomy story* about data sharing

We have translated the suggestions from the personal autonomy story into design principles. As mentioned in the introduction of this chapter, these design principles for energy data commons may vary based on the preferences and values of a community.

- **Efficiency and reliable energy use:** data sharing should serve the efficient utilisation of available energy and ensure consistent and reliable energy access for all users.
- **Data confidentiality**: all data should be protected to ensure confidentiality and restrict access to (on)authorized users.
- **Respect for autonomy:** individuals should have the right to make their own decisions about energy usage without interference from neighbours.
- **Privacy through data anonymisation**: all energy data should be anonymized to prevent linking it to specific households.

2.2 The group equal effort (or anti-free rider) story

Sustainability, trust and equality are the values prioritized by this group. The most important topic of consideration of this group was the quality of the collaboration that is needed in a community to realize trusted sharing of energy data. Sustainability was the first card that they chose, because it was considered the goal and the whole reason why they would consider to share data. It was also considered inevitable, as it was clear to them that everyone has to start living in a more sustainable way:

Person E: `and sustainability...Yes, well, because you also understand that that is an important path. And that you have to go that route anyway. (..)'

As sustainability is the goal of this group, participants talked a lot about the importance of having the feeling that people are 'in it together' to realize it. They want to see that everyone involved is willing to invest in realizing the common goal of sustainability. Sharing energy with others, means then that you can trust others to not only profit from the energy collected with solar panels, but will also do effort to contribute clean energy whenever they can.

Person D: 'And we saw trust more in the context of...If you start sharing things with each other, then my solar panels also become a bit yours and vice versa. So, then you have to be able to trust each other that no one will abuse…Especially based on the idea that you will do something with your energy in a group.

Facilitator: Can you explain that a little further? You're saying that my solar panels also become the neighbour's?

Person D: I don't have an electric car, but when I'm not home and solar panels cause an energy surplus, then the neighbours might use it [the surplus], perhaps.

Person E: Of course, they already do that?

Person D: They already do that, but then it becomes clearer that it comes from me.

Person E: But if it is the other way around, then you have to think about it too. (..) Then neighbours say, I need your energy [for my car], for I have to leave now.

Developers of this storyline find it problematic when there is a disbalance between those who provide clean energy and those who use it. They bring forward the problem of free riders in the community; meaning that some may do very little to realize the shared goals, but they profit from the good behaviour of the rest.

Person D: Or that people (..) say: the neighbours have 16 [solar panels], and they there have 15, I think I only need 6. A bit of strategic thinking, but then you have to... Well, I think trust is important in that. I think that becomes complicated very quickly, about the principle of equality. Are we all doing the same?

Facilitator: And that is important, that everyone invests equally?

Person E: Yes, that you might invest approximately the same thing in the basics.'

Reflecting on the type of behaviour that they would consider desirable in the community; they argue that everyone should try just as hard to do what is necessary to realize sustainability. That means that they should all diminish the peaks in energy supply and use by adapting their behaviour, and they should invest in clean energy sources (solar panels, wind energy) whenever they can. If members of an energy community do not trust each other to do that, and some do a lot more to realize the common goal than others, then this can undermine the collaboration and improved sustainability will fail to come about.

The topic of learning and knowledge also came forward in this group, as a data common is thought to help foster knowledge. While the group sees this as an advantage, they eventually do not choose it as a main value.

Person F: This way you can help and advice each other. I can imagine that there are a few people in such a group who perhaps have a little more time or find it more interesting and do so, I wouldn't mind that so much if people have insight into my use and can advise me.

Person E: Helping and advising that's really what this is all about.

Person F: Oh yes, definitely.'

Considering the topic of knowledge, and relating it to the earlier discussion about provision of an equal contribution to the data sharing community, some participants suggested the data

common should make visible who the people are who contribute with solar panels to the provision of clean energy to the community, and who is only using that energy. Making this visible, would make everyone's contribution common knowledge, and foster reflection on whether and to what extent people are contributing equally to the common goal of sustainability.

Suggestions we derived from the '***equal contribution (or anti-free rider) story*** ', are noted in the following table.

1	The data common should first and foremost aim to realize sustainability in the neighbourhood
2	Everyone participating in the data common should contribute equally to realizing the goal of sustainability by doing effort to reduce energy use or by investing in solar panels for the community
3	Freeriding is forbidden, as it undermines trust in the data sharing community
4	Knowledge sharing should be fostered, about efficient ways to generate and use energy, but also regarding the contribution that people make towards realizing the sustainability goal in the neighbourhood
	Possible dilemma's: • What should be done with participants in the energy data common who are not contributing to sustainable energy provision? • What count as equal contribution to the sustainability goal? How is it decided whether participants contribute enough? • What should be done about unequal motivation or capacity to contribute to the sustainability goal?

Table 3. Suggestions derived from the *equal contribution (or anti-free rider) story* about data sharing

We have translated the suggestions from the '***equal contribution (or anti-free rider) story*** into design principles. As mentioned in the introduction of this chapter, these design principles for energy data commons may vary based on the preferences and values of a community.

- **Neighbourhood sustainability**: the energy data commons should primarily focus on realising local sustainability within the neighbourhood.
- **Equal contribution to sustainability:** all data commons participants should equally work toward sustainability by reducing energy use or investing in community solar panels.
- **Prevent freeriding:** freeriding (the act of benefiting from the hard work and contributions of others while making minimal effort towards the shared goal of neighbourhood sustainability) should not be allowed as it damages trust in the data sharing community.
- **Promote knowledge sharing**: the energy data commons should promote sharing insights on efficient energy usage and contributions to neighbourhood sustainability.

2.3 The group sovereignty and solidarity story

This group prioritized four values: ***data ownership, sovereignty, inclusiveness and solidarity***. These values were used to develop a story about energy data commons in which the community of neighbours is the main actor. Sustainability is not mentioned as a value, but

it is playing a role in the background and provides the reason for creating a data common according to participants in this group.

Person G: `Well look, I think this is the most important thing for me. Sustainability.

Person H: Sustainability, yes of course. That's what we do it all for.

Person G: Yes.

Person H: The future of our children.'

Next to sustainability, this group chose the value 'solidarity' or inclusiveness, as they consider it important that everyone has access to clean and affordable energy.

Person H: Well, I... Maybe a bit brainwashed lately, but something like... Solidarity, inclusion and empowerment... So, I do indeed think, look, we are only sitting here with white, I suspect highly educated, somewhat older men.

Person G: Yes

Person H: …and if we as a community are going to benefit from this, then …. especially if we are talking about sustainability and climate justice…. we should also think about this.

Person G: I completely agree.

Person H: And that may even be an extension of community and justice, but not just for a select group, but for ... perhaps other people who need it even more, who can benefit from it.

Doing effort to involve everyone in the neighbourhood is important for the participants in this group. They think that collaboration in the neighbourhood should have a social goal of making clean and affordable energy accessible to everyone. Collaboration in the data common should not serve to make the rich richer than they already are. Within the neighbourhood they observe that rich people with a lot of tech knowledge and who have a dynamic contract, might use their knowledge to manoeuvre their energy use into the timeframes when the prices are low, and therewith reduce their costs, while others who are less tech savvy pay the highest price. Eventually this could aggravate the divide between the richer and poorer people within the neighbourhood. This is what this group finds undesirable. It is important to share knowledge, in order to enable everyone to have access to clean and affordable energy.

Furthermore, participants in this group want the community to be enabled to act by itself, without interference of (large) tech companies, the government, or energy companies. It is important in this story not to become dependent on such powerful 'others', who may use data to enrich themselves, or steer behaviour of people. Instead, they argue that the community of neighbours should be enabled to act by itself. Participants considered picking the value 'autonomy' to express the importance of independence of the community and the capacity to make choices freely. However, later on, they decided that 'autonomy' is not the right word, as autonomy is often considered to be a property of individuals, while they would rather enhance freedom and strengthen the decision-making power of communities. It is for this reason that eventually they decided to exchange autonomy for sovereignty, as they would like the community to act sovereign from other larger powers, such as big tech companies or the government. It is the community that should be enabled to act as an independent actor in this story.

Person G: So still, I also think about privacy, about honesty, about a little bit of liability and safety. I link all of this to the fact that I do not want the state and the business community to abuse it. .... But I do think that using and helping each other in that triangle to accelerate that energy transition, I am open to that. So, if there are companies that use it for the good of society...

Sharing knowledge and doing effort to involve everyone, is important according to this group. This could compromise privacy, as neighbours can only help each other to learn if data are openly accessible within the group. This allows to see that others use less energy, or have lower costs, and allows neighbours to connect and help each other improve their energy use and consequently produce more sustainability and a lower energy price. This group is willing to give up some privacy to the advantage of the group, as long as the group is not too big and people know each other. The question they were considering is what constitutes a good group size in which it would be acceptable to give up some privacy, and at what point the group becomes too large to trust others with one's data.

Person I: But I do find that privacy, I also think it is a, not secondary, but a...

Person G: Yes, because that is also big tech. I am also allergic to data sharing. But that also applies to the business community and less so to each other.

Person H: Yes, that is why we would like to arrange this among ourselves.

Person I: Yes, but also there, the larger the group of people that participates becomes and the less well you know each other, the less confidence I have that privacy will be guaranteed within the group. Or well, I mean, that it doesn't go outside the group...

The group discusses the privacy issue at length, reflecting on different situations in which it may be problematic to share data with neighbours. Here is a quote illustrating difficulties that they see for personal autonomy:

> *Person I: '…. if you invite your uncle and aunt, they come to your house charge their car at your place, because we have better conditions. Is that allowed or is it not allowed? If my neighbours complain about that, are they right? I often see someone I don't know in our street who comes to empty their car into the waste bins. Apparently, we have more space than he has at his home. It doesn't say anywhere that this is forbidden and yet you look at it a bit like... "Are you coming to dump all that rubbish on us?" That feels strange. That kind of examples, and you also talked about that, it [the data common] should not become a vehicle to check each other, because then it makes you uncomfortable. And that seems likely to lead to misunderstandings, and then you get people complaining and well, you get fuss.'*

The group explores the question how large the group can be to not mind about privacy. They imagine that if the group is rather small, it would be easy to accept the behaviour of others, or the checking that neighbours do of your behaviour. It is said that surveillance of that behaviour is not comfortable, yet they also see an advantage as neighbours can draw your attention to useful things, such as forgetting to turn the lights off, or failing to do the laundry or turn on the dishwasher when there is energy available. They however do not reach a final conclusion on this issue, and go on to imagine possibilities to delegate decisions to machines, which would make such mutual checking of behaviour obsolete.

> *Person G: Well, but look, on the other hand, when the group becomes larger, you can also choose to show certain data at a slightly more abstract level... So, no more. individual use, but more cumulative.*
>
> *Person H: Or simply not combined with a name, with personally identifiable information.*
>
> *Person G: Yes, but if you ..., then it is less noticeable that someone is always doing something crazy at 4 o'clock in the morning. Then the group is so large that it is no longer noticeable (..). And you don't know who it is.*
>
> *Person H: Yes, I think so too. Plus, as a person you don't always have to be in the middle. If your solar panels tell my dishwasher.....that there is power left..... my dishwasher can turn on by itself...*
>
> *Person G: Yes, in the end it doesn't matter who it is anymore... I think that is wonderful... that those solar panels and those dishwashers just talk to each other.*

Based on the '***sovereignty and solidarity story'***, we formulated the following goals and preconditions for data sharing.

1	The energy data common should serve climate justice in the neighbourhood; everyone should be enabled to use the data to their advantage. This can mean that: • Information about data and its meaning for daily actions should be clear and accessible to everyone • Effort is requested of people in the neighbourhood to foster energy literacy and data literacy in the neighbourhood.
2	The energy community should be enabled to take their own decisions and act freely and independently of big tech companies or the government. This could mean that: • Data are governed within the neighbourhood to serve ends that participants find valuable/important • The community avoids dependence on big tech companies or the government
3	All sharing of energy data should serve making the community sustainable
4	The energy community cannot be very large, as people need to know each other to trust each other with their data and to provide support to improve data literacy and energy literacy
	Dilemma: Empowering the community as well as its diverse members to understand information about energy and use it in their own choices, is thought to have priority over protection of privacy. But this is not acceptable for everyone. • Are there (technical) ways to protect privacy and also serve data/energy literacy? • At what point is it not OK anymore to share data with neighbours, and you want to protect your privacy also from them?

Table 4. Suggestions derived from the *sovereignty and solidarity story* about data sharing

We have translated the suggestions from the '***sovereignty and solidarity story'*** into design principles. As mentioned in the introduction of this chapter, these design principles for energy data commons may vary based on the preferences and values of a community.

- **Climate justice and data accessibility:** the energy data commons should advance climate justice by making data accessible to everyone and promoting energy and data literacy in the community.
- **Autonomy and independence:** the energy community should make independent decisions and avoid reliance on big tech companies or government entities. Data governance should be managed within the community, focusing on outcomes that are considered as valuable by participants.
- **Community sustainability:** all energy data sharing should be focusing on advancing the sustainability of the community
- **Manageable community size:** the energy community should be of a manageable size to ensure that members can build personal connections, fostering trust for sharing data and supporting data and energy literacy.

3 Conclusions

Our workshops revealed both common goals and differing interpretations among groups regarding data sharing in an energy data common. More specifically, the three storylines about data sharing that we saw emerging from the conversations gave rise to different ideas concerning the preconditions for data sharing. These storylines that we distinguished are: the personal autonomy story, the equal contribution story and the sovereignty and solidarity storyline.

The sharing of energy data in a data common prioritizes sustainability in all storylines. However, interpretations differ. The *personal autonomy* storyline focuses on efficiency: aiming to achieve sustainability by making the supply and use of energy more efficient. Whereas in the *sovereignty and solidarity* storyline emphasize equal access to affordable energy as the primary goal and climate justice.

In all three storylines, different ideas emerged with regard to the preconditions to satisfy before sharing data. Each of the storylines provided a context to focus on different elements that ought to be considered by energy communities prior to sharing data. In the personal autonomy story, for example, a lot of attention goes to the preservation of individual freedom of choice and action and a protection of individual's privacy, whereas in the context of the other two storylines the storytellers imagine difficulties that may arise in the collaboration between people who contribute to the common. In the equal contribution story, it is considered important that everyone does effort to realize the shared goal of sustainability, and that there are no free riders who profit from the good behaviour of others. The sovereignty and solidarity story draw attention to a data sharing community as a community in which people help each other to acquire the required knowledge to get access to affordable energy. Here efforts are done to diminish the differences between people in order to realize equal outcomes for everyone.

Lastly, different groups think about agency in differing ways. The most striking difference is between the personal autonomy story, where the individual is considered the agent who acts and who needs protection from interference by others; but in the sovereignty and solidarity story, by contrast, it is the community who acts and who needs to be protected against interference by large organisations such as big tech companies or the government.

While it is not possible to derive from this a consensus about goals and conditions for data sharing in a data common, we do think that all of these stories together point to important aspects that deserve to be taken into account and which demand to reflect on individual as well as shared interests and benefits related to data commons, and find an answer to moments in which these might clash. Summarizing, we would identify the following design principles that deserve further consideration in energy communities considering to shape an energy data common:

- **Sustainability**: the energy data commons should prioritize achieving sustainability by using energy efficiently (at times when it is available), while also ensuring affordable energy access for all community members.

- **Data protection**: the data commons should prioritize protecting personal data, while also promoting awareness and mutual learning through sharing insights into each other's data.

- **Freedom**: the data commons should uphold personal freedom in decision-making, while also protecting the community from manipulation by large tech companies or policies that seek to exploit decisions for their own benefit.

- **Autonomy**: the data commons should respect individual decision-making, while also delegate decisions to automated systems which decide what serves sustainability best.

- **Climate justice**: the data commons should commit to fostering equal contributions towards sustainability, while also ensuring equitable outcomes towards sustainability for all members of the community.

These considerations will inform the design of the energy data common. For instance, a mutual learning-focused design may allow some data visibility, while a privacy-focused design would restrict it. Or, a design can reveal information on how much effort everyone does to realize sustainability in the community thus providing everyone motivation to do whatever they can, but a design could instead also show who needs help in improving their behaviour to allow them to get energy at a cheaper price and improve general sustainability outcomes for everyone. Depending on the importance attached to these various topics by the members of an energy community, a design would have to be shaped that fits their demands and provides support to realise the desired behaviour.

Given that the storylines and design principles we identified, give rise to differing ideas regarding the preconditions for data sharing, we doubt whether they can be translated into just one set of user requirements. Given the diversity of values chosen, which partly coincide and partly conflict, we suspect that groups that grow into a data sharing community, will each shape their collaboration in differing ways. The design of energy data commons may therefore have to answer to the preferences of each data sharing community.

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