Normative Challenges in Europe's Digital Infrastructure: A Transdisciplinary Exploration of Smart Meter Data Sharing

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Abstract. With its digital strategy "Shaping Europe's Digital Future", the EU is decisively pursuing the goal of building an innovative data economy. The central building blocks of this strategy are interoperable data spaces, which are intended to enable the sovereign and trustworthy exchange of data across application sectors and national borders. However, despite explicitly formulated regulatory principles, it remains unclear how these can be made tangible in concrete implementation. This paper offers a conceptual contribution to the design of data spaces by examining the diverse perspectives involved and the value conflicts that arise between them. Drawing on our experience as designers in an EU energy data space project, we use the notion of trustworthiness as an entry point to explore these tensions: How can systems be designed in ways that meet users' expectations of trust, while also aligning with ethical, legal, economic, technical, and political demands? To ground our reflection, we complement it with empirical insights from a survey ($n = 24$) and qualitative interviews with potential users. In our analysis, we follow basic principles of Green Technology and Digital Humanism. Rather than offering solutions, this paper aims to clarify the conceptual problem space and support critical reflection in future design and governance processes.

Keywords: Energy Data Space · Smart Meter · Energy Transition · Prosumer Economy · User Perspective · Ethics · Digital Capitalism

1 Introduction

Towards European Data Spaces. A few years ago, digital *data spaces* were proclaimed the central infrastructure of the European data economy [5]. A data space refers to a decentralized data ecosystem in which participants can securely share, access, and use data based on common rules and standards, without relinquishing control over their data [2] – an endeavor that deeply resonates with the aims of Digital Humanism, which similarly seeks to establish guiding rules and

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standards for technology design in order to aid the people [34]. With initiatives such as GAIA-X [18] and the provision of legal frameworks such as the Data Governance Act [6] and the Data Act [11], the European Union (EU) aims to enable trustworthy and sovereign handling of data. This political strategy is guided by principles such as Human-Centeredness and Transparency. These values are echoed in related regulatory efforts, such as the Ethics Guidelines for Trustworthy AI [19], and most recently the AI Act [15], both of which emphasize accountability, fairness, and respect for fundamental rights in the design of digital systems. Ultimately, the EU's goal is to create (digital) data space infrastructures that are both technologically powerful and based on European values. This anchoring in European values is a core concern of Digital Humanism, a concept prominently expressed by Julian Nida-Rümelin, who emphasizes the fundamental role of the Enlightenment and humanistic ideals in shaping the digital transformation in a human-centered way [26,27].

Different Data Space Domains. Data spaces are typically specialized in a particular type of data, such as the Agriculture Data Space [8] or Health Data Space [7]. In this paper, we will focus specifically on the energy sector, directing our analysis and considerations toward this critical infrastructure. Its importance is particularly heightened in the context of the European Green Deal [4] and the transition to green energy, which require efficient data sharing frameworks.

Normative Considerations from the Outset. We argue, in line with the principles of Digital Humanism, for the need to engage with normative considerations from the very outset, rather than addressing ethical issues only retrospectively. Tackling the complex challenges involved in data space design, requires a transdisciplinary approach at the intersection of various fields like computer science/technology, social sciences, and Philosophy. Therefore, this paper follows/probes an integrative and iterative research strategy that includes technical design practice, engineering, an empirical survey, and an ethical assessment (as will be discussed later with reference to Fig. 4). This goal can be substantiated, among other things, by the fact that decisive factors in data space design are underdetermined. While their objectives are clearly formulated, the specific approach for implementing the proclaimed principles remains open.

Different Roles and Interests in the Design of Data Spaces. How, for example, data sovereignty and trustworthiness can actually be made tangible for people in practical application depends on the skill of the operators and developers of data spaces and corresponding applications. Taking a further step back to gain a clearer view of the situation quickly reveals that things are even more complex or more 'messy'. Numerous roles and interests in are intertwined in the design of data spaces. Just to mention the most generic and obvious ones (see also Figs. 1 and 3, introduced later in the paper):

– *Philosophers* have been thinking critically about Europe's digital infrastructure for quite some time [32] as evidenced, for example, by the Ethics Guidelines for Trustworthy AI [19].

- *Legislators* want to provide a framework for creating data spaces that are trustworthy for citizens. Among many other reasons, this is important in order to ensure the transition to a sustainable energy economy.
- From a plain *technical perspective*, mechanisms must then be developed that allow this large-scale project to be efficiently implemented in accordance with the necessary technical security standards. Compliance with data protection must be guaranteed so that there can be no data breaches, for example, and thus no damage or loss of trust.
- The *developers and operators* of data spaces naturally also want to gain the trust of their users, not least in order to be able to earn money.
- Thus, the legal framework must allow data to be used in an *economically viable* way. Data protection that prevents any business ideas from being realized would make the whole endeavor impossible. At this point at the latest, critics from the field of Digital Humanism will point to the concept of *Surveillance Capitalism* [16,36] – the systemic commercialization of personal data under the guise of innovation and user benefit. Ultimately, the decision of whether to trust or not rests with the *individual*. However, it also depends on the societal context of individual actions, including humanistic values, legal legislation, and cultural habits [17]. Trust in technology depends on various factors [21, 29]. This makes the mix of involved perspectives complex, to say the least.

Research Question and Contributions of the Present Paper. Against this broader backdrop, this paper turns to a concrete and technically relevant application: energy data spaces, with a particular focus on smart meter infrastructures. These systems hold significant potential for supporting Europe's energy transition, yet they also bring to the surface tensions between individual data sovereignty and collective sustainability goals. At the same time, the economic viability of data-driven services must be balanced with privacy concerns and user autonomy. This raises our central research question:

> *What are the main normative challenges in designing energy data spaces, especially in the context of smart meter implementations?*

To explore this, we build on our practical experience in a European data space project in the energy domain. We enrich this perspective through preliminary empirical findings from a survey and user interviews, which reveal insights into trust and consent, and perceived risks. In addition, we draw on philosophical reasoning (combining ethical guidance with critical reflection) to illuminate the normative foundations of responsible infrastructures.

The paper proceeds as follows: Sect. 2 introduces the political and technical context of energy data spaces, with a focus on smart meters and EU regulation. Section 3 presents conceptual work, discussing the intersection of Digital Capitalism and the energy transition. Section 4 outlines our empirical approach and highlights insights from user surveys and interviews. Section 5 offers a broader discussion of normative tensions across individual, political, and economic perspectives. Finally, Sect. 6 concludes the paper.

2 Smart Meters and the Role of Energy Data Spaces in the EU

The European Union (EU) has introduced regulatory frameworks such as the directive 2009/72/EC and directive (EU) 2019/944 which were set up to change and liberalize the Union's energy market and promoting the energy transition of the EU [12,14]. These liberalization policies of energy markets have shown over the years that they have effectively reduced CO2-emissions, particularly in European high-income countries by promoting renewable energy and eliminating trade barriers [28]. Directive 2019/944 further emancipates the member state's energy consumers in the energy market by establishing an "Active Customer"-someone who can participate in the internal energy market, thus enabling a "Prosumer Economy" [30]. The directive also states that the absence of real-time or near real-time information on consumers' energy consumption has prevented them from being active participants in the market. As a result, energy consumers and their households must be equipped with smart meters that can record and provide this data.

These meters are also beneficial for the grid, as distribution system operators (DSOs) and transmission system operators (TSOs) can better monitor the current energy load demand for energy distribution and transmission [13,25]. Additionally, the collected data should be transparent and easily accessible to end users, enabling them to share or transfer it to third parties in line with their right to data portability under EU data protection regulations [14]. However, the directives do not clearly specify how data sharing and accessibility should be implemented.

Therefore, the European strategy for data has resulted in the creation of "Common European Data Spaces" that aim to ensure that data will become available for the economy and society while maintaining that the individual who created the data will remain in control of it [10]. The concept and key features of European data spaces include the open participation of all individuals, a secure and privacy-ensuring infrastructure, clearly defined access rules, respect for EU laws and values, the ability for data holders to share information, and empowerment to make data available for reuse, either for free or against compensation. [9]. Nagel et al. defined four design principles for European data spaces to be built on, which are data sovereignty, data level playing field, decentralized infrastructure and public-private governance. Furthermore, building blocks can be categorized into technical which deal with the data exchange and governance blocks for access policies ensuring trustworthy exchange [24].

In terms of energy-related data spaces, the main idea is that making data more available will increase the efficiency of energy systems and operations. Consequentially, through the smart meter rollout, this data can also be integrated into data spaces which further enable unique use cases such as predictive maintenance or energy management for buildings [1]. There are many European projects such as IntNET, OMEGA-X and EDDIE [9] that are creating various energy related data spaces for specific use cases within this sector and enable data exchange across national borders [9]. Within these projects, energy data exchange is a core component and functionality. As a result, various perspectives—such as economic, legal, and user viewpoints—often come into conflict. We identified a gap in how the user perspective is addressed within energy data spaces and argue that the user's role in data exchange should be approached more thoughtfully.

3 Smart Meter Data: Usage in the Context of the Energy Transition and Digital Capitalism

As discussed, there is a challenge within the EU's data strategy, particularly in the creation of data spaces and in meeting the expectations of various perspectives, including legal, economic, user-centric viewpoints etc. On one hand, privacy and trust must be secured; on the other, data should be available for the economy, thus enabling novel service ideas for the energy market and advancing green and sustainable technology for the energy transition, for instance.

How Smart Meter Data Reveal Behavior. However, with these services relying so heavily on data and profiting from it, it is unclear how else this data can be used beyond its original use case once it is in the company's possession. Energy data from smart meters, for example, is very sensitive and can reveal a lot about a household, such as which devices are used, when tenants are home, and their usage patterns, which can shed light on their behavior [3]. This can uncover what Shoshana Zuboff calls "behavioral surplus", referring to the additional data collected beyond what is necessary for the service [36]. As a consequence, there are immense privacy issues to consider when sharing this information, as energy data has the potential for further intrusive data mining and collection practices for commercial gain, similar to those of social media companies. Through "Surveillance Capitalism", these services can profit even more from customers' energy data [22]. As a consequence, from a user perspective, these immense data-hungry services could feel overwhelming for a typical European household, as their personal data is a gold mine, an analogy used by Zuboff [36] as well.

Regulating the Digital Energy Economy. At the same time, Allison Stanger [31] argues that Big Tech companies are not as powerful as they appear, as there is a difference between voluntary and involuntary surveillance. These companies may only seem to have total information control if citizens allow them to commercialize their personal data. The primary danger appears when initially consented data is sold to third parties by the data-driven service. Furthermore, Stanger argues that the problem lies not with Big Data technology or the use of personal data for behavior change itself, but rather with whether it is used for positive or negative purposes and without the user's consent or knowledge. Therefore, as the GDPR (General Data Protection Regulation) and DSA (Digital Service Act) have laid the first steps for promoting a fair playground for a modern digital economy, third-party markets for personal data should be further regulated.

Consequentially, Paul Timmers [33] mentions that in the digital age, a central problem in developing policies for sovereignty lies in the way digital technologies are advancing in collecting information from citizens and interacting with them. He argues that in this new era, policies for sovereignty must equally take geopolitical and technological perspectives into account. This highlights a transformation in traditional policymaking, as the unique speed, scale, and impact of digital technologies are increasingly influencing the focus on achieving digital strategic autonomy.

Müller and Kettemann [23] further highlight the European Union's growing regulatory response to the societal and economic power of digital platforms through legal instruments such as the GDPR, DSA, DMA (Digital Markets Act), and the proposed AI Act. These regulations aim to balance innovation and data-driven services with the protection of fundamental rights, such as privacy, freedom of expression, and contractual freedom. A key aspect of their analysis is the EU's attempt to enforce a form of horizontal fundamental rights accountability, where private tech platforms—especially those with systemic influence—are increasingly obligated to respect users' rights. In the context of energy data, this regulatory trajectory is crucial, as it seeks to prevent the unchecked commodification of personal data while enabling innovation for sustainability.

Furthermore, the political and economic perspectives are also seeking to advance Green Technology to transition to a sustainable economy, as seen with the mentioned EU directives and the deployment of smart meters. However, the desired energy transition is highly complex, with social, legal, economic, and climatic factors playing a role. Aleksander Jakimowicz [20] writes that with the active customer-which is now enabled through the EU regulations- playing a vital role, such a "Prosumer" economic system would also involve performing free labor for a system that benefits from it at the expense of personal freedoms and privacy. This highlights the need to critically examine how participatory roles in digital energy systems are structured, and to what extent they align with broader goals of autonomy, fairness, and transparency.

Navigating Competing Values. It therefore remains questionable whether these data-driven services, the sharing of sensitive data (e.g., energy data from smart meters) and the Prosumer Economy are the right approaches to tackling climate change and improving energy economy with novel innovations and efficiency, especially when sacrificing user perspectives in terms of privacy and sovereignty. It is also unclear how the various perspectives should be weighed to advance the green energy transition, which is being implemented through policies such as the European Green Deal (see Sect. 5). This includes balancing individual user rights, the perspective of progressing the green energy transition with sustainability as a guiding principle, and the Digital Capitalism perspective, which involves collecting information on energy usage behavior to provide solutions for the collective energy transition. Figure 1 provides an overview of the normative problem area to illustrate the challenges of technical development and applied Digital Humanism.

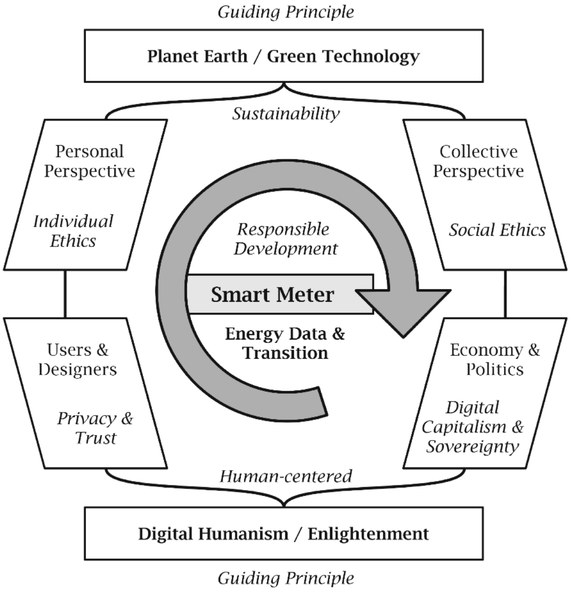

Fig. 1. Problem area of smart meters and energy data, highlighting tensions between ethics and societal frameworks within Green Technology and Digital Humanism.

To further understand the different views, as well as the interplay and potential clash of interests, additional research is needed. Therefore, we explored the user perspective in a practical, empirical way in terms of what is more important for the individual while sharing smart meter data: an innovative, novel service that helps change energy behavior by providing data analytical insights from the smart meter data, thus saving energy and using it more efficiently for a sustainable energy system, or the protection of personal rights such as privacy.

4 Insights from Practice: Context and User Voices

During our work on an EU project on energy data spaces, we encountered the issue of *users' trust* in our designed system on numerous occasions (see [35] for a description of the design process). Specifically, our task was to import our users' electricity data from their smart meters through a data space to a service that processes the data for visualizations and data analytical functionalities[1]. With their consent, we were able to create relatively simple but effective visualizations of the consumption data. This enabled them, among other things, to track their electricity consumption, estimate their costs, view forecasts for the future, and

[1] Technically, the data space is designed as a foundational framework that aggregates users' data from diverse sources. With the users' consent, third parties can access this data to develop their own applications that make use of it. The application mentioned in this paper thus represents a third-party use case within the data space.

even estimate their ecological footprint: all potentially useful functions for which the user must give their consent to share their energy data with our system or data space.

From a technical perspective, a lower layer of the data space took some of the work off our hands. We were able to use a ready-made mechanism that obtained the user's consent via a small web mask and then automatically retrieved the data from the user's respective energy consumer. The system also managed how long this consent was valid for us, and once it expired, no more data would flows to us. It was our responsibility to process the energy data as soon as it was available in the data space and, of course, not to pass it on or use it inappropriately. We were also responsible for designing the user interface that informs the user about the consent form and the subsequent processing steps; this gave us a great deal of freedom in the design, which had a significant impact on user trust.

In numerous discussions in the context of the project and interviews with potential users, the topic of trust came up repeatedly. For example, when asked for feedback on a concept, one person said: *"Well, I don't know if I really need it. Your app is certainly interesting, but it's also interesting to see when I'm not at home. And what else are you trying to sell me with it?"* This statement certainly reflected a healthy skepticism about the loss of control over one's own data. For example, if the wrong people get hold of consumption patterns, they can potentially deduce when the house is unoccupied from the electricity consumption, according to the interviewee's assumption (see Sect. 3). This and similar statements prompted us to deepen our research by designing a survey and conducting targeted interviews.

4.1 Survey and Interviews

Survey: To better understand whether and under what conditions potential users would trust and adopt the system, we introduced it to 24 individuals and walked them through a detailed demonstration of the web interface. Subsequently, we invited them to complete a 14-item survey designed to encourage honest and low-pressure responses. They received no financial compensation, and data was processed anonymously. The questions focused on a) functionality, b) trust in the system, and c) whether they would use it or even pay for it. As usual, they were formulated as statements, and participants had to indicate on a five-point Likert scale how much they agreed with them, ranging from 1 (strongly disagree) to 5 (strongly agree).

In the following, we will focus on the questions (statements) concerning part b – trust. These are shown in Fig. 2 with abbreviated designations. In addition, the questions from part c and one exemplary question from part a are included in this figure. This latter question from part a – "Visualization is useful"[2] – was included into the figure to provide the readers with an impression of whether

[2] Full statement in survey: "The visualization of my historical energy consumption in kWh is useful.".

the system was considered useful by the respondents. With an average response across genders of M = 4.21 (SD = 0.83), this result clearly favors our application.

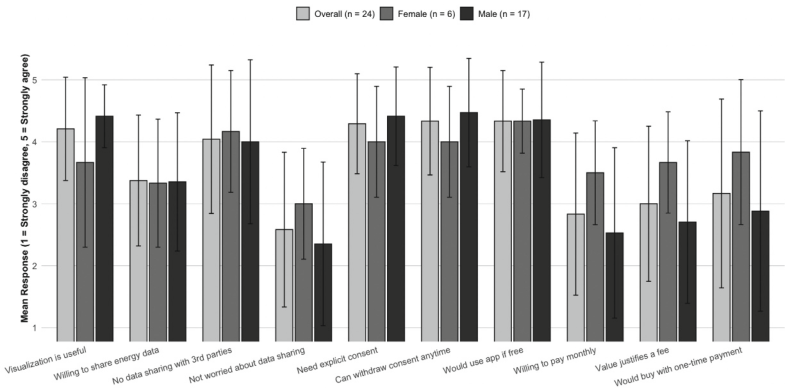

Fig. 2. Mean agreement ratings (±1 SD) across ten statements on energy data usage and app adoption, by gender (Female, Male) and total sample (Overall). Higher values indicate stronger agreement (1 = Strongly disagree, 5 = Strongly agree).

Figure 2 presents mean agreement ratings and standard deviations (SD) for all ten statements concerning the use of energy data and app-related attitudes. Results are reported separately for female (n = 6) and male (n = 17) respondents, as well as for the overall sample (n=24) including all gender identities[3]. We go on to highlight trust-related results.

Willingness to share energy data showed similar values across groups, with the overall mean at 3.38 (SD = 1.06), females at 3.33 (SD = 1.03), and males slightly higher at 3.35 (SD = 1.11). The demand for *no data sharing with third parties* was generally high, especially among females (M = 4.17, SD = 0.98), while males and the overall sample averaged 4.00 and 4.04 (SD = 1.32 and 1.20, respectively). Conversely, when asked whether they were *not worried about data sharing*, agreement was lower overall (M = 2.58 SD = 1.25), with females reporting slightly more agreement (M = 3.00, SD = 0.89) than males (M = 2.35, SD = 1.32). The importance of *giving explicit consent before data is processed* received high agreement across all groups, with an overall mean of 4.29 (SD = 0.81), females scoring slightly lower (M = 4.00, SD = 0.89), and males higher (M = 4.41, SD = 0.80). Agreement was similarly high regarding the *ability to withdraw consent at any time*, with an overall mean of 4.33 (SD = 0.87), females at 4.00 (SD = 0.89), and males at 4.47 (SD = 0.87).

Overall, the findings suggest a general skepticism toward sharing energy data, with participants placing high importance on privacy and control. Agreement

[3] One respondent did not indicate their gender. This individual is included in the overall statistics but not separately in gender-specific comparisons due to size.

was particularly strong for explicit consent and the ability to withdraw it at any time. Opposition to third-party data sharing was also high, while few agreed they were unconcerned about data sharing. Due to the small sample size, comparisons remain descriptive and should not be interpreted as statistically significant.

Interviews: Throughout the project, we further conducted numerous interviews with the same target group to gather feedback on our system's design. We were interested in many aspects, such as users' attitudes toward environmental protection (a key objective of our app) and its overall usability. However, what stood out most were the numerous curious and at times skeptical to even heated reactions regarding the topic of data sharing.

During the analysis of the interviews, participants' statements frequently clustered into five distinct groups that emerged inductively from the data: *Resisters*, who reject or avoid the technology; *Suspicious Users*, who are not categorically opposed but remain highly cautious and alert to potential risks; *Strategic Users*, who weigh benefits and drawbacks before engaging; *Fine-Print Readers*, who carefully scrutinize terms and conditions; and *Anonymous Users*, who seek to prevent traceability by obscuring their identity[4].

Resisters, for example, rejected the idea behind data spaces outright and made this clear through statements such as: "I don't like the idea of surveilling nor the thought of control."[5] Table 1 presents illustrative quotes from all groups. Note, the categorization is intended as an exploratory analytical tool to help structure and interpret the data. It does not imply clear-cut typologies, as individual respondents may express views that span multiple categories.

4.2 Pulling the Empirical Insights Together

While the empirical impressions presented here do not claim to be generalizable, they do provide interesting insights into the concerns that preoccupy users of data spaces. The above statements indicate that one of the target groups of energy data spaces (young people with an affinity for technology) have many questions about data security, *etc.*. They stated that they attach great importance to being able to determine exactly who can access their data, for what purpose, and for how long. Through our empirical survey, we observed a willingness to share energy data; however, there are concerns regarding privacy. Consequently, a trustworthy environment is needed, as seen from the quotes from the interviews. Data-driven energy services and the underlying data space used for data transmission should be designed in such a way that people are aware of where their data is going, what it is used for, and have control over who can access it.

[4] The user type labels are deliberately descriptive and somewhat exaggerated to illustrate the salient characteristics observed in the data. They serve as analytical tools rather than definitive classifications.

[5] The interviews were conducted in German and translated into English for this paper.

Table 1. Overview of different kinds of users as emerged from explorative interviews

User Group	Representative Quote
Resister	"I don't like the idea of surveilling nor the thought of control."
Suspicious User	"Yes, I would ... if I don't then start getting 10 messages from my electricity supplier like: 'We've seen this and that, would you like to change your tariff?' So, only if it's not connected to that kind of thing."
Fine-Print Reader	"Yes, I would share my data. I would carefully read where exactly my data is being stored and whether it remains stored locally."
Strategic User	"It really depends on the exchange ... on what I get in return for sharing my data."
Anonymous User	"Yes, as long as it's not personalized and is shared anonymously."

5 Discussion

This section systematically structures the complex problem area of energy data spaces and examines the inherent normative conflicts of values from different perspectives. It therefore provides some answers to our initial question: *What are the main normative challenges in designing energy data spaces, especially in the context of smart meter implementations?* Fig. 1 in Sect. 3 illustrates an overview of the problem area, flanked by the normative principles of Human-Centeredness and Green Technology. Previous sections have shown that the main normative challenges arise at the intersection of a) personal practice (individual ethics), including the perspectives of designers and users, and b) societal embedding (social ethics), including legal regulation, the economy, and political power (Fig. 3).

Some of the main challenges arise at the intersection of individual users and the economy: Earning money (Digital Capitalism) versus individual autonomy (privacy and user trust). Technical developers, including designers, engineers, etc., also run into a normative conflict with legal regulation when it comes to the freedom of technological innovation. Note that these conflicts are somewhat generic and cannot be reduced to energy data management or smart meters. However, they are intertwined at the central nexus of shifting from energy consumers to Prosumers (see the central box in Fig. 3). On the one hand, the shift towards independent energy producers who engage in reliable technical practices could be considered the ideal of Digital Humanism and the guiding principle of Human-Centeredness. On the other hand, Prosumers gain joint responsibility for the energy infrastructure, which extends beyond individual freedom of energy consumption. With this, citizens are placed at the intersection of political power and data monopolies. They become increasingly important players in terms of critical infrastructure and digital sovereignty. In short: One of the main

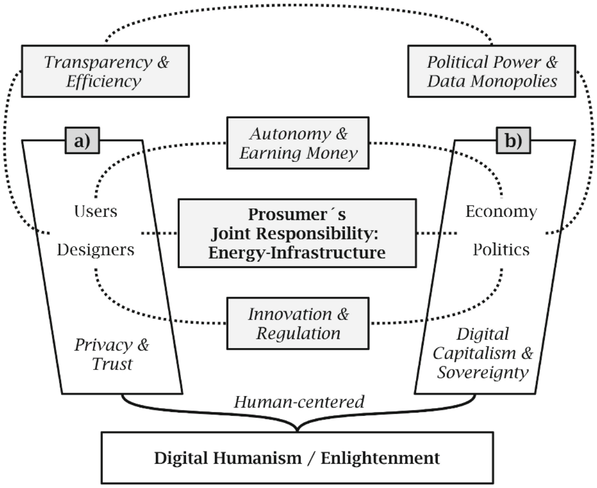

Fig. 3. Systematic structure of normative conflicts in using smart meters, showing prosumers' responsibility amid competing values.

challenges that needs further transdisciplinary investigation is reconciling the conflicting values of prosuming freedom in energy consumption and prosuming responsibility for critical infrastructure (the energy market).

Rather than offering definitive solutions, this discussion aims to stimulate thought and identify initial points for future normative analyses and design decisions. The conceptual analysis applied here allows us to differentiate the various relationships within the problem area more precisely. Some follow-up questions could be: How can we negotiate the design of human-centered, sustainable energy data spaces in a technological way? How can technical development, public interest, and individual user requirements be combined in the case of smart meter technologies and energy data services? Do we need the kind of producers that we have, and do we have the producers that we need from an ethical point

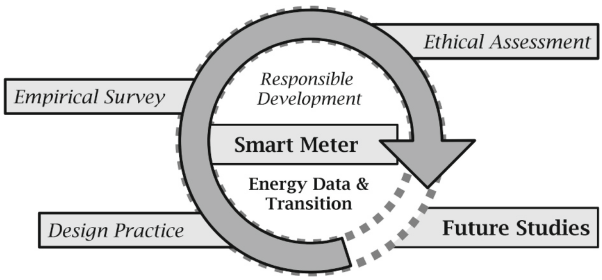

Fig. 4. Transdisciplinary integration toward ethically grounded design of smart meters and energy data spaces.

of view? How can transdisciplinary approaches and empirical user perspectives help address these tensions in practice? To shed more light on these issues, we encourage iterative and integrative research (Fig. 4).

6 Conclusion

During our work on energy data spaces, questions about data protection arose regularly. Potential users consistently expressed high expectations regarding data security. As developers, we were confronted with the challenge of translating these requirements into technical solutions. This ongoing confrontation with value-laden demands led us to a deeper inquiry into the normative foundations and ethical tensions involved in shaping digital infrastructures for the energy sector, particularly in the highly sensitive context of smart meter technology.

We approached this exploration through the guiding principles of Digital Humanism and Green Technology. Our specific methodology involved moving from empirical observations, gathered through surveys and interviews, toward philosophical reflection. This paper thus provides not only preliminary empirical data (Sect. 4) but also a conceptual mapping of the problem space that emerges around energy data spaces and smart meters (Fig. 1). It highlights how this space is structured by differing roles or perspectives and how it is framed by broader value systems. In addition, we outlined potential normative conflicts inherent in this field (Fig. 3). To support our analysis, we draw on the concept of Digital Capitalism, among other things (Sect. 3). We concluded with a sketch of transdisciplinary working processes (Fig. 4), an approach we are actively engaged in ourselves, that may offer a path toward more measured and ethically grounded design and implementation of smart meters and energy data spaces.

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