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# Debating (In)Justice of Energy Futures Through Design

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## Abstract

This article presents a design investigation of how to address social justice concerns in participatory activities when debating energy futures. As the climate crisis grows and technological progress exacerbates environmental issues, the design field is increasingly committed to understanding and mitigating the impact of new products in the world. This is resulting in a conscious redesign of products or in developing strategies to nudge sustainable behaviours. Yet little methodological work exists on how to address social concerns when designing in the context of energy transitions. This paper explores this gap by delineating an energy scenario of Switzerland in 2030, designing two fictional artefacts and a participatory toolkit, and then hosting a world café with twelve participants. The results provide insights into the value as well as the methodological challenges of designing for debating justice in energy futures.

## Keywords

Discursive design  
Fictional design  
Energy futures  
Social inequality  
Justice

## Introduction

In recent decades, the design and human-computer interaction (HCI) fields have increasingly engaged with the concern that while some technological solutions may be useful for purposes of sustainability, “technology is itself deeply implicated in the problems of sustainability” (DiSalvo et al., 2010). Especially with the latest technological developments, such as the broad adoption of Artificial Intelligence (AI) systems that are now being contested because of the massive amount of electricity they require (Saul and Bass, 2023), designers are confronted with the moral imperative of understanding the *ecological impact* of their actions.

To give an example, a recent study has shown how training one large language model has a carbon footprint that is equivalent to about 390 km driven by an average passenger vehicle (Patterson et al., 2021); furthermore the energy demands of these models are not limited to training, but rather are required throughout their lifecycle, from data processing to inference (Wu et al., 2022).

In response a growing body of research and approaches, such as Sustainable HCI (DiSalvo et al., 2010), Design for X (Norman and Stappers, 2015), Systemic Design (Jones, 2014), and Critical Design (Malpass, 2013), have increasingly investigated ways to promote critical views towards techno-solutionist approaches to sustainability, and to *energy futures* more specifically (Pierce and Paulos, 2012).

An extensive body of research has investigated how design actions and product features can respond to and even inform about alternative paths toward different energy futures, which governments and institutions are exploring to tackle the current human-induced climate crisis (Kruger et al., 2022). In this landscape, design research is distinctively committed to challenging dominant techno-determinist ideas that present technologies (whether AI, 5G or blockchain) as the solution to environmental issues (Strangers et al., 2022). Through their projects, researchers have warned about how energy future discourses fail to address aspects of energy disruptions and unreliable access to electricity (Hasselqvist et al., 2022); others have questioned whether behavioural change strategies that seek to sensitise consumers to sustainable consumption can actually promote the desired change (Jensen et al, 2018; Snow et al., 2021); and some have raised concerns regarding the costs in terms of privacy that a transition towards a smart grid and smart products would entail (Snow et al., 2021; Desjardins et al., 2020; Pschetz et al., 2019).

These works thus provide a broader view of energy futures and confront the expert community with the complexity of designing for such a transition. Questions of social impact and justice that are quite prominent in the science and technology studies (STS) discourse about energy futures (Kruger et al., 2022; Jasanoff, 2018; Bickerstaff et al., 2013), however, remain relatively under-investigated in the design and HCI fields. As a matter of fact, while the move towards clean energy is a positive one, it is important to recognize that there are significant disparities in access to renewable energy sources. These technologies are typically more difficult and costly to implement than traditional energy sources such as fossil fuel, leading to privileged access for developed countries, and related industries

and individuals (see current trends worldwide (Bocca et al., 2021)). Developing countries, instead, may have an unequal distribution of resources to invest in renewable energies, or lack the capabilities for some social groups to get involved in the processes of shaping the future for an energy transition (Kruger et al., 2022). Furthermore, STS research warns us that climate crises “impose spatially uneven harms on present and future generations, and the burden of mitigation is also socially and spatially unequally distributed” (Bickerstaff et al., 2013). Yet we hardly find design and HCI research engaging with these issues.

Therefore, this paper investigates how design can contribute to addressing aspects of social inequality and foster collective imagining and debate about *justice in energy futures*.

## Methodology

Building on the rich body of design research challenging techno-determinist visions for energy futures (Hasselqvist et al., 2022; Snow et al., 2021; Desjardins et al., 2020; Pschetz et al., 2019; Jensen et al., 2018), this paper unfolded as a participatory design investigation where fictional artefacts were designed and used to spark debate about justice in energy futures, in Switzerland. Fictional design (and speculative design more broadly), in fact, was shown to be useful in participatory design to shift attention from dominant claims and narrow assumptions toward real-life concerns and everyday context, as collectively negotiated and contested imaginaries (Chopra et al., 2022). Through this approach, then, this paper engages with the call by Kruger and colleagues (2022) for studies addressing the “struggles, contradictions, and social conflicts associated with energy transitions”. More specifically, the process involved four steps: the envisioning of a future scenario, the crafting of two fictional artefacts, the development of a participatory toolkit, and the engagement of the audience.

### Envisioning (In)Justice in Energy Future Scenarios

Building on Smith and Ashby’s (2020) approach to futuring, the first phase of the project focused on understanding how multiple factors can affect the future production and consumption of electricity, and what their impact could be on people’s daily habits. A combination of desk research and context mapping activities were performed to inform the vision of a plausible future scenario. The scenario was grounded on academic knowledge, industry trends and institutional reports and policies, such as the Review of Swiss Electricity Scenarios 2050 (Densing et al. 2014), Vision 2030 (KPMG), and the Long-term climate strategy to 2050 (FOEN). The institutional landscape delineated by the scenario refers to the strategic plans of Switzerland which, together with other countries, pledged in 2015 to reduce the rate of greenhouse gas emissions, as they committed to the Paris Climate Agreement by 2030. In this 2030 Swiss horizon, the scenario envisions a wide spread of energy storing technologies, as current market trends show a constant increase in solar panels, which are also the primary method for household energy production. Techni-

cal insights into energy storing technologies were gained through interviews with experts from the renewable energy sector. The temporal and technological landscapes were then complemented with insights into the potential impact on social inequality from academic literature on energy future justice, especially from STS studies. These insights were then further reflected upon through the lens of *Societal, Technological, Economical, Environmental, and Political* (STEEP) factors (Szigeti et al., 2011), and summarised as follows:

In 2030, Switzerland, like every country, will also face dramatic environmental challenges due to global warming. The need for swift actions will generate political pressure and lead the government to impose a maximum energy quota for each household that covers basic human needs. As a consequence, certain everyday activities such as watching TV, using the oven, or taking a warm shower become luxuries. The underlying objective of this policy is to encourage individuals to consume less and produce more energy in-house. Industry will respond by leveraging new technological advancements and introducing extremely efficient energy-storing products to mitigate the issues arising from the excess of energy produced by solar panels and pressure on smart grids. These technologies, however, come with high costs and will be affordable only for a limited portion of the population. This will exacerbate economic issues and increase social division, especially for already struggling communities.

### Crafting Fictional Artefacts

As the aim of this paper was also to move from abstract discussions of energy futures to situated and complex intricacies of these possibilities in people's everyday lives, the scenario was further materialised into two fictional artefacts. Design fiction, in fact, is a type of design that sits in-between the traditions of storytelling and material crafting to generate *objects that tell stories* and as such encourage imagination, provoke, and raise questions (Bleeker, 2022). As envisioned in the scenario, batteries will become crucial commodities in energy futures (Kittner et al., 2017) and, as such, they may be seen as an embodiment of economic impact and social inequality. With political pressure to produce and consume one's own energy, in fact, it is reasonable to believe that energy storing systems will also undergo extensive developments, such as environmentally friendly options that are already being developed by industry. These advanced products, such as the Gravity batteries, however, will also have high costs and thus, be affordable only for a limited part of the population.

Therefore, two fictional artefacts were crafted. On the one hand, the plausibility of the technological grounding was ensured by leveraging the expertise of the CEO of a leading Swiss company in the photovoltaic sector, who was involved in the project as an expert consultant. On the other hand, the issue of social inequality and uneven access to these technologies was materialised through the development of two alternative embodiments: one representing a luxury product, and the other representing a do-it-yourself (DIY) alternative.

The first artefact Fig. 1 left is a luxurious product characterised by a minimalistic style and two pendants, crucial elements in the functioning of the battery. As the pendants of the luxury product are reminiscent of the pendants on a *cuckoo clock*, the DIY artefact Fig. 1 right is imagined as a ready-made assemblage of existing parts, like an actual cuckoo clock, with repurposed electronic components.



Fig. 1  
Fictional Natural Power Batteries. On the left, the luxurious concept of a home gravity battery. On the right, the DIY version of the power battery that repurposes an old cuckoo clock combined with electronics.

Both prototypes share the same mission, to visualise the complexity of the plausible future towards which we are evolving and present the audience with the possibility that social divisions might deepen in society because of the energy transition. Intended to tell the story of inequalities in energy futures, the artefacts are not fully developed into functioning prototypes but rather positioned and described in two videos Fig. 2 illustrating the two alternative social contexts they would live in.

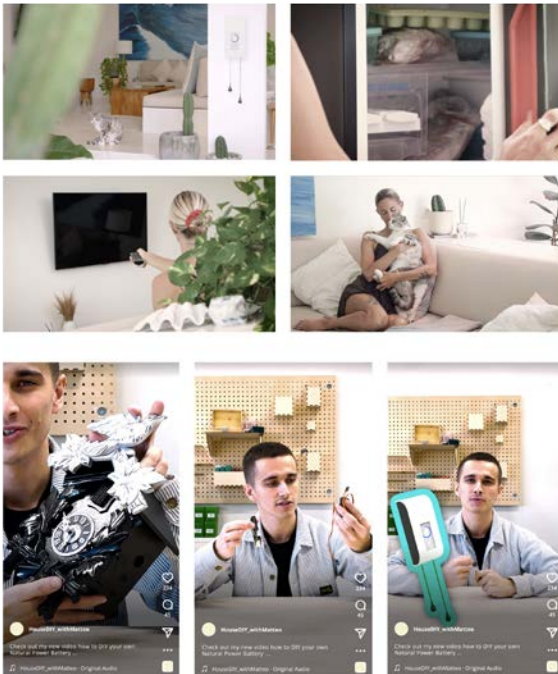


Fig. 2  
Videos of the fictional artefacts in context. The four screenshots above are extracted from the fictional promotional video of the luxurious Natural Power Battery. The three screenshots below are from a fictional Instagram Reel of a maker sharing how to DIY your own Natural Power Battery.

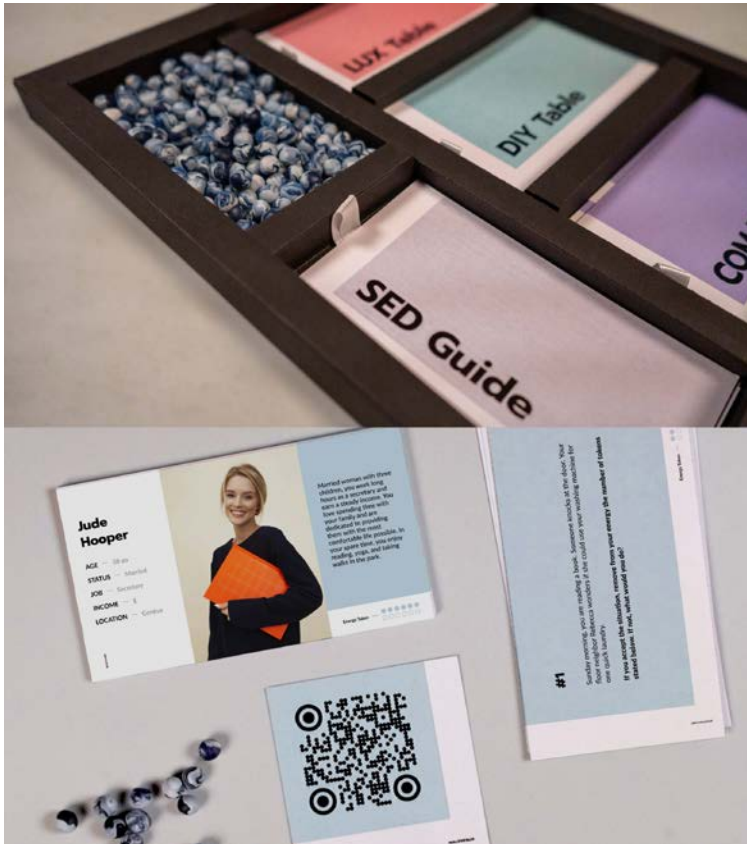


Fig. 3  
Justice in Energy Futures Toolkit and its components: role cards, energy tokens, situation cards and QR code cards to access the introduction videos.

To have the audience experience possible injustice and social inequalities in the energy future envisioned in the scenario and materialised through the artefacts, the research also required the development of a participatory toolkit and instructions for related activities.

The Justice in Energy Futures (JEF) toolkit Fig. 3 is composed of three main elements:

- *role cards* describe one persona and invite the participant to take on a role. This allows participants to project themselves into the context. Each card brings a different social perspective through diverse profiles in terms of age, job, and income.
- *energy tokens* are a physical representation of energy. The tokens were quantified and distributed according to the status of the persona described in the role card. As each character had different income levels and therefore more or less solar panels, access to light (e.g. because of apartment height), or efficient batteries, they would have more or fewer tokens. Personas in the luxury social group had between six and twelve energy tokens while the personas in the less wealthy social group, associated with the DIY device, had between three and six.
- *situation cards* present occurrences that would challenge

the participants' social status. Each card would cost the participants a certain amount of energy tokens. Intentionally, a participant would end up not having enough energy tokens to solve all situations and need to ask others for help. The idea was to understand whether and how people would react when sharing energy with someone of the same social status or someone of different social status.

The JEF toolkit is intended to be used in participatory sessions in which to address and debate how the energy transition might become a source of even greater social divisions. As such, this work builds on and contributes to the field of *design for debate* (Tharp and Tharp, 2022). Specifically, the fictional artefacts and the JEF toolkit are employed in a participatory session organised as a public event, inspired by the *world café methodology* (Löhr et al., 2020). This methodology is particularly suited for debating justice in energy futures because it represents an assessment tool proved to be effective in community development and organisational change processes (Löhr et al., 2020). It is beneficial not only because it allows data to be produced for the research but also, and above all, because it can benefit the participants, in that it allows them to have a voice and to take part in complex societal transitions (Löhr et al., 2020). By creating a space for debate, the world café allows participants to reflect on their current and future production and consumption of energy, and to explore what actual needs industries in the energy sector should target in the future.

### A World Café to Debate Justice in Energy Futures

Following the world café methodology, the last part of the project involved a participatory session, which was attended by 12 people. The choice of the number of participants was guided by prior work, which found that small groups are more effective in generating debate (Schieffer et al., 2004), though less than four participants would present several problems (Cortini et al., 2019). The age of the participants ranged from 25 to 65 years, there was a balanced mix of men and women, and also diversity in terms of nationality. All were currently living in Switzerland.

The activity included an introduction, conversation tables, and a vernissage.

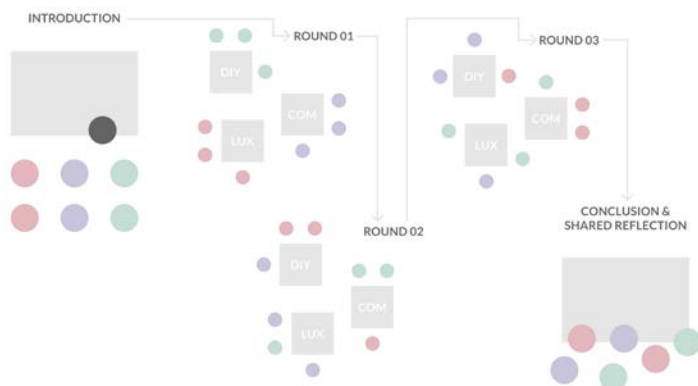


Fig. 4  
World Café activity  
process.

In the introduction, participants were invited to immerse themselves in the future energy scenario. To do so, the participants were presented with both a textual description of the scenario as well as the two videos portraying the fictional artefacts and the social reality for which they were developed. The conversation tables, three in total, allowed the discussion to be organised in terms of thematic areas and perspectives. The tables were covered in tablecloths on which participants could write and take notes. As participants moved from one table to the other after a certain amount of time, each participant experienced all tables. The first table, called the communal table, facilitated debate around the topic of energy futures in general and allowed participants to speculate about potential concerns and opportunities. At this table, the conversation was guided by two cards, one inviting the participants to envision and discuss what a “worst-case scenario” would be in the context described to them. The second card invited participants to ponder the topic thinking in terms of “I wish, I like, I wonder”. The second and third tables, called the luxury table and the DIY table, aimed to confront the participants with the intricacies of energy futures for different social statuses. These tables were engaged in more hands-on playful activities, where the participants had to take on a role (from the role cards) and were confronted with a materialisation of their consumption (through the energy tokens) and a situation (from the situation cards) meant to question their beliefs about social impact in the energy future scenario. The LUX and DIY tables projected participants into one social segment. Each participant had to choose a different character to impersonate (among the ten described in the role cards). They would then use four situation cards together to confront their possible energy consumption behaviours and willingness to share with others in need. Energy transactions, required by the situation cards, were materialised through the tokens. Last, the tablecloths were hung on a wall to provide a bird’s-eye view and collective reflection on the emerging discussions. While enjoying drinks and snacks, the participants could mingle and walk around the room to observe on the wall what they and others had written. Post-its and markers were available to share additional reflections where they saw fit. To close the session, the participants were invited to share their most important takeaway thoughts about the afternoon.



Fig. 5  
Photos from the JEF world café. On the left, participants interacting at the DIY table. Top right, the result of the first round of the communal table. Bottom right, a participant writing their thoughts on the luxury table.

## Learning from the World Café

Overall, the insights collected during the world café showed that the methodology and the related toolkit and artefacts were effective. The debate created around each table was successful and each participant seemed to leave with a new perspective on their energy consumption. Even the specific focus on justice, and more precisely on the possible social impact of energy futures was clearly addressed. In this regard, some expressed concerns regarding the societal lack of a communal spirit. The vernissage session was illuminating as it revealed how people felt very confronted with a tough future perspective. Some of the participants found the introduction and, more specifically the presented scenario, to be shocking. These people explained that they could relate to this possible future reality and were triggered by the idea of such a difficult time ahead of us. One person noted in particular that “The introduction was quite scary, it made me realise all the things we’ve done personally and as a society these past four decades. I’m sorry, we are leaving you a planet in pretty bad shape. I hope the younger generation will be inspired to effect positive change”.

### Methodological Reflections

The world café provided rich insights into the effectiveness and challenges of designing for debate around the topic of justice in the energy future. This work highlighted the important role of materialising something intangible like energy, the potential importance of perspective-taking tools (the role cards) as research instruments, and the benefits but also the challenges of conducting this type of process. The energy tokens, in fact, were crucial in the activity as they helped to materialise and experience the situation and the participants’ choices. As one person remarked during the vernissage “When you physically have the energy in your hand, you suddenly start to see it almost as money and are more aware of its value”.

The role cards, another crucial element of the JEF toolkit, forced participants to take somebody else’s perspective and, as intended, were very effective. Even without stating the wealth of the person they were “playing against” in the dynamics dictated by the situation cards, given the context, participants intuitively inferred if a character had more or less income than they did in the role they were embodying. Participants quickly got accustomed to adjusting their judgement, whether they believed the person deserved “help” in terms of energy tokens or not. The cards then brought different tendencies to the surface in relation to the different social statuses. At the DIY table, the tendency was to share with people in the same social bracket as themselves, while at the LUX table sharing with the “less fortunate” prevailed. This was an interesting observation that could have important implications for developing just energy futures. Building on this experience and materials then, future studies around the design of debates about justice in energy futures could further explore patterns of social behaviour across groups of people identifying with different social statuses. In this perspective, the design of the role cards could be further expanded to either provide greater

diversity in terms of populations and possible social inequalities, or even to allow the participants to actually make their own cards as a way to reflect on their positionality (Liang et al., 2021).

Finally, the *world café* process was very effective, yet, some areas for improvement also emerged. When the round of tables started, for instance, it was still somewhat unclear to participants what they were supposed to do. Feeling confused, some asked for clarification on what they were or were not allowed to do, especially the older participants. It took some time for participants to become accustomed to the idea of activities where there was no right or wrong answer, and the purpose was rather to have challenging discussions. The confusion, however, gradually waned during the course of the session and the second round was very productive and engaging. At this point, the participants were confident in the progress of the session and challenged their positions more easily. Especially in tables two and three they were much more immersed in the situation and energetically negotiating energy tokens. During the first round, the tendency was to share energy tokens almost recklessly. Many participants ended with little to no tokens at the end of the round. When given a second chance, they began to be more careful, almost protective. It was in the third round that a conscious tendency towards sharing really emerged. Although this behaviour had been observed in previous rounds, it almost became common sense at this stage to give energy tokens for a return of favours when they needed it. The last round was also characterised by a diminishing number of comments on the tablecloth, which suggests that the participants might have started to feel tired, or that they might have felt so comfortable with the process that the activity partially lost its power to provoke and engage. Nevertheless, the final stage, the vernissage, again triggered very interesting reflections and remarks from the participants, especially as they looked at each other's actions and reactions. Thereafter, when designing a world café intended to provoke debate and confront people with a possible future, the intention of the activity must be explicit and participants may also benefit from a trial round of the activity (especially for tables involving a game-like mechanism, such as tables 2 and 3 of this work).

## Conclusion

With the exponentially growing technological landscape which has direct implications on the production and consumption of energy, and the ongoing climate crisis, designers are increasingly confronted with the need to take responsibility for the environmental impact of what is designed and produced. Therefore, the issues of environmental sustainability in general and of energy consumption have become a primary economic and political concern, but also a design challenge. A growing body of research, such as sustainable HCI (DiSalvo et al., 2010), is now engaged in understanding how design can contribute to achieving desirable energy futures. Yet, while the design discourse has been very successful in bringing attention to the question of the effectiveness of techno-determinist perspectives in energy futures, and raising issues of social impact, such as debating aspects of privacy, the topic of justice and social inequality related to a potential energy transition remains relatively under-investigated.

This paper provides a practical example of how design and HCI can engage with the topic of justice when working on energy futures. The paper shows how to easily create spaces for debating a plausible future delineated by academic research, industry reports, and national strategies. The methodological insights discussed in the previous section represent a potential resource for the design community to engage with the topic and with analogous societal transitions that may have important social consequences. By creating a space for people to debate and reflect upon their needs, work like this creates spaces for collective reflection and confrontation; spaces that have the potential to inspire the public to act toward a desirable change.

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