Social innovation in energy transition: Evaluation challenges and innovative solutions

Regina Betz
Center for Energy and the Environment (CEE)
Zurich University of Applied Sciences (ZHAW)
Bahnhofplatz 12
8400 Winterthur
Switzerland
betz@zhaw.ch

Christian Winzer
Center for Energy and the Environment (CEE)
Zurich University of Applied Sciences (ZHAW)
Bahnhofplatz 12
8400 Winterthur
Switzerland

Keywords

social innovation, impact evaluation, community energy systems

Abstract

The climate crisis needs urgent solutions and potential agents of change are cooperatives, citizen initiatives, start-ups etc., which form social innovation initiatives. Social innovations in energy transition (SIEs) are defined as "(combinations of) ideas, objects and/or actions that change social relations and involve new ways of doing, thinking and/or organising energy. " (Wittmayer et al. 2020, iv). This is how the H2020 project SONNET defines SIEs, on which this paper is based on.

The aim of the paper is to illustrate how challenging the evaluation of the success of those diverse types of SIEs is and what approaches were and can be applied. Evaluating whether SIEs are successful means to understand whether SIE-initiatives have been successful in achieving goals and which types of SIEs are more successful in achieving certain goals than others. We differentiated between the aims held by SIE-initiatives themselves (SIE-aims), aims which are shared by the EU and SIEs (shared-aims), and aims of the European Energy Union which are not shared by SIE's (EU-aims). The aims of the SIE-initiatives were based on literature review and a survey among the empirically studied SIEs in SONNET.

We find that many of the studied SIE-initiatives do not monitor their impacts as resources are scarce. Some of the impacts occur in people's mind (such as impacts on "thinking"), and even the impacts which can and have been monitored are hard to compare across different initiatives, due to their diversity. Therefore, our surveys only capture the perceived contributions of SIEs to the different goals.

Based on the surveys we find that SIE-initiatives achieved significantly higher contributions towards SIE-aims than towards EU-aims or shared-aims and that the perceived contribution is stronger for those aims with higher importance. The SIE-aims with the highest contributions were "improve social acceptance of renewable energy production" and "strengthen local community". The shared-aims with the highest contributions were "increased renewables production" and "reduced greenhouse gas emissions". The perceived contribution towards other EU-aims or shared-aims was rather low. Looking at the different SIE-types, in general SIE-initiatives focusing on "Thinking"-type of activities seem to achieve slightly lower contributions for many of the aims we assessed than the other types of activities ("Doing", "Organizing"). Regarding the social relation, contributions towards shared aims were significantly higher in case of SIE-initiatives working on a "Competition" setting, and significantly lower in case of SIE-initiatives that were in "Conflict" than for the other types of social relations (i.e. "Cooperation" and "Exchange").

Our conclusion was that not one evaluation method fits all SIEs and we explored in a workshop how innovative approaches such as media analysis (news databases, websites, social media) and web tracking (google analytics/facebook) might be used for future evaluations of SIEs.

Introduction

This paper presents the findings of the H2020 project SONNET with regard to the evaluation of social innovations in energy transitions (SIE). But what are SIEs? People are trying out new practices that change social relations – or reviving practices from the past – in the hope that they accelerate the energy transition. Those new (or revived) practices are social innovations, if they deviate from the dominant ways of doing, thinking and/or organising in the current energy systems. Under SONNET SIEs are formally defined as "socio-technical configurations of ideas, actions and/or objects that change social relations and involve new ways of doing, thinking and organising" (Wittmayer et al. 2020, iv). Within the project a typology was developed which differentiated 12 different SIE types employing the social interactions according to Brinckeroff et al. (2008) which encompass competition, exchange, cooperation and conflict. They include energy cooperatives, new funding schemes for energy retrofits, crowdfunding for energy saving projects, local electricity exchange and many others (see Figure 1). A focus on energy efficiency was given in some SIE fields such as City level competition for sustainable energy which included SIEs in Switzerland like the 2000-Watt Areal; Energy Regions (Energie-Region); EnergieStadt label as well as in the Participatory incubation and experimentation field which included the Zgorzelec Renewable Energy Sources Development and Energy Efficiency Cluster in Poland.

The aim of the paper is to illustrate how challenging the evaluation of the success of those diverse types of SIEs is and what approaches may be applied. Evaluating whether SIE are successful means to understand whether SIE-initiatives have been successful in achieving goals and which types of SIE are more successful in achieving certain goals than others. We differentiated between the aims held by SIE-initiatives themselves (SIE-aims), aims which are shared by the EU and SIEs (shared-aims), and aims of the European Energy Union which are not shared by SIE's (EU-aims). The goals of the SIE-initiatives were based on literature review (Winzer et al. 2020) and complemented by surveys.[1]

Evaluation Challenges of SIE contributions

The original plan was that in addition to surveys, SIE contributions will be measured with specific, measurable, achievable, relevant and timely (SMART) indicators to provide a more objective measure of the contributions of SIE(-initiatives). However, this approach was given up, as we found that many SIE-initiatives do not monitor their impacts. What is usually available are the number of members of a SIE-initiative or the capacity of renewables installed, but when it comes to SIE-initiatives which organise networks against certain energy pathways other indicators are necessary. As the types of SIE-initiatives were very broad (see Figure 1), there was no common indicator which was able to measure the success across all initiatives in a meaningful way.

We concluded that quantifying the aims and contributions of SIE-initiatives is particularly challenging because:

- Aims of SIE-initiatives are subjective and heterogeneous
- They are hard to compare across different initiatives, due to their diversity
- Contributions and successes of SIE-initiatives are hard to quantify, as some impacts occur in people's mind (such as impacts on "thinking"), which cannot be inferred from objective actions (i.e. raising awareness and increasing acceptance)
- Data is scarce, as many SIE-initiatives do not have the resources and time that is required to quantify their contributions.

Therefore, we developed surveys which allowed us to capture the perceived contributions of SIEs to the different aims which we explain in more detail in the following sections. We also explored the potential of innovative approaches such as media analysis (news databases, websites, social media) and web tracking (google analytics/facebook) for future evaluations of SIEs.

Method

The data gathering process consisted of three steps. We first composed a list of the aims of the EU based on EU documents describing the European Union's goals (see European Commission, 2015 and 2019) as well as different SIE-initiatives in the energy sector based on a review of relevant academic articles and grey literature (Winzer et al 2019). As a second step, the results from our literature review were clustered into 20 groups of similar aims from socio-economic, socio-political, socio-cultural, socio-environmental and socio-technical or cross-cutting areas. In a third step a survey was developed which contained two main standardized questions on the perceived importance of and contribution of an SIE-initiative or SIE-field to the list of aims.

The survey used a mix of closed and open questions and took about 10–15 minutes to answer and was conducted between October 2020 and May 2021 (see details Dzukowski et al. 2021). SONNET researchers were asked to fill the survey out prior to each interview with a SIE-representative or a field-actor and had to ask their interview partner to fill in the same survey at the end of the interview. Involving researchers and representatives of SIE-initiatives as well as field-actors allows to explore differences between the perspective of the different respondent types. SIE-representatives consisted of individuals, that can speak for an SIE-initiative, such as the founders, president, program manager or spokesperson, or any other SIE-member that has an official role within the SIE-initiative. Field actors are part of an arena or space that includes a specific SIE, which they support or hinder with their actions and have a shared (but not necessarily consensual) understanding of the SIE and of their relationship to other actors. They recognise (but not necessarily follow) shared norms, beliefs and rules. The number of survey responses was 42 from researchers, 18 from SIE-representatives, 36 field-actors. The distribution of responses per SIE-type is shown in Figure 1.

1. More details on the survey can be found in Dzukowski et al. 2021.

Aim: (All)	Cooperation	Exchange	Competition	Conflict	AVERAGE CONTRIBUTION
DOING	**1) Cooperative action** ▪ *Local energy prod.& consumption* ▪ *Cooperative energy prod.& consumption* ▪ *Collaborative eco-efficient housing* avg.contribution: 1.3 #respondents: 29	**4) Local elec. exchange** ▪ *Local peer-to-peer electricity exchange* avg.contribution: 1.2 #respondents: 15	**7) Competitive action** ▪ *For profit services and technologies* - -	**10) Conflicting practices** ▪ *Action against specific energy pathway* avg.contribution: 1.2 #respondents: 6	1.3
THINKING	**2) Cooperative framing** ▪ *Advocacy for specific energy pathways* avg.contribution: 1.3 #respondents: 3	**5) Knowledge exchange** ▪ *Energy education* ▪ *Non-profit consulting* ▪ *Peer to peer learning* avg.contribution: 1 #respondents: 4	**8) Competitive narrations** ▪ *For-profit consulting* - -	**11) Conflicting frames** ▪ *Campaigns against specific energy pathways* avg.contribution: 0.9 #respondents: 2	1.1
ORGANISING	**3) Cooperative organization** ▪ *Participatory energy dialogues* ▪ *Participatory experimentation and incubation* avg.contribution: 1 #respondents: 10	**6) Organized exchange** ▪ *Platforms for direct energy transactions* ▪ *Investment and finance mechanisms* avg.contribution: 1.4 #respondents: 8	**9) Organized competition** ▪ *Energy gamification & nudges* avg.contribution: 1.4 #respondents: 13	**12) Organized conflict** ▪ *Networks against specific energy pathways* avg.contribution: 1.5 #respondents: 6	1.3
AVERAGE CONTRIBUTION	1.2	1.2	1.4	1.2	1.2

Figure 1. SIE-initiatives Typology.
Note: SIE-types 7 and 8 were excluded from the analysis, as there were no responses for the corresponding types of SIE-initiatives.

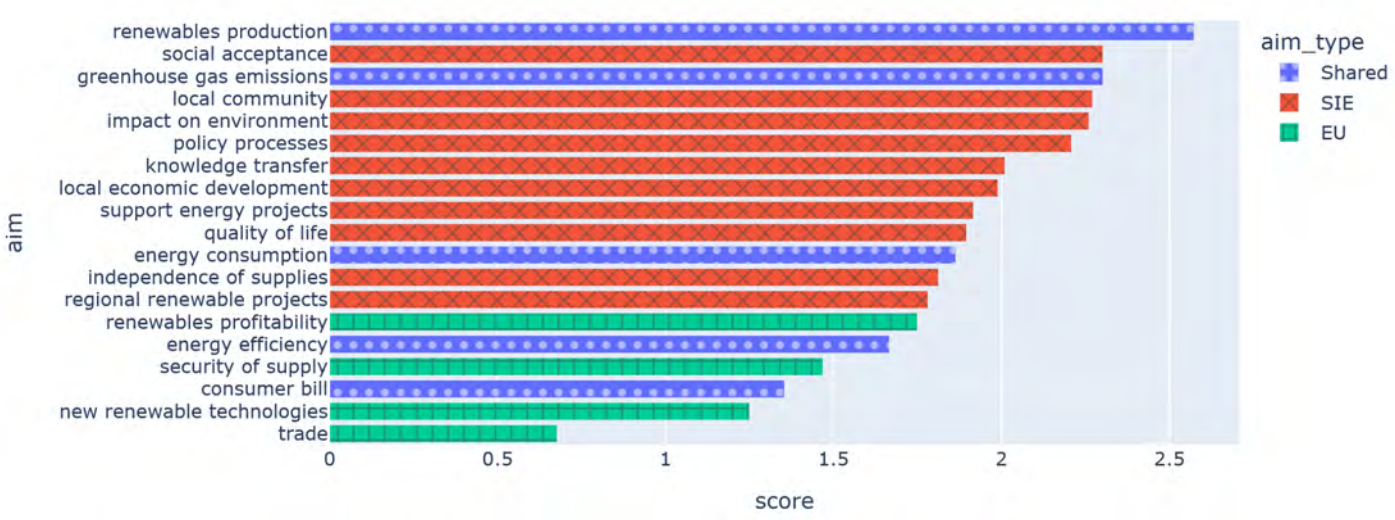

Figure 2. Average importance of aims for SIE-initiatives.

Results

WHICH AIMS ARE IMPORTANT?

As first step of analysis we calculated the average importance of different aims. Ranking these values in ascending or descending order allowed us to quantify the importance of different goals for SIE-initiatives (see Figure 2).

While the shared-aims of "reduced energy consumption" and increasing "energy efficiency" and increased "renewables profitability" received an average score close to 2 (=moderately important), goals of SIE-initiatives related to their local community that were identified in the literature, such as to increase "social acceptance", "strengthen local community", and "impact energy policy processes" were clearly seen as more important.

On average the remaining EU-goals of "security of supply", "consumer bills", "new renewable technologies", and in particular "trade" were mostly seen as hardly important or not important, which indicates that SIE-initiatives may be less well aligned with the EU on these goals.

HOW DO AIMS BETWEEN THE EU AND THE SIE ALIGN?

We use pairwise correlations to explore the similarity or alignment between EU-aims, shared-aims and SIE-aims. Figure 3 gives an overview of the correlation between importance

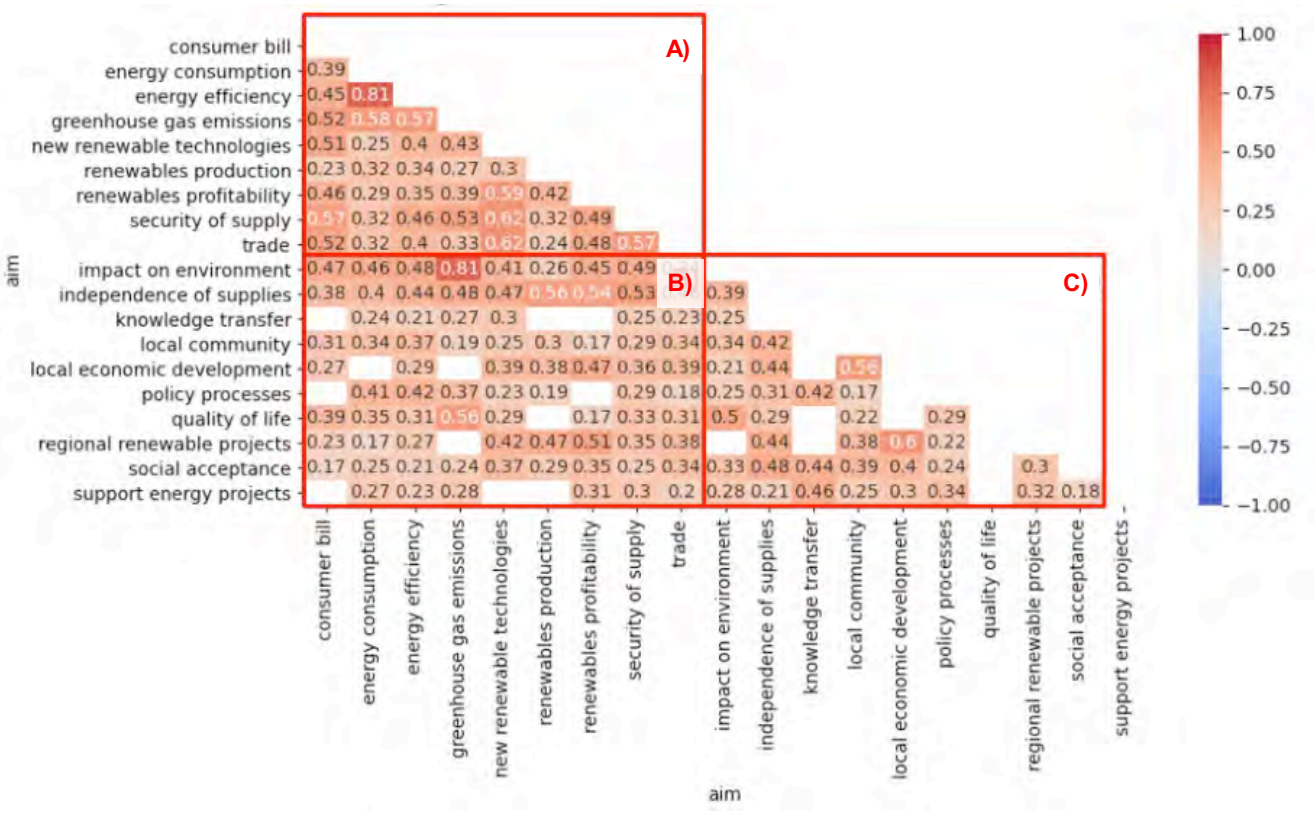

Figure 3. Heatmap of correlations between importance rankings for A) EU-aims and shared-aims, B) EU- and shared-aims vs. SIE-aims and C) SIE-aims.

rankings for each pair of aims which allows to detect potential alignment (=positive correlation) or potential misalignment (=negative correlation) between different aims. The figure only shows correlations, which are significant at least at the p=10 % level.

A) EU- and shared-aims: The strongest positive correlation was between the importance ratings for higher "energy efficiency" and "lower energy consumption". Intuitively this makes sense because energy efficiency is one of the means to achieve a lower energy consumption. Besides that, it is striking to see that many of the other correlations above 0.5 are between the aim of "new renewable technologies" and other EU policy goals. One potential interpretation of these findings could be that new renewable technologies were sometimes perceived as a means to achieve these other policy goals.

B) EU- and shared-aims vs. SIE-aims: The strongest positive correlation was between the "quality of life" and "reduced greenhouse gas emissions". This could indicate an assumption by SIE-initiatives that a rising global temperature will have a negative effect on the quality of life. Apart from that there are several high correlations between aims related to renewables, such as "new renewable technologies" / "regional renewable projects"/"renewables profitability", which may indicate a certain degree of similarity between these aims.

C) SIE-aims: There is a high correlation between the importance rating for an increasing "independence of supplies" and other goals with a strong regional component, such as regional renewable projects, local economic development and a strengthening of the local community. This could indicate important synergies between these aims. In a similar way, the aim of "knowledge transfer" was positively correlated with aims such as "supporting renewable projects", "increasing social acceptance", and impacting "policy processes", indicating a positive alignment between these aims.

All of the statistically relevant correlations were positive and would indicate that what we hoped to learn, that there are synergies between EU-aims, shared-aims and SIE-aims. This could mean that even though SIEs may not find the EU-aims important, they may contribute to achieving EU goals through achievement in their own SIE aims. However, there could also be other reasons for these positive correlations such as that these aims are fairly similar concepts (such as "energy efficiency" and "reduced energy consumption") or that they are caused by other reasons, such as a bias by some respondents to attach a higher importance to all aims.

WHAT IS THE PERCEIVED CONTRIBUTION TOWARDS THE DIFFERENT AIMS?

All three aims with the highest perceived contributions towards SIE initiatives are SIE-aims. Out of the shared-aims "renewables production" and "greenhouse gas emissions" show the highest contributions. The lower contributions towards the EU-aims and shared-aims compared to the SIE-aims align with the lower importance ratings of these aims. On average the ten SIE-types we investigated seem to contribute little to "energy efficiency", "energy consumption", "security of supply", "new renewables technologies", "consumer bill" and "trade", at least as indicated by our survey respondents. Given the small sample size these finding should be interpreted with caution.

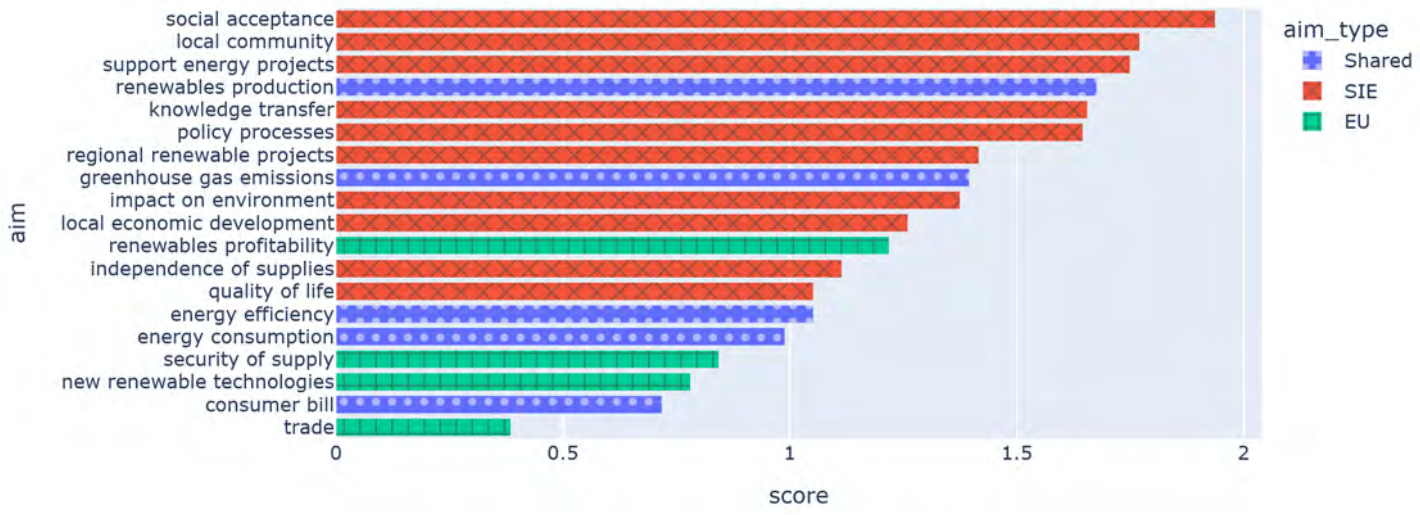

Figure 4. Average perceived contribution of aims for SIE-initiatives.
Note: Average contribution ratings range between 0.4 and 2 on a 4-point Likert-scale where 0= No effect, 1=Little effect, 2=Moderate effect, 3=Significant effect.

DOES THE TYPE OF SIE-ACTIVITY OR SOCIAL RELATION TO WHICH AN SIE-INITIATIVE BELONGS HAVE AN EFFECT ON THE AVERAGE CONTRIBUTION RATING?

An overview of the average contribution rating across all aims is provided in Figure 1 for all combinations of activity and social relation. As shown the SIE-initiatives focused on SIE-type 1 "cooperative action" were evaluated by 29 respondents and achieved an average contribution rating across all aims and all survey respondents of 1.3.

SIE-initiatives focused on "Thinking" seem to achieve the lowest average contributions (1.1). This could indicate that the contribution made by SIE-initiatives that are focused on "Thinking" affects aspects such as opinions and attitudes, which are less visible, because they do not result in a direct output.

With regards to the social relation, Figure 5 shows the average contribution of SIE-initiatives engaged in different types of social relation towards each type of aims. As we can see, for the shared-aims SIE-initiatives focused on "Competition" perform significantly better, and SIE-initiatives focused on "Conflict" perform significantly worse than SIE-initiatives engaged in other forms of social relation ("Exchange" or "Co-operation").

As shown for specific types of SIE-initiatives which are less visible such as campaigns or networks against specific energy pathways other evaluation approaches seem necessary. Therefore, we explored alternative approaches which we present in the next section.

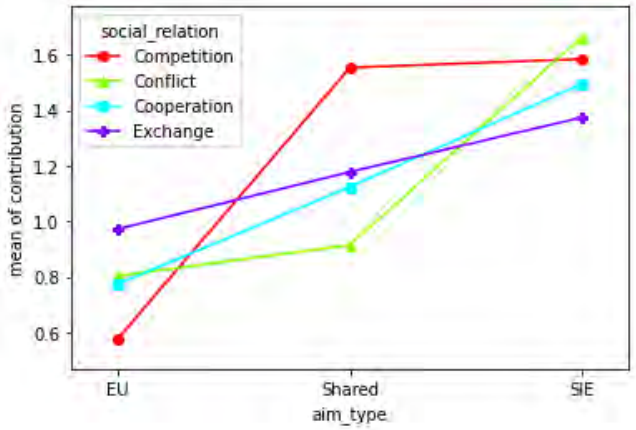

Figure 5. Mean contribution towards different types of aims by SIE-initiatives engaged in different types of social relation.

Alternative evaluation approaches

MEDIA ANALYSIS

To evaluate the success of SIE-initiatives which organise networks against specific energy pathways, media analysis may be a better approach to evaluate their impact on the energy transition. Media analysis, or digital discourse analysis can be used to automatically extract specific information from very large text corpora. Examples of information that could be extracted include – but are not limited to – the frequency of mutual references by different organisations (left part of Figure 6), the frequency of mentioning different hashtags by different organisations (central part of Figure 6) and the frequency and location where different terms had been used (right part of Figure 6). In addition to simple frequency counts, evaluations of the context where a word is used can be used to determine whether it is used in a positive or a negative context, or even more advanced questions, such as whether an organization X was cited in support of a certain activity Y (so-called "relations", although this may require human interpretation). Algorithms can be programmed to process any text sources which are provided (e.g. websites, social media, news archives). Data can be read from files or be collected from websites and online archives through web scraping. Due to the automatic data collection and evaluation, the results can easily be updated when new information becomes available.

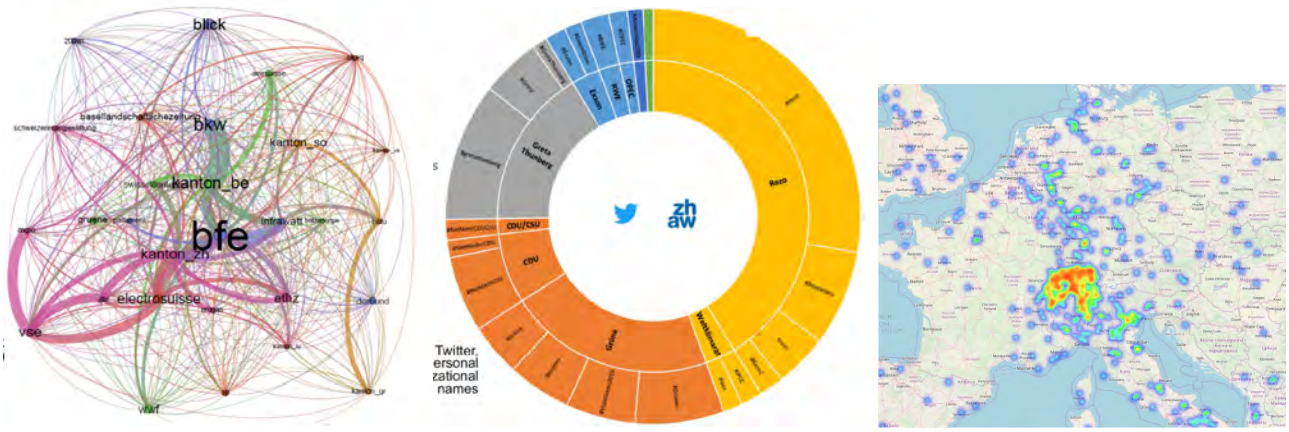

Figure 6. Media-analysis examples (Source: Peter Stuecheli Hertach).

A number of promising ideas how media analysis could be used to quantify the impact of SIEs on EU-aims and shared-aims include:

- Web crawling media / forums / blogs: to measure mentions of SIE-initiatives, including the context (e.g. EU-policy aim) and frequency in which they are mentioned;
- Web crawling websites of SIE-initiatives, political parties and (reports by) organisations responsible for meeting EU-aims and shared-aims such as national regulators: to determine mutual mentions and construct actor networks;
- Crawl existing databases: such as the database by the European Energy Awards for mentions of different SIEs and/or SIE-initiatives, as well as to extract quantitative information regarding the contribution towards EU-aims and shared-aims.

WEB TRACKING

Another alternative approach to evaluate the impact of SIE-initiatives would be web tracking to analyze the number of visitors and their behaviour on a specific website, or to track their behaviour across different websites through services such as google analytics and facebook. Analysing the browsing behaviour of web users before and after they visited the website of an SIE-initiative could shed some light on the impact which this initiative may have had.

However, obtaining web tracking data may be very challenging. Information about website visitors is often considered as confidential and SIE-initiatives are unlikely to have obtained the consent from their users to collect, process and forward more detailed data (e.g. regarding the websites visited before coming to their page). An approach to solve this problem could be to ask web users to make their data available in the form of voluntary data donations. However, even if the data is obtained, it may not include enough information, as it could be limited to the browsing history. Due to the concerns about confidentiality, data access, and the potentially limited value of the data, web tracking seems to be less promising compared to media analysis for quantifying the impact of SIEs or SIE-initiatives on EU-aims and shared-aims.

Conclusions

The data revealed that SIE-initiatives achieved significantly higher contributions towards SIE-aims than towards shared-aims or EU-aims. The SIE-aims with the highest contributions were "strengthen local community" and "provide support for other energy-related initiatives or projects". The shared-aims (i.e. aims identified for SIE and EU) with the highest contributions were "increased renewables production" and "reduced greenhouse gas emissions". The perceived contribution towards other EU-aims or shared-aims was rather low. To a large extent, the contribution scores reflect the importance which the SIE-initiatives attach to these aims.

Looking at the different SIE-types, in general SIE-initiatives focusing on "Thinking" seem to achieve the lowest average contributions. This could indicate that the contribution made by SIE-initiatives that are focused on "Thinking" affects aspects such as opinions and attitudes, which are less visible, because they do not result in a direct output.

Regarding the social-relations, for shared-aims SIE-initiatives engaged in "Competition" achieve higher average contribution scores than SIE-initiatives engaged in other types of social-relations (i.e. "Cooperation", "Exchange" or "Conflict"). This could indicate a particularly good fit of competition settings to achieve shared aims. Likewise, SIE-initiatives engaged in "Conflict" achieve lower average contribution scores for shared-aims than the other types of social relation (i.e. "Competition", "Cooperation" or "Exchange"), which could indicate that this type of social relation is not a good fit for shared aims. Contribution ratings for several of the aims were strongly correlated, which could indicate the presence of spill-over effects between these aims (e.g. "higher energy efficiency" will help to "reduce energy consumption", or an "increasing renewables production" could help to "lower CO_2-emissions" etc.).

But our findings should be interpreted with the necessary caution due to the small sample size, low response rates (total of 101 respondents). In addition, the subjective contribution ratings are dimensionless and may suffer from respondent biases. With regard to alternative approaches we conclude that media analysis seems to be the best suited approach to measure the impact for the diversity of SIE-initiatives and should be explored in future research.

References

Brinkerhoff, D.B., White, L.K., Ortega, S.T., Weitz, R., 2008. Essentials of Sociology, 7th ed. Thomson Learning, Belmont.

Dzukowski, T., Winzer, C., Müller, L., Schmid, J. 2021, SIE evaluation: Characterising successful SIE to enable secure, sustainable, competitive, and affordable energy transitions, https://sonnet-energy.eu/

European Commission. (2015). Energy Union Package – A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy. COM(2015) 80 final, 1–21. https://doi.org/10.1017/CBO9781107415324.004

European Commission (2019). Annex to the Fourth Report on the State of the Energy Union. https://doi.org/10.1017/CBO9781107415324.004

Winzer, C., Schmid, B., Dzukowski, T. & D. Wemyss (2019) Research Brief #4: Defining the success of social innovation in energy, https://sonnet-energy.eu/

Wittmayer, J. M., Hielscher, S., Rogge, K., Avelino, F. (2020) Report on SONNET's initial conceptual framework, https://sonnet-energy.eu/