Inhabitants' activity and experience as a starting point for the design of collective energy tools

L'activité et l'expérience des habitants comme point de départ pour la conception de dispositifs énergétiques collectifs

Antoine MARTIN, Marie-France AGNOLETTI, Eric BRANGIER
PErSEUs – Université de Lorraine

Energy communities for collective self-consumption: frameworks, practices and tools
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Consumers' role in the design and management of energy systems: from the individual to the collective

IMPACT

ULHyS

1. Purpose of the presentation

- Designing tools requires understanding user needs and activity to define artefacts, their functionalities and characteristics

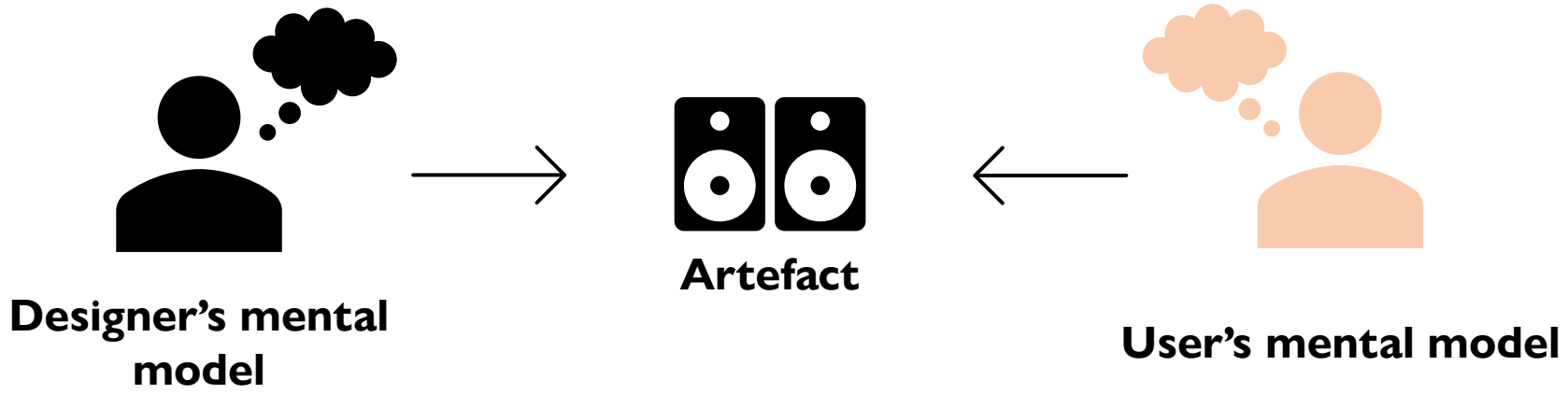
- This study had the applied goal of anticipating future needs and activities related to energy for housing (not specifically on energy communities)

- Activities related to energy in the home (individual and collective), are the activities that will be carried out collectively : knowledge of these activities, their related needs and how they might change is a prerequisite for the definition of artefacts which will assist collective activities related to energy in the home

2 . Introduction

2 . Framework: User needs' analysis

Designers refer to a hypothetical representation – which does not necessarily correspond to reality – of the user's needs and use of the artifact (Norman, 1988; Hassenzahl, 2018)



2 . Framework: User needs' analysis

The aim of the needs analysis is to provide the designer with knowledge about the user and his needs, to enrich his representation of the user to define:

- the utility of the artifact (Brangier, 2006; Loup-Escande et al., 2013; Scapin & Bastien, 2001)
- the characteristics of the artifact so that:
    - it will be adapted to the users' abilities and the situation of use to be usable (Scapin & Bastien, 2001)
    - it will be the source of satisfaction, well-being or pleasure for the user (Brangier, 2006)

2 . Framework: User's needs

2 types of user's needs:

- **Pragmatic needs**: refer to the user activity and to the quality of interaction offered by the artifact (Hassenzahl, 2018)

- **Hedonic needs:** refer to pleasure and psychological well-being of the user. It is the capacity of the artefact to meet basic psychological need (Hassenzahl, 2018)

2 . Framework: User's needs

- General categories of pragmatic (e.g., utility need) and hedonic (e.g., skill need) needs have been identified. They are not very useful for designing artefacts, it is necessary to make a more microscopic description of needs which allow to detail their specificities (Brangier, 2006)

- User experience can be analysed to access detailed needs and is considered easier because the description it is more accessible to the user, is not based on specific skills and does not require extensive reflection, unlike artefact or needs based assessment (Hassenzahl et al., 2010, 2015)

2 . Framework: User needs' anticipation

The demand for future artifact design lead to take into account users' future needs, to design artifacts that will be adapted to future users (Barré et al., 2018; Bourgeois-Bougrine et al., 2018; Brangier et al., 2017; Loup-Escande et al., 2013)

2 . Framework: User needs' anticipation

Users and designers are limited in their ability to identify future needs:

- Designers have difficutlies to imagine the real needs of users (Hassenzahl, 2018; Norman, 1988)

- Users have difficulties:
  - to imagine an artifact they do not know or that does not exist (Anastassova et al., 2007; Anastassova & Mayora-Ibarra, 2009; Barré et al., 2018; Bourgeois-Bougrine et al., 2018; Loup-Escande et al., 2014; Petiot & Yannou, 2004)
  - to imagine the future (Barré et al., 2018; Bourgeois-Bougrine et al., 2018; Trope & Liberman, 2003, 2010)

2 . Framework: **User needs' anticipation**

Some individuals are assumed to have a better ability to imagine the future (Brangier et al., 2019):

- experts (elaborate representation of the future of the field)

- precursory users (precursory use expertise)

2 . Users and energy systems: **influence of users**

Users greatly influence the success of energy projects (Fournis & Fortin, 2017), especially in the building sector:

- experiments to reduce energy consumption have taken place with a focus on the energy efficiency of buildings and equipment. The estimated reductions in energy consumption have not been observed (Blaise & Glachant, 2019; Sidler, 2011) and can be explained partially by inhabitants' behaviour which can greatly affect energy consumption (Delzendeh et al., 2017; Swan & Ugursal, 2009)

- Revell and Stanton (2017) have shown that users can increase their energy consumption even as they seek to reduce it, if they do not have a device that fits their mental model of the activity (e.g., heating)

2 . Users and energy systems: **influence of users**

- This discrepancy can be explained by differences between the actual needs of users, and the representation of user activities and needs by building and energy system designers

- User is the element that is least studied and least integrated in the design (Delzendeh et al., 2017)

2 . Users and energy systems: **new domestic energy related activities**

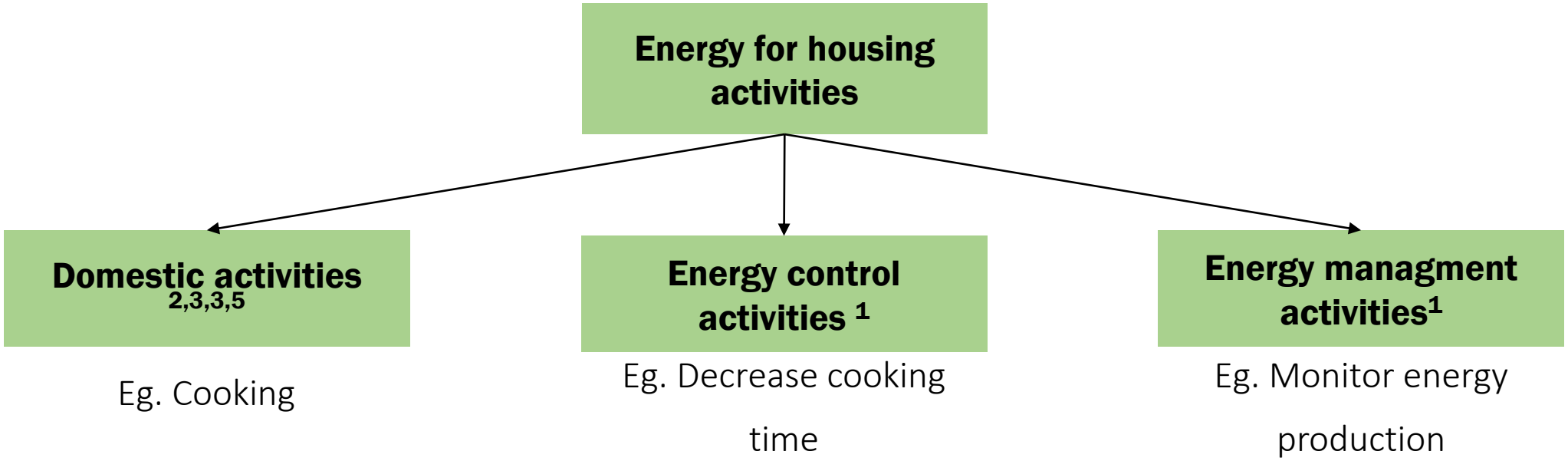
The energy transition is at the origin of a diversification of energy sources, specifically towards Renewable Energies (Reuß et al., 2017) which are:

- are spatially distributed
- for the most fluctuating

→ energy production does not necessarily match with energy consumption

These very specific characteristics are at the origin of the emergence of new domestic energy related activities (self-production, self-consumption, storage etc.), which call for new artifacts to assist these new activities both individually and collectively

2 . Users and energy systems: **energy for housing activities**

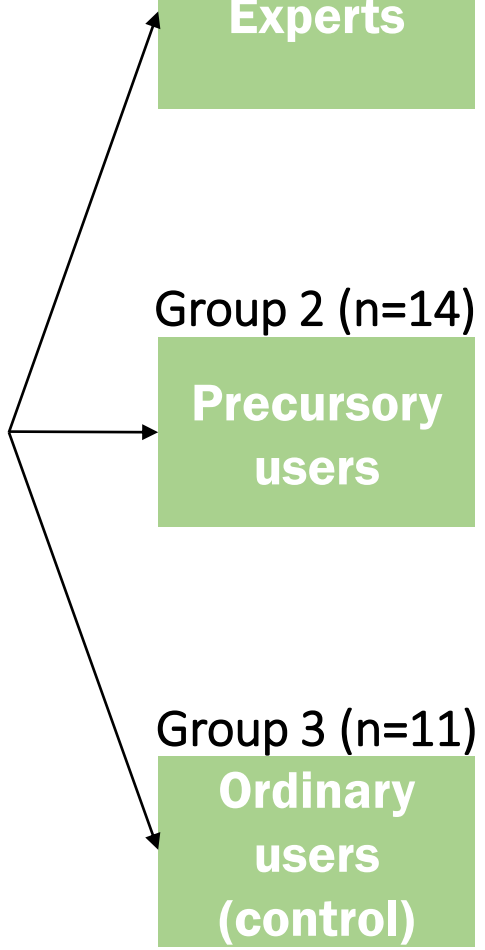


[1]Lahoual & Fréjus (2013)
[2]Guibourdenche (2013)
[3]Guibourdenche, Vacherand-Revel, Fréjus & Haradji (2015)
[3]Bovay et al (1987)
[5]Bonnin (2016)

3 . Study

3 . Method: **Participants**

Needs anticipation interview
(Brangier et al., 2019)



Group 1 (n=11)

Experts

professional expertise (eg. Researcher in smart grids)

Group 2 (n=14)

Precursory users

precursory uses (eg. Inhabitant of an energy self-sufficient house)

Group 3 (n=11)

Ordinary users (control)

no professional expertise or precursory uses

3 . Method: **Participants**

- **Individual offgrid** (Inhabitant of a self-built, non-interconnected hut with self-generation, storage and self-consumption of energy)

- **Community offgrid** (Inhabitant of a self-built, participatory and non-interconnected ecovillage)

- **Network connected individual** (Inhabitant of a smarthouse with self-production, self-built storage and self-consumption of energy)

- **Network connected community** (Inhabitant of a participatory and intergenerational eco-neighbourhood, with self-generation of energy)

3 . Method: **Protocol**

Duration : ~ 2 hours (min=1; max=3)

1 **Priming**: interviewee is asked to talk freely about energy for housing

2 **Experiences**: interviewee is brought to verbalise is experience related to energy for housing with activity maps

3 **Future projection**: interviewee is lead to project himself into the future :

1. describe in a general way his long-term vision of the future
2. imagine and describe in as much detail as possible the place in which he would live in this future.

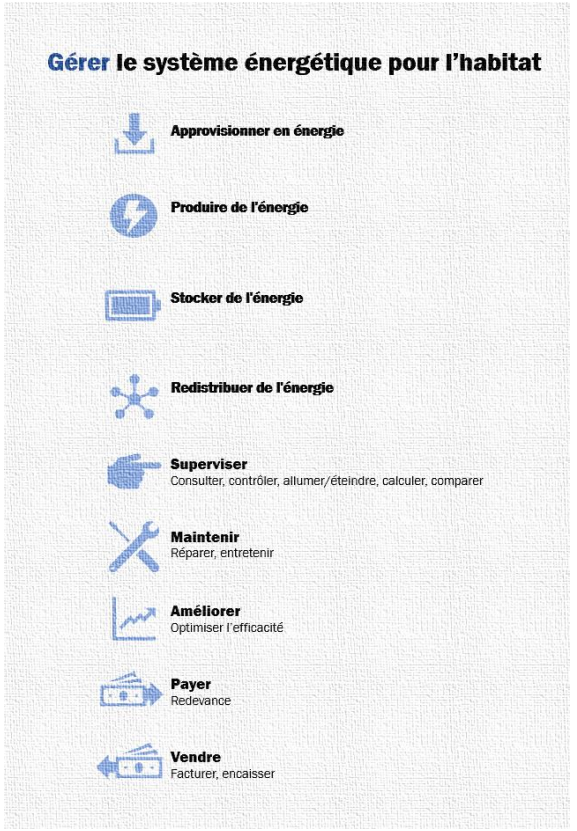
3 **Future ideation**: interviewee is brought to ideate on the future of of energy for housing:

1. freely to enrich theme's future context
2. with activity maps to elaborate future needs ideas

3 . Method: **Activity maps**

Obtained through:

- Energy for housing literature analysis
- Exploratory interviews related to the use of energy for housing, conducted with 9 individual energy producers



3 . Method: **Analysis**

1 Transcription

2 Identification of

- Users's activities
- User's motivations
- Elements that support a positive user experience (using a coding grid)
- Elements that lead to a negative user experience (using a coding grid)

3 Identification of patterns of activies and motivations

3 . Results: Users' activities

1. Energy system installation/renovation

1.1. Inquire
1.2. Decide
1.3. Design the system
1.3. Anticipate the exploitation
1.5. Plan the work
1.6. Administer
1.7. Financing the acquisition and the work
1.8. Install/Renovate
1.9. Check compliance
1.10. Appropriate the system

3 . Results: Users' activities

2. Energy system management

2.1. Check operation
2.2. Check condition
2.3. Follow up
2.3. Keep in condition
2.5. Repair
2.6. Supply energy
2.7. Choose the use of energy
2.8. Buy energy
2.9. Distribute energy

Activities previously identified in the literature

3 . Results: Users' activities

3. Energy consumption management

3.1. Consult consumption
3.2. Anticipate/Simulate consumption
3.3. Understand consumption
3.4. Consult the available energy
3.5. Anticipate/Simulate available energy
3.6. Change activity
3.7. Act on equipment

Activities previously identified in the literature

3 . Results: Users' experiences

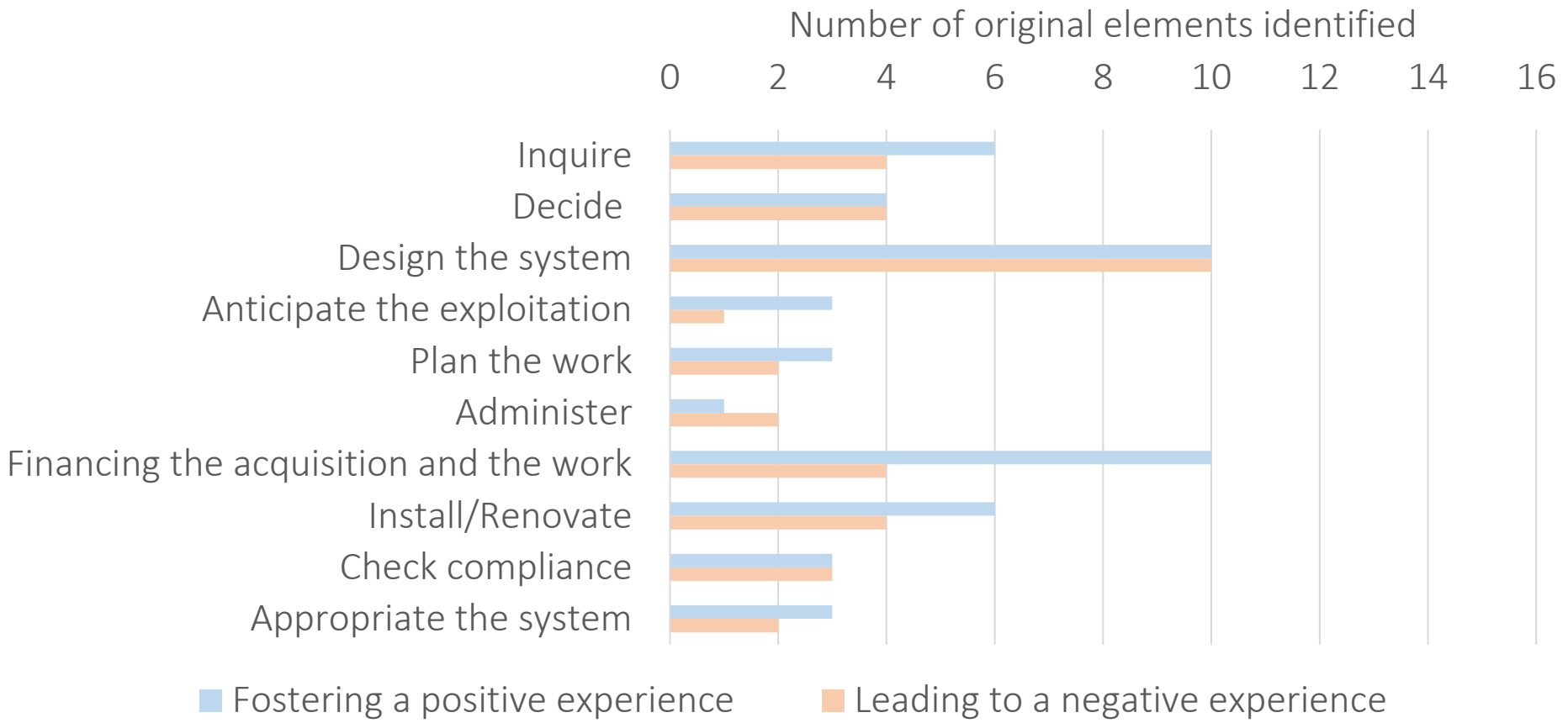


Figure: Number of elements identified as fostering a positive or leading to a negative experience for energy system installation/renovation activities

3 . Results: Users' experiences

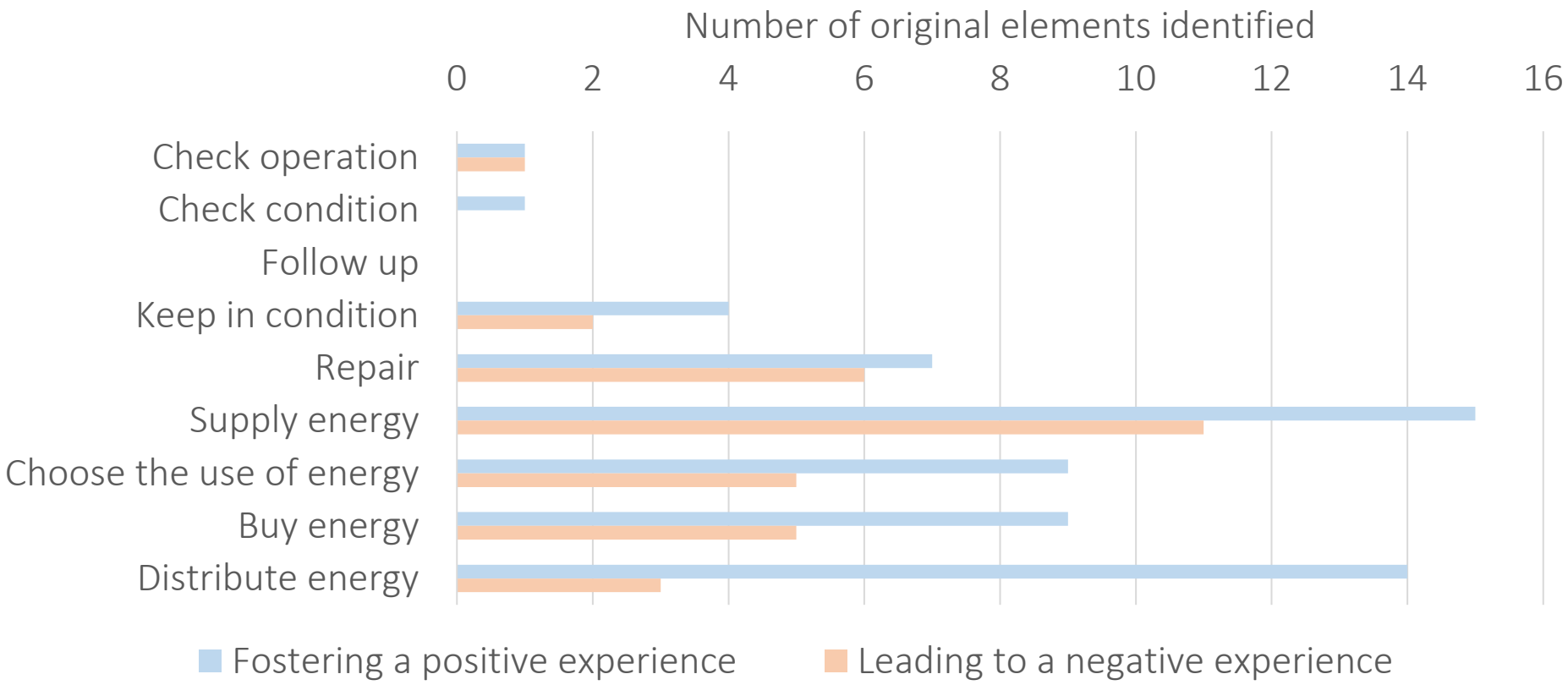


Figure: Number of elements identified as fostering a positive or leading to a negative experience for energy system management activities

3 . Results: Users' experiences

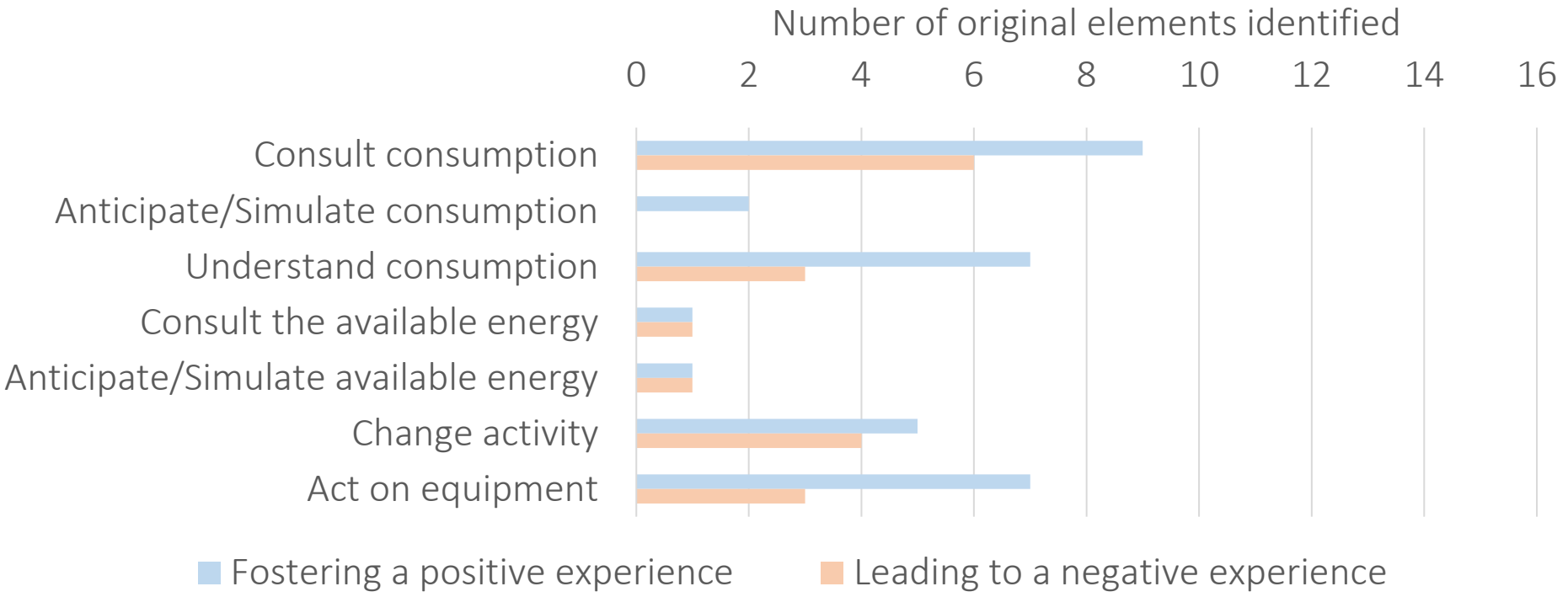
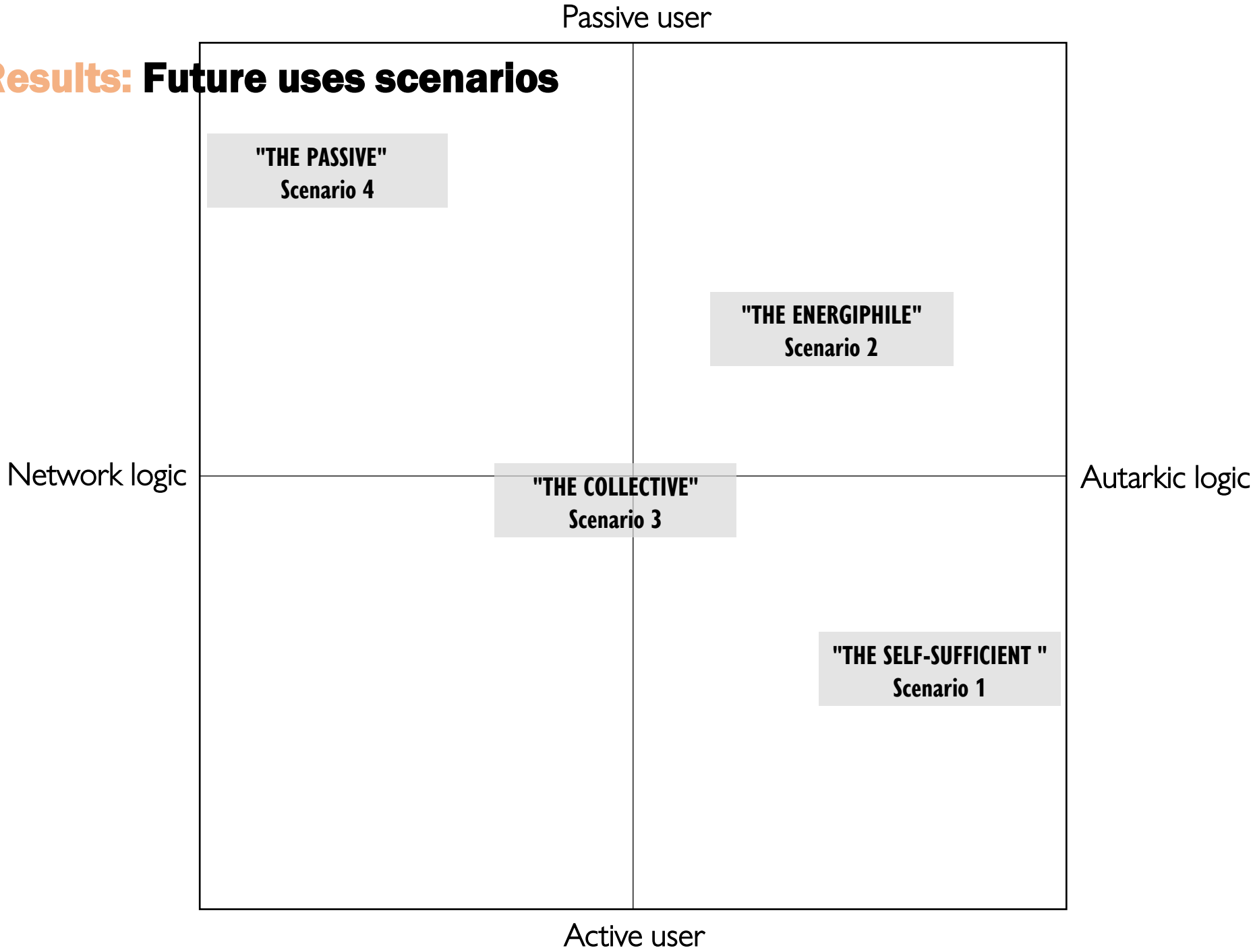


Figure: Number of elements identified as fostering a positive or leading to a negative experience for energy consumption management activities

3 . Results: Users' motivations

1. Energy self-sufficiency
2. Control/Independence from other people and organizations
3. Involvement in the energy system
4. Comfort
5. Respect for the environment
6. Profitability/Cost
7. Enthusiasm for technology
8. Security

3 . Results: Future uses scenarios



4 . Discussion - Conclusion

There are different ways of forming or not forming a community around energy, which are motivated by different reasons and which are at the origin of different individual and collective activities, and which therefore need to be supported by different and adapted artefacts

To ensure that decentralised energy systems are accepted, usable and perform well, they need to be adapted to these activities and motivations. This can be done by thinking about the "core technologies", their deployment (network, sizing etc.) and the solutions (technical and organisational) that can support the use of the "core technologies" (e.g. ambient system, tools to help control consumption for collective housing)