

How to Transfer Best Practice Interventions (BPIs)?"

VERSION: 01

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ENCHANT Report

Evaluation Report on Pilot Implementations

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ABSTRACT

The primary objective of D5.2 is to comprehensively discuss and compare individual interventions at a meta-level, focusing on the three key target behaviors: energy conservation, public transport utilization, and investment in energy efficiency (EE) and renewable energy sources (RES). The aim is to provide insights enabling stakeholders to effectively replicate interventions by establishing best practices. Leveraging the insights obtained from the analysis conducted in Kirchler et al. (2023), which examined the implementation and impact of each intervention through data analysis, this report aims to draw comparative conclusions from individual results wherever feasible and meaningful. Additionally, the report will explore potential long-term effects and discuss potential social and economic impacts stemming from the interventions.

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1 Introduction

As the window for achieving critical reductions in CO₂ emissions narrows (IPCC, 2023), it becomes increasingly important to enhance sustainable behavior and practices. Behavioral science has shed light on the mechanisms of behavior change through numerous (small-scale) pilot studies. Yet, the pressing nature of our climate goals necessitates the large-scale deployment of such interventions. Research has shown how different incentives affect sustainable behavior, such as energy saving or public transport usage, relatively less is known how such interventions can be implemented at large-scale. To transition from theory to practice, from small-scale pilots to widespread application, and to make this process efficiently, acceptable and inclusive we must understand how to implement behavior science-based intervention programs in real-life settings, on a grand scale, across various territories, cultures, within large cities and small ones, and in a manner that is resource-efficient for market actors.

Thus, the main objective of D5.2 is to discuss and compare individual interventions at a meta-level, covering the three main target behaviors: **energy conservation, public transport use, and investment in EE and RES**. in order to allow policy makers to replicate interventions in a best practice manner. To do this, we will build on the findings from (Kirchler, Haider, Knöbl, Garzon, & Kollmann, 2023), which analyzed both the implementation of each intervention and the impact of the interventions through data analysis. Building on these findings, we will draw comparative conclusions from individual results (where possible and meaningful). Where possible, the report will also discuss long term effects, as well as possible social and economic impacts.

Historically, economic approaches believed that only monetary incentives, such as taxes on goods with negative externalities, could induce behavioral change Pigou (1920). Internalizing the negative effects would raise the price of carbon-intensive goods, while making more sustainable alternatives comparatively cheap. The so-called substitution effect would shift individual consumption patterns towards more sustainable choices. However, people do not typically behave in this way and can be motivated to change their behavior through a variety of channels. Over the years, behavioral science research has expanded the toolkit for influencing sustainable behavior, introducing strategies that use social and personal norms and financial incentives, among others, to encourage energy-efficient practices and adjust consumption patterns (Stoll, Brandt, and Nordström (2014); Carrus et al. (2021); Schultz, Estrada, Schmitt, Sokoloski, and Silva-Send (2015); Vesely et al. (2022)). Research in controlled laboratory settings has been instrumental in dissecting the effects of these diverse motivators, particularly the impact of social norms and individual commitment on making behavioral shifts towards sustainability Carrus et al. (2021); Nisa, Bélanger, Schumpe, and Faller (2019); Delmas and Lessem (2014).



1.1 Saving Energy

Regarding the first domain of targeted behavior, saving energy previous research has shown mixed results. While some studies show that saving tips can help households save energy others could not find such effect (Allcott, 2011; Ayres, Raseman, & Shih, 2013; Costa & Kahn, 2013; Hutton & McNeill, 1981; Staats, Wit, & Midden, 1996). One of the main reasons for ambiguous results is that electricity is commonly perceived as a homogeneous commodity that often lacks attention from households or general users (Fischer, 2008). Users typically are not aware, when, or by which appliances electricity is currently used. They are not informed whether their consumption is relatively high or low, impeding their ability to search for reasons or determine the effectiveness of their actions.

However, behavioral science has shown that information provision, that helps individuals to understand their energy consumption patterns better, combined with monetary incentives or saving tips can help market participants to shift their energy and save energy (Kapeller, Cohen, Kollmann, & Reichl, 2023). Therefore, improving sustainable electricity consumption entails enhancing feedback on consumption, its cost, and its environmental impacts. Our intervention builds on previous research and tries to enrich them by combining different interventions types and apply them in different cultural settings using different scales.

1.2 Public Transport

With regard to the second level of targeted behavior, previous research focused on behavioral modification in transportation choices (Cairns et al., 2008; Fujii & Taniguchi, 2006; Kearney & De Young, 1996; Scheepers et al., 2014). Despite the wealth of knowledge, experimental studies specifically investigating the impact of complimentary public transportation are scarce in international journals (Abou-Zeid & Ben-Akiva, 2012). The range of research includes early work by Everett, Hayward, and Meyers (1974) and extends to more recent studies like those by Thøgersen (2009), covering topics from mode switching to the influence of psychological factors.

Everett et al. (1974) found a notable 50% increase in bus ridership when free transit was offered, attracting a diverse group of new users, including pedestrians and university affiliates. Yet, this uptick in ridership was not sustained post-incentive. In a similar vein, Bachman and Katzev (1982) observed that free bus tickets could significantly boost public transport use during and after the intervention when compared to a control group. Delving into psychological aspects, Fujii and Taniguchi (2006) distributed one-month free bus passes to car-using students at Kyoto University, which led to a persistent increase in bus ridership, suggesting a shift in habit and a more favorable view of bus travel.

These studies, however, are not without their limitations. The applicability of their



findings is often restricted by the specific demographic and regional contexts of the study, calling for experiments across varied settings to confirm the universality of the results. Our study aims to close this knowledge gap. To overcome the common hurdle of small sample sizes, we conducted two large-scale experiments, providing a more comprehensive understanding of the impact as the sample size grows under various cultural backgrounds.

1.3 Investment in EE and RES

Finally, the third level focuses on motivating people to invest in energy efficiency (EE) and renewable energy sources (RES). Addressing this investment is crucial as the sector accounts for a substantial portion of GHG emissions and shows one of the largest investment gaps (European Commission, 2020). Investments in EE and RES are therefore highly important for achieving the EU's 2030 emission reduction goals, and progressing toward climate neutrality by 2050.

The refurbishment of homes to enhance energy and resource efficiency promises not only cost savings on energy bills but also significant improvements in health, comfort, and overall well-being. Moreover, renovation initiatives provide a valuable opportunity for the 34 million Europeans currently facing challenges in affording adequate heating for their homes.

In this context, the next set of interventions will investigate people's interest in investing in energy efficiency (EE) and renewable energy sources (RES) measures in the public and private sectors using surveys and field experiments. These studies aim to understand the factors influencing individuals' investment decisions and their willingness to participate in energy-efficient and renewable energy initiatives. The controlled nature of these studies, however, often leads to questions about their external validity and their real-world applicability (Cook, Campbell, and Shadish (2002); Campbell and Stanley (2015)). To bridge this gap, field experiments replicate more natural environments to improve the generalizability of findings, yet they grapple with the complexities of conducting randomized control trials (RCTs) in the unpredictable real world (Gerber and Green (2008)). While RCTs are indispensable for establishing causality, real-world applications are fraught with ethical, consent, and practical challenges (Levitt and List (2009)).

Despite these challenges, field experiments offer a closer look at the acceptability, feasibility, scalability, and reproducibility of interventions. Moreover, they test the robustness of expected effects; whether they hold up or diminish when faced with external variables that are typically controlled for or eliminated in laboratory settings but are omnipresent in everyday life. Moreover, an equally critical aspect of intervention design is the degree of complexity involved and the resources required for implementation. Some interventions may adopt a more complex approach, prescribing specific behaviors and requiring signif-



ificant investment of time and financial resources. These may be effective on a small scale, but can be challenging to implement broadly due to their intensive nature. In addition, a change in the cultural context or a shift from more urban to more rural areas may render previously successful interventions less effective.

On the other hand, interventions that are less salient tend to demand less time and money, making them more adaptable and easier to deploy across various cities and cultural contexts. These interventions may offer a more general framework for behavior change that can be tailored to local needs and conditions, thereby increasing their potential for widespread adoption. Understanding these dynamics is crucial for developing interventions that are not only effective in specific context but can be scaled to a broader application. The post-intervention survey aimed to capture a range of perspectives on these issues and allows to compare interventions at the meta level. By involving user partners responsible for conducting the interventions, the survey provided insights into the operational challenges and successes. It also explored the economic costs associated with the interventions, the barriers to their uptake, and the cultural and contextual factors influencing their acceptance and effectiveness, essential for informing future policy and practice. It helps to identify which interventions are most likely to be embraced by communities and policymakers, which are most cost-effective, and which have the greatest potential for positive impact on both individual behavior and broader societal goals.

The remaining sections of the report follow this structure: Section 2 provides an overview of interventions at the meta level, emphasizing energy-saving efforts. This section begins by presenting the overarching results and subsequently narrows its focus to similar use cases for a comparative analysis. Subsequently, Section 2.7 delves into an in-depth analysis of the ENCHANT Platform. This subsection explores the platform's recruitment phase, offering valuable insights for future research on optimal recruitment strategies. Following that, it outlines the outcomes of the energy-saving intervention. The section concludes by discussing key insights into the motivations of participants who successfully completed the longitudinal study. Moving on, Section 3 presents a comparative analysis of two interventions centered around public transport. It unveils innovative approaches to boost public transport usage. In contrast, Section 4 focuses on insights related to the willingness to invest in and donate to energy efficiency and renewable energy sources. Finally, Section 5 draws conclusions based on the findings and analyses presented throughout the report.

2 Saving Energy

2.1 Intervention Overview

ENCHANT encompasses a series of interventions across different European countries, primarily focused on reducing energy consumption through innovative strategies. These interventions, conducted by Energie Kompass in Austria, Electrica Furnizare in Romania,



Gediz Electricity in Turkey, and a collaborative effort between Badenova and Hansgrohe in Germany, showcased a range of methods and varying levels of randomization in their implementation. The interventions employed varied methods ranging from newsletter campaigns and online messaging to physical installations in households. Energie Kompass in Austria leveraged newsletter campaigns to provide energy-saving tips to community members. Electrica Furnizare in Romania conducted both online and offline interventions, disseminating messages related to individual benefits, altruism, and social norms. Gediz Electricity in Turkey communicated through messages on electricity bills, targeting different regional groups. In Germany, Badenova and Hansgrohe collaborated to install the Pontos water management system in households, providing real-time water consumption data to residents. Moreover, the duration of the campaigns varied, which makes a direct comparison difficult.

Table 1: Effects of ENCHANT Project Interventions

Country/Organization	Intervention Approach	Observed Effects
Austria/Energie Kompass	Newsletter campaign with energy-saving tips	Significant difference (reduction) in electricity consumption among experimental groups compared to control group
Italy/Energia Positiva	Newsletters with descriptive and injunctive norm messages	Some reduction in electricity consumption, but not statistically significant in all experimental groups.
Turkey/Gediz Electricity	Messages on electricity bills in different regions	Decrease in electricity consumption by about 1.9% in the northern regions and 1.3% in the southern regions compared to control region.
Romania/Electrica Furnizare	Online and offline messaging focused on individual benefits, altruism, and social norms	Collective framing information led to a decrease in electricity consumption of around 1%.
Germany/Badenova and Hansgrohe	Installation of Pontos water management system in households	High acceptance among participants but no significant change in electricity or water consumption reported.



2.2 Overall Results and Implications

The effectiveness of these interventions varied, with notable changes observed in consumption patterns for some. In Austria, distinct differences in electricity consumption emerged among different groups, with the control group exhibiting the highest consumption. Romania's intervention, particularly the incorporation of collective framing information, resulted in a substantial decrease in electricity consumption by around 1%. However, the diverse framing and focuses of the messages led to varying outcomes (some are not statistically significant). Turkey's intervention yielded a 1.9% decrease in electricity consumption in the northern regions and a 1.3% decrease in the southern regions. In Germany, despite the intervention's positive reception, no significant changes in electricity or water consumption were reported.

2.3 Comparative analysis

To transfer the insights from our energy savings interventions into best practice interventions and to guide future research and policy makers in the replication, we grouped the intervention that are most comparable. This grouping considered similarities in their approaches, target audiences, data collection methods, and analytical techniques. Table 2 provides an overview of the selected pairs for comparison.

Table 2: Comparison of Energy-Saving Interventions

Aspect	Energia Positiva (Italy)	Energie Kompass (Austria)
Target Audience	Members of existing communities	Members of existing communities
Intervention Type	Newsletter with normative messages.	Newsletter with practical, actionable tips.
Data Type	Survey data plus aggregated meter readings	Survey data plus aggregated meter readings
Aspect	Gediz Electricity (Turkey)	Electrica Furnizare (Romania)
Target Audience	Regular utility customers	Regular utility customers
Intervention Type	Nudges on monthly bills.	Online: Varied interventions; Offline: Diverse methods
Data Type	Time series with monthly electricity consumption and weather data	Time series with electricity data and some information about energy prices etc.

2.4 Energie Kompass (Austria) and Energia Positiva (Italy):

The **Energie Kompass** intervention in Austria focused on a newsletter campaign aimed at members of the energy community. The main objective was to provide members with tips



on how to save energy and encourage them to adopt more sustainable energy consumption patterns. The approach was direct and informative, using the power of communication to influence behavior.

Energia Positiva in Italy, like *Energie Kompass*, employed a newsletter campaign but with a slightly different strategy. Their campaign focused on using descriptive and injunctive norm messages to influence customers' energy consumption behavior. This approach was rooted in social psychology, leveraging the concept that individuals are influenced by the norms and behaviors of their peers. Similar to the Austrian intervention also in this community, the relative interest in the interventions was high. The high participation rate suggests that members of existing communities may be easier to reach and motivate to participate in energy saving initiatives because they already have higher levels of interest in the subject, necessary knowledge about it, and a sense of group belongingness. Future research could build on these intrinsic motivation and attempt to observe the difference in effectiveness of energy saving tips between members of energy communities and non-members. Because members share a sense of belonging to the group, they may also be more interested in participating in energy-saving investment opportunities.

In a comparative analysis of the interventions by *Energie Kompass* in Austria and *Energia Positiva* in Italy, several key factors emerge that are vital for designing similar energy conservation campaigns.

2.4.1 Targeted Communication Strategy

Both interventions relied on newsletters as their main communication channel, but they differed in their content delivery strategies. *Energie Kompass* concentrated on providing practical and actionable energy-saving tips, tailoring their content to align with the daily energy consumption patterns of households. In contrast, *Energia Positiva* adopted a psychological approach, utilizing normative messages to shape behavior. This implies that for future interventions to be effective, targeting members of established communities with personalized and evidence-based experimental methods may be more successful than employing broad information campaigns. These strategies can be further enhanced by incorporating psychological insights.

2.4.2 Desing of Intervention (Framing)

Energie Kompass's approach was direct, providing clear guidance on optimizing energy use, especially in leveraging renewable energy sources. *Energia Positiva's* approach, rooted in social psychology, aimed to motivate behavior change through social norms and peer influence. This indicates that the framing of content should align with both the cultural context and the behavioral patterns of the target audience. Moreover, the absence of a di-



rect connection between the participants' actual energy consumption data and the survey hinders the capability to analyze individual behavioral changes in response to the intervention. The lack of a clear link to real consumption makes it challenging to accurately measure the specific impact of social norm messages on individual consumption behavior. Nevertheless, findings from a separate intervention (ENCHANT Platform) suggest a positive correlation between subjective assessments of saving behavior and actual consumption. People demonstrated the ability to assess if they had, to some extent, reduced their energy consumption.

2.4.3 Measuring Effectiveness

The effectiveness of these interventions was measured differently. Energie Kompass observed a direct correlation between the intervention and energy consumption patterns, indicating a clear impact of their action-oriented tips. On the other hand, Energia Positiva's approach led to strong reduction in energy consumption in one experimental group but did not produce uniformly significant results across all groups. This outcome implies that altering behavior through social norms may demand more intricate strategies and potentially longer periods to manifest substantial changes. Notably, the injunctive norm messages in Energia Positiva's campaign had a pronounced effect, showing a reduction in energy consumption of over 17% compared to the control group. This suggests that injunctive norm messages could be particularly influential in communities where social persuasion is a key factor in decision-making.

2.4.4 Lessons Learned

When designing an intervention similar to these two, it is essential to consider the nature of the target audience, the framing of the message, and the intended outcome of the campaign (see Table 3). A more action-oriented approach may be effective for an audience that is already somewhat engaged and receptive to direct guidance. In contrast, a campaign aiming to reach a broader, possibly less engaged audience might benefit from incorporating social normative elements to tap into the influential power of community and peer behaviors. The choice of strategy should also be informed by how the effectiveness of the intervention will be measured and over what period significant changes can be realistically observed.



Table 3: Considerations for Designing Effective Energy-Saving Interventions in the future

Factor	Consideration Based on Campaign Insights
Understanding the Audience	For audiences already inclined towards energy conservation (like Energie Kompass's), direct, actionable tips are effective. In contrast, diverse or less engaged audiences (like Energia Positiva's) may respond better to social normative messages.
Message Framing	Injunctive norm messages (Energia Positiva) are effective in communities influenced by social norms and peer behaviors. Direct, actionable tips (Energie Kompass) work well for an audience receptive to specific guidance.
Long-Term Engagement	Sustained efforts over extended periods are crucial for influencing behavior, especially in strategies based on social norms (Energia Positiva).
Measurement of Effectiveness	Align the measurement strategy with the intervention's goals. Direct correlation between intervention and consumption (Energie Kompass) vs. nuanced psychological impact analysis (Energia Positiva).
Adapting to Contextual Variables	Consider contextual factors like energy crises, cultural norms, and socio-economic conditions, as they can significantly influence the effectiveness of campaigns.
Integration with Real-Time Data	Linking behavioral interventions with real-time energy consumption data can provide more accurate insights into the effectiveness of different strategies.

2.5 Turkey (Gediz Electricity) and Romania (Electrica Furnizare)

Now, we compare two large scale energy-saving campaigns that did not engage with a community characterized by a higher level of familiarity with energy issues, possessing more information and feedback regarding their energy consumption behaviors like in the previous cases. Instead, these campaigns targeted regular utility customers and therefore allow to observe how energy saving tips work in this context. Table 4 provides a summary of the two interventions.



Table 4: Comparative Analysis of Gediz Electricity and Electrica Furnizare Energy-Saving Campaigns

Aspect	Gediz Electricity (Turkey)	Electrica Furnizare (Romania)
Target Audience	Regular utility customers.	Regular utility customers.
Intervention Type	Nudges on monthly bills. Experiment group North: 136,785 customers; South: 320,598; and Control group Metropolitan: 1,104,261.	Online: 30,596; Offline: 2,521,474; Varied online interventions: 1) Individual benefit information (5,648 customers), 2) Altruism and social norm information (5,389 customers), 3.1) Individual framing information (5,182 customers), 3.2) Collective framing information (4,791 customers).
Results	Decrease by 1.9% (North) and 1.3% (South).	Individual benefit 0.3% increase, Altruism and Social Norm 0.6% decrease, Individual Framing 1.1% decrease, Collective Framing .9% decrease compared to control. Offline: observed 15% decrease but without a causal link.
Challenges	GDPR issues, data collection, messaging framing and choice	Online: Legislative changes; Offline: No control group.

2.5.1 Intervention Design

Gediz Electricity in Turkey chose to deliver messages through electricity bills, targeting consumers directly in a familiar and routine context. In contrast, Electrica Furnizare in Romania employed a more diverse approach, utilizing both online and offline channels. Participants in the online intervention were exposed to slightly different information campaigns, framing the goal of energy-saving either collectively or individually. They also varied the emphasis between highlighting the monetary savings associated with energy conservation and emphasizing the more altruistic (social norm) perspective.

2.5.2 Effectiveness

The results indicate that both campaigns effectively reduced energy consumption, suggesting that future interventions can leverage information campaigns to assist individuals in saving energy. However, the long-term effects remain unclear, and it's possible that the



impact diminishes over time. Therefore, future campaigns should focus on helping individuals develop sustainable, long-term saving strategies. Additionally, providing positive feedback could facilitate behavior change and the development of energy-saving routines. Despite inconclusive results from the Romanian energy campaign, future interventions should transcend simplistic energy-saving framing and emphasize altruistic motives over purely economic advantages. Opting for a direct and routine channel like utility bills can be effective for consistent messaging in similar interventions, while a combination of on-line and offline methods may be more appropriate for reaching a broader audience.

2.5.3 Effectiveness and Cultural Context

The interventions' effectiveness also reflects the cultural and social context of the target audience. In Turkey, a straightforward, bill-based messaging approach led to a clear reduction in electricity consumption. In Romania, the diverse messaging strategy also showed effectiveness, particularly with collective framing leading to significant reductions. Nevertheless, billing strategies may vary in other countries. Some nations employ yearly billing systems, whereas in numerous other countries, these payments are processed automatically, leading to a reduction in their informational content.

2.5.4 Lessons Learned and Future Directions

The results underscore the effectiveness of nudges, showing reductions in energy use within the experimental groups in both countries. Nevertheless, fully randomized control trials remain the gold standard in behavioral science. Given that energy-saving nudges may have relatively modest effects on energy consumption, it is essential to collect additional data on alternative factors. Without this information, it is difficult to establish a causal relationship between the observed reduction and the intervention, as other unobserved events could potentially contribute to a small reduction in the experimental group. For interventions aimed at reducing energy consumption in contexts similar to Turkey and Romania, it's crucial to consider the most effective communication channels and to take cultural effects into account when developing energy-saving tips. Finally, the potential of using electricity bills as a medium for messaging experiments depends on the billing system.



Table 5: Lessons Learned and Future Directions for Designing Effective Energy-Saving Interventions (Gediz Electricity and Electrica Furnizare)

Factor		Consideration Based on Campaign Insights
Communication Channel		Future campaigns should try to replicate the findings from ENCHANT using both direct and simple messages and more specific types including social and private norms, focusing on altruistic motives as well as individual benefits
Long-Term Behavior Change		Develop strategies that go beyond reminders and foster long-term energy-saving habits. Consider the effectiveness of various approaches for different types of customers (Electrica Furnizare).
Impact Assessment		Measure the effectiveness of interventions in terms of actual energy consumption reduction (Gediz Electricity showed a 1.3 - 1.9% reduction). Understand the limitations in establishing causal relationships in the absence of control groups (Electrica Furnizare). Collect additional data that allows to control for potential other factors, like weather, household size, income etc.
Better Understanding of Customers		Different interventions may be necessary to address distinct types of customers effectively (as seen in Electrica Furnizare's campaign).
Consideration of Psychological Factors		Include psychological factors such as personal and social norms, habits, and attitudes in the design of interventions and messages.

2.6 Badenova and Hansgrohe

The Germany intervention (Badenova and Hansgrohe) stands apart due to its focus on installing physical equipment (Pontos system) to monitor water usage, which is a different approach compared to the other interventions that relied primarily on communication strategies. Therefore, it might be less directly comparable to the others.

2.7 Enchant Platform

As most of the interventions conducted in Enchant were affected by at least one of two major crises - COVID-19 or the energy crisis (see (Kirchler et al., 2023)), we also developed an online platform that allows allocating users randomly into different intervention groups to collect their electricity meter readings as well as socio-economic and psychological information by simultaneously over a longer period. The ENCHANT platform thereby allows to provide households from different socio-economic and cultural backgrounds with identical interventions. This allows us to compare cultural and socio economic affects and observe how different interventions work within and between countries. Overall there are six



different types of interventions, each with a unique approach to influencing energy-saving behaviors. Moreover, the intervention platform allows combining different interventions (e.g. Information + Social Norms) in order to test how different combinations work. In addition to the other interventions that were compared, the Platform allows us also to observe how the interest of people, their emotions, attitudes towards energy conservation have changed over time, important insights that other interventions are lacking. Finally, it is possible to draw conclusion about different recruiting strategies and channels.

The first part of this section introduces the ENCHANT platform and its functionality. The second part focuses on the recruitment process, showing the effectiveness of various communication chanelles in recruiting people for a longitudinal study. The third part employs a descriptive analysis, illustrating how mean electricity consumption has evolved over time, across countries, and in comparison to the control group. Furthermore, the combination of various interventions is explored. Finally, a psychological analysis will inform conclusions about emotional changes. The main interventions include:

Table 6: Description of Interventions

Intervention	Description
Information Provision	Educating households about energy consumption and savings, providing specific tips on what actions to take and explaining the reasons behind them.
Message Framing	Utilizing collective versus individual framing to motivate energy conservation. This involves presenting tips as either individual or collective actions on the platform.
Social Norms	Leveraging societal norms to encourage lower energy use by informing participants about the energy use practices of others in their intervention group.
Consumption Feedback	Providing direct feedback to households on their energy consumption patterns, compared to their consumption in the first week.
Competitive Elements	Introducing competition to stimulate energy-saving efforts. This includes a leaderboard on the platform's dashboard showing participants' performance in electricity saving.
Commitment Strategies	Encouraging households to make pledges to reduce energy usage, with the option of a private or public commitment (the latter includes participant numbers on a dashboard list of pledges).



2.8 Analyses of Recruitment for the Intervention Platform

This section explores the organization of participant recruitment across six countries, drawing conclusions from variations in recruitment rates based on channels, communicators, and features. The analysis relies on three key sources of data:

1. Recruitment channel(s) self-reported by participants during the initial interview ("How did you become aware of the electricity saving campaign?").
2. A report from user and academic partners outlining the channels used and the estimated reach for each channel.
3. Dropout rates during registration and progression through the intervention platform.

2.8.1 Recruitment Procedures

Recruitment for the campaign started in January 2023 in Norway, driven by Viken county (VIKEN) and Friends of the Earth Norway (FOTE). They used a large selection of different communication strategies and channels in their recruitment. Later the same month, the user partner badenova (an electricity provider in Germany) followed up with recruiting participants through their channels, an endeavour which they had been preparing for several months by successively collecting potentially interested participants in a database. In March/April, Gediz (electricity company in Türkiye), EnergieKompass (an Austrian company working with energy communities), Babeş-Bolyai University (Romania) and University ROMA3 (Italy) started recruiting for their respective countries. Whereas decent numbers of participants were recruited in Norway and Germany, all other countries recruited only between 13 and 124 participants. Therefore, it was decided that additional participants should be recruited in Romania through a survey panel.

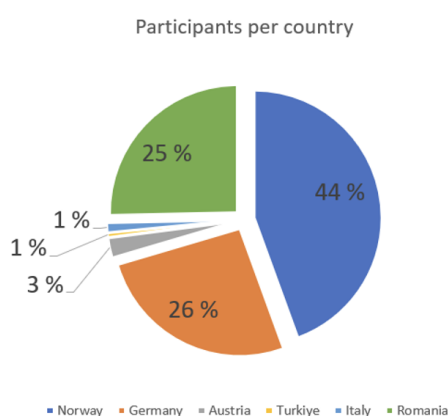


Figure 1: Distribution of campaign registrations per country

Recruitment by Country and Dropout Rates

In total 2,554 participants registered for the campaign, 1,135 of which from Norway, 664 from Germany, 647 from Romania (523 from the panel, 124 from the recruitment through



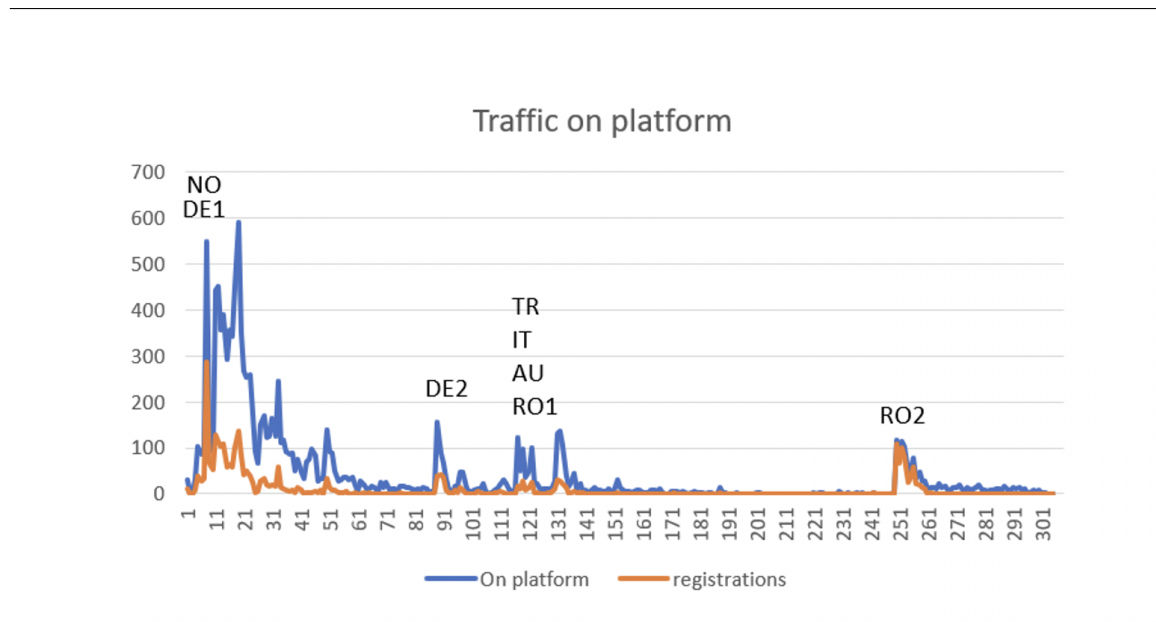


Figure 2: Traffic on campaign platform depending on recruitment campaigns

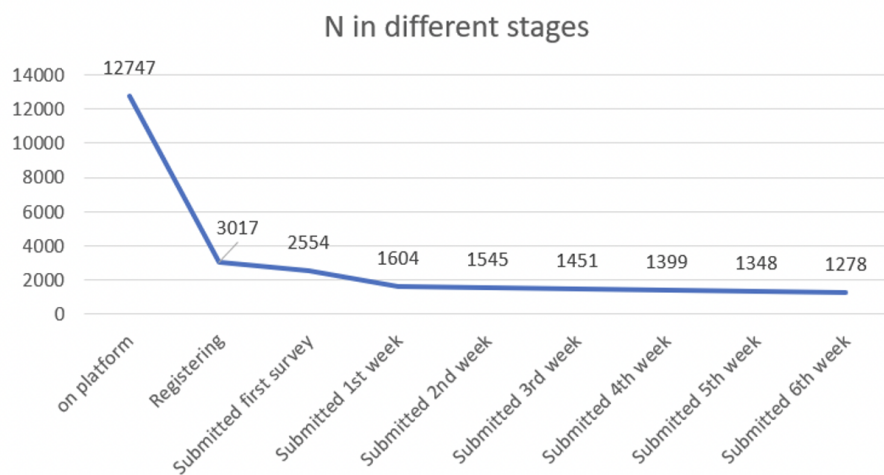


Figure 3: Number of participants per stage of the campaign

the university), 64 from Austria, 31 from Italy, and 13 from Türkiye (see Figure 1). As can be seen in Figure 2, traffic on the platform varied largely, depending on when larger recruitment waves were started. The figure shows also, that usually substantially more new people visited the platform per day than registered for the campaign. Overall, 12,747 unique people visited the campaign platform, of which slightly more than 3,000 registered, 2,554 answered the initial survey and from 1,604 to 1,278 delivered the weekly meter readings and answered the weekly survey. The dropout rates in the different stages of the campaign are substantial, especially in the early steps of the process, between going to the campaign platform, registering for the campaign, answering the initial survey and starting the weekly readings. As Figure 4 shows, this is in addition rather different for different countries: Whereas the initial number of registered participants who answered the first questionnaire is relatively high in Norway, the number drops quickly and weekly



dropout rates in Norway are high. In Germany, however, there is a smaller dropout between the initial survey and the first meter reading, but then the participation rates remain rather stable. The same can be said for Romania, but here this is driven by the participants recruited by the survey panel, where hardly any dropout in the six-week period can be seen. Starting numbers in Austria were low to begin with, and then many dropped out before the weekly readings started. In Italy and Türkiye, no relevant numbers of people could be recruited.

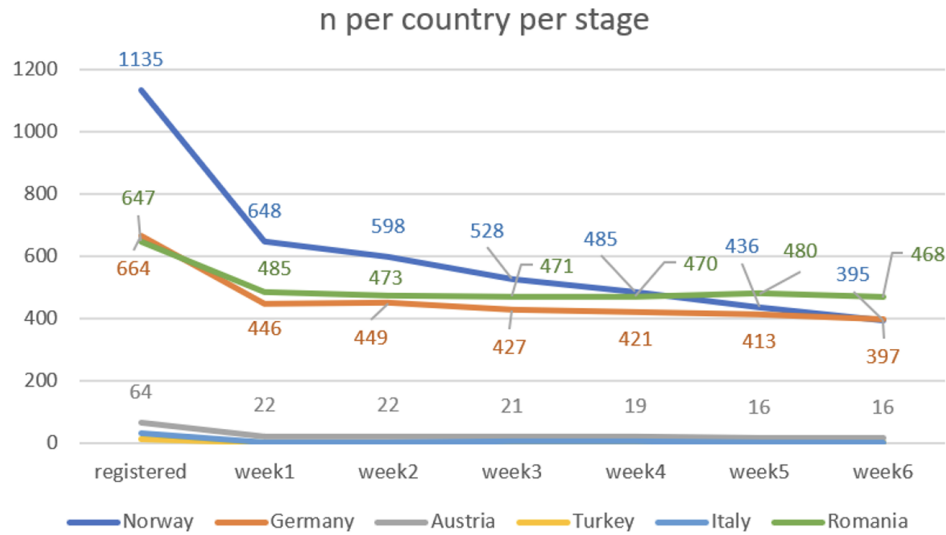


Figure 4: Number of participants per stage of the campaign per country

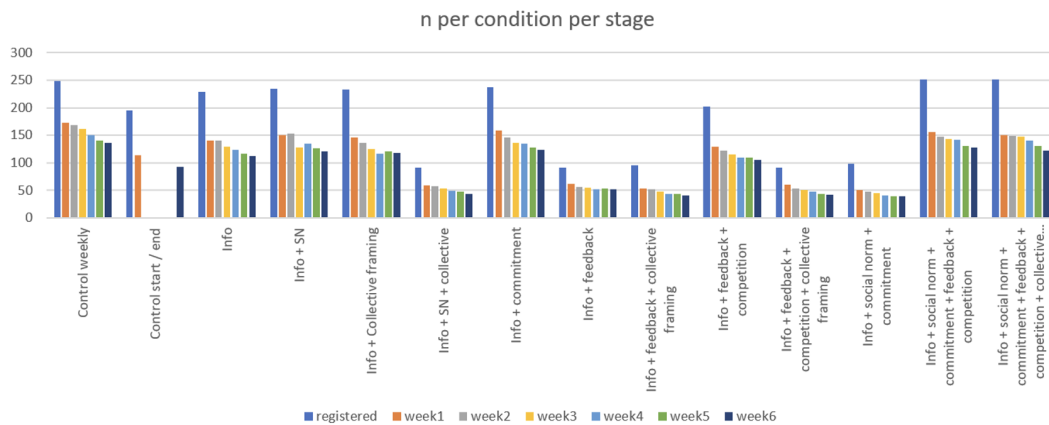


Figure 5: Number of participants per stage of the campaign per experimental condition

2.8.2 Recruitment Channels

Various communication channels were employed for recruitment, encompassing social media, homepages, email lists, and newsletters, with an estimated cumulative reach of around 6.23 million targets (refer to Figure 6). In essence, channels with an aggregate



reach of approximately 6.23 million targets were instrumental in enlisting the 2,554 participants for the campaign. This corresponds to a participation rate of 0.04% relative to the potential targets. It is important to note that there might be an unknown overlap in the target groups of different channels used by a user partner (e.g., individuals following the municipality on Facebook, subscribed to the local newspaper, and connected to the municipality on LinkedIn). As a primary observation, it is evident that recruiting individuals for energy-saving campaigns, which necessitate active participation over six weeks, poses a formidable challenge.

Italy and Austria were unable to provide estimates for the reach of the communication channels they utilized. Consequently, Figure 6 exclusively illustrates the participant-to-addressed-target ratio for the remaining four countries. The turnout rate in Romania (excluding the survey panel) and Türkiye is notably lower compared to Norway and Germany. Specifically, in Norway, the recruitment rate stands at its "highest" with 0.09% of the targets, while in Türkiye, it is at its lowest with 0.002% of the targets.

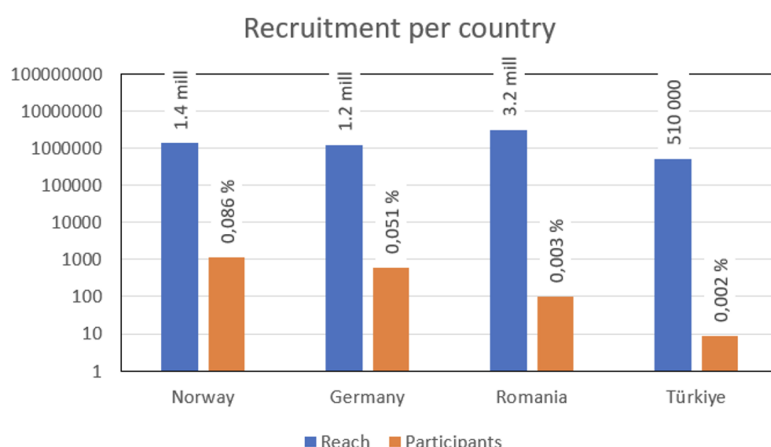


Figure 6: Number of potential targets of the communication campaign in relation to recruited participants

As Figure 7 shows, so are most of the participants in absolute numbers recruited through social media, e-mail / online newsletters and intranet, or through the survey panel. Electricity bills traditional media and more unusual channels contributed to a much lesser degree to the absolute number of participants. As Figure 8 shows, however, this is a combination of the reachable number of targets and the recruitment rate. Usually, channels with a higher number of targets in turn deliver lower recruitment rates. Whereas 0.9% of people addressed through unusual channels like their sports club participated in the campaign, only 0.005% of people addressed through traditional media participated. E-mail lists, newsletters and intranet were substantially more successful (but had a lower absolute reach), whereas social media and communication through electricity bills seems to have a good balance between reach and recruitment rates.

As a conclusion, it can be said that communication via specialized and more unusual



Participants per recruitment channel

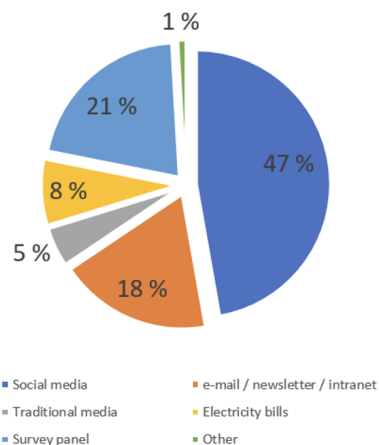


Figure 7: Percentage of recruited participants per communication channel

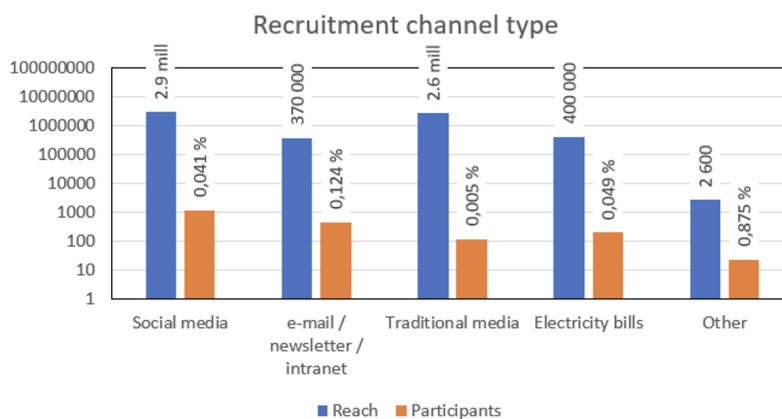


Figure 8: Number of potential targets of the communication campaign in relation to recruited participants

channels like involving sport clubs gives a much higher recruitment rate, but the total reach is very limited. Traditional media come out as particularly weak in the recruitment per number of targets, whereas more personalized communication channels like e-mail lists, newsletters, or intranet communication lead to relatively high recruitment rates, but – again – at the cost of lower numbers of potential targets. Social media and communication via electricity bills seems to be a good compromise to reach many people while at the same time not having extremely low recruitment rates.

2.8.3 Recruitment Partner Types

Recruitment success varies not only by communication channel but also by the type of partner addressing the target group. Municipalities, NGOs, and electricity companies played significant roles in recruitment (see Figure 9).



Participants per recruitment partner

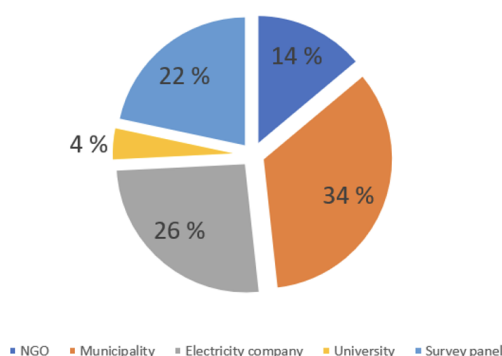


Figure 9: Percentage of recruited participants per user partner type

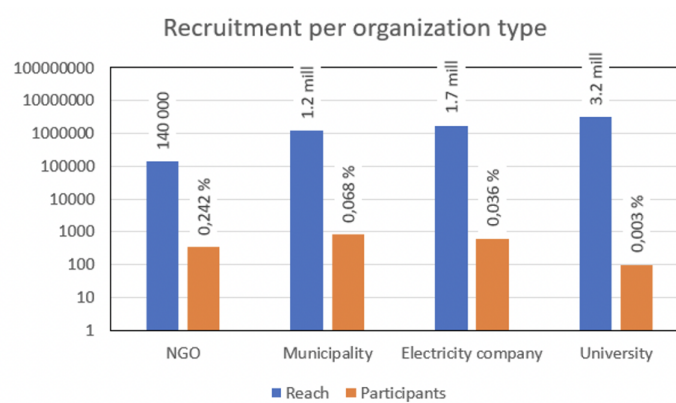


Figure 10: Number of potential targets of the communication campaign in relation to recruited participants

2.8.4 More Detailed Channel Analyses

As channels, countries and communicating partners are confounded, this section displays the recruitment rates on a higher level of specificity. Figure 11 shows the overall recruitment success through the channels in all countries.

2.8.5 Incentives and Geographical Focus

For example, during the recruitment phase in Viken county, different variations of Facebook posts were employed. One variant emphasized the energy-saving aspect of the campaign, highlighting the potential to save money by conserving electricity. In contrast, the other variant focused on a lottery of prizes among all participants who completed the campaign. The initial variant reached 197,802 Facebook users, with 1,042 clicking the platform link (0.5%). Conversely, the second variant, targeting 117,547 users, resulted in 2,701 clicks (2.3%). This signifies that a post emphasizing a lottery and the chance to win something was nearly five times more successful than a post centered on electricity savings and the associated monetary benefits (see 12. Consequently, it can be inferred that, in communi-



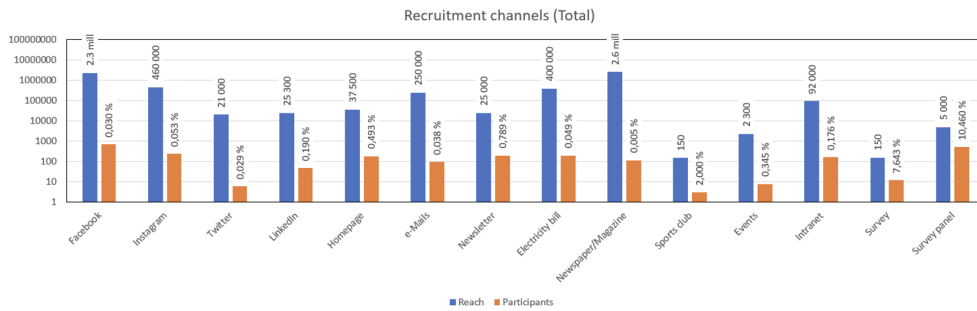


Figure 11: Number of potential targets of the communication campaign in relation to recruited participants

cations regarding electricity saving, incentives not directly linked to energy conservation may enhance participant engagement. Additionally, Badenova implemented a lottery for all participants completing the German campaign, potentially explaining their comparatively low dropout rates and heightened recruitment success compared to the Turkish partner.

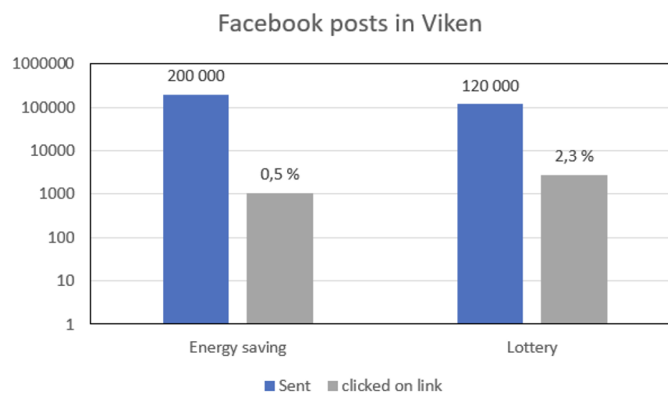


Figure 12: Number of potential targets of the communication campaign in relation to recruited participants

Another interesting effect could be seen when the success of a message in the newsletters sent by Friends of the Earth Norway to their members was analysed: In the national newsletter, which was sent to 23,486 recipients, 10,988 opened the newsletter and 769 clicked on the link to the platform (see Figure 13). In the local newsletter only sent to the members in Hordaland (a region of Norway), of the 2,386 recipients, 2,001 opened the newsletter and 456 clicked the link. The more local the scope of the newsletter was, the more relevant it apparently was perceived and the more it was opened and followed up. A conclusion can be, that the more local the message framing is, the more interest it gathers.

- Recruiting people for energy-saving campaigns requiring active participation for six weeks is challenging.



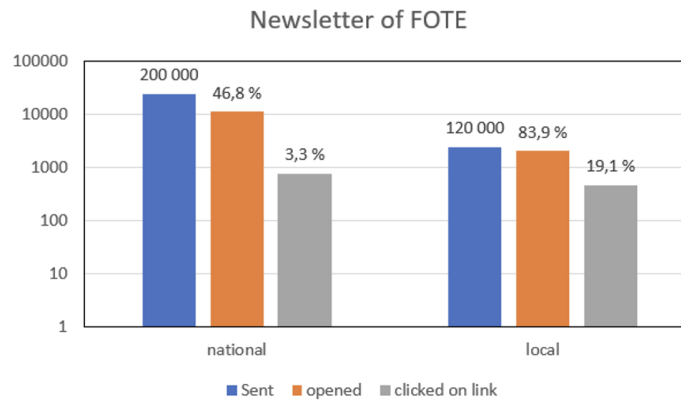


Figure 13: Differences in interest depending on the geographical focus

- Social media and communication via electricity bills seem to be a good compromise to reach many people.
- NGOs communicating with already interested people in energy saving are more successful, but municipalities and electricity companies are also interesting recruitment channels.
- Each entity running such a campaign needs to evaluate the best balance between reaching many people and reaching those interested and motivated to participate.
- Incentives not directly related to energy saving might increase participation.
- The more local the message framing is, the more interest it gathers.

2.9 Energy saving Results

The Results section delves into the impact of various experimental groups over time, examining each country separately. As mentioned earlier, these experimental groups encompass diverse incentive types. To facilitate a clear and comprehensible assessment, we concentrate on average energy consumption as the primary variable. A descriptive analysis is conducted to discern the effectiveness of different intervention combinations. Due to significant heterogeneity in total energy consumption and distinct recruitment periods across countries (Norway, Germany, Romania), the analysis is carried out separately for each. Initially, we initiate the discussion by comparing all groups with the control group, which did not receive any additional information. Subsequently, we explore the combined effects of different intervention types by adjusting the reference group. For example, to evaluate the impact of information coupled with an additional intervention, we compare the average savings with the information-only intervention.



2.10 Energy Saving Results Norway

The Results section explores the impact of various experimental groups over time, examining each country separately. These experimental groups incorporate diverse incentive types. To ensure a clear assessment, we focus on average energy consumption as the primary variable, conducting a descriptive analysis to discern the effectiveness of different intervention combinations. Due to significant heterogeneity in total energy consumption and distinct recruitment periods across countries (Norway, Germany, Romania), the analysis is conducted separately for each. Initially, we compare all groups with the control group, which did not receive any additional information. Subsequently, we explore the combined effects of different intervention types by adjusting the reference group. For example, to evaluate the impact of information coupled with an additional intervention, we compare the average savings with the information-only intervention.

2.10.1 Norway Results

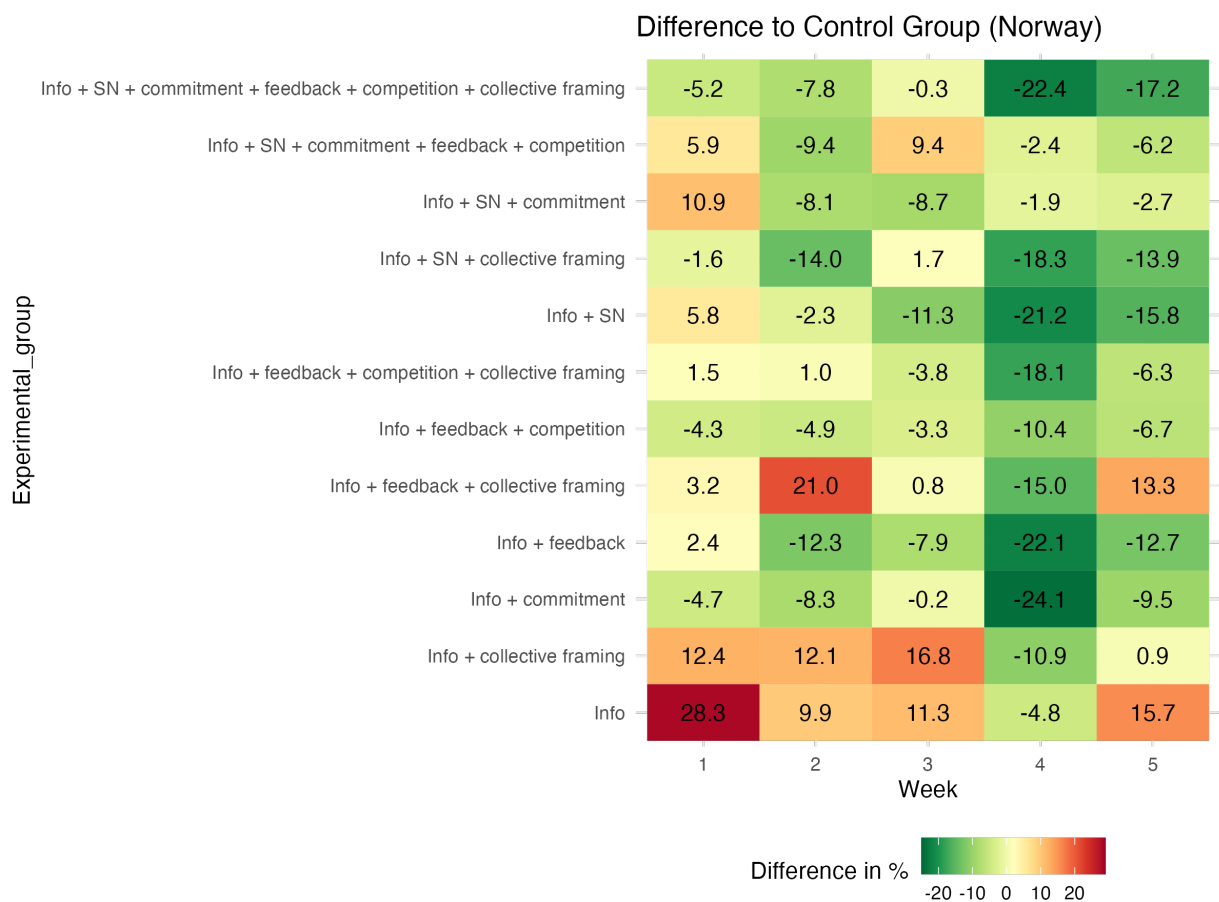


Figure 14: Difference in electricity consumption between experimental groups and control group over time in Norway.

Figure 14 provides an initial assessment of the intervention effectiveness in Norway. This assessment is grounded in three primary criteria: effect size, consistency, and the



magnitude of effect. The horizontal axis represents different weeks, while the vertical axis illustrates the mean energy consumption as a percentage deviation from the control group. Negative values are depicted in green, with darker shades indicating more substantial energy consumption reductions, signifying higher savings. Conversely, red colors signify positive deviations and increased energy consumption compared to the control group.

The analysis of the Norway sample shows how diverse experimental groups have affected energy consumption behavior.

- Comparing the Info group with the control group shows that providing information does not reduce average energy consumption. We observe, on average, larger consumption in 4 out of 5 weeks.
- Overall, most interventions seem to help participants decline their energy consumption; however, there is some difference in the consistency of the interventions.
- Collective framing seems to perform slightly worse than interventions with Feedback.
- Social Norms (SN) seem to work well and consistently, with savings becoming more pronounced over time.

To understand how the combination of information and one additional intervention works, it becomes imperative to modify the reference group. The outcomes, illustrated in Figure 15, depict the results where information now serves as the new control group.

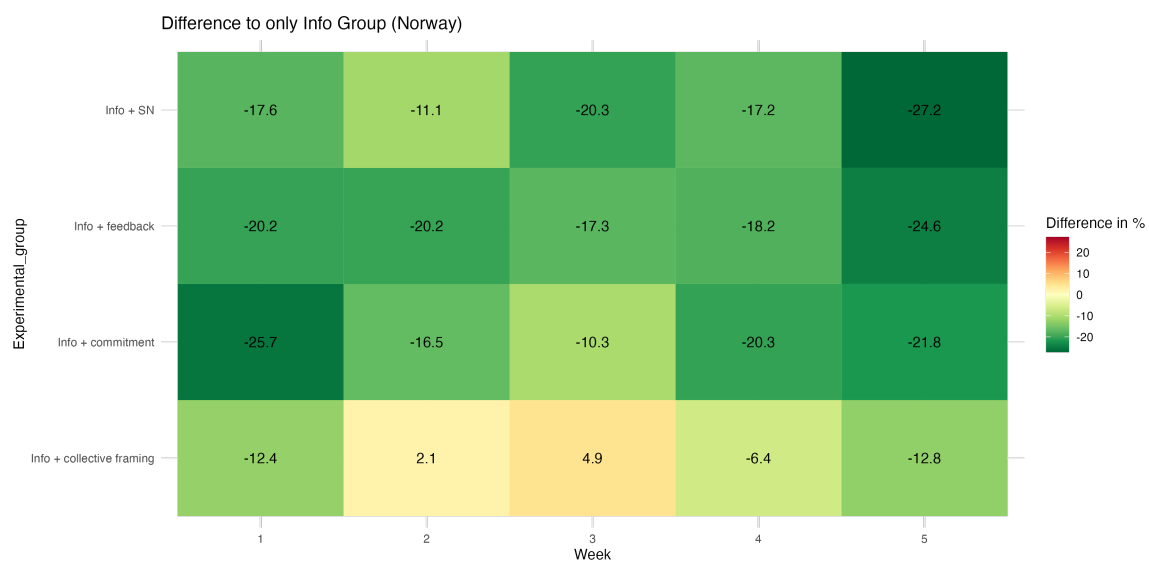


Figure 15: Difference in electricity consumption between info and info and an additional condition for Norway.

- Augmenting participants with additional feedback, commitment, social norm (SN), or collective framing consistently contributes to a reduction in their energy consumption. The most robust and sustained decrease in average energy consumption is observed in these intervention groups.



- In comparison to the control group (info), energy savings are evident in all groups, except for collective framing, where instances of increased consumption are also noted.
- The Info + Feedback group exhibits the most substantial and consistent declines when compared to the Info-only group.
- Comparing the outcomes with the initial control group, the Info + Feedback group stands out with an average savings rate exceeding 10%, making it the most effective, followed by Info + Commitment with approximately 9% average savings over time in contrast to the control group (refer to the plot above).

Furthermore, Figure 16 illustrates the performance of Info and Feedback when combined with either competition or collective framing. Shifting the reference group to Info and Feedback reveals that an additional intervention does not result in energy savings. Similar results are observed when comparing information and social norm interventions with additional commitment or collective framing. The results show some initial savings in the collective framing group (see Figure 17), but these diminish over time, and consumption increases compared to the control group. This suggests that a combination of multiple interventions does not necessarily lead to more pronounced savings.

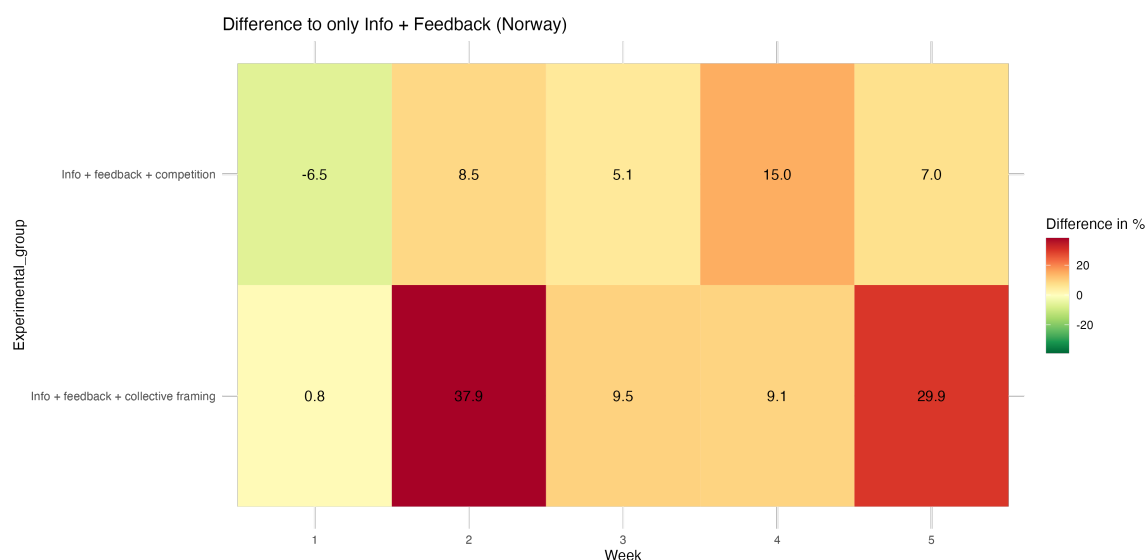


Figure 16: Difference in electricity consumption between info and info and an additional condition for Norway.

In summary, the results show that most of the intervention types can help individuals reduce their energy consumption. Interventions combining social norms, commitment, and feedback, with or without competition and collective framing, consistently led to reduced energy consumption in Norway over the 5-week duration.



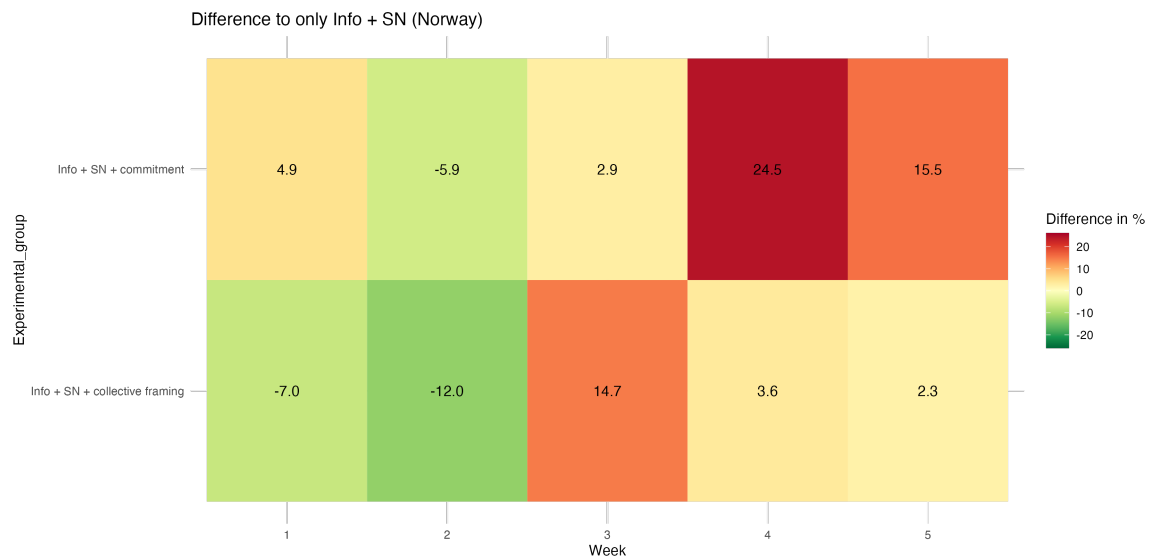


Figure 17: Difference in electricity consumption between info and info and an additional condition for Norway.

2.10.2 Results Germany

Figure 18 illustrates the results for the German sample. A comparative analysis with the results from Norway and Romania (see Section 2.10.3) enables the identification of country-specific differences.

- When comparing the overall outcomes with Norway, we observe more diverse results, and, on the whole, the achieved savings are less significant.
- Info and SN consistently exhibit effects ranging between 18-30%.
- Info, feedback, and collective framing also demonstrate promising results. Interestingly, these intervention types were less successful in Norway, emphasizing the impact of cultural differences.
- Providing only feedback appears to be more effective in Germany than in Norway. However, even in this case, there are instances of consumption increases rather than savings.
- The additive combination of various intervention types does not yield positive results in Germany.

Moreover, Figure 19 shows that savings can be improved by giving participants other types of interventions in addition to information. The strongest effect can be achieved by combining information with either SN or commitment. However, collective framing also works well and shows consistent reductions. Savings vary in magnitude over time, but the pattern seems to be very consistent. In comparison to results in Norway (see Figure 16), info and feedback did not have the strongest but rather the lowest impact. Moreover, collective framing seems to work better in Germany.



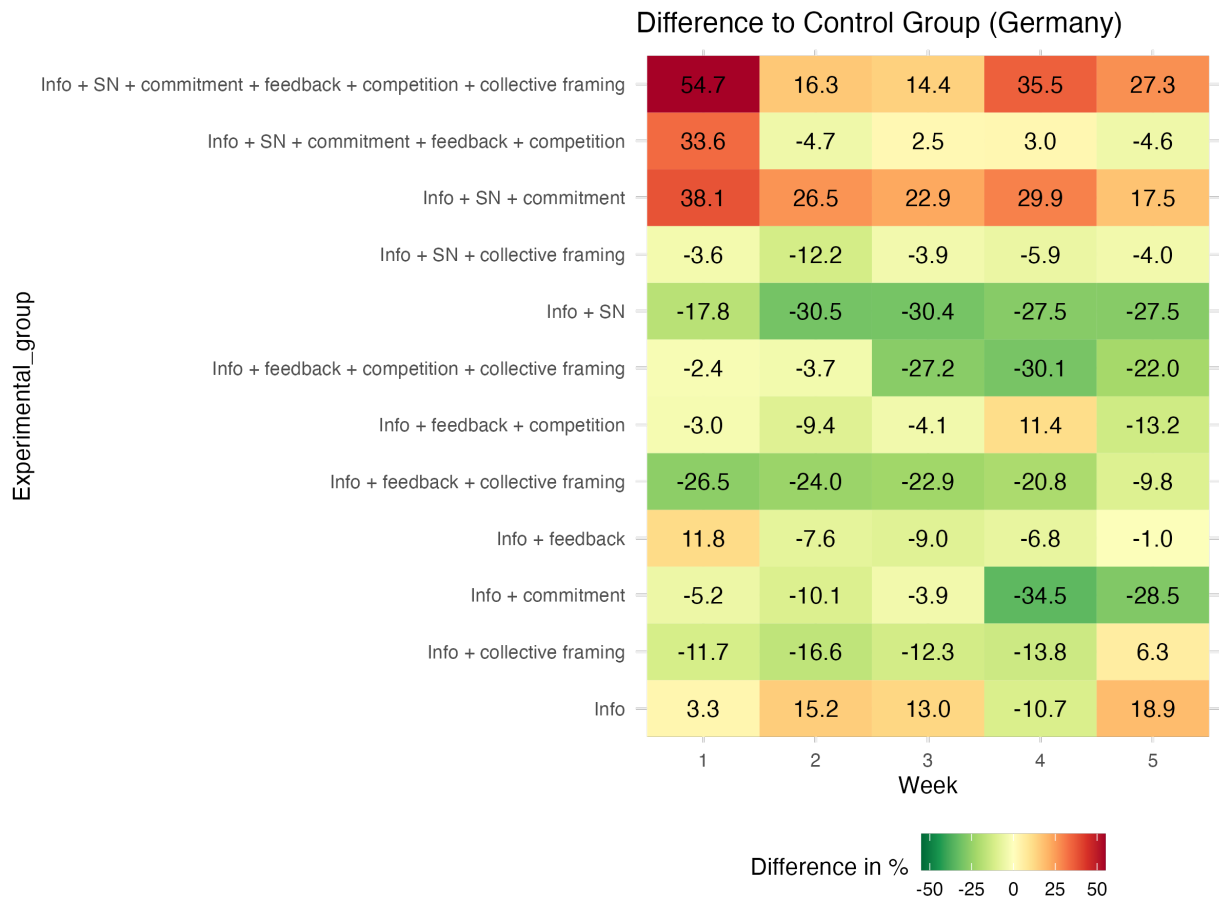


Figure 18: Difference in electricity consumption between experimental and control groups over time in Germany.

Ultimately, when examining the combination of interventions involving the provision of information and social norms, distinct effects emerge compared to the Norwegian sample. Figure 20 shows that the addition of collective framing does not only decline energy consumption at the beginning but consistently and also more effectively than in Norway. Moreover, we also see additional savings when competition is activated in Germany. This shows again that some countries might prefer completion or collective framing more compared to other countries, such as Scandinavian ones.

2.10.3 Romania Results

Figure 21 showcases the results for the Romanian sample. Importantly to note, the data collection in Romania occurred later than in the German and Norwegian samples, potentially affecting comparability. Additionally, our analysis was informed by insights gained from previous samples, guiding our focus on specific combinations of interventions. However, not all possible combinations were utilized in this study.

- While the Info campaign did not show consistent energy-saving effects in Norway or Germany, savings are visible in Romania in four out of 5 periods.



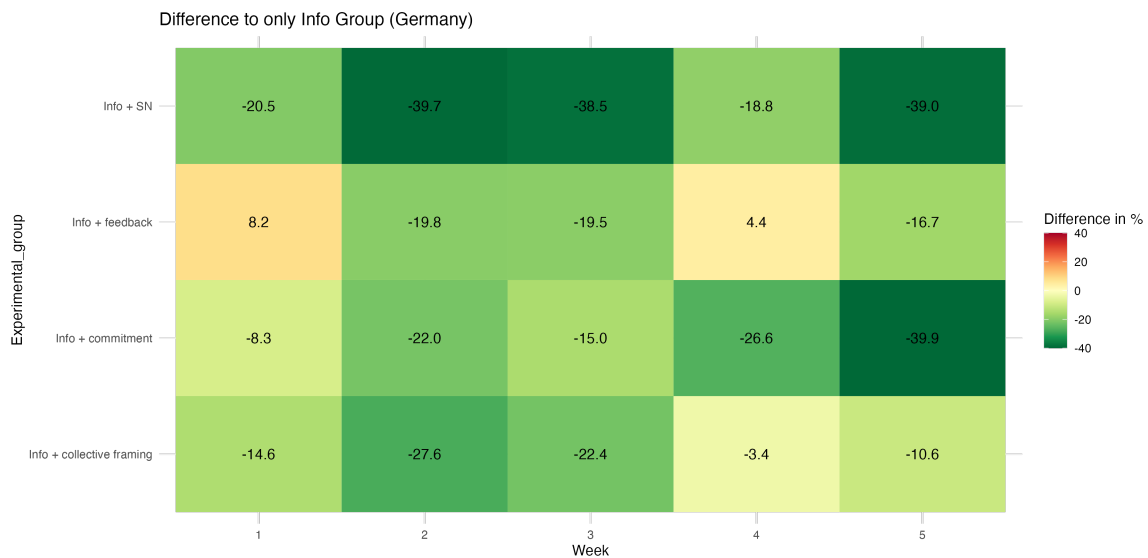


Figure 19: Difference in electricity consumption between experimental groups and control group over time in Germany.

- The combination of Info Feedback and competition seem to work very well in Romania and also better than in the other countries.
- Info and SN show smaller but consistent effects. The effects are stronger compared to Norway and visible already in the first week but less pronounced compared to Germany.
- Considering these factors, the Info and Info + SN interventions stand out as the most effective in achieving consistent and moderate reductions in energy consumption. These treatments leverage information and social norms, providing a balanced approach that resonates well with participants over the entire 5-week intervention period.

To assess various combinations of interventions on energy-saving behavior, we changed the reference category to Info. The results from Romania indicate that combining interventions can indeed assist participants in lowering their energy consumption. Both collective framing and commitment in combination with info result in reduced energy consumption. Furthermore, akin to other countries, a positive effect over time is observed with commitment, whereas collective framing exhibits efficacy right from the start of the intervention. In contrast to other countries, the addition of social norms (SN) does not yield the desired impact.

In addition to electricity data, the platform also collected detailed information about psychological factors, including the intention to save electricity, perceived difficulty of energy-saving actions, attitudes towards energy conservation, electricity saving habit strength, social and personal norms, collective efficacy, emotional responses to energy use, and national identity (which was important to interpret the effect of the collective framing which was done at the national level). These factors are crucial for understanding the mech-



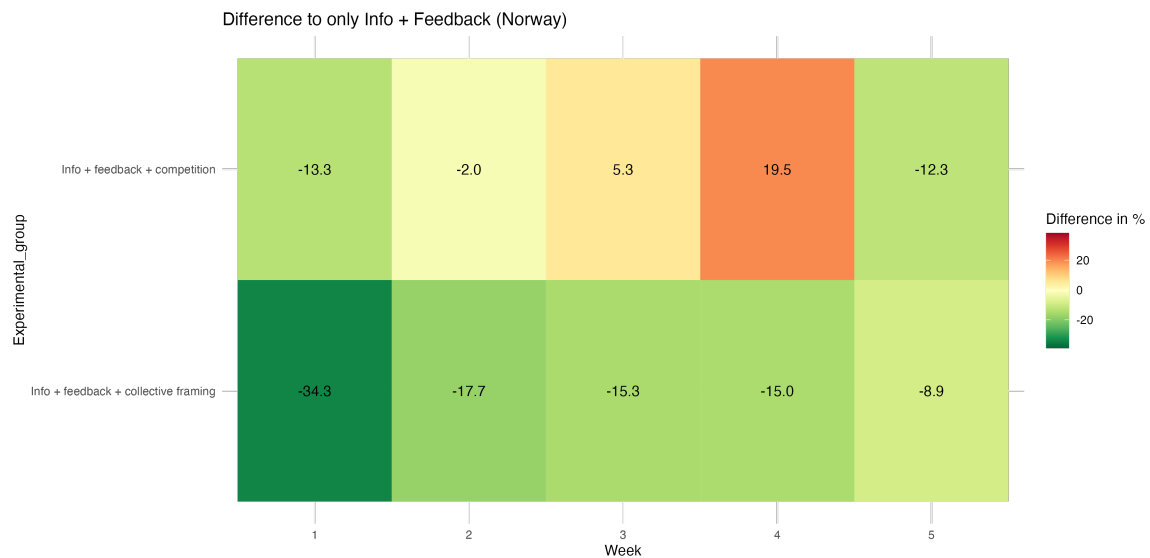


Figure 20: Difference in electricity consumption between experimental groups and control group over time in Germany.

anisms through which the interventions exert their influence. Participants of the ENCHANT platform were recruited through different communication channels (see Table ??).

2.10.4 Conclusion

Analyzing the results from Norway, Germany, and Romania provides valuable insights into the effectiveness of diverse intervention types on energy-saving behavior. Across all three countries, certain commonalities and differences emerge.

2.10.4.1 Commonalities:

- **Info Campaigns:** In all countries, the Info campaign alone did not consistently lead to reductions in average energy consumption.
- **Combining Interventions:** Combining information with additional interventions, such as feedback, commitment, social norms, or collective framing, consistently contributed to a reduction in energy consumption.
- **Feedback Effectiveness:** Feedback, when included, often showed positive effects, with the Info + Feedback group exhibiting substantial and consistent declines.

2.10.4.2 Differences:

- **Cultural Variances:** The effectiveness of certain interventions, such as collective framing, varied across countries, emphasizing the influence of cultural factors on energy-saving behavior.



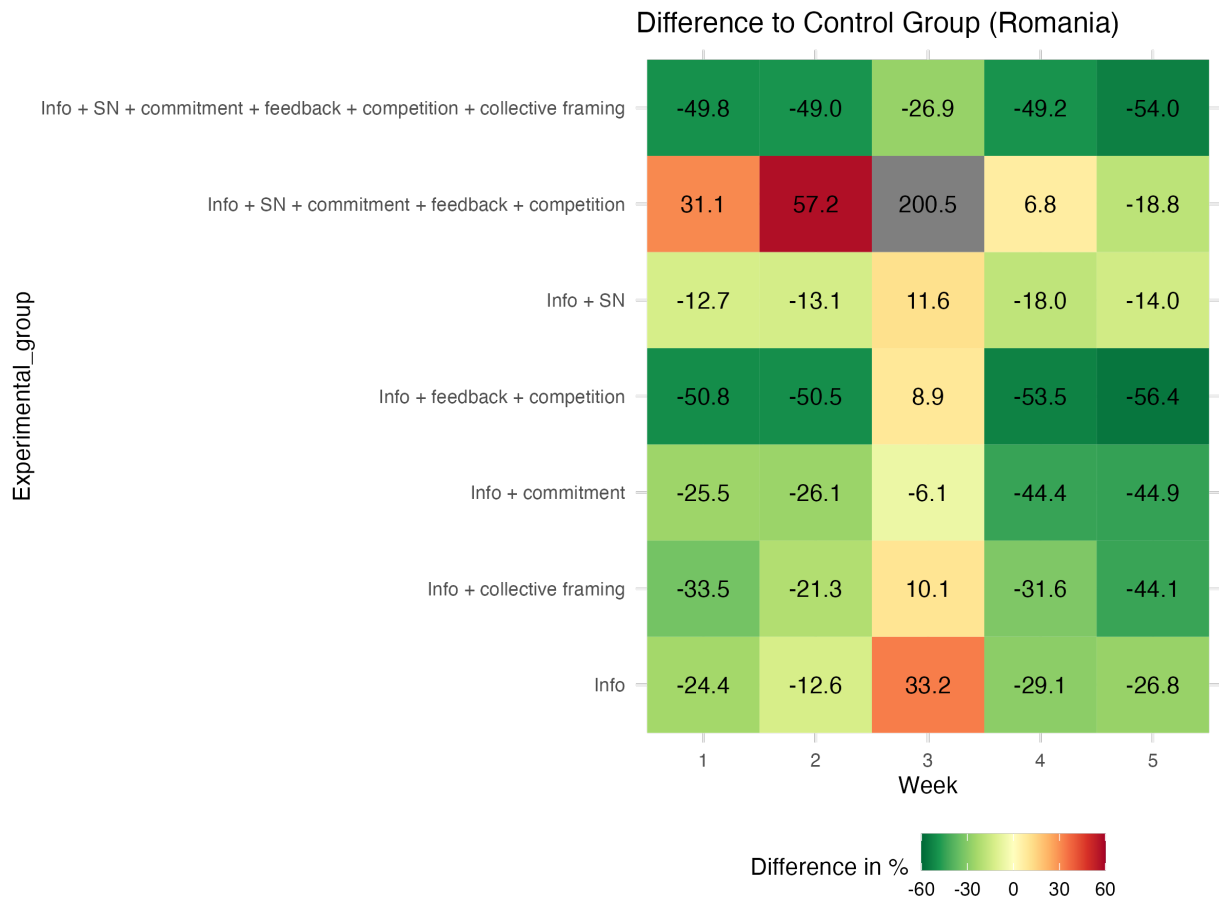


Figure 21: Difference in electricity consumption between experimental groups and control group over time in Romania.

- **Competition Impact:** The impact of competition as an additional intervention differed, with Germany showing positive results, while the effect in Norway was less pronounced.

2.10.4.3 Overall Insights:

- **Balanced Approaches:** Combining information with social norms (SN) consistently proved effective across countries, providing a balanced approach that resonated well with participants.
- **Feedback Dominance:** In various contexts, interventions incorporating feedback, such as Info + Feedback, exhibited strong and sustained reductions in energy consumption.
- **Cultural Considerations:** Tailoring interventions to cultural nuances and preferences is crucial for maximizing effectiveness.

These insights highlight the complexity of behavior change interventions and the importance of considering cultural, contextual, and individual factors in designing effective energy-saving campaigns.



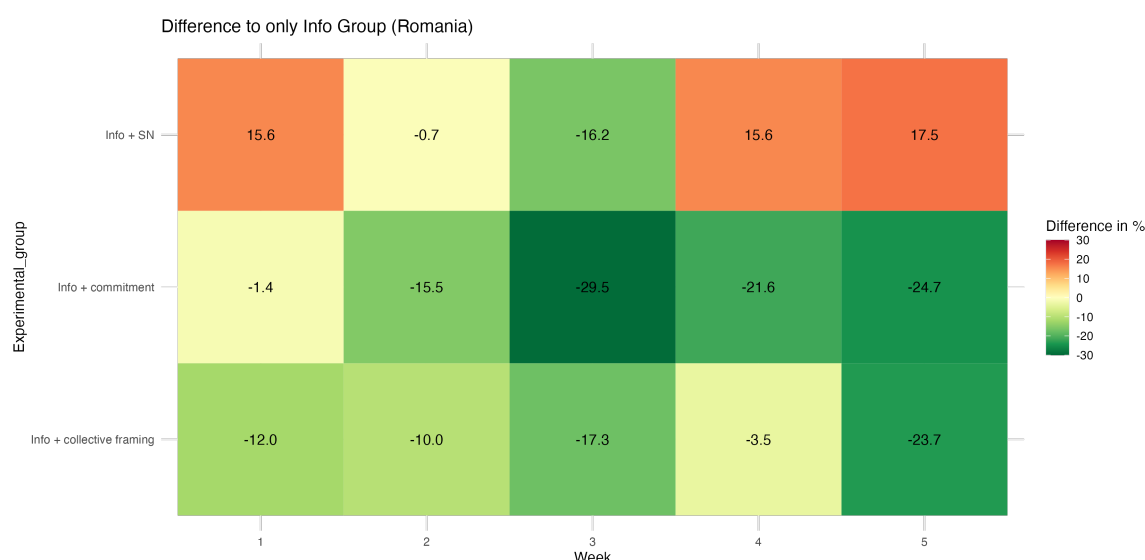


Figure 22: Difference in electricity consumption between experimental groups and control group over time in Romania.

2.10.5 Emotional Reactions in the ENCHANT Intervention Platform Survey

In the survey on the ENCHANT intervention platform, four questions about the emotional reaction to the current electricity use were included, asking how people felt about their consumption (very negative – very positive), how happy they were with their electricity consumption, how upset they were, and how excited. A factor analysis of these items confirmed that all four of them formed one factor (with the last item only loading weakly and the third item loading negatively). Thus a mean score of the first two items and the third (reversed) was calculated for week 1 (before the interventions) and week 5 (after the follow-up measure). In addition, it was calculated, how much people reduced their electricity consumption per person between week 1 and week 5. Then, it was tested if more emotional activation related to current electricity consumption in week 1, to intentions to save, and to electricity consumption reduction. Furthermore, it was tested, if changes in emotional activation related to electricity consumption reductions. A question at the end of the campaign asked for if people were feeling that their freedom was infringed by the campaign, so this question was also analyzed as an indication of peoples reactance towards the campaign.

Are Emotions a Motivator for Intentions to Change and How Are They Related to Consumption Levels?

In week 1, the level of emotional activation did not significantly relate to neither the level of per-person electricity consumption ($r = -.01$; $N = 2554$; $p = .538$), nor to the intentions to reduce consumption ($r = .03$; $N = 2554$; $p = .104$). Thus, it seems that emotions are not a significant factor for engaging in the electricity-saving campaign, at least not depending on the level of consumption.



How Do Emotional Reactions Relate to Success or Failure in Saving Electricity Throughout the Campaign?

The level of electricity saving between week 1 and week 5 also does not relate to emotions: Neither the level of emotions in week 5 ($r = .04$; $N = 2554$; $p = 0.054$) nor the change in emotional reaction ($r = .04$; $N = 2554$; $p = .053$) show a significant relation. Interestingly, the level of intention to save recorded in week 1 relates significantly to both aspects, namely the level of emotional activation in week 5 ($r = .08$; $N = 2554$; $p < .001$), and the increase in emotional activation between week 1 and week 5 ($r = .05$; $N = 2554$, $p = .013$). More specifically, this means that people who intended more strongly to save energy in week 1 reported more positive emotional reactions in week 5 and also a stronger increase in positive emotional activation, but this is not related to if they succeeded in saving in reality or not. A negative relation can be found between the consumption in week 1 and the emotional activation in week 5 ($r = -.119$; $N = 2554$; $p < .001$) as well as the change in emotions between week 1 and week 5 ($r = -.118$; $N = 2554$; $p < .001$). In other words, people with a higher consumption per capita to begin with did not have less positive emotions in week 1, but in week 5, so they apparently learned more about their own consumption and therefore were likely to feel worse.

The feeling of reactance (being infringed in your freedom by the campaign) was mostly unrelated to the other aspects studied here, with two exceptions: The higher the consumption at the beginning of the campaign was, the less likely participants felt infringed at the end ($r = -.09$; $N = 255$; $p < .001$), and the more positive the emotional reactions in week 1 were, the less infringed they felt ($r = -.04$; $N = 2554$; $p = .033$). Interestingly, real electricity saving, emotions in week 5, and the change of emotions were not related to this feeling.

Are Specific Intervention Techniques Connected to Specific Emotional Reactions?

Whereas the degree of success or failure with saving electricity is mostly unrelated to the emotional reaction and also is a weak motivator for engagement at best, it is another question if the interventions introduced in the experiment caused positive or aversive emotional reactions in the participants. Therefore, we tested first, if each intervention technique tested had an effect on emotions in week 5, the change in emotional reactions, and the degree of reactance.

Information Provision

As expected, there was no difference between participants who received information (in the form of electricity-saving tips) and participants in the control conditions in any of the three variables. Providing information might, therefore, be regarded as emotionally rather neutral.



Social Norm Communication

The picture is different for communication of social norms to participants: In the experimental groups that included communication of how other people in the same group performed, the increase in positive emotions was slightly higher than in the other groups ($ANOVAF = 10.823, df = 1/2552, p < .001, eta2 = .004$). The effect is statistically significant but very small. This means that receiving information about how others in a similar situation perform seems to rather support decreasing people's well-being.

Asking for Commitment

Overall, asking the participants to commit to electricity saving did not have an effect on any of the tested variables. However, the picture changes when the numbers are separated for people who refused the commitment, gave a private commitment, or gave a public commitment: People who refused a commitment in week 3, when it was asked for the first time, had less positive emotions in week 5 than people who gave a commitment (see Fig. 1); the most positive emotional reaction was reported in week 5 by people who gave a public commitment ($ANOVAF = 3.152, df = 1/2552, p = .024, eta2 = .011$). The same effect can be shown for the commitment given in week 4 ($ANOVAF = 4.607, df = 1/2552, p < .001, eta2 = .034$). Whereas people who rejected the commitment did not improve their emotional well-being from week 1 to week 5, people who gave commitment in week 3 ($ANOVAF = 6.807, df = 1/2552, p < .001, eta2 = .024$) and in week 4 ($ANOVAF = 10.564, df = 1/2552, p < .001, eta2 = .036$) improved their emotional well-being. For the commitment in week 4, this effect is mostly driven by the public commitments. Interestingly, people who only accepted a private and not a public commitment felt the strongest infringement of their personal freedom through the campaign (Week 3: $ANOVAF = 11.143, df = 1/2552, p < .001, eta2 = .038$; Week 4: $ANOVAF = 14.908, df = 1/2552, p < .001, eta2 = .051$), even stronger than the people who rejected the commitment totally.

Feedback on Development of Own Consumption

Giving feedback on how the consumption at a given point in time relates to the initial consumption was not significantly related to any of the three emotional components.

Competition

Overall, there is no effect of inviting the participants into a competition on their emotions at the end of the campaign, their reactance, or the change in emotions from week 1 to week 5. There is a difference, however, when comparing people who accept the competition and people who reject it: People who participate in the competition report a higher increase in emotional well-being ($ANOVAF = 4.492, df = 1/2552, p = .011, eta2 = .011$), but at the same time, also a higher perceived infringement of their personal freedom ($ANOVAF = 3.531, df = 1/2552, p = .030, eta2 = .009$).



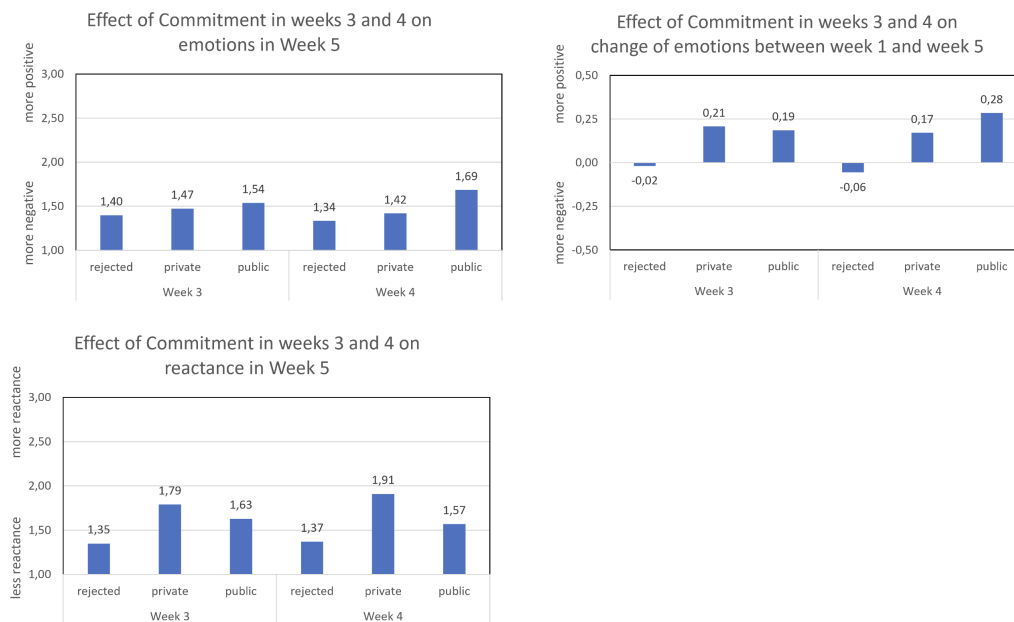


Figure 23: Effects of the participants' reactions to the plea for commitment in weeks 3 and 4 on emotional well-being in week 5, improvement of emotional well-being between week 1 and 5, and perceived reactance in week 5.

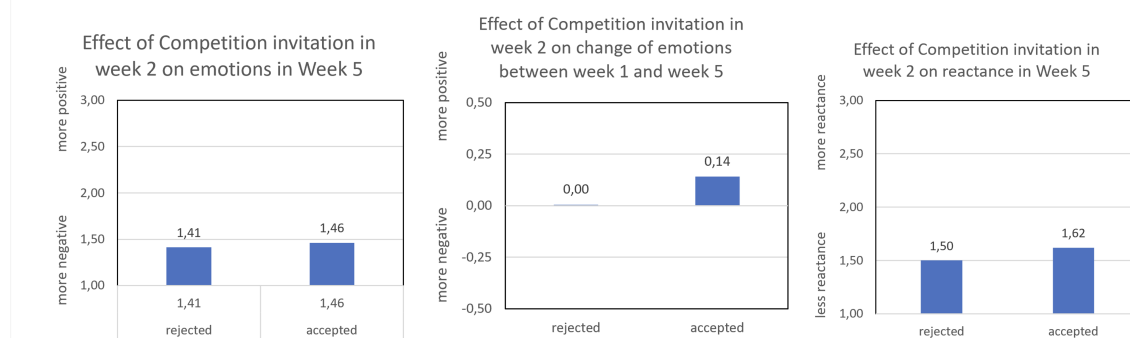


Figure 24: Effects of the participants' reactions to the invitation to the competition in week 2 on emotional well-being in week 5, improvement of emotional well-being between week 1 and 5, and perceived reactance in week 5.



Collective vs. Individual Framing

There was no statistically significant difference in any of the tested emotional categories depending on if electricity saving was framed as an individual or collective task.

General Conclusions

The analyses show that the relation between electricity saving and emotional reactions is not very strong. However, there are some meaningful patterns:

- Emotions do not seem to be the starting point for an impulse to change, but people with high initial consumption feel worse at the end of the campaign, no matter if they actually save or not, thus it seems like the campaign increased their understanding of being high consumers.
- People who are motivated to change in the beginning of the campaign tend to feel better at the end, no matter if they actually save electricity or not.
- Social norm communication is an intervention that has been suspected to cause negative emotions in people (through high social pressure), but we rather find a positive emotional effect over the whole campaign.
- Commitment and competition have positive emotional effects for people who accept these interventions; people who reject them do not seem to decrease their emotional status.

3 Public Transport Interventions

Sustainable urban mobility is a priority for cities around the world as they grapple with the effects of climate change, air pollution, and traffic congestion. Shifting from private car use to public transport is a multidimensional challenge that requires strategic initiatives, community engagement, and a nuanced understanding of urban dynamics. This section provides guidance on how policymakers can replicate and scale up ENCHANT's interventions to increase public transport use. The interventions in Cluj-Napoca, Romania, and Izmir, Turkey, provide insight into the strategies local authorities are using to manage this transition. First, we present the interventions at a meta-level and compare key findings. Second, we discuss challenges and opportunities, and finally, we draw lessons to guide future directions.

3.1 Intervention Overview

In ENCHANT, we conducted two large scale interventions in two different countries that aimed to increase public transport usage (see Table 7). The "Green Friday" intervention in Cluj-Napoca provides policy makers with an example how monetary incentives can be



used. In this specific intervention the municipality offered all citizens free public transport on Fridays between March 2021 and December 2022. The intervention used various channels that motivate people to take public transport. First, there is a clear monetary incentive as the relative cost of car usage increased. Second, the initiative exploits also psychological factors like the opportunity of free services through the appeal of cost savings and the fear of missing out on a beneficial offer.

Table 7: Comparative Analysis of ENCHANT’s Public Transport Interventions in Cluj-Napoca and Izmir

Aspect	Cluj-Napoca, Romania	Izmir, Turkey
Objective	Increase public transport usage	Increase public transport usage
Intervention Type	“Green Friday” initiative: Free public transport on Fridays (March 2021 - December 2022)	Information campaign focusing on awareness and environmental responsibility
Incentive Strategy	Monetary incentive: Free transport on Fridays, exploiting psychological factors	Indirect approach: Raise awareness, promote environmental responsibility
Relative Effect	Approximately 5% increase in transport usage	Approximately 8% increase in average passenger usage
Impact Factors	Impacted by COVID-19 outbreak, statistical power reduced	Impacted by COVID-19 pandemic and recovery phase, increased variance in average passengers
Overall Success Factors	Broader societal impact with over 10 million passengers on Green Fridays	Positive trajectory in the ongoing cultural shift toward environmental awareness
Integrated Initiatives	Components of a larger plan for sustainable urban living, including educational efforts, green space development, and infrastructure improvements	Part of a broader plan for sustainable urban living
Challenges	Broad application of “Green Friday is expensive,” GDPR constraints	Bureaucratic and communication barriers

3.2 Comparative analysis of Izmir’s Public Information Campaign and Green Friday Cluj-Napoca

In contrast, Izmir’s campaign takes a more indirect approach, focusing on raising awareness and promoting environmental responsibility. The city’s information campaign uses visual aids to highlight the benefits of public transport, aiming to change commuter behavior through informed choice rather than immediate financial gain.

Given the very different incentive strategy, the relative effect of each intervention is



also different. Moreover, both interventions are affected by the Covid-19 outbreak, which reduces the statistical power of the results and induces an important limitation (See D4.3 for more details). For the intervention in Cluj, we observe that free transport increased the transport usage by approximately 5%. However, the effect on the difference in difference estimator was not statistically significant. The Green Friday initiative may not have a significant impact on those with pre-purchased passes, and unaware tourists and infrequent users may miss the opportunity to change their travel habits. However, considering that over 10 million passengers used the public on Fridays the broader impact of Green Fridays on the society is very large.

In comparison, the intervention in Türkiye increased the average passenger usage by around 8%. Even though the difference in difference estimator is very pronounced, the effect was not statistically significant. The COVID-19 pandemic and more precisely the recovery phase increased the variance in the average passengers and thus makes it more difficult to identify any causal effects.

However, the overall success of an intervention depends on several factors, including economic costs, environmental benefits, and broader social and well-being factors. The initiatives in both cities are components of a larger plan to cultivate sustainable urban living that includes educational efforts, green space development, and improvements to pedestrian and bicycle infrastructure. The true measure of these initiatives lies not only in the reduction of vehicular traffic, but also in the progressive shift in public attitudes toward environmental conservation and sustainable commuting practices.

The ongoing cultural shift toward environmental awareness and increased consideration of public transportation options, while not immediately quantifiable, suggests a positive trajectory. The lasting value of these initiatives is likely to be found in the long-term transformation of urban transportation culture and public environmental awareness.

The effectiveness of the Izmir campaign is evidenced by the increase in public transport use, although isolating the influence of the campaign from other variables, such as the impact of the COVID-19 pandemic on travel behavior, is complex. Nevertheless, the role of the campaign in maintaining and potentially increasing public transport use during such a disruptive period is commendable. The campaign also acts as a conduit for the municipality to communicate improvements in the public transport system, reinforcing the notion that public transport is not only the environmentally friendly choice, but also the superior one in terms of comfort and service quality.

3.3 Challenges and Considerations

The implementation of the initiatives in Cluj-Napoca and Izmir was not without obstacles. In Cluj-Napoca, the broad application of "Green Friday" posed challenges for a controlled



impact assessment, while GDPR constraints prevented a detailed analysis of travel patterns. Izmir faced bureaucratic and communication barriers that required careful navigation. These challenges highlight the need for a well-defined data collection and analysis strategy. Without solid data, assessing the success of such initiatives is speculative at best. In addition, understanding the full impact of these interventions requires consideration of qualitative factors such as user satisfaction, public perception, and administrative challenges.

3.4 Lessons Learned and Future Directions

Other cities seeking to improve the use of public transport can learn from the experiences of Cluj-Napoca and Izmir. Clear objectives are essential for designing effective interventions, as are adequate financial resources and the commitment of all stakeholders. Open communication and early involvement of these groups can facilitate the smooth implementation and acceptance of transport initiatives. Cities must also remain flexible and ready to adapt their strategies to evolving circumstances, such as those presented by the COVID-19 pandemic. As urban centers recover, there is a unique opportunity to rethink urban mobility and strengthen the role of public transport in a post-pandemic landscape. Taken together, the initiatives in Cluj-Napoca and Izmir represent significant progress towards sustainable urban mobility. While their approaches differ, both cities recognize the need for inventive solutions to today's urban transportation challenges. In future efforts to promote public transportation and foster more sustainable, livable urban spaces, the lessons learned from these interventions will prove invaluable.



Table 8: Key Considerations for Designing Effective Public Transport Interventions

Factor	Consideration Based on Public Transport Interventions	
Understanding the Audience and Framing		Customize interventions to suit varied audience profiles. Information campaigns can tap into diverse motivational factors, addressing both social and individual norms while triggering various aspects such as financial incentives or altruistic appeals, mirroring the approach of other campaigns within the ENCHANT framework. Scaling up initiatives like “Green Friday” has the potential to resonate with a wide audience, fostering long-term behavioral shifts and enhancing public awareness regarding energy-related issues and the pivotal role of the mobility sector in the energy transition. Broader and more extensive campaigns, like the one implemented in Izmir, offer a comparatively straightforward implementation and still have the capacity to boost short-term public transport usage.
Long-Term engagement:	En-	Acknowledge the significance of continuous commitment. The periodic free transport initiative on Green Fridays not only made a substantial impact during its specific timeframe but also has the potential to influence individuals to consider using public transport on other days as they become accustomed to it. In the case of Izmir, the short-term campaign successfully raised awareness and, if complemented by additional interventions, could contribute to a more lasting behavioral change. However, longitudinal data as well as more detail information (surveys, focus groups etc) would be needed to assess long term impacts.
Adapting to Contextual Variables:		Factor in contextual elements, including local challenges, prevailing public attitudes, and external disruptions such as the impact of COVID-19. Subsequent research endeavors should aim to collect more supplementary data, conduct additional surveys to link the overall effects to individual socio-economic information. This would allow to make more precise conclusion and would help policy makers also to address other important spheres, receive feedback about changes in attitudes and behaviors or knowledge. Moreover, the added information facilitates the control of potential confounding variables and reduction of noise in the data, enhancing the robustness of analyses.

4 Investment in EE and RES

Stimulating investment in energy efficiency (EE) and renewable energy sources (RES) is critical to addressing the significant impact of the European Union’s housing sector. With more than 220 million buildings constructed before 2001, renovation of these structures is essential to meet emission reduction targets and increase resilience to climate-related impacts. This section provides guidance for policymakers based on EE and RES interven-



tions, exemplified by Ninfa Garden in Italy and Building Energy Efficiency Online Counseling in Norway. These case studies provide valuable insights into possible strategies used by local authorities to motivate citizens to engage with EE and RES. In the following sections, key findings are briefly discussed and compared. The following section discusses challenges and opportunities, and the final section draws lessons for future directions.

ENCHANT conducted two large-scale interventions in different countries to motivate investments in energy efficiency (EE) and renewable energy sources (RES). The first intervention took place at Ninfa Gardens in Latina, Italy, and explored visitors' interactions with renewable energy investments and their commitment to energy efficiency. Specifically, this intervention investigated the impact of different levels of information on visitors' willingness to invest in renewable projects. Visitors received additional information on specific days, allowing for a comparison between intervention and control groups. The evaluation included socio-demographic variables and environmental attitudes. The second intervention was conducted in Norway and dealt with building energy efficiency online counseling through two portals, the Naturvernforbundet's and the Viken municipality's energy portal. The intervention provided targeted advice on energy efficiency improvements. The study compared users of these websites with representative samples of households for whom similar data had been collected in a different project. The users of the energy counseling websites received targeted information on how to upgrade the energy standard of their houses (based on data from the Norwegian register of buildings), assessments of costs, as well as contacts to possible contractors.

While the Ninfa Garden intervention showed no statistically significant differences between groups, the Norwegian Counseling interventions showed a higher proportion of large renovation projects and increased renovation and energy efficiency ambition among the website users compared to the general population. In particular, the study shed light on the influential role of psychological factors in shaping participants' behavior in relation to major renovations. The identification of social norms, attitudes, personal norms, and self-efficacy as significant influencing factors provides valuable insights for policy makers and researchers. Understanding these psychological determinants allows for more targeted and effective intervention strategies.

4.1 Challenges and Considerations

The Ninfa Garden intervention faced significant challenges, particularly in the early stages, with one notable issue being the difficulty in obtaining follow-up surveys from participants. This challenge was attributed to participant fatigue, possibly due to a decrease in motivation after the initial visit. Recognizing this hurdle, the research team proactively implemented modifications for the second wave, refining survey administration methods to improve data collection logistics. The intervention also faced unforeseen obstacles in the midst of the global COVID-19 pandemic, requiring further adjustments to the origi-



nal design. These adaptations were extensive and addressed logistical, ethical, and privacy issues. Given the sensitive nature of the data collected and the need to comply with evolving health regulations, the research team demonstrated flexibility and adaptability in addressing pandemic-related challenges. This highlights the importance of integrating contingency plans and ethical considerations into the intervention design process to ensure the resilience of the study in the face of unexpected external factors.

In contrast, the Building Energy Efficiency Online Counseling interventions experienced minimal challenges and largely adhered to the original design throughout implementation. The success of the Naturvernforbundet energy portal intervention can be attributed to effective planning, seamless execution, and possibly a more resilient study design. The Viken energy portal intervention faced challenges due to the unexpected effects of COVID-19. This led to a delayed and scaled-down rollout of the energy counseling campaign in Viken. Despite these challenges, similar to the Naturvernforbundet intervention, the Viken intervention did not require any changes to the original design and GDPR compliance was maintained.

4.2 Lessons Learned and Future Directions

The Ninfa Garden intervention did not reveal significant impacts of providing different levels of information to visitors on their willingness to invest in renewable energy projects. The lessons learned underscore the importance of tailoring intervention strategies to the specific context, with identified improvements such as specialized training for guides on energy and climate-related issues. Conditions for future projects in similar contexts should encompass sufficient financial resources, realistic time management, involvement of relevant stakeholders, and support from suitable partners.

On the other hand, both Naturvernforbundet's and Viken's energy portal interventions are commendable successes and provide valuable insights into the dynamic nature of interest in counseling platforms for energy efficiency improvement. These interventions showed that positive user experiences with the platforms acted as a powerful motivator, encouraging individuals to move forward with their energy improvement plans and achieving high levels of adoption among the target population. The collaborative involvement of multiple actors, including scientific and technical institutions, further underscored the synergistic nature that contributes to the effectiveness of such interventions. One key takeaway is the potential for policymakers to increase the likelihood of success in promoting energy-efficient behavior and large-scale renovations by leveraging psychological motivators. For instance, design interventions that align with prevailing social norms, address attitudes, appeal to personal norms, and enhance self-efficacy. Another important lesson is that contextual factors, such as energy prices and public discourse, play a crucial role in influencing interest and adoption, highlighting the need for tailored approaches in designing effective energy efficiency improvement interventions.



5 Conclusions

To summarise, the comprehensive evaluation of the ENCHANT project, covering different interventions in several European countries, provides valuable insights into the nuances of saving energy, promoting public transport and investing in energy efficiency and renewable energy sources. This multi-layered analysis is an important contribution to understanding the complexity of sustainable practices in different cultural and contextual settings.

In reviewing the measures, we want to highlight the multi-faceted nature of influencing sustainable behaviour and the role of social norms, personal norms and financial incentives. The findings emphasise the importance of tailoring strategies to specific contexts and understanding the different motivations of target groups. The energy saving measures show the effectiveness of combining information offers with monetary incentives or saving tips and emphasise the need for tailored approaches in different cultural contexts. In relation to public transport use, we want to address the lack of experimental research by conducting large-scale experiments to fully understand the impact in different cultural contexts. This contributes to a more general understanding of the promotion of public transport use.

In the area of EE and RES investment, the study recognises the importance of spanning the gap between controlled laboratory conditions and real-world applications. Field experiments provide valuable insights into the acceptability, feasibility and scalability of interventions, recognising the challenges while emphasising their role in testing the expected impact in everyday life.

The ENCHANT project aims to promote sustainable behaviour on a large scale and navigates the complex landscape of behavioural measures for energy savings, the use of public transport and investments in energy efficiency (EE) and renewable energy sources (RES). The project recognises the urgency of tackling CO₂ emissions and emphasises the transition from small pilot studies to widespread application. The project-internal survey conducted as part of the interventions played a central role in learning about the operational challenges, economic costs and cultural factors that influence the uptake and effectiveness of these interventions. The insights gained from this analysis provide a solid foundation for future policies and practices related to energy conservation.

The structured comparative analysis of measures in Austria, Romania, Turkey and Germany sheds light on the effectiveness of customised communication strategies to reduce energy consumption. The insights gained underline the importance of taking into account the different needs and characteristics of the target groups, adapting to the cultural context and designing the measures with a differentiated understanding of the desired behavioural outcomes. Beyond energy savings, the study of public transport measures in



Cluj-Napoca and Izmir illustrates the complexity involved in changing urban mobility patterns. While “Green Friday” in Cluj-Napoca utilised monetary incentives, Izmir focused on raising awareness and promoting environmental responsibility. Both approaches reflect the different strategies needed to promote sustainable urban transport and the lessons learnt contribute to the ongoing transformation of urban mobility culture.

In the area of energy efficiency and renewable energy sources, interventions in Italy and Norway show how important psychological motivators are for influencing behaviour. The success of advisory platforms illustrates the positive impact of user experience and collaboration with scientific and technical institutions. Policy makers can learn from these experiences to develop policies that align with social norms, address attitudes and increase self-efficacy.

Despite challenges such as the COVID-19 pandemic, the ENCHANT project is an example of resilience and adaptability in the pursuit of sustainable practices. The lessons learned highlight the need for flexible strategies, robust data collection and continuous stakeholder involvement in the development and implementation of measures.

As we think about the future, the ENCHANT project provides a roadmap for policy makers, researchers and communities. Collaboration remains paramount, and the multi-faceted approach demonstrated in this project is critical to promoting long-term behaviour change and cultivating a culture of energy conservation. The experiences and insights shared pave the way for innovative, effective and culturally sensitive interventions that contribute to a sustainable and resilient future.

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