

Challenges and approaches for an LCA of smart grid use cases

A Delphi approach

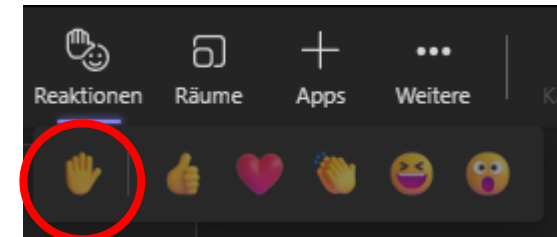


Online expert workshop
MS Teams, 7th of November 2022
Swantje Gährs, Hannes Bluhm (IÖW),
Daniela Wohlschlager (FfE), Severin Beucker (Borderstep),
Johanna Pohl (TU Berlin), Magnus Fröhling (TU Munich)

Technical information



- **Please raise your virtual hand if you want to make a comment**
- **Please unmute and mute yourself**
- **In case of technical issues:**
 - Use the chat
 - Re-join the meeting
 - Write an email to marlen.ihm@ioew.de
- **Recording of the workshop**
 - Only for internal documentation (starting now)
- **We are working with**
 - Google Forms
 - Miro
 - Please see chat for links



Background and goals



 – **LCA of smart energy use cases is challenging!**

– **Purpose of an upcoming scientific paper:**

- Overview of environmental effects of smart energy use cases
- Definition of challenges for a holistic environmental assessment
- Provision of approaches to solutions for LCA practitioners

 – **Goals of the workshop:**

- Based on the experience of LCA practitioners in the field of smart energy systems, we want to:
 - define the relevance and challenges of assessment per environmental effect,
 - discuss guiding questions for LCA on smart energy use cases to determine viable approaches for solution.

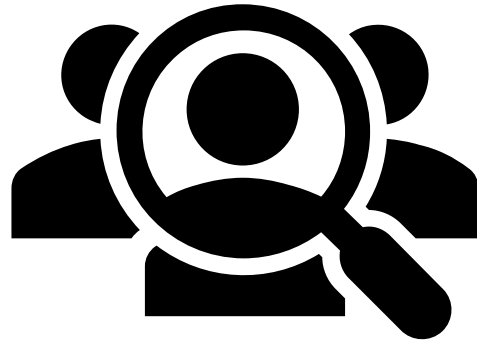
 – **Workshop approach:** Interactive communication of expert group (Delphi method)

Agenda



Time	Item
Part 1	
2:00	Introduction
2:15	Input: Smart energy use cases
2:25	Input: Environmental effects
Part 2	
2:35	Online survey on environmental effects
3:10	<i>Break</i>
Part 3	
3:20	Discussion of solution approaches in two groups
4:15	Summary and goodbye
4:30	<i>End</i>

Short round of introduction



- **Name**
- **Institution**
- **One(!) sentence on your work**
- **Motivation for the workshop**

Content



Part 1

- a) Introduction
- b) Input: Smart energy use cases**
- c) Input: Environmental effects

Part 2

- a) Online survey on environmental effects

Part 3

- a) Discussion of solution approaches
- b) Summary and goodbye

Definitions



- **Smart grid** can be defined as intelligent electric grid using ICT to combine power generation, storage, and consumption, balancing volatile production and consumption (physically and economically). Management is organized through combination of centralized and decentralized energy management systems. *(European Commission and German Federal Environmental Agency)*
- **Smart energy** expands the concept of interconnected and intelligent management of energy in the electric grid to other sectors and applications of energy generation, storage, consumption, and distribution. *(European Commission)*
- **Use case** can be understood as a scenario describing the process and application of achieving a specific goal, for a specific stakeholder with a particular solution or technology. *(Cockburn 2008)*

Types of use case classification schemes



Background	General	Regulation	Consulting	Industry support / standardization	Science
	Method	Meta study	Derived from regulation	Derived from framework	Submission by industry / users
Focus	Scope	General	Energy	Certain subcategories	Specific energy infrastructures / technologies
	Clustering	Voltage levels	Type of infrastructure / technologies	Energy sectors	Overarching services

Classification according Weigel et al. (modified)



System balance	Smart grid & optimized operation	<ul style="list-style-type: none"> - Grid operation: ... - Optimized generation: ... - ...
	Smart market & flexibility	<ul style="list-style-type: none"> - Smart marketes: ... - Ancillary services: ... - ...
Process optimization	Identification of anomalies & prediction	<ul style="list-style-type: none"> - Predictive maintenance: .. - Simplified qualification and administration: ...
	Process efficiency	<ul style="list-style-type: none"> - ...
Customer/ User orientation	Smart energy management of buildings	<ul style="list-style-type: none"> - Energy management and sector coupling: ... - Smart building and smart neighborhood services: ...
	Secure metering, billing & communic.	<ul style="list-style-type: none"> - Smart and multi metering: ... - Certification of CO2-emissions of electricity: ... - ...

Content



Part 1

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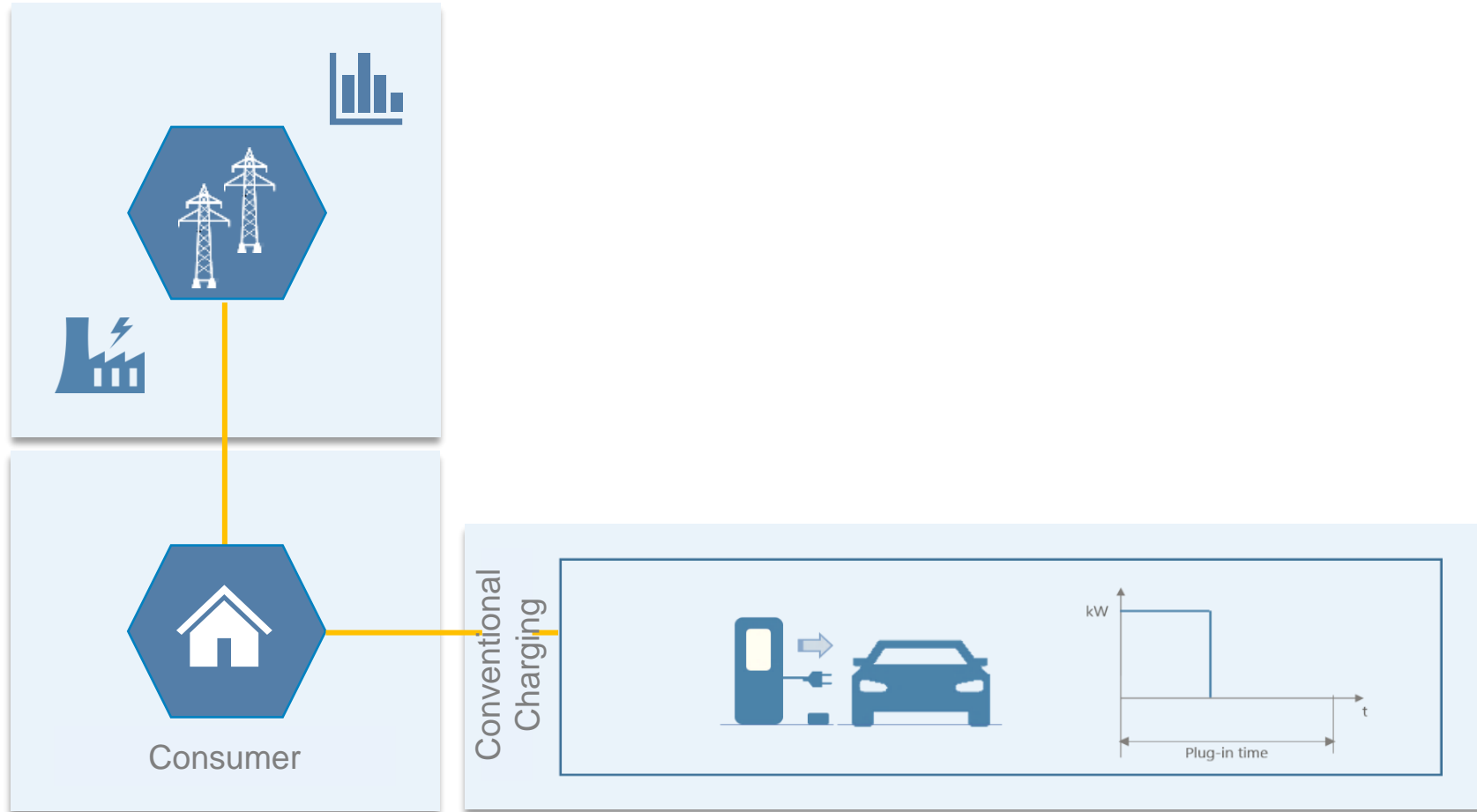
Part 2

- a) Online survey on environmental effects

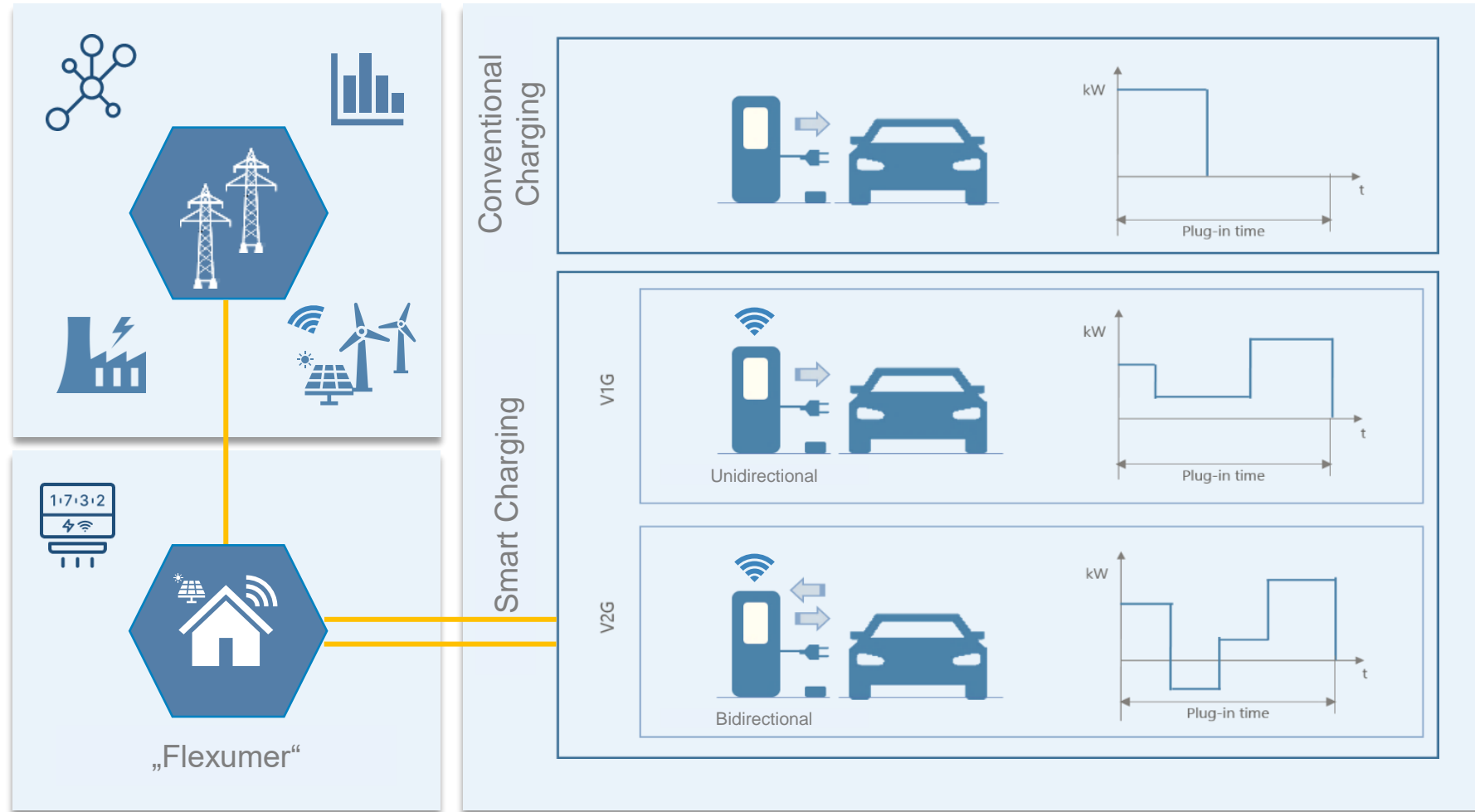
Part 3

- a) Discussion of solution approaches
- b) Summary and goodbye

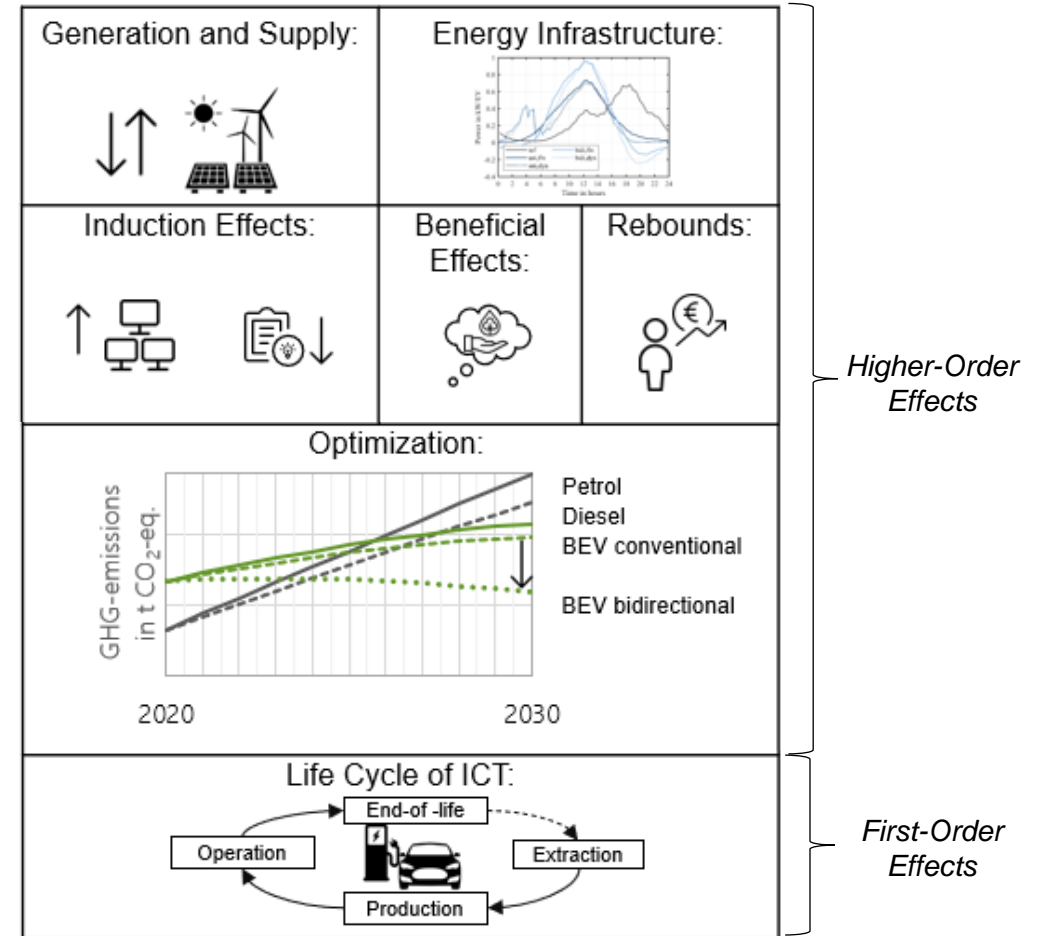
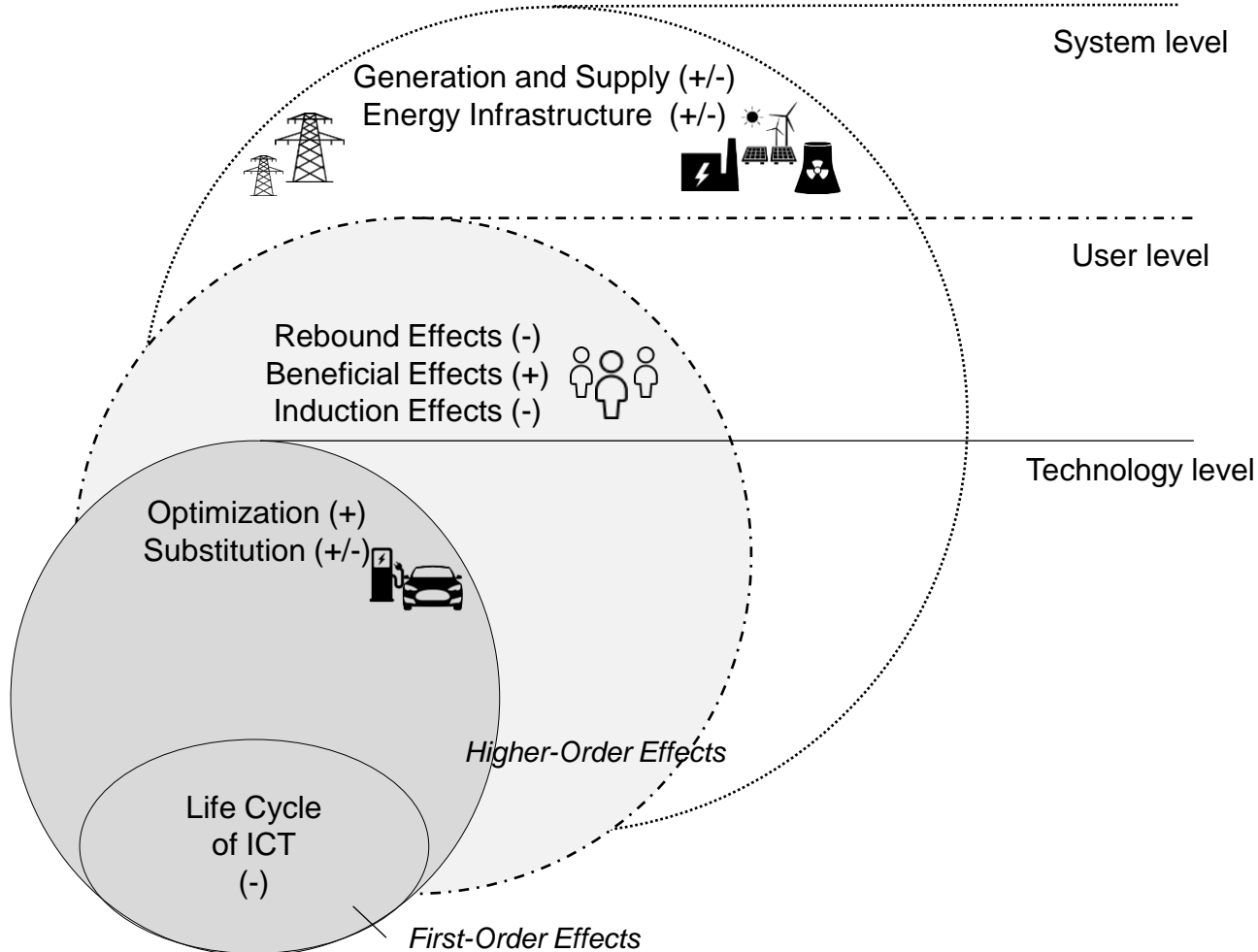
While BEVs represent an additional consumer in the conventional energy system...



...smart charging allows to use BEVs as flexible storage options in a renewable-based energy system



Literature shows: environmental effects of ICT occur on different levels



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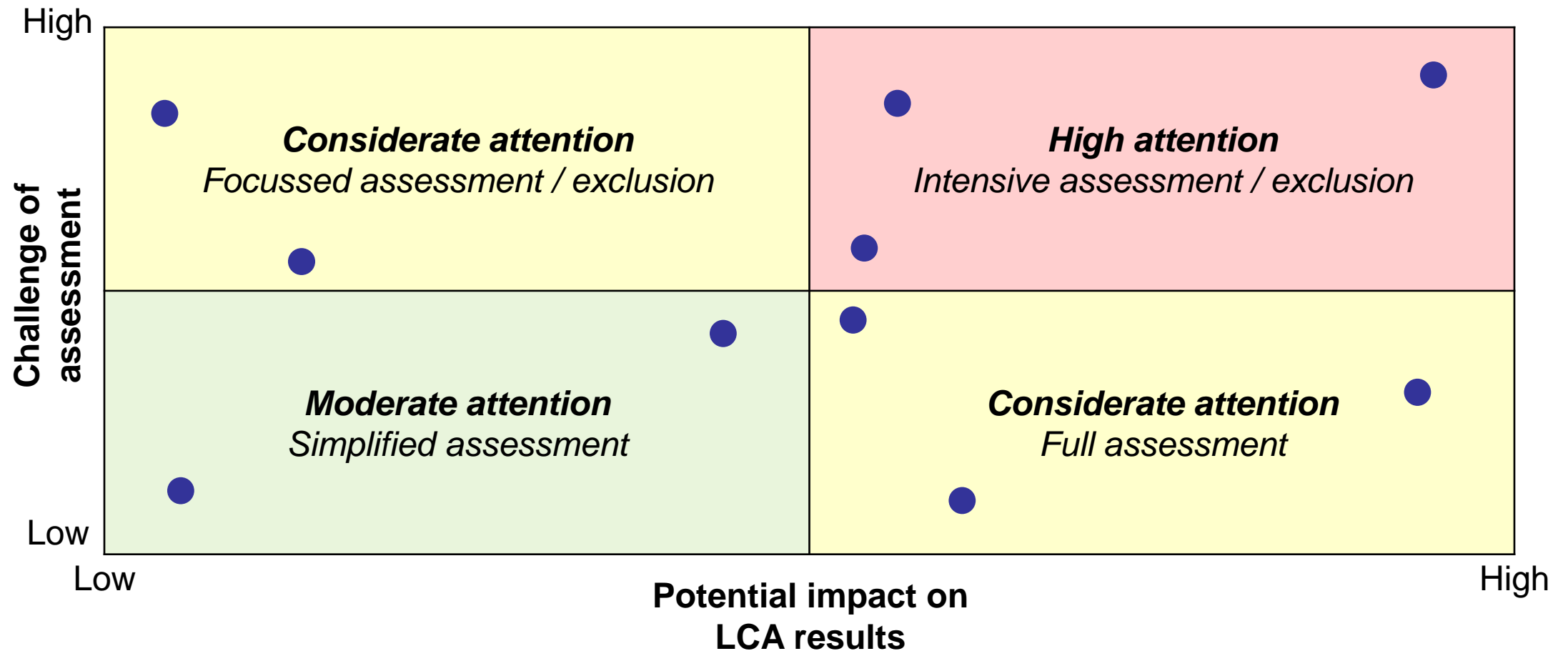
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Are certain environmental effects more challenging to assess than others? Let's find out.



Survey process

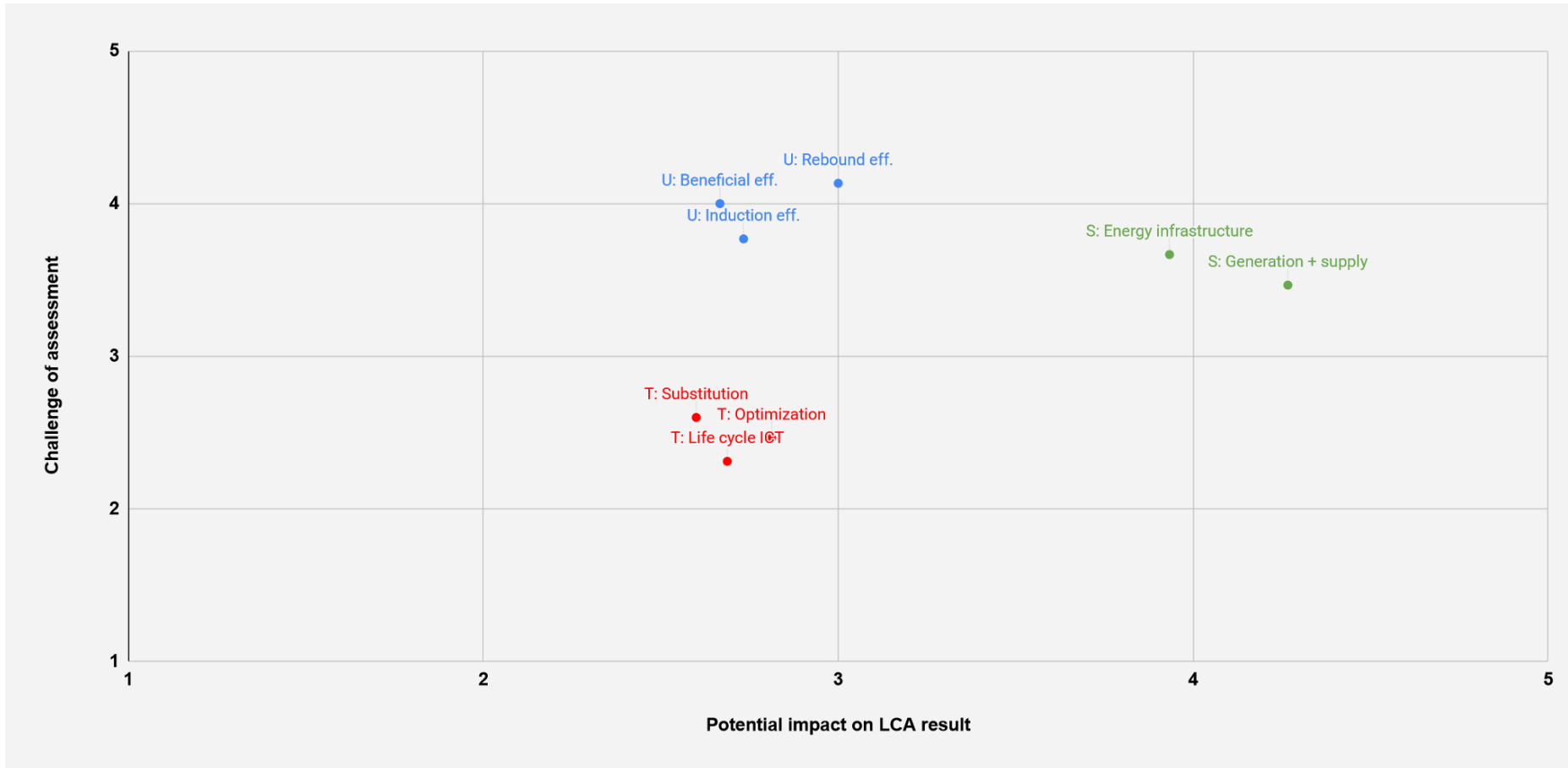


1. **Go to link (see chat)**
2. **Take up to 15 minutes to**
 - Fill out the survey (Q1, Q2)
 - Leave comments in the blank field (Q3, e.g. on effects, research recommendations etc.)
 - Watch the live results and change your assessment if necessary, interact!
3. **Discussion (15 min)**

Remarks:

- **Generalization is – of course – limited → best guess**
- **Answer based on your experience or a hypothetical example**
- **You can leave effects unanswered**

Survey result



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We have identified 4 key guiding questions for LCAs on smart energy use cases



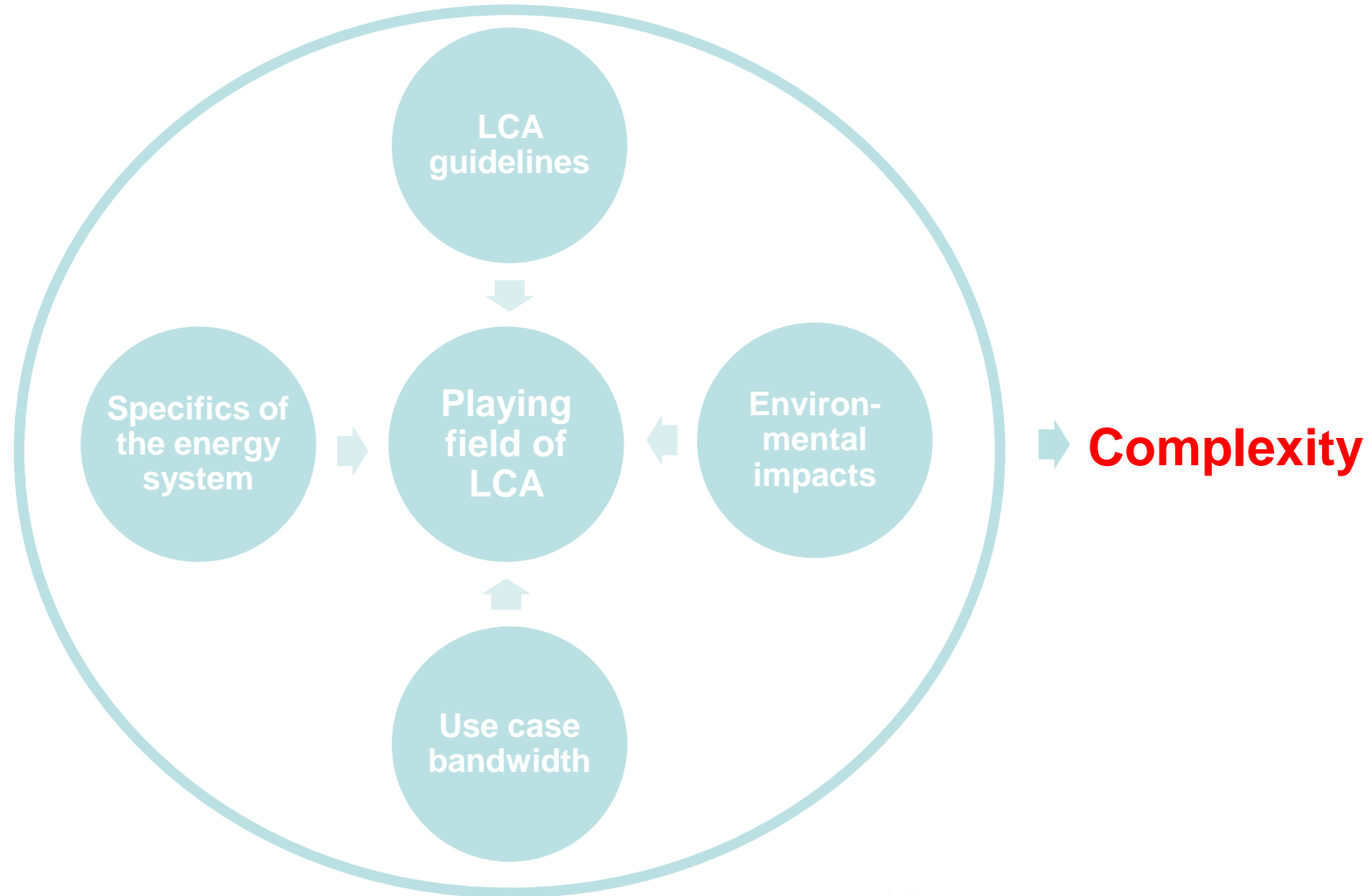
Focus of
group 1

- 1. What needs to be considered when setting the playing field of the LCA?**
- 2. How to collect data and address missing data?**

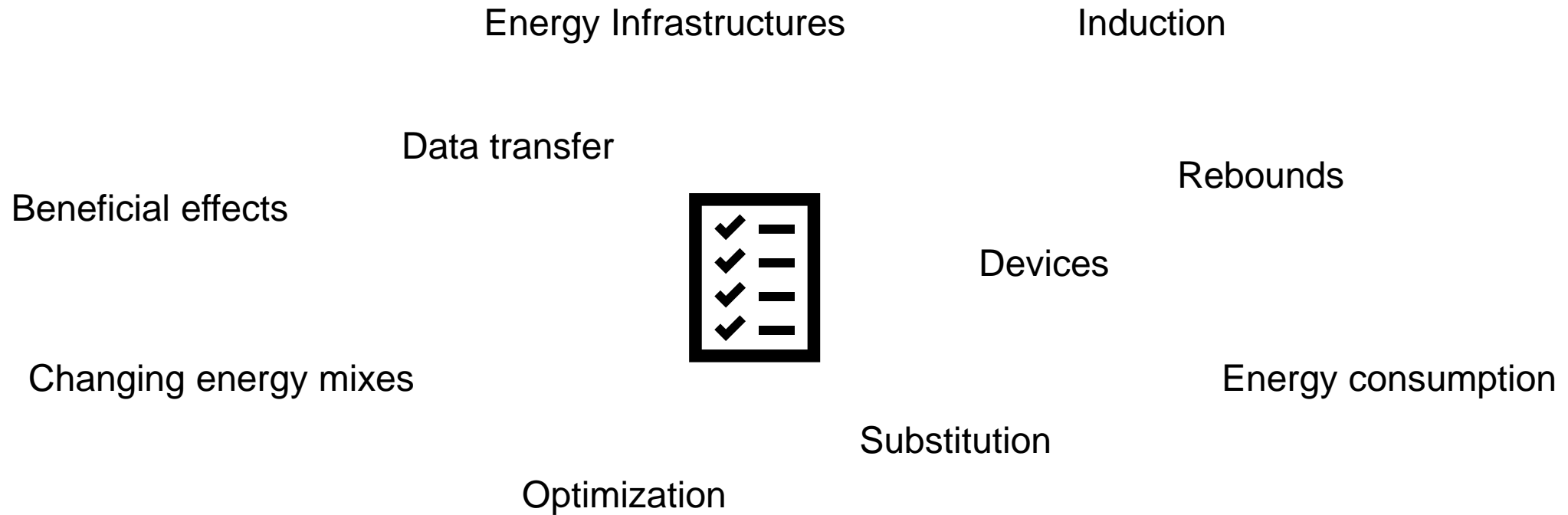
Focus of
group 2

- 3. What are the challenges in defining the goal and scope elements to assess smart energy system use cases?**
- 4. How to consider future developments?**

1. What needs to be considered when setting the playing field of the LCA?



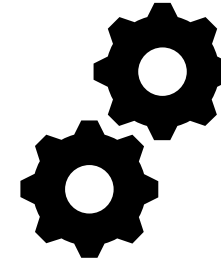
2. How to collect data and address missing data?



3. What are the challenges in defining the goal and scope elements to assess smart energy system use cases?



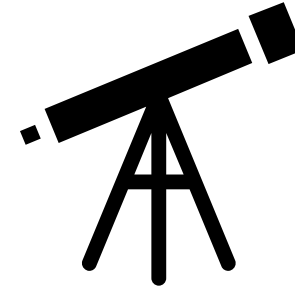
- Reference system
- Functional unit
- System boundaries
- Allocation vs. substitution
- Method (e.g. prosp. LCA, hybrid LCA)
- Impact categories
- ...



4. How to consider future developments?



- **Scenario definition and differentiation**
- **Technology development (roadmaps)**
- **Growth rates and diffusion**
- **Scale-up of technology and production**
- ...

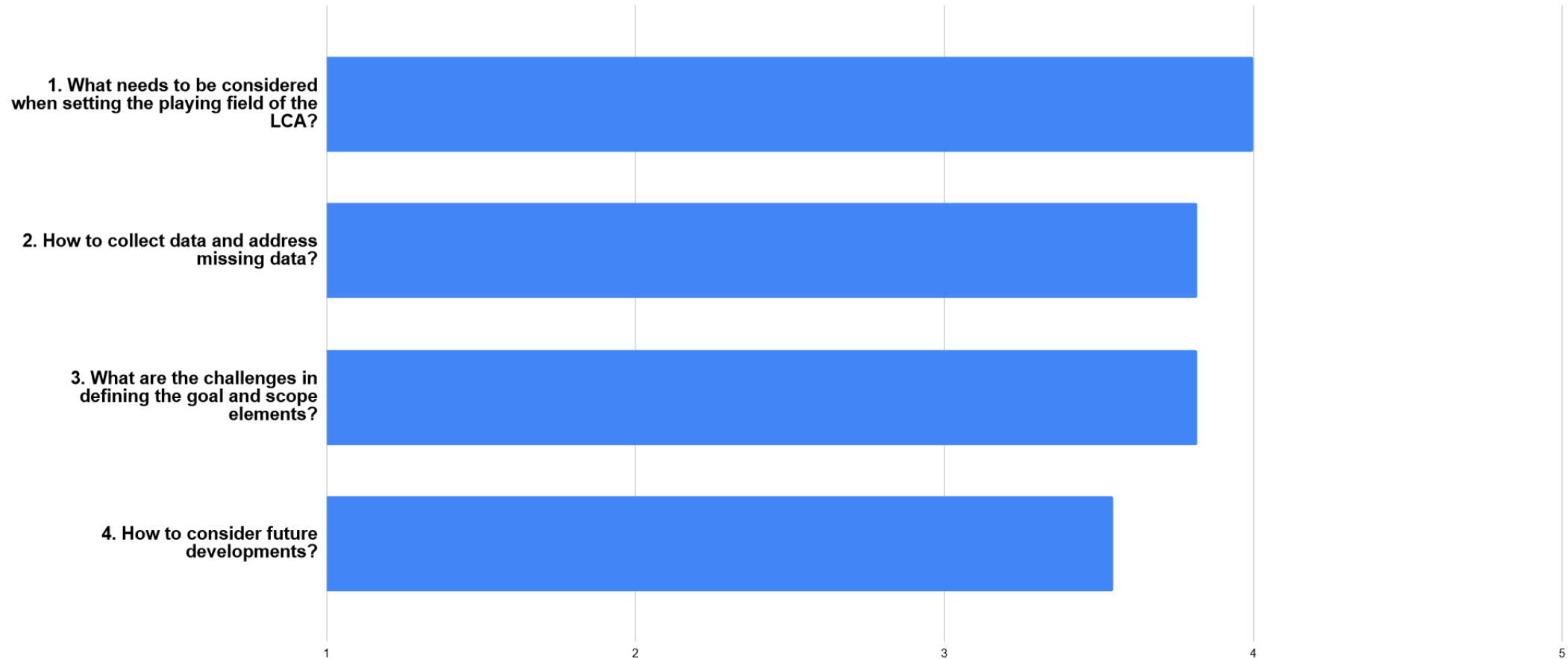


Discussion process



- **Two groups**
 - Group A: Q1 (Setting the playing field of the LCA) + Q2 (Data collection strategies)
 - Group B: Q3 (Challenges in the assessment with LCA) + Q4 (Consider future developments)
- **Access the Miro board (see chat; password: lcaws2022)**
- **Discussion in groups (30 min)**
- **Change of questions; discussion in groups (15 min)**
- **Summary by moderators in plenary (5 min)**

How relevant are the guiding questions while conducting a LCA on smart grid/energy use cases?



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Next steps and outlook



We:

- Workshop follow-up:
 - Sharing of presentation and results
 - Individual interviews (if needed)
 - Creation of mailing list
- Scientific paper:
 - Consolidation and writing
 - Invitation to presentation of final results

You:

- Miro-Board: available until Friday 11 November
- Mailing list: confirmation to participate
- Other: contact us for questions and discussions!

Thank you for your attention.



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Daniela Wohlschlager (FfE), Severin Beucker (Borderstep),
Johanna Pohl (TU Berlin), Magnus Fröhling (TU Munich)
Contact: hannes.bluhm@ioew.de

7th of November 2022