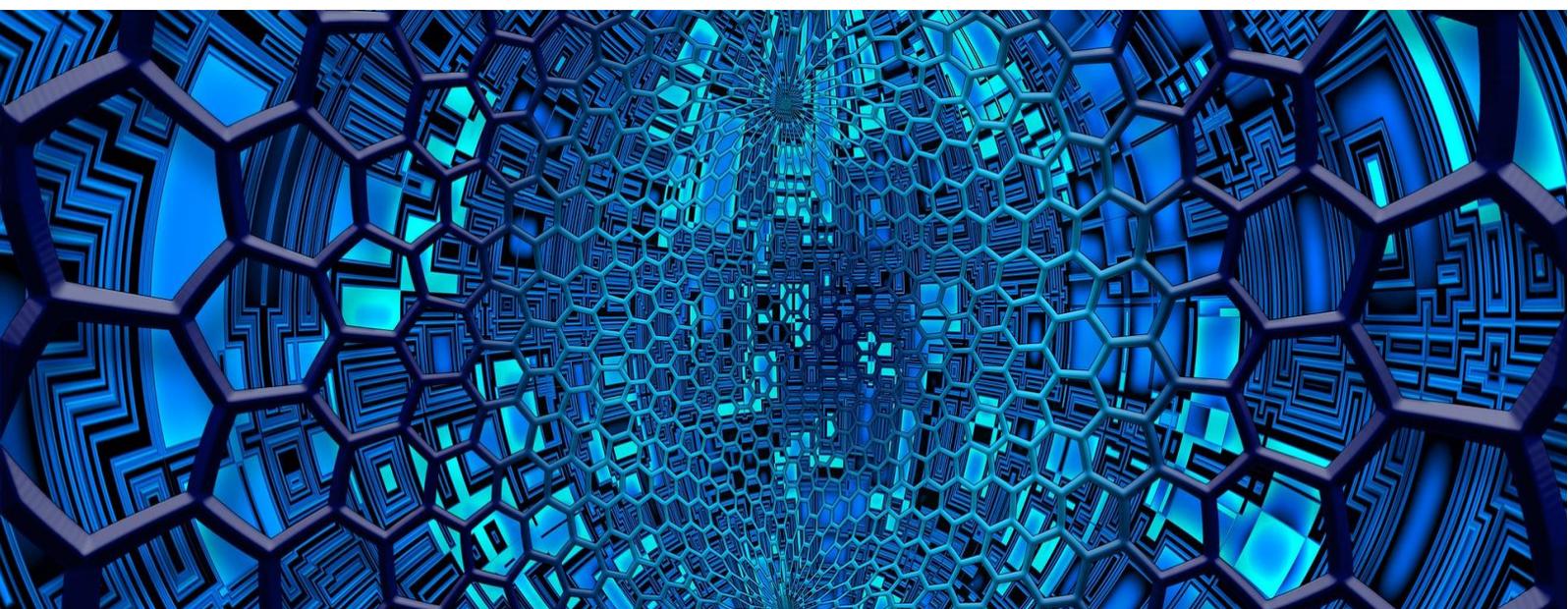


DESIGN OF INTERVENTION MATRIX AND DEFINITION OF RCT RESEARCH PROTOCOLS

Report No. ENCHANT Deliverable D2.2 // Date: 31/07/2021



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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957115.

ENCHANT Report

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VERSION: 02 // DATE: 31/07/2021

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PROJECT NO.: 957115 (H2020) // PAGES/APPENDICES: 55/0

ABSTRACT

This report is an internal working document for the ENCHANT project and describes the research activities related to project tasks T2.2, T2.3 and T2.4. It defines a set of standardised procedures and research protocols for effective behavioural interventions (such as Feedback, Social Norms, Information, Monetary Incentives, Commitment, Competition, Individual/Collective Framing), that will be conducted and assessed in the subsequent phases of the project through the collaboration between the main academic and user partners of ENCHANT, in different countries (i.e.: Austria, Germany, Italy, Norway, Romania, Turkey). This document describes the main characteristics of each set of RCT pilot studies that will be conducted in ENCHANT, to evaluate the efficacy of a wide range of behavioural interventions for the promotion of more sustainable energy choices of individuals, groups, and communities. We report the main features of each planned intervention pilot, in terms of country involved, general background context, main user partner involved, typology of behavioural intervention planned, and type of behaviour targeted. The report will be an input to the design and implementation of the activities foreseen in the ensuing ENCHANT work packages.

REPORT NO.: D2.2

ISBN: NA

CLASSIFICATION: Public

CLASSIFICATION THIS PAGE: Public



DOCUMENT HISTORY:

VERSION	DATE	VERSION DESCRIPTION
1	July 8th 2021	First version for quality check
2	July 31st 2021	Final version delivered to the European Commission



Table of contents

1. Introduction	6
1.1 Executive summary	6
1.2 Report scope	7
1.3 ENCHANT Intervention Matrix	8
2. User Partners Case Studies integrated into the ENCHANT consortium	15
2.1. AUSTRIA	15
2.2.1 Energie Kompass	15
2.2. ITALY	19
2.2.1 Ninfa Garden and its Hydroelectric Power Plant	20
Intervention Matrix and RCT	21
2.2.2 Energia Positiva Cooperative	22
Intervention Matrix and RCT protocol	22
2.3. NORWAY	26
2.3.1 Norges Naturvernforbund (Nnv)	26
2.3.2 Viken Municipality	27
Intervention Matrix and RCT protocol	28
2.4. ROMANIA	34
2.4.1 Consumers With An Online Account	34
Intervention Matrix and RCT protocol	35
2.4.2 Consumers Without An Online Account	35
Intervention Matrix and RCT protocol	35
2.5. TURKEY	38
2.5.1 Gediz	38
Intervention Matrix and RCT protocol	38
2.5.2 Izmir Metropolitan Municipality	39
Intervention Matrix and RCT protocol	39
2.6. GERMANY	44
2.6.1 Hansgrohe – Pontos	44
Intervention Matrix and RCT protocol	45
2.6.2 Solar Panel	46



Intervention Matrix and RCT protocol	46
2.6.3 Waldsee Quartier Street Festival	49
Intervention Matrix and RCT protocol	49
2.6.4 Landesgartenschau	50
Intervention Matrix and RCT protocol	50
3. Conclusions	51
Sources	54



1 Introduction

1.1 Executive summary

This document reports on the activities related to the Tasks 2.2, 2.3 and 2.4 included in work package 2 of the H2020 EU-funded research project titled “ENCHANT”.

Coherently with the ambitious goals that the new European Commission is driving forward for deeply decarbonizing European lifestyles and economies, the focus of ENCHANT WP2 is to “identify key factors affecting intervention impact on energy behaviour”. After having conducted an extensive systematic review of existing behavioural interventions, drawing on established findings from previous psychological and social sciences studies, research projects and practical interventions in the domain of energy choices and sustainable lifestyles in general (which is reported in Deliverable 2.1 of the ENCHANT project), we define and describe here a set of standardised procedures and protocols of effective behavioural interventions, to be conducted and assessed in the subsequent phases of the ENCHANT project.

In the ENCHANT project we follow the main logic of the randomized control trial (RCT) experimental approach, to evaluate the efficacy of a wide range of behavioural interventions for the promotion of more sustainable energy choices at an individual and collective level. The choice to adopt an RCT-based approach is motivated by the possibility that such an experimental methodology provides robust responses to questions of causality and efficacy in the domain of human behaviour. This allows decision makers, evaluators and program implementers to understand if any observed change is likely to be the actual outcome of specific interventions and policies, and not the result of other unknown factors.

In the ENCHANT RCT field studies, we recruit participants from selected target populations and, whenever possible, we randomly assign portions of these samples to either an experimental condition (where participants receive a set of standardized behavioural intervention packages) or a control condition, (where participants do not receive an intervention). This approach is useful to ascertain the actual causal effect of the interventions conducted, with a good degree of confidence.

Our purpose in ENCHANT is to adopt, whenever possible, what is conventionally defined as an RCT research design. However, whenever specific circumstances makes a random assignment of participants to treatments vs. control conditions impossible (for example, for ethical or practical reasons), we employ alternative field research designs and procedures, always ensuring the maximum possible levels of robustness, scientific soundness and ecological validity of the research protocols used.

This report describes the intervention matrix developed in a collaborative effort by the ENCHANT academic and user partners. This collaborative effort has been conducted through a series of participatory co-construction workshops among all the ENCHANT partners involved in WP2, where the practical implications, the main infrastructures and



existing or potential policy schemes in each consortium member country were discussed and identified. The definition of the matrix is preliminary to the planning and implementation of the RCT procedures, which will occur in the ensuing phases of the project.

Specifically, the matrix of the interventions to be implemented in collaboration with the different user partners, was defined taking into account a number of factors, such as

1. Background conditions of the country
2. Typology and main characteristics of the citizens/users/customers of the user partner involved
3. Typology of behavioural interventions to be employed and tested
4. Type of behaviour targeted
5. Population numbers and accessibility of individual participants
6. Possibility of implementing testing multiple intervention strategies

For each of the countries where the pilot behavioural intervention will take place (i.e., Austria, Germany, Italy, Norway, Romania, Turkey), we present and discuss the main background information of the user partners and their target audience, and we describe the major protocol information that will be followed for conducting the pilot in the next phases of the project.

1.2 Report scope

The aim of this document is to report on the activities related to the Tasks 2.2 (Preparation of the standardized packages), 2.3 (Select and define the ENCHANT intervention matrix) and 2.4 (Define the RCT procedure and research protocols for intervention evaluation) included in the Work Package 2 of the H2020 research project titled “ENCHANT”.

In particular, Task 2.2 was devoted to identifying and defining a set of standardised procedures and protocols to conduct effective behavioural interventions, to be assessed in the subsequent phases of the project, referring to one or more typologies of interventions, such as Feedback, Social Norms, Information, Monetary Incentives, Commitment, Competition, Individual/collective Framing. The existing knowledge about the efficacy of each of these types of intervention was systematically reviewed in previous tasks, and was the object of the previous ENCHANT WP2 report (see Deliverable 2.1).

Building up on these activities, Task 2.3 has involved and coordinated both the academic and non-academic partners of ENCHANT in a series of participatory co-construction virtual sessions (both collectively or bilaterally between the WP2 leader team (Roma Tre) and one or more user or academic partners, with the aim of selecting and defining the specific intervention matrix and the experimental research protocol necessary for their assessment. These collaborative activities have in particular aimed at discussing the practical implications and constraints for each possible intervention package, and at



identifying and evaluating the main infrastructures and existing or potential policy schemes available for each different type of partner and for each different type of intervention to be implemented.

Finally, with the relevant contribution and help of all the involved consortium partners, T2.4 has made the definition and sharing of the main intervention protocols to be implemented in ENCHANT possible, and to have a preliminary definition of the experimental research procedures and RCT approaches to be used for their evaluation. We have thus targeted the definition of main independent variables, of the implementation strategy and of the main communication channels to be used. In collaboration with other WPs (WP4 and WP5), we have also started to define the outcome indicators to be used for monitoring and assessing the success of the interventions.

As already stated, the goal of ENCHANT is to understand which are the most effective, feasible and reliable behavioural intervention strategies to promote energy efficient choices among the general public in Europe. This understanding is achieved by assessing a large-scale rollout of interventions informed by social, psychological, and behavioural science. ENCHANT's overall objective is to affect energy behaviour in a more sustainable direction in European citizens and households under real-life conditions, thereby supporting international, national, regional, and local policies targeting the sustainable energy transition in Europe. To help authorities, organisations, public decision-makers and energy providers/suppliers in driving the process of a global sustainability transition, and to increase the impact, acceptance, and effectiveness of ambitious public policies in the energy domain, it is now conventionally accepted at the scientific and policy levels that behavioural change in real-life situations can be promoted and steered through behavioural insights that can be easily understood and assimilated by the general public. Some also argue that energy-related behavioural interventions might be comparatively cheaper than structural – potentially risky in the mid-long-term – interventions requiring high upfront costs, leading to a quite significant cost-impact ratio.

While it is usually assumed that the ability to improve energy-related behaviours is linked to the behavioural choices of users and to the specific conditions that facilitate people's willingness to accept sustainable energy policies and energy system changes, it is, however, important to provide a clear and robust empirical support to the specific behavioural strategies that have been identified and used in the past as means for promoting energy efficient behaviours in the general public.

The selection of a broad range of strategies to be implemented, and the definition of the empirical protocols necessary to test their efficacy is therefore the objective of this report, and will be used as a guide for the ensuing operative tasks in the other WPs of the ENCHANT project.

1.3 ENCHANT Intervention Matrix

This section introduces and describes the intervention matrix developed for each user partner in order to identify and develop protocols for the intervention packages for



evaluating behavioral change. This work is the result of a series of participatory co-construction workshops among the ENCHANT consortium's academic and user partners. These workshops aimed at discussing and identifying practical implications, main infrastructures and existing or potential policy schemes in each consortium member country. The definition of the matrix is preliminary to the planning and implementation of the randomized controlled trial (RCT) procedures. The RCT experimental approach will be employed to evaluate the efficacy of a wide range of behavioural interventions for the promotion of more sustainable energy choices of individuals, groups, and communities. The choice to adopt an approach based on RCT was motivated by the fact that it is an experimental methodology that provides a powerful response to questions of causality and efficacy, thus potentially helping decision makers, evaluators and program implementers to know that what is being achieved through the interventions is the result of the intervention and not of other factors (see e.g., Falk & Heckman, 2009 for a discussion of experimental methods in the social sciences). In other words, RCTs test the extent to which specific, planned impacts are being achieved through a certain behavioural intervention strategy. At the same time, field experiments (as opposed to lab or online experiments) importantly also add a degree of realism, as they allow studying the behaviour of policy-relevant populations in naturalistic settings (see e.g. Levitt & List, 2007 for a discussion). RCTs conducted in the field are thus starting to earn increased attention from policy makers in the energy domain (Frederiks et al., 2016) as well as in many other areas of human behaviour in relation to the environment (e.g., Dolan & Galizzi, 2014), thanks to the unbiased, realistic estimates of the potential of various policies, such as informational campaigns or fiscal measures. In our work, we hope to contribute in important ways to this line of applied research.

One question that has not been sufficiently scrutinized in the past, and on which we want to shed new light, is whether combined interventions (e.g., provision of incentives combined with an appeal to social norms) work better than simpler, streamlined single-type interventions in the energy behaviour domain (e.g., provision of incentives only). It is often believed that richer interventions utilizing a combination of behaviour change levers are more effective than simple interventions (e.g., Dietz et al., 2009). However, in a recent paper, Drews et al. (2020) correctly points out that there is little empirical evidence yet to support such a claim, simply because, *ceteris paribus*, comparisons between combined and simple interventions are rare. Some existing evidence even seems to actually suggest an absence of synergistic effects from combining multiple intervention elements (e.g., Harries et al., 2013; Pellerano et al., 2017; Sudarshan, 2017). While in the ENCHANT project we start from the assumption that combined interventions might work better than simpler interventions, it is important to empirically investigate under which conditions and circumstances this assumption might hold true. Our empirical field work in ENCHANT will help to better understand when and why this might be the case, as well as the circumstances under which this might not be the case.

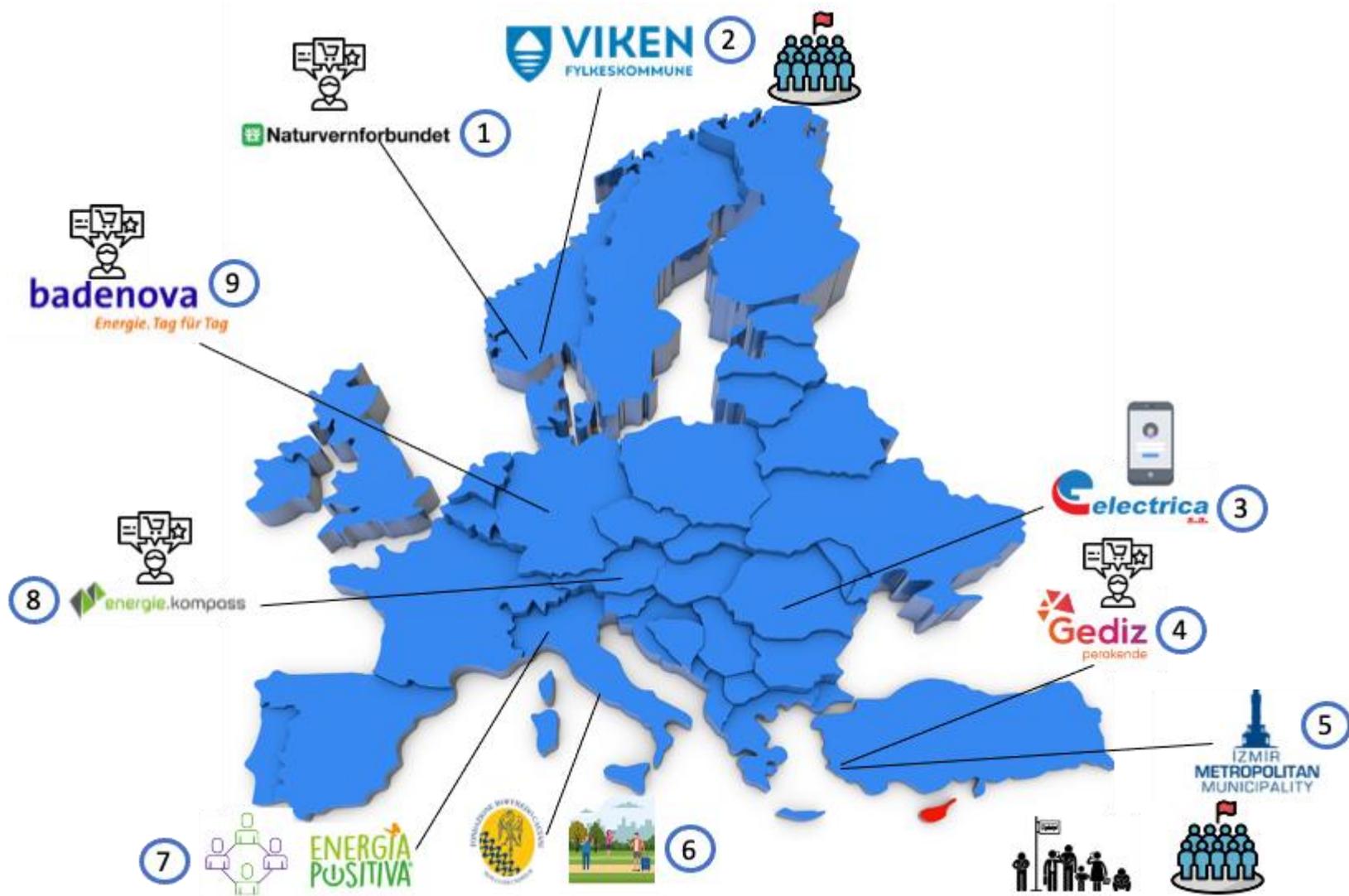
In sum, in the ENCHANT project, the overarching logic of the RCT experimental approach is aimed at evaluating the efficacy of a wide range of behavioural interventions for the



promotion of more sustainable energy choices at an individual and collective level. In our field RCTs, we recruit samples of participants from selected target populations, and then we aim at randomly assigning portions of these samples to either receive one or more behavioural intervention packages, or assign them to a control group that does not receive an intervention. As noted above, this approach, which is standard for RCTs, makes it possible to determine the causal effect of the interventions with a certain degree of confidence, which is considerably more difficult when applying research design that are only based on observational or survey data collections (e.g., Ferraro & Miranda, 2014, 2017). Of course, it is important to state here that, whilst our purpose in the ENCHANT project is to align as much as possible our field investigations to what is conventionally defined as an RCT research design, working in the field (instead of in the laboratory) sometimes makes it impossible, unethical or practically impossible to achieve a completely random assignment of members of a given population to treatments vs. control conditions. As a consequence, while applying an RCT-like procedure is the general assumed strategy for any empirical investigation conducted in ENCHANT, there might be cases and circumstances where more simple field research designs are implemented, to ensure sufficient robustness and scientifically soundness of the research protocols used, and to ensure an adequate balance between the explanatory and heuristic power and the ecological validity and feasibility of the empirical research conducted.

Over the next pages, we provide a synthetic map with all the user partners who will be involved in the RCT research protocols to be conducted in ENCHANT and an overview table with the main details of the research design protocols that will be implemented in each case. The most important information is reported in the overview table. The planned interventions will also allow to explore and assess the effects of possible interactions between intervention elements: for example, understanding whether intervention element A has a stronger effect on a certain behaviour in the presence of intervention element B. Findings about the overall and combined effects of different intervention strategies considered here in ENCHANT will be a useful achievement, and will be reported in the next phases of the project and related deliverable reports.





1. Norges Naturvernforbund (NNV) (Friends of the Earth Norway) is Norway's oldest environmental and nature protection organisation. In this case study, the target population of the behavioral interventions are selected members of *Norges Naturvernforbund* who are undertaking house refurbishing and/or moving to a new house mode for one of the interventions and the whole member group for a second intervention.
2. Viken Municipality is a county in Eastern Norway that comprises 51 municipalities. Target population of the behavioral interventions concerns inhabitants of specific municipalities in Viken county.
3. Electrica Furnizare is the electricity provider with the largest market share in Romania. The behavioral interventions planned by this case study are designed for customers of this energy provider.
4. Gediz Elektrik Perakende Satis AS is a branch of Bereket Energy Group. Target population of the behavioral interventions consist of customers of the energy provider.
5. Izmir, also known as Smyrna historically, is Turkey's third largest city and the second most important port city in Turkey. Citizens and potential public transportation users represent the target population in this case study.
6. The Fondazione Roffredo Caetani (Roffredo Caetani Foundation) operates in the Lazio Region in a vast territory that covers many municipalities. Its main mission is to manage activities related to the Giardino di Ninfa (Ninfa Garden), one of the most important touristic hotspots in Italy. Visitors/tourists characterize the target population of the case study.
7. Energia Positiva is an energy cooperative founded at the end of 2015 in Turin, Italy, serving 700 Italian citizens. Target population of the behavioral interventions consist of members of the energy cooperative.
8. Energie Kompass GmbH is an innovative, service oriented company located in Stegersbach in South-East Austria with a strong focus on the intelligent utilization of renewable energy sources. In this case study, the target population of the behavioral interventions concerns the users of energy account app and members of a renewable energy community called 7energy platform
9. Badenova is a mid-sized German public utility and service provider. It plans, builds and operates energy conversion installations such as wind turbines, biogas plants, PV-systems and combined heat and power plants. The behavioral interventions planned in this case study are designed to target customers of Badenova, individual residents, private households and relevant local stakeholders in and around the Freiburg city area, as well as members of the NGO Climate Partner Upper Rhine Valley. Badenova also coordinates the access to the citizens of Freiburg through the city of Freiburg and to the members of the NGO.



For each country member, Table 1 below shows a summary of the type of user partner involved, the behavioural intervention that will be implemented, the behavior measured and the intervention matrix for the RCT.

Table 1: Overview of the RCT empirical studies to be conducted in ENCHANT

COUNTRY	User Partner	Intervention	Behaviour	MATRIX
AUSTRIA	Energy Company/Provider	<ul style="list-style-type: none"> • Information • Monetary Incentives 	<ul style="list-style-type: none"> • Energy consumption 	2x1
ITALY	NGO	<ul style="list-style-type: none"> • Information 	<ul style="list-style-type: none"> • Investment/Maintenance (actual/reported) 	1x1
	Energy Company/Provider	<ul style="list-style-type: none"> • Information • Feedback • Social Norms 	<ul style="list-style-type: none"> • Energy consumption • Investment 	3x2
NORWAY	NGO	<ul style="list-style-type: none"> • Information • Social norms • Feedback • Commitment 	<ul style="list-style-type: none"> • Energy consumption • Water use 	4x2
	Municipality	<ul style="list-style-type: none"> • Information • Social norms • Feedback • Commitment 	<ul style="list-style-type: none"> • Energy consumption • Water use 	4x2



COUNTRY	User Partner	Intervention	Behaviour	MATRIX
ROMANIA	Energy Provider	<ul style="list-style-type: none"> • Information including simplification • Feedback on own consumption • Commitment • Social norms 	<ul style="list-style-type: none"> • Energy consumption 	4x1
TURKEY	Energy Provider	<ul style="list-style-type: none"> • Information • Feedback • Social Norms 	<ul style="list-style-type: none"> • Energy consumption 	3x1
	Municipality	<ul style="list-style-type: none"> • Information • Social Norms 	<ul style="list-style-type: none"> • Energy consumption 	2x1
GERMANY	Energy Provider	<ul style="list-style-type: none"> • Information + Incentives 	<ul style="list-style-type: none"> • Energy consumption • Maintenance 	2x2
	Energy Company/Provider, Municipality & NGO	<ul style="list-style-type: none"> • Information 	<ul style="list-style-type: none"> • Energy consumption • Investment 	1x2



2 User Partners Case Studies integrated into the ENCHANT consortium

2.1 AUSTRIA

The Austrian case studies are based in the framework of the Innovation Lab act4.energy (<https://www.act4.energy/>), a research and innovation initiative within the program “City of Tomorrow” (“Stadt der Zukunft”), that aims to support innovation actions to promote the energy transition and that is hosted and operated by the ENCHANT project partner Energie Kompass. The Innovation Lab act4.energy builds and operates experimental environments and provides a framework for innovation in the energy and e-mobility sector. It supports research and development projects with the development and testing of new products, solutions and services for the better utilization of renewable energy sources. Focal topics are the increase of PV-self consumption, the sector coupling of power, heat and transport as well as the advancement of e-mobility. As part of its core services, the Innovation Lab provides co-creation and open innovation methodologies, and conducts stakeholder processes for the projects being carried out. Building a bridge from research to the general public is one of the main goals of act4.energy. Within this innovation framework, a couple of projects are currently being carried out that provide direct interaction with private households, municipal organizations and small enterprises. For the planned Austrian case studies in ENCHANT, these already established communication channels will be utilized to carry out the interventions described below.

2.1.1 Energie Kompass

The Austrian case studies will be carried out in Südburgenland (south-east Austria), where Energie Kompass is the hosting organization for the Innovation Lab initiative act4.energy, which aims at developing and demonstrating solutions for regional, renewable energy systems. As part of these activities, the technical, administrative and legal framework to establish Renewable Energy Communities (REC) in accordance with the new Austrian Renewables Development Act (Erneuerbaren Ausbaugesetz, EAG), which is the Austrian implementation of the Renewable Energy Directive, are currently being developed. In the following, two activities that Energie Kompass is steering in Austria are described, the 7Energy platform and the Energiekonto.

One of these two core activities is the 7Energy – Platform (www.7energy.at), a digital platform for incorporating, managing and balancing the settling of energy communities in accordance with the EAG and Austrian energy market regulations. The 7Energy platform was officially launched in July 2021 and will start with 3 pilot communities (2 in Südburgenland and 1 in Styria).



The Energiekonto is a new service, which allows the users to integrate all their energy expenses and energy services into a single app. This will help the customer to easily follow all of their energy-related expenses (electric, heat, mobility, etc.) and energy feed-in to the grid (PV, battery, bi-directional EV) in this app. The customer's energy balance between self-consumed energy and feed-in energy is tracked and displayed in an easily understandable form. Energy service providers can integrate into the system and accept energy as “currency” for their services from the customers. A partner of the system will directly charge energy (in a currency called ekWh) from the customer's energy account when the EV is charged. Furthermore, the Energiekonto acts as a customer loyalty program as users can get energy booked to their account for a variety of things for example for grid friendly charging behaviour.

Another important part of the Energiekonto is that energy can be shared and transferred from one account to another. This has various applications, such as one account simply gifting energy to another account (e.g. grandparents gifting energy to their grandchildren to support them). Another way of utilizing this is when a customer might have two places of residence, with only one of them having a PV plant. Now this customer would have a single energy account where the energy expenses of both residences are deducted from and the feed in from the one PV plant is accounted for, allowing for the virtual self consumption of the PV from both houses.

Intervention Matrix and RCT

The goal of this study is to test the means for reducing the electricity consumption of households. We could test the effects of a) environmental information provision and/or b) financial incentives on the electricity consumption of households.

The members of 7Energy, the renewable energy community platform, will be randomly sorted into ‘treatment’ and ‘control’ groups. The treated group will receive information treatment through selected environmental messages over the newsletter of 7energy. We will observe the electricity consumption of the members before and after the treatment and test whether the information treatment decreased their electricity consumption. In addition, or alternatively, testing a possible difference in electricity consumption after becoming a prosumer can be performed.

In addition to the study design in Part a), we could use in-app notifications of the Energiekonto app to measure the impact of monetary incentives on electricity use. These financial incentives could take place in the form of announcements for time periods when electricity from the grid is cheaper. Different reasons for the cheaper tariff could be stated to investigate the impacts of the same monetary incentives based on different reasons. In this case, the treated app users will be sorted into treatment groups depending on the stated reason for the cheaper tariff. The examples for these reasons could be the high current electricity production from PV in the local REC.



The table below summarizes the methodology of the two RCT for testing the intervention strategies targeting the electricity consumption of households in Austria.

	Energie Kompass - 7energy platform	Energie Kompass - Energy Account App
Sector	Energy Consulting Company	Energy Consulting Company
Type of intervention	Information provision	Monetary incentives
Behaviour	Electricity consumption	Electricity consumption
Matrix Variables	TBD	TBD
Participants	Members of 7energy platform	Users of Energy Account App
Expected goals	To investigate the effects of information provision on customers' energy consumption	To investigate the effects of monetary incentives on customers' energy consumption
Methods (Quantitative, Qualitative; Mixed)	Quantitative	Quantitative
Type of data (Questionnaire, Observational, Structured test, Interviews, Focus groups GPS positioning, etc.)	Measured electricity consumption Self-reported energy consumption/saving behaviour, lifestyles	Measured electricity consumption
Criteria for randomization	Full randomization over the web-platform	Full randomization over the app



<p><i>Name of data collection instrument (if available in your national language)</i></p>	<p>7energy platform</p>	<p>Energy Account App</p>
<p><i>Design</i></p>	<p>Number of groups TBD Monthly measurements (electricity bills)</p>	<p>Number of groups TBD Monthly measurements (electricity bills)</p>



2.2 ITALY

The Italian case studies in which the interventions will be tested include an NGO in the sustainability sector and an energy provider company, as examples of relevant stakeholders and real actors involved in ENCHANT. The NGO is the Roffredo Caetani Foundation, and one of its main activities is to manage and preserve the historic Garden of Ninfa, located in the Lazio region, Italy (about 100 km south of Rome). The Garden of Ninfa is internationally known for being a splendid example of a unique "informal garden", built around and within the ruins of the medieval city of Ninfa, where numerous species and botanical varieties from all over the world coexist, thanks to the unifying element of water.

The energy provider company is ENERGIA POSITIVA, a cooperative of people who share the ownership of renewable energy production plants. By joining the cooperative, the individuals become partners and share-holders, and thus actively participate in the management of the cooperative.

The choice of these case studies is motivated by the fact that both represent important realities on the Italian territory interested in promoting more energy efficient lifestyles. On the basis of this common mission, they also represent a valuable context of study to broaden our knowledge of how to affect energy behaviors and also how various energy efficiency related interventions could be applied in real-world settings, outside academic laboratory situations, thus improving the generalizability of our scientific findings. The characteristic of both case studies of being players who are already active in the field, makes them particularly suitable for the purposes of ENCHANT to implement an RCT experimental approach in order to test the behavioural interventions' applicability under a large variety of real-life conditions on large populations.

Specifically, the case study in collaboration with Roffredo Caetani Foundation is chosen in order to survey daily energy behaviors of a specific type of user (garden visitors), but also to investigate intentions and behaviors in relation to the possibility of encouraging and maintaining the energy efficiency of the private equipment (e.g., heat pumps, cars) of the visitors, but also the energy efficiency of a public site, such as the naturalistic and heritage-protection preserve of the Ninfa Garden, through innovative technologies and low energy consumption equipment.

The choice of Energia Positiva is motivated by the fact that the company already represents a small community of people aware of the impact we generate on the environment through our energy consumption. The community embraces the principle of energy sharing and offers to its users and to the energy market a highly participatory, democratic and innovative service, with the aim of making people increasingly conscious and aware of their consumption patterns, and thus more involved in the decarbonization process.



More detailed information, describing the selected case studies, are provided below.

2.2.1 Ninfa Garden and its Hydroelectric Power Plant

In 2018, the Garden of NINFA won second place at the European Garden Award. The key to the Gardens of Ninfa's success is its geographical location. The territory is almost a natural greenhouse: the sea is a few miles away, the mountains that keep away the cold and block the marine currents are behind it. It is a truly unique garden, built around and within the ruins of an ancient medieval city, where numerous species and botanical varieties, from all over the world, have acclimatized and coexist together, also thanks to a unifying element: water. The Ninfa Garden is one of the most important touristic hotspots in Italy (the Ninfa Garden and the Sermoneta castle, managed by the Caetani Foundation, attract on average more than 100.000 visitors per year).

One of the peculiar aspects of this case study that make it highly remarkable for ENCHANT's purposes is precisely the presence of water. Not only as a fundamental resource for life, but also as a sustainable resource. Inside the garden, it is possible to find a lake which, thanks to the favourable morphological conformation of the territory since the times of the first pre-Roman and Roman settlements, was barred. This made it possible to regulate the spring flows that originate the lake and give rise to an emissary water course (the River Ninfa) that emerges from the lake.

The first industrial activities, such as mills, ironworks, paper mills and tanneries, dating back to the Middle Ages, served the entire surrounding area. The use of water as a renewable energy source has continued over the centuries, moving from mechanical energy to electricity. In fact, at the end of the 19th century a pair of twin turbines were installed. From archival documents, it appears that the two turbines worked well until 1945, when one of the two was severely damaged due to a WWII aerial bombardment. Today only one of the two turbines remains, but it still produces electricity. The turbine has been working at reduced rates in the last 20 years, producing a power of about 30 kW and requiring significant economic efforts on the part of the Foundation for its maintenance. Surely, the presence of this ancient hydroelectric power station makes this case study even more relevant for ENCHANT's purposes, allowing us to observe and study the behaviors of Garden's visitors in relation to their willingness to endorse investments and maintenance of the turbines.

The interventions that will be implemented in this case study aim to increase participant's awareness and involvement in energy efficiency initiatives, among a specific type of user such as visitors or tourists. The RCT study will test the impacts of different ways of providing information on energy efficiency, and on the importance that the environmental sustainability of a naturalistic site could have for its maintenance. The goal will be to find strategies and means to provide this information, that triggers a behavioural change



towards more pro-environmental lifestyles, and a greater willingness to engage in environmental sustainability actions.

Intervention Matrix and RCT

The study design will rely on 1 treatment developed by the ENCHANT research team relating to test the impacts of various energy efficiency information on the collective and individual benefits of the hydroelectric plant's renewal and use for the maintenance of the NINFA Garden and its services. The goal will be to find effective strategies and feasible means of providing this information/knowledge, promoting a behavioral change in the garden visitors. By evaluating and implementing this treatment in a naturalistic site that has been working for years to become a local energy community and contribute to renewables expansion, we will be able to assess its impact on people's awareness and education on different issues, such as sustainable energy consumption, renewables energies, and reducing carbon emissions. The effect of the intervention designed will be focused on:

- contributing to the implementation of the renewal of the hydroelectric plant for the use of green energy used exclusively for the maintenance of the garden;
- informing people about how they can personally contribute to mitigate climate change;
- sensitize people to the use of renewable energy sources, and to the economic costs of energy consumption.

This treatment information will be conveyed to the garden visitors through (1) immersive and informative tours (e.g., an on-site exhibition) and (2) informative brochures on the history and renewal project of the hydroelectric plan. Our behavioural indicators will be the actual willingness to contribute and invest for the maintenance of the renewable energy plant, and other self-reported energy saving behaviours.

This study can be thought of as two parallel studies using two different samples (garden visitors that are lead to see a short exhibition and/or a brochure about the hydroelectric plant located inside the Ninfa Garden vs. garden visitors that are not exposed to any informative content about the hydroelectric plant). In a first study, we will sort the participants into two groups: 'treated' and 'control'. The treated group will take part in an immersive and informative tour of the hydroelectric plant. The control group will take part in a standard tour of the Ninfa Garden, without receiving specific information on the power plant.

In a second study, we will sort the participants into two groups: 'treated' and 'control' groups. The treated group will receive an information brochure on the renewal project of the hydroelectric plant. The control group will not receive such kind of information.



We will then estimate the effects of each information package on participant's willingness to invest for the maintenance of the power plant and their adoption of energy saving behaviors, either actual or self-reported by visitors to the garden. At the end of their visits, participants will find a simulated charity fundraising box, where they can voluntarily leave a token for the hydroelectric plant. Possible randomization criteria will consider the alternation of visits between days (Saturday vs Sunday) and hours (morning vs afternoon). In fact, some evidence suggests that people might donate more on Sundays (Martin & Randal, 2009). Thus, we will take into account this aspect to balance the application of treatment vs. control across the different days.

2.2.2 Energia Positiva Cooperative

Energia Positiva is an energy cooperative founded at the end of 2015 in Turin, Italy. It is a cooperative of people (partners) who share the ownership of renewable energy production plants. It aims to offer citizens the possibility of producing and using energy from renewable sources only, helping them to reduce the costs of their bills and to improve the environment. One of the key elements that makes this case study suitable for the purposes of the project is the fact that it embraces an energy sharing cooperative model. According to this model, each person, gathering in cooperatives, can share the ownership and production of renewable energy plants both to obtain an individual benefit and to contribute to environmental sustainability. In addition, Energia Positiva allows citizens to participate personally in the national market for the production of renewable energy, in order to "democratize" the sector and to give new impetus to the energy transition taking place in the country. Taking into account the current environmental targets defined at national, European and global level, Energia Positiva can be defined as a useful tool to intercept "particular" community interests supporting all those policies aimed at reducing greenhouse gas emissions deriving from the sector of national energy production. Specifically, the cooperative wants to demonstrate that, through effective collective action by citizens, significant pro-environmental results can be achieved, both in terms of reducing climate-altering emissions, and of rationalizing energy consumption and waste. In its first years of activity, the cooperative was able to aggregate over 700 citizens around its sharing-production-energy model, from whom it raised 7.5 million euros, in order to purchase 15 renewable energy production plants and develop 3 projects related to energy efficiency. Currently, the cooperative has planned to expand its mission in order to become also a direct energy provider in June 2021, while still keeping their main organizational model; this expansion will also be in the focus of our planned studies in ENCHANT.

Intervention Matrix and RCT protocol

The interventions in collaboration with Energia Positiva aims at reducing customers' energy consumption and increasing investment behaviours. The RCT study will test the impacts of different energy use information and feedback programs on energy



conservation of household customers of cooperatives as a major electricity provider. The goal will be to encourage more sustainable energy consumption by the members of the cooperative and to strengthen the sense of belonging to a renewable energy community in terms of benefits and collective commitment in fighting climate change together. The study design will rely on 3 different typologies of treatment (Information, Feedback on Own Consumption and Social Norms) developed by the ENCHANT research team relating to energy consumption and investment behaviours. The planned treatments will be aimed to improve households' energy renewables use and promote more sustainable energy behaviour change.

The tools for implementing these treatments with the cooperative's members will be informative feedback on own consumption, descriptive social norm messages notifying the cooperative member of the mean energy use of other similar household's cooperative members and the mean use of efficient households. An injunctive norm message complements the descriptive norm messages and comments on the social desirability of the member's current behaviour (e.g., Excellent job this month!). The best members (i.e., most energy efficient) receive a sort of top rating "Excellent job this month!" and two sustainable light bulbs. Members who have energy use below the median would receive a rating like "Not bad, keep working at it!" and would get one sustainable light bulb as a reward. Finally, members who use more energy than the median user receive the message "Not good, but keep working at it!" and no sustainable light bulb. These energy use messages will be delivered to members by their monthly bills. The sample of the cooperative members will be divided into four separate groups. Three groups will receive the messages in their bills. Each group receives a message depending on the type of intervention implemented. A control group will continue to receive bills with the usual information. An intake survey focused on energy consumption/investment behaviours will be conducted electronically and sent out via email to cooperative members before the implementation of interventions in order to collect baseline data on energy consumption and behavioural determinants. Subsequently all treatment groups will receive a specific intervention described above for 6 months. A post treatment survey will be conducted electronically and sent out via email. The final survey will be sent out upon the conclusion of the RCT.

Below is a table summarizing the methodology of the two Randomized Control Trials to test environmental sustainability intervention strategies in Italian case studies.

	NINFA GARDEN and HYDROELECTRIC POWER PLANT	ENERGIA POSITIVA
Sector	NGO	Energy Provider Company



Type of intervention	<ul style="list-style-type: none"> • Information • Incentives (eventual 2nd study to be conducted) 	<ul style="list-style-type: none"> • Information • Feedback • Social Norms
Behaviour	<ul style="list-style-type: none"> • Investment/Maintenance (actual/reported) 	<ul style="list-style-type: none"> • Energy consumption • Investment
Matrix Variables	2x2	3x2
Participants	Garden visitors (based visitors during 2020 = 75000)	Users, customers, members (N = 600)
Expected goals	<ol style="list-style-type: none"> 1. To investigate the effects of the interventions on visitors' investment and maintenance behaviours for the hydroelectric power plant (e.g charity box donations) 2. Follow up survey on energy consumption behaviour 	<ol style="list-style-type: none"> 1. To investigate the effects of the interventions on customers' energy consumptions and investment behaviours
Methods (Quantitative, Qualitative; Mixed)	Quantitative	Quantitative
Type of data (Questionnaire, Observational, Structured test, Interviews, Focus groups GPS positioning, etc.)	<ul style="list-style-type: none"> • Observed behaviour on investment and maintenance • Self-reported energy consumption/saving behaviour and proenvironmental practices, lifestyles 	<ul style="list-style-type: none"> • Measured and self-reported energy consumption (kW and costs) and investment behaviour (e.g. energy efficient house)
Criteria for randomization	Alternation between days (Saturday vs Sunday) and hours (morning vs afternoon)	TBD
Name of data collection instrument (if available in your national language)	<i>To be identified and shared among the partners (TBD)</i>	<i>To be identified and shared among the partners (TBD)</i>



<p><i>Design</i></p>	<p>Study A T0: G1, G2:</p> <ul style="list-style-type: none"> questionnaire on energy consumption/saving behaviour and proenvironmental practices <p><u>Immersive tour to the hydroelectric power plant:</u></p> <ul style="list-style-type: none"> G1 immersive tour (information) at hydroelectric power plant G2 control group <p>T1: G1, G2:</p> <ul style="list-style-type: none"> Observed behaviour on investment and/or maintenance of the hydroelectric power plant (charity box) questionnaire on energy consumption/saving behaviour and proenvironmental practices <p>T2: G1, G2:</p> <ul style="list-style-type: none"> follow up for those who declare that they are available to be contacted by email to fill in the questionnaire one month after the visit <p>Study B: <u>Informative brochure about hydroelectric power plant</u> (follows the same methodology as study A)</p>	<p>T0: G1, G2, G3, G4:</p> <ul style="list-style-type: none"> questionnaire on energy consumption/investment behaviours measured consumption overall/peak (referring to specific hours) <p><u>On the bill:</u></p> <ul style="list-style-type: none"> G1 feedback on own consumption G2 info on other customers' consumption (social norms) G3 general info on climate change/energy saving G4 control <p>T1: G1, G2, G3, G4:</p> <ul style="list-style-type: none"> questionnaire on energy consumption/investment behaviours measured consumption overall/peak (referring to specific hours)
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2.3 NORWAY

The Norwegian user partners where the interventions will be tested include Naturvernforbundet NNV (Friends of the Earth Norway) – an environmental and nature protection NGO, and Viken – Norway’s most populous county.

An overall motivation for NNV to collaborate with ENCHANT research partners and themselves become a partner in the project is based on a desire to get validated knowledge and insight into the effects of their communication with their members and other audiences. In addition, they have an aim to focus more on energy-related topics, particularly energy behaviour. NNV is a well-respected organisation, with many years of experience with communicating to audiences that have already demonstrated their interest in sustainable choices. They can therefore contribute with knowledge of a group that is positive to green change and in the front of adopting new technologies, green behaviour etc.

Viken, the result of three counties merging in 2020, is on the other hand a very new organisation. It is, however, a county highly committed to sustainability and climate initiatives, with a very qualified and engaged staff. Consisting of municipalities ranging from small, rural communities (16 of the municipalities have less than 5000 inhabitants), to municipalities with more than 100 000 inhabitants, Viken can offer both a very high number and a very diverse group of recipients. Viken also actively seeks out to take part in sustainability research projects and aspires to further develop their common knowledge ensuring a green transition. Of particular interest to Viken are efforts to reduce water consumption, on a municipal level, but also amongst its inhabitants, particularly due to the high amount of energy required to clean used water. The high number of potential recipients, Viken’s outspoken ambitions and their very dedicated staff are all reasons for including Viken as a partner in ENCHANT.

2.3.1 Norges Naturvernforbund (Nnv)

Founded in 1914, *Norges Naturvernforbund* (NNV) (Friends of the Earth Norway) is Norway's oldest environmental and nature protection organisation. NNV is a democratic, membership-based organization consisting of over 35,000 members. NNV has approximately 100 local groups across the country, working to solve environmental issues both locally and globally. NNV’s main goal is to protect nature and the environment so that human activity does not exceed the tolerance limits of the planet. They are concerned with a wide range of issues in environmental and nature conservation, but are particularly focusing on conservation, climate change, energy, and transportation. NNV is concerned with a wide range of issues in environmental and nature conservation, but are particularly focusing on conservation, climate change, energy, and transportation. As a member of Friends of the Earth International, NNV is Norway’s representative in the world's largest grassroots environmental network with more than 2 million members worldwide. The organisation campaigns a relatively broad spectrum of urgent environmental and social



issues, through a wide range of communication channels. Environmental engagement is growing in Norway, which can be seen by a (fairly) new political party (Green Party) and growing environmental organizations. A big share of these voters/members are young adults in urban areas. NNV sees that politics regarding energy efficiency or -saving seldom is in the media or part of political discussions, and also notices that consumer tips amongst young, urban environmentally engaged consumers focus more on eating habits and second-hand clothes than energy saving tips.

The first intervention targets energy saving behaviour. NNV wants to see if they – by using behaviour altering interventions which have scientifically proven to be effective – can make this target group do small and easy energy saving changes in habits in their everyday life.

Norwegians love to redecorate and refurbish; Norway is actually one of the countries who invest in that activity the most per capita. The second intervention is targeted towards people who are in refurbishing and/or moving to a new house mode, who can afford to spend money on a more expensive installation if it is more environmentally friendly (and saves money in the long run). The target group here are the middle aged and financially able? where NNV wants to see the difference in impact when they are met with general information about energy saving installations versus a user-friendly website which puts them in direct contact with a business who specializes in energy saving installations.

2.3.2 Viken Municipality

Established on 1 January 2020, Viken county in Eastern Norway was the result of a merger between three former counties and three additional municipalities, making it the most populated county in Norway. Viken comprises 51 municipalities, ranging in size, demography, industry and business profile, education offerings and competence as well as value creation and average income. VIKEN has several initiatives going to prepare its inhabitants, public authorities and the local businesses for future climate challenges and a low emission society. Through networking, support of and competence in energy efficiency and climate initiatives, Viken further wants to be an instrument in driving this development forward. One example of this work is Climate partners Viken, with a goal to help ensure that the region's business community is well equipped to meet the climate challenges and tomorrow's requirements for a low-emission society. Climate Østfold/Viken is a similar network of municipalities, where the municipalities co-operate in implementing measures to achieve their own climate goals, and at the same time contribute to achieving the national climate goals.

Another strategy Viken has applied to drive the development forward, is being a partner in other research projects, such as the INCLUDE project, a research centre looking at how to realise a socially just low-carbon society through socially inclusive processes based on close collaboration between researchers and partners in the public, private and voluntary sectors.



Viken chose to focus on the opportunities the transition to a low-emission society contains, rather than potential difficulties or losses. Viken has decided to base its overall development on UN's 17 Sustainability goals, echoed in the county's vision and main aims: Sustainability – Development – Competence. The goals are also the foundation in the new regional planning strategy. Viken's aim is to combine energy efficiency efforts already in motion, and other research projects with work in ENCHANT.

The first intervention targets energy saving behaviour (as explained in the narrative of NNV). This is as demonstrated something Viken already is working with a lot, through projects on county, municipal and local level, both strategically as well as through research projects. In ENCHANT, they want to target specific energy saving behaviours (like water usage), through short and simple tips and messages, communicated via a range of channels, to get insights into the effect of both sender and use of channels.

For the second intervention, the aim is to test the effect, appeal and use of home renovation counselling, through a website promoted throughout the county. What kind of solutions do people end up with renovating "on their own", and what kind do they end up with after receiving counselling is interesting to find out.

Intervention Matrix and RCT protocol

In Norway, the plan is to have a parallel setup for the experiments so that Viken and Naturvernforbundet (NNV) can be compared, because they use similar approaches. With both partners, the plan is one large-scale data collection, where as many respondents are reached out to as possible and try to recruit them into a website on which experiments are set-up.

There will also be an additional experiment with fewer / selected participants, in which people who are in the process of planning a building upgrade / renovation receive access to a website which gives specific, tailored energy efficiency advice and connects the participants to companies able to implement the upgrade. Viken and NNV already collaborate with each of their website provider, which are somewhat similar although not completely comparable.

Below is a table summarising the methodology of the two trials to test intervention strategies in the Norwegian case studies. The plan is to coordinate the interventions, communication channels and information to be able to compare the effects of senders and various communication channels.

That gives us the following design:

1)

Large-scale study: Viken and NNV communicate through all appropriate channels to their citizens/members/followers to recruit them for accessing the experimental web page for research purposes. The recruitment is done via communicating energy saving tips. They will be randomly directed to one out of several (e.g., 3 to 5) versions of a webpage where they are put into different experimental conditions (and one control group): for example,



one goal will be to try to combine different conditions like Control, information condition (energy saving tips), information + social norm, information + feedback, information + commitment, information + social norm + feedback + commitment and so forth. They will then be asked to answer a short survey about their meaning/attitudes towards energy saving/energy saving behaviour, and by which communication channel they ended up on the website.

We need to get people there to register their email-address, either as they enter the website, as the last question on the survey (or very visible on the website), to volunteer for a second, follow-up survey where impact can be measured.

The specific of these tips/information would be defined in order to be relevant and shared for both user partners. Water-usage could be an example, but there can be others as well, which will be defined in accordance with the partners.

2)

In the smaller scale intervention for renovators, the access to the energy counselling website (energiportalen.no) is rolled out municipality by municipality in Viken County. In the design, we can select municipalities with certain characteristics (demography, economy, business etc.), as test municipalities and as their control-municipalities (so that municipalities with a later rollout can be a control group for earlier rollouts). In addition, the later rollouts in Viken might also be the control for the Naturvernforbundet group which is recruited for their website (energismart.no). For NNV, recruitment will be from their member-base as well as other targeted groups (needs to determine who/how).

The intervention provided here is tailored advice for home renovation. The dependent variable here is the engagement in renovation activities (e.g., what is done in a given time period in the target group, and which energy improvements does that correspond to). Independent variables are factors such as the communication channel / communicator (Viken/NNV) which is also confounded with the type of website (unfortunately). The intervention type is the provision of very specific information and in some cases the performance of an energy audit.

In both cases, the study will aim at reaching out to participants for a second wave of data gathering, and ask them to report what kind of refurbishing has actually been done.

In the VIKEN case study, the portal Energiportalen.no will have to send an email to the ones who get an audit, so an important indicator could be the number of how many people will have actually applied for the energy audit.

In our aims, ENCHANT could also be part of the answer sent to the applicants (both those who receive an audit and those who don't), so that extra information might be placed in the email to some, and not to others (and save information about who gets what). Later on, we plan to send a survey to both samples and ask for what kind of refurbishing participants will have actually done.



In the case of the NNV case study, the portal Energismart.no is different in that there is information about the members receiving the info, and it will be useful to collect contact info for other recipients. The rigging can be similar to the previous one, in that target info is sent to a selected group (based on criteria chosen in accordance with NNV), where a random half will receive our “message” and the other half not. There as well, a survey is sent afterwards to see if there are differences in the two groups.

The two tables below summarize the main characteristics of the planned interventions.

Study 1: Large-scale recruitment, RCT on newly programmed intervention website

	VIKEN COUNTY	Naturvernforbundet
<i>Sector</i>	County/Municipality	NGO
<i>Type of interventions</i>	<ul style="list-style-type: none"> • Control group • Information • Information + social norms • Information + feedback • Information + commitment • Information + social norms + feedback + commitment 	<ul style="list-style-type: none"> • Control group • Information • Information + social norms • Information + feedback • Information + commitment • Information + social norms + feedback + commitment
<i>Behaviour</i>	• Reduced energy consumption/maybe water use through behavioural change.	Reduced energy consumption/maybe water use(?) through behavioural change.
<i>Matrix Variables</i>	2x6x2	2x6x2
<i>Participants</i>	Inhabitants of Viken county (Approx. 1,3 mills in total)	Users, customers, members (Approx. 30 000 in total)
<i>Expected goals (shared by both user partners)</i>	<ul style="list-style-type: none"> • Comparing the impact of two different types of senders (Municipality vs NGO). • Comparing the impact of different types of communication channels. • To investigate the effects of the interventions on customers’ energy consumption behaviours 	<ul style="list-style-type: none"> • Comparing the impact of two different types of senders (Municipality vs NGO). • Comparing the impact of different types of communication channels. • To investigate the effects of the interventions on customers’ energy consumption behaviours



Methods (Quantitative, Qualitative; Mixed)	Mostly quantitative, some additional qualitative interviews	Mostly quantitative, some additional qualitative interviews
Type of data (Questionnaire, Observational, Structured test, Interviews, Focus groups GPS positioning, etc.)	<ul style="list-style-type: none"> Self-reported behaviour on energy use behaviour Information about how the people ended up on the website User behaviour on the website self-reported energy consumption (kW and costs) pre- and post intervention Comparison of who checks out the website and who does not (as far as possible) <p>Type of data: Survey, interview, web-use data</p>	<ul style="list-style-type: none"> Self-reported behaviour on energy use behaviour Information about how the people ended up on the website User behaviour on the website self-reported energy consumption (kW and costs) pre- and post intervention Comparison of who checks out the website and who does not (as far as possible) <p>Type of data: Survey, interview, web-use data</p>
Criteria for randomization	Full randomisation determined by web-platform developed by academic partners.	Full randomisation determined by web-platform developed by academic partners.
Name of data collection instrument (if available in your national language)	<i>To be identified and shared among the partners (TBD)</i>	<i>To be identified and shared among the partners (TBD)</i>
Design	<p>T0: G1, G2, G3, G4, G5, G6 ... Tx1: G1, G2, G3, G4, G5, G6 Tx2: G1, G2, G3, G4, G5, G6 Tx3: G1, G2, G3, G4, G5, G6 Tx4: G1, G2, G3, G4, G5, G6 ... T1: G1, G2, G3, G4, G5, G6</p> <p>Tx1-Tx? Are short in-between measures. T0 and T1 are the main data collection points</p>	<p>T0: G7, G8, G9, G10, G11, G12 ... Tx1: G7, G8, G9, G10, G11, G12 Tx2: G7, G8, G9, G10, G11, G12 Tx3: G7, G8, G9, G10, G11, G12 Tx4: G7, G8, G9, G10, G11, G12 ... T1: G7, G8, G9, G10, G11, G12</p> <p>Tx1-Tx? Are short in-between measures. T0 and T1 are the main data collection points</p>



Study 2: Small-scale recruitment, deep targeted counselling on energy upgrades of homes

	VIKEN COUNTY	Naturvernforbundet
Sector	County/Municipality	NGO
Type of interventions	<ul style="list-style-type: none"> • Information • Energy audit 	<ul style="list-style-type: none"> • Information • Energy audit
Behaviour	<ul style="list-style-type: none"> • Reduced energy consumption through Renovation/technology-investment 	<ul style="list-style-type: none"> • Reduced energy consumption through Renovation/technology-investment
Matrix Variables	2x3	2x3
Participants	Inhabitants of specific municipalities in Viken county recruited because they are planning a renovation process, recruited in waves following the different rollout processes (6 x 100: role-out in six municipalities + a comparison group which is waiting on the role-out)	Selected members and others recruited because they are planning a renovation process (N=300)
Expected goals (shared by both user partners)	<ul style="list-style-type: none"> • Comparing the impact of two different types of senders (Municipality vs NGO). • Comparing the impact of different types of communication channels. • To investigate the effects of the tailored energy counselling on investment behaviours • To test the effects of the two different counselling platforms (energiportalen and energismart) 	<ul style="list-style-type: none"> • Comparing the impact of two different types of senders (Municipality vs NGO). • Comparing the impact of different types of communication channels. • To investigate the effects of the tailored energy counselling on investment behaviours • To test the effects of the two different counselling platforms (energiportalen and energismart)
Methods (Quantitative, Qualitative; Mixed)	Quantitative assessments of investments made and changes in peoples' mindsets (requires a pre- and post questionnaire), in-depth interviews with selected participants	Quantitative assessments of investments made and changes in peoples' mindsets (requires a pre- and post questionnaire), in-depth interviews with selected participants



<p>Type of data (Questionnaire, Observational, Structured test, Interviews, Focus groups GPS positioning, etc.)</p>	<ul style="list-style-type: none"> • Self-reported b investment and maintenance behaviour • Monitoring activities on the web-counselling platforms measuring various activities. • Measured and self-reported energy consumption (kW and costs) • Changes in energy investment related mind-sets <p>Data types: questionnaire, interviews, focus groups, electricity consumption data, web-use data.</p>	<ul style="list-style-type: none"> • Self-reported b investment and maintenance behaviour • Monitoring activities on the web-counselling platforms measuring various activities. • Measured and self-reported energy consumption (kW and costs) • Changes in energy investment related mind-sets <p>Data types: questionnaire, interviews, focus groups, electricity consumption data, web-use data.</p>
<p>Criteria for randomization</p>	<p>No real randomization possible, therefore a design is chosen where participants in a later rollout will be the control for people at a later roll out.</p>	<p>No real randomization possible, therefore a design is chosen where participants in a later rollout will be the control for people at a later roll out.</p>
<p>Name of data collection instrument (if available in your national language)</p>	<p><i>To be identified and shared among the partners (TBD)</i></p>	<p><i>To be identified and shared among the partners (TBD)</i></p>
<p>Design</p>	<p>T0: G1 T1: G1, G2 T2: G1, G2, G3 T3: G2, G3</p>	<p>T0: T1: G4 T2: G4 T3: G4</p>



2.4 ROMANIA

The Romanian case studies, where the interventions will be implemented, involve two categories of consumers of the same energy provider – Electrica Furnizare SA.

The choice of performing the interventions with the consumers of Electrica Furnizare SA was motivated by the large number of consumers in various regions of the country, as Electrica Furnizare SA is the supplier with the largest consumers portfolio on the national energy market. This allows for a better insight into the consumption habits of the population and the factors that might contribute to their behavioral change, while also accounting for possible variations depending on location or various socio-demographic variables.

The size of the population included in the study does also allow us to perform two parallel studies and identify variations across online and offline populations. Another factor that determined us to perform this study was the capacity and experience that the supplier company possesses to perform such large scale studies. The two other partners included in the study, the Cluj-Napoca Municipality and the Center for the Study of Democracy will support the trials. At the level of Cluj-Napoca most households are Electrica consumers due to the incipient level of electricity market liberalization. Therefore, performing an additional study at the local level would be redundant. The role of the Cluj-Napoca Municipality would rather be that of enabling the communication with the citizens and policy-makers by disseminating project results and ideas. The Municipality has a number of locally functioning instruments and policies where these ideas can be integrated. Nationally, the Cluj-Napoca Municipality is overall politically well-placed due to its leadership at the level of the Metropolitan Area Association, the National Association of Municipalities, and its leadership position in respect to its climate-ambitions. The Center for the Study of Democracies is due to it's profile well-equipped to support the data research and analysis process through advice on methodology and data protection issues.

2.4.1 Consumers With An Online Account

The consumers who have an online account and use the MyElectrica Application to manage their relationship with the energy provider are included in the RCTs. Electrica Furnizare is the electricity provider with the largest market share in Romania, however the population using online instruments to manage their relationship with the provider is rather a minority – around 10,000 households. Despite this limitation, the provider interacts well with this population and has a very good knowledge of their behavior and preferences, as it is currently included in many market studies the company performs for internal use.



Intervention Matrix and RCT protocol

The Romanian partners plan to perform an RCT on this population of online customers and to apply research instruments that allow us to develop in-depth knowledge about the behaviour. The population will be divided to allow for the application of three interventions out of the following four: Information including Simplification, Feedback on Own Consumption, Commitment, and Social Norms. The exact types of interventions will be decided in the consortium in cooperation with the energy provider in order to coordinate with the rest of the case studies and to allow for cross-national comparison. In order to apply the RCT the population targeted will be invited to two general surveys – one at the beginning and another at the end of the pilot. This survey is aimed at measuring changes in their energy consumption behaviour on a variety of variables. It is expected that the rate of response in this group would be up to 20%. For the application of interventions we will have three intervention groups and three corresponding control groups. Data on the behaviour of this population will be retrieved from three sources: the surveys applied, the consumption data that covers the intervention period (at the beginning, the end and during the pilot period, as agreed in the consortium) and historical data from the relevant months in the previous years in order to establish real changes in consumption.

2.4.2 Consumers Without An Online Account

The second group are consumers who do not possess an online account and are not users of the MyElectrica application and have a traditional relation to the electricity provider. This population of consumers is much larger: approximately 3.5 million households. When the RCT study will be applied it is important to mention that the online population will be separated from the rest of the population in order to avoid distortion of results. This type of population uses local company offices and the invoice as the most important communication tool with the provider and real consumption is regularly recorded by the company.

Intervention Matrix and RCT protocol

The RCT study will be applied in the following manner: the interventions applied in the online group will also be printed on a separate sheet that will be included in the invoice envelope and delivered to the consumer. Details of the methodology are still to be determined. Generally, this RCT will be applied to three intervention groups and three control groups in parallel with the online study. The details of this intervention remain to be finalized, through a collaborative dialogue among the consortium partners, the energy provider and the relevant state authorities in order to make sure that the procedures involved comply with all legal requirements and allow for solid scientific results at the same time. The impact of the interventions will be established from the consumption data collected by the provider during the pilot period. The analysis will also be based on historical consumption data collected by the provider during the relevant months in the



past. Additional data possessed by the provider with respect to its consumers (such as the location of the household, structure, etc.) can also be used. After performing these studies, the third step will be to establish a comparison between similar data retrieved from the online and the offline RCT study and to identify to what extent interventions applied online generate more or less impact compared to offline interventions.

Below is a table summarizing the methodology of the two Randomized Control Trials to test environmental sustainability intervention strategies in the Romanian case study.

	ELECTRICA Furnizare online	ELECTRICA Furnizare offline
Sector	Energy Provider Company – possessors of online and MyElectrica App account	Energy Provider Company – offline consumers
Type of intervention	<ul style="list-style-type: none"> • Information including simplification • Commitment • Social norms 	<ul style="list-style-type: none"> • Information including simplification • Commitment • Social norms
Behaviour	Adjustment of everyday behaviours and behaviours in the private sphere	Adjustment of everyday behaviours and behaviours in the private sphere
Matrix Variables	3x1	3x1
Participants	10.000	3.5 mil
Expected goals	<ol style="list-style-type: none"> 1. To investigate the effects of the interventions on visitors’ investment and maintenance behaviours for the hydroelectric power plant (e.g charity box donations) 2. Follow up survey on energy consumption behaviour 	<ol style="list-style-type: none"> 1. To investigate the effects of the interventions on customers’ energy consumptions and investment behaviours
Methods (Quantitative, Qualitative; Mixed)	Quantitative	Quantitative



<p>Type of data (Questionnaire, Observational, Structured test, Interviews, Focus groups GPS positioning, etc.)</p>	<ul style="list-style-type: none"> • Questionnaire on self-reported energy consumption/saving behaviour and proenvironmental practices, lifestyles • Consumption data including historical data • Other socio-demographic data owned by the company with respect to the specific consumers. 	<ul style="list-style-type: none"> • Questionnaire (optional) • Consumption data including historical data • Other socio-demographic data owned by the company with respect to the specific consumers.
<p>Criteria for randomization</p>	<p>TBD</p>	<p>TBD</p>
<p>Name of data collection instrument (if available in your national language)</p>	<p>To be identified and shared among the partners (TBD)</p>	<p>To be identified and shared among the partners (TBD)</p>
<p>Design</p>	<p>T0: G1, G2, G3, G4 (control group)</p> <ul style="list-style-type: none"> • questionnaire on energy consumption/saving behaviour and proenvironmental practices <p>T1: G1, G2, G3, G4:</p> <ul style="list-style-type: none"> • application of treatments <p>T2: G1, G2, G3, G4</p> <ul style="list-style-type: none"> • follow-up questionnaire on energy consumption/saving behaviour and proenvironmental practices <p>T3: G1, G2, G3, G4</p> <ul style="list-style-type: none"> • consumption data interrogation 	<p>T0: G1', G2', G3', G4'(control group) (groups marked with apostrophe are randomly generated survey groups from the intervention groups G1, G2...):</p> <ul style="list-style-type: none"> • questionnaire on energy consumption/saving behaviour and proenvironmental practices <p>T1: G1, G2, G3, G4(control group):</p> <ul style="list-style-type: none"> • application of treatments <p>T2: G1, G2, G3, G4</p> <ul style="list-style-type: none"> • follow-up questionnaire on energy consumption/saving behaviour and proenvironmental practices <p>T3: G1, G2, G3, G4, G5:</p> <ul style="list-style-type: none"> • consumption data interrogation



2.5 TURKEY

The Turkish case studies for testing the ENCHANT interventions will be carried out in collaboration with a major electricity provider and a municipality.

The electricity provider is GEDİZ Electricity Distribution Company, which is also a user partner of ENCHANT. The municipality involved in the interventions is the Izmir Metropolitan Municipality, also a user partner of ENCHANT. The case study in collaboration with Gediz is chosen in order to capture the orientations and potential changes in the energy behaviours of households. According to the International Energy Agency (IEA), this is particularly important since households have the second highest share in global electricity consumption, second to the industrial sector. The large consumer base of Gediz is also promising in terms of contributing to the design and implementation of the RCT trials as intended by ENCHANT.

The choice of Izmir Metropolitan Municipality for testing the interventions is motivated by several factors. The designed interventions and the RCT approach will provide information on to what extent a change in energy behaviours and everyday lifestyles of the citizens can be achieved. They will also enhance collecting information on the lifestyles, habits and everyday behaviours of the citizens in Izmir reflected by, for instance the frequency and mode of public transportation use. Moreover, the interventions will also provide evidence on the role and effectiveness of local governments (municipalities) in terms of behavioural change of citizens as well as of their communication channels.

2.5.1 Gediz

Gediz Electricity is one of the 21 electricity distribution companies in Turkey. Gediz operates mainly in Izmir and Manisa, located in the Aegean (Western) Region of Turkey, serving around 6 million people (more than 3.5 million consumers), and distributing 21.200 GWh of energy. Gediz Electricity has over 1,000 employees and serves its customers through online channels (online services web portal, call centre, messaging apps, live chat and messaging through company website), as well as 126 physical Customer Service Centers. Gediz has recently started offering “green tariffs” (i.e., tariffs where the electricity provided to the customer is produced from renewable sources) to its commercial and industrial customers.

Intervention Matrix and RCT protocol

The interventions in collaboration with Gediz aim at increasing household energy efficiency. The RCT study will test the impacts of various energy efficiency information and ideas on the electricity use of household customers of Gediz as a major electricity provider. The goal will be to find salient information and means of providing this information that causes a behavioural shift in households towards lower electricity use.

The study design will rely on 3 information treatments developed by the ENCHANT research team relating to the societal and personal benefits of decreasing electricity usage. Currently, the planned treatments include outlining a decrease in the monthly bills



of the households, a reduction in the households' contribution to climate change, and the household's contribution to reducing air pollution in their region.

The tools for communicating these treatments to households will be informative graphics and short messages. The communication channels to be used are Gediz's computer and smartphone app and monthly bills sent from Gediz to its customers.

The availability of multiple communication channels allows the study to be designed as two parallels that use two different samples (users of the Gediz's smartphone app - which is expected to launch by July 2021- and non-app users). Both studies will sort their sample into the 'treated' and 'control' subgroups. In both studies, the 'treatment' group will receive one of the new information graphics developed by the research team, whereas the 'control' group will not. The treatment group for the app user sample will receive the information graphics through the app. On the other hand, the treatment group for the non-app users sample will receive the information graphics as an addendum to their monthly electricity bill. This will allow for the estimation of the effects of each information packet within the virtual and non-virtual environments, as well as a comparison between virtual and non-virtual treatments.

As discussed with Gediz, access to anonymized monthly electricity consumption values and bill amounts for each household both before and after the application of the information packets will be provided. Also, depending on the availability, they will provide the historical data as well.

2.5.2 Izmir Metropolitan Municipality

Located in the Aegean Region, Izmir is the third largest city of Turkey. Izmir covers an area of 12,000 square kilometres around the Gulf of Izmir and has a population of 4.3 million, with an average population density of 360 people per square kilometre. Izmir has 31 districts, where the central district, Konak, has a population density of around 15,000 people per square kilometre. Six main districts, Bayraklı, Bornova, Buca, Karabağlar, Karşıyaka, and Konak host around 60% of the population of Izmir. The public transportation system of Izmir integrates the three modes of rail (including metro and trams), buses, and maritime transportation. As of 2020, the total number of public transportation trips using metro and trams is 229 million, the total number public transportation trips using buses is 506 million, the total number of passengers using maritime in public transportation is 9.5 million. Izmir Metropolitan Municipality currently has 20 electric buses being used in public transportation, which is planned to reach 100 by the end of 2021.

Intervention Matrix and RCT protocol

This study in collaboration with Izmir Metropolitan Municipality aims at testing the effects of interventions designed for increasing the ridership and use of public transit with the messages. The interventions will be conveyed through climate and environmental



messaging. The messages will be at public transport stops (tram, metro, bus and ferry) in Izmir. This study is also designed for observing the effect of the changing fuel prices on the usage of public transport.

For the treatment involving messages at public transport stops, 'treatment' and 'control' groups will be randomly selected from among the tram, bus, ferry and metro stops within the city of Izmir. For the selection of the treated stops, residential areas will be considered in order to reduce the "loss-to-follow-up" from departing passengers reading the signage. The stops in the treatment group will receive new messages / posters / information / videos that describe, for example, how riding the public transit is a climate-positive action, and contributes to a healthier city by reducing pollution, or other selected messages. The usage intensities at the treated and control stops will be measured before and after the application of the treatments, i.e., the application of the new messages / posters / information / videos. The results of these measurements will be analysed to observe if the new messages / posters / information / videos campaign increased public transit ridership.

After the implementation of the intervention, a follow-up will be performed through a questionnaire on the BizIzmir platform (a web-based interactive platform hosted by the Izmir Metropolitan Municipality for information exchange, announcements, surveys etc.). The questionnaire will ask people about their experiences using the public transit system and if their perception changed after seeing the new messages / posters / information / videos. In order to measure the accuracy of the statements of those who said they have seen the new messages / posters / information / videos, verification questions will be included in the questionnaire.

Anonymized data (for both before and after the treatments are implemented) on daily (if possible hourly –not sure yet) usage (passengers riding the public transport) at each stop in Izmir will be provided. Also, depending on the availability, they will provide the historical data - the usage data (number of entering passengers) for each stop recorded a few months back.

Depending on the availability from IBB the statistical Data of all districts in Izmir, location of all public transport stops within the areas that are observed in the study, including the average public transport frequency in each stop (to differentiate between better/worse public transport availability), an indicator for the "quality of the public transport infrastructure" (such as number of bus stops per 5x5 km area) will also be provided. In addition to that, we will provide weekly or monthly automobile fuel prices in Izmir for the same time period as the data of the public transport usage, observing the effect of the changing fuel prices on the usage of public transport.

Below is a table summarizing the methodology of the two Randomized Control Trials to test environmental sustainability intervention strategies in Turkish case studies.



	Gediz Electricity	Izmir Metropolitan Municipality
Sector	Energy Provider Company	Local government (Municipality)
Type of intervention	<ul style="list-style-type: none"> • Information • Feedback • Social Norms 	<ul style="list-style-type: none"> • Information • Social Norms
Behaviour	Energy Saving Behaviour	Energy Saving Behaviour
Matrix Variables	3x1	2x1
Participants	Customers (users of the smart phone app) (N =100K-150K for the app - which is expected to be deployed until October 2021 and N= 250K- 300K (non-users of the smart phone app)	Citizens, potential public transportation users (N =250K-300K)
Expected goals	<ol style="list-style-type: none"> 1. To test the impacts of various energy efficiency information and ideas on the electricity use of household customers 2. To find salient information and means of providing this information that causes a behavioural shift in households towards lower electricity use 3. To compare the effectiveness of treatments through virtual and non- virtual environments 	<ol style="list-style-type: none"> 1. To investigate the effects of climate and environmental messaging on increasing the ridership and use of public transportation 2. To observe the effect of changing fuel prices on the usage of public transport
Methods (Quantitative, Qualitative; Mixed)	Quantitative	Quantitative
Type of data (Questionnaire, Observational, Structured test, Interviews, Focus groups GPS positioning, etc.)	Observed changes in energy consumption	<ul style="list-style-type: none"> • Measured usage intensities of public transportation • Self-reported changes in energy savings behaviour and use of public transportation through the BizIzmir platform



<p>Criteria for randomization</p>	<p>Use a random sorting of users of smartphone app Use a random sorting of non-users of smartphone app (customers receiving electricity bills)</p>	<p>Sort public transport stations randomly into treatment and control groups</p>
<p>Name of data collection instrument (if available in your national language)</p>	<p><i>Gediz smart phone app (name not determined yet) Electricity bills</i></p> <p><i>Others to be identified and shared among the partners</i></p>	<p><i>Izmir Metropolitan Municipality's transportation Database - IZULAŞ BizIzmir platform (web-based interactive platform hosted by the Izmir Metropolitan Municipality for information exchange, announcements, surveys etc.)</i></p> <p><i>Others to be identified and shared among the partners</i></p>
<p>Design</p>	<p>STUDY A (Users of the smart phone app)</p> <p>T0: G1, G2:</p> <ul style="list-style-type: none"> Information on pre-intervention monthly energy consumption through energy consumption data and/or electricity bills. (Data from Gediz) <p><u>TA: Informative graphics and on societal and personal benefits of decreasing electricity usage:</u></p> <ul style="list-style-type: none"> G1 informative graphics and short messages through the app G2 control group <p>T1: G1, G2:</p> <ul style="list-style-type: none"> Observed behaviour regarding changes in energy consumption through energy consumption data and/or electricity bills. (data will be provided by Gediz) <p>STUDY B (Non-users of the smart phone app)</p> <p>T0: G1, G2:</p> <ul style="list-style-type: none"> Information on pre-intervention monthly energy consumption through energy consumption data and/or electricity bills. 	<p>Study A T0: G1, G2</p> <ul style="list-style-type: none"> Information on pre-intervention public transportation usage intensities in the selected stops through the usage frequencies (Data from IZULAS) <p><u>TA: Climate and environmental messaging on public transport stations for incrising the rideship and use of public transportation</u></p> <ul style="list-style-type: none"> G1 public transport stations with new messages / posters / information / videos G2 control group <p>T1:</p> <ul style="list-style-type: none"> G1, G2 Observed behaviour regarding changes in the intensity of public transport usage through the usage frequencies (Data will be provided by IBB and IZULAS) <p>T2: G1</p> <ul style="list-style-type: none"> Follow-up questionnaire on the BizIzmir platform for those who have seen the messages on public transport stations



	<p>TA: Informative graphics and on societal and personal benefits of decreasing electricity usage:</p> <ul style="list-style-type: none"> • G1 informative graphics and short messages through electricity bills • G2 control group <p>T1: G1, G2:</p> <ul style="list-style-type: none"> • Observed behaviour regarding changes in energy consumption through energy consumption data and/or electricity bills. 	<ul style="list-style-type: none"> • Self-reported changes in the intensity of public transport usage through the questionnaire on the BizIzmir platform
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2.6 GERMANY

The German case studies are carried out in cooperation with Badenova, a large energy supplier, the City of Freiburg im Breisgau and the NGO Climate Partner Upper Rhine Valley.

The cooperation with Badenova for the selected case studies was chosen because the energy supplier has a correspondingly large reach in and around Freiburg im Breisgau due to its large number of existing customers (800,000 in total consisting of private households and SME's). In addition, the close cooperation with municipalities in the region leads to many years of experience, in activating and motivating residents for renewable energies and providing advice on energy-efficient action (for example via the blog "Energievoll")<https://www.badenova.de/blog/>. Through badenova, it is thus possible to contact the private households in the region in a more targeted manner and in large numbers, which will benefit the implementation of the RCT trials within ENCHANT.

The City of Freiburg and the Climate Partner Upper Rhine Valley, were selected as multipliers to significantly increase the reach in south-west Germany. Both partners are important actors in the region concerning sustainability, increasing energy efficiency together with the inhabitants of the city and with engaged SME's. The City of Freiburg which also names itself "Green City" is internationally known as a pioneer in sustainability. To only name a few of the milestones achieved, in 1994, the city built the worldwide first plus-energy house. In 2010, the Sustainability Department of the city was founded and has been very active since. The Climate Protection Concept has been updated several times and is now planning a 60% reduction of the CO₂ emissions by 2030 and climate neutrality by 2050.

The NGO Climate Partner Upper Rhine Valley is bringing together actors for climate protection from the Upper Rhine region and generating benefits for science, business and municipalities via several projects. To do this, they bring the right partners to the table: innovative medium-sized companies, universities, research institutions and municipalities. The NGO supports them in research and development, in investment projects or in knowledge transfer.

The case studies planned with these partners have the aim to collect information on the use of different energy resources in private households and to learn what is the most effective way to promote a more sustainable energy use.

2.6.1 Hansgrohe – Pontos

The private company that Badenova is going to work with for this intervention is Hansgrohe. The company focuses on fittings for bathrooms and kitchens. To protect the home from possible water leaks, Hansgrohe has developed the Pontos water



management system. It measures different parameters of the water supply such as consumption, pressure, temperature or hardness grade.

The system consists of two different components: a Pontos base and several Pontos scouts. The Pontos base is an intelligent and connectable measuring and analysis device that is attached directly to the house connection. The Pontos scouts are pods that are flexibly mounted in the house and help to detect leaks. Optionally, an app can also be used on a mobile end device that communicates with the Pontos base and can display the measured parameters graphically to the consumer, among other things. In addition, the consumer can be contacted via push-up messages when abnormalities are detected. The aim of the system is to convey a feeling of security and at the same time to contribute to the conservation of water and energy resources (due to the high energy consumption of warm water).

A cooperation with badenova in the framework of the ENCHANT project is taking place, because this way an insight into the handling of the resource water in private households can also be included in the project. As drinking water is also a limited resource, it is also important to sensitise private households to the sustainable use of water. The Pontos water management system also contributes to preventing unnecessary loss of water by protecting against leakage. In addition, a reduction in water consumption can also lead to a reduction in energy consumption. By using less water (especially hot water), less energy must be used to fulfill basic daily life hygiene needs, and to transport the water from the house connection to the tap. In another way, lower consumption of hot water would also save energy indirectly, as less hot water must be treated.

Intervention Matrix and RCT protocol

For this intervention, private households in and around Freiburg are going to be contacted and mobilized. The target group was defined in advance as homeowners with their own water house connection, as the handling of the installation of Pontos can be done directly with the owner of the house.

In order to reach as many people as possible in this target group, the channels of badenova and Hansgrohe will be used. It is planned to call for participation via a paid post on two different social media channels and a press release by Badenova.

Via the press release and the posts on the social networks, interested readers are redirected to a landing page on the Badenova website. Here, the potential participants can apply via a form and provide information about their water connection, as well as uploading pictures of the installation. Based on these details and pictures, a selection of 10 test customers will be made depending on the technical feasibility, who will receive the Pontos water management system from Hansgrohe provided for free. In addition, two test households will be placed on a waiting list in case the planned installation in one of the 10 test households is not possible.



During the project phase, a total of two interviews (pre and post installation) and one survey will be conducted.

The online survey will be conducted with the participants who did not win the Pontos system. The tool "Formstack" will be used for this purpose. In the survey, questions about the reason for participation, the impression of the Pontos product and the topic "Dealing with water in everyday life" are going to be asked. The aim is to assess how these households deal with water, if there is already an awareness of efficient water use and if it is correlating with the awareness of energy efficient behavior.

A video interview with the same questions from the online survey will be conducted with the 10 test customers before the Pontos systems are installed. However, the questions here will not have fixed answer options, so that the participants can answer in their own words. Another video interview will be conducted with the 10 test customers 4 to 6 weeks after the installation of the Pontos system. Here again open questions will be asked. The purpose of this second interview is to find out more about the integration of the Pontos System into everyday life. In particular, about the changed or unchanged behavior regarding the usage of water.

2.6.2 Solar Panel

In this case study, Badenova will cooperate with the two subcontracted actors, the NGO Climate Partner Upper Rhine Valley (KPO) and the City of Freiburg.

In this cooperation, they primarily serve as multipliers for the scope of the case study. In this way, as many households as possible will be informed and motivated to participate in a regionwide survey. The survey is to be carried out in autumn / winter 2021 and in order to achieve the greatest possible participation, the survey will take place within the framework of a competition.

Intervention Matrix and RCT protocol

The aim of this campaign is to reach as many different people as possible and to encourage them to participate, so that the participants reflect the Freiburg region as accurately as possible. In this way, the most diverse results can be collected on the geographical location, the socio-economic reference areas, the population targets and the relevant interest groups. For this purpose, posts on the Badenova social media channels and a press release will be used to call for participation. At the moment, it is still being clarified to what extent the existing customers of Badenova may be contacted directly and whether an article can be published for this intervention on the company's own blog for sustainable topics "ENERGIEVOLL" ("full of energy"). Which channels may be used by KPO and the City of Freiburg is not yet defined.



People who are willing to take part in the survey will get the chance to participate in the raffle. The people must answer a questionnaire (quantitative survey) asking questions about their daily energy consumption and habits. Afterwards, a raffle will be held among the participants, where the winner will receive a solar panel. This solar panel is a micro PV that can be installed on the balcony and produces electricity that is mostly self-consumed. Surplus electricity is fed into the public grid without remuneration. In this way, flat tenants can also produce their own electricity in a regenerative way. More information about the panel itself can be found on the website: <https://www.badenova.de/blog/balkonsolar/>. Since the solar panel can be easily installed on the balcony, the expectation is high that many people will register for this lottery.

A condition of participation in the competition is, in addition to a first survey, a second one. The idea here is that the group of participants is divided into two. One half will be provided with information on the topic of energy saving and the other half will not. How this access to the relevant information and saving tips will look is not yet clear. After a certain period of time, all participants will again be asked to take part in a survey. The aim is to check whether the provision of information and tips on how to save energy has had a positive effect on the more sustainable use of energy in everyday life. In addition, it should also be checked whether the participants themselves have dealt with the topic of energy saving without information input.

	Hansgrohe	Solar Panel
Sector	Energy Provider Company + Hansgrohe (private company)	Energy Provider Company, City & NGO
Type of intervention	Information + Incentives	Information
Behaviour	<ul style="list-style-type: none"> • Maintenance • Consumption 	<ul style="list-style-type: none"> • Energy consumption • Investment
Matrix Variables	2x2	1x2
Participants	Approx. 30 households	N= 5000



Expected goals	<ol style="list-style-type: none"> 1. Investigate the influence of the visualization of the own water consumption (via Pontos System) on the consumption 2. Investigate if there is a correlation: are people saving water also saving energy and vice versa 	<ol style="list-style-type: none"> 1. Motivation: Are people responding to the intervention to save money or to win the solar panel? 2. Addressing "other" target groups: Are people not thinking about energy saving in their daily habits also willing to participate to win the solar panel? 3. Are there more people willing to invest into green energy if it is affordable (=200-300€) & easy to implement? 5. Are only big energy consumer willing to participate (as not used energy is not sold but gets into house network)
Methods (Quantitative, Qualitative; Mixed)	Quantitative (10 exp group + 20 control group) Qualitative interviews (10 exp group)	Quantitative + Qualitative (1)
Type of data (Questionnaire, Observational, Structured test, Interviews, Focus groups, GPS positioning, etc.)	2 groups: <ol style="list-style-type: none"> 1. households receiving the pontos -> pre & post survey (questionnaire + interview) before & after installation of the pontos system 2. Households not receiving the system: questionnaire (1 time) 	2 groups: <ol style="list-style-type: none"> 1. Questionnaire pre and post with and without energy-related information 2. Interview of household receiving solar panel
Criteria for randomization	No randomization	TBD
Name of data collection instrument if available in your national language)	<i>Ad-hoc questionnaire and interview track</i>	<i>TBD</i>
Design	<ol style="list-style-type: none"> 1. Qualitative interview on water and energy consumption habits + quantitative questionnaire 2. Installation of the Pontos system 3. Interview + questionnaire after 4-6 weeks on water and energy consumption 	<ol style="list-style-type: none"> 1. Households have to respond to a survey questionnaire as candidature for a lottery (also using channels from City of Freiburg and the NGO KPO) 2. Selection of the winning household (according to technical criteria + person not saving energy in its daily habit) 3. Installation of the solar panel 4. Post competition survey questionnaire 4. Interview of the prize-winning person 4-6 weeks after installation of the solar panel



2.6.3 Waldsee Quartier Street Festival

The city district Waldsee with its about 5.400 inhabitants is named after its local recreation area, a small lake with a lido and restaurant. In the city area there is the Schwarzwaldstadion (the football stadium of SC Freiburg), a sports mile connects the Institute for Sports and Sports Science with the lido. A hydroelectric screw provides energy for about 120 households.

In the fall of 2021, the city of Freiburg has planned a street festival in the Waldsee district. In this district, the city of Freiburg wants to test how climate protection can look like in everyday life with the project "Our Waldsee Climate Quarter". For urban development, it is an exciting question whether people who live in an environmentally friendly neighbourhood save more energy. The street festival is intended to offer citizens the opportunity to exchange ideas on the topic of climate protection, to inform themselves and to get involved. It is an offer for all interested parties, both residents and visitors, in and around Freiburg.

Among other things, various hands-on activities will be offered and information stands will be set up. In this way, information on energy efficiency in the household, energy-efficient renovation of residential buildings, renewable energies, sustainable furniture and climate-friendly consumption are going to be given to the citizens via the central topic of climate protection. In addition, also information about the direct effects of continued high energy consumption will be provided.

As a regional energy service provider, Badenova will inform citizens, for example, about possible measures to save energy. Information will be provided on topics such as personal behaviour, new energy-saving techniques and innovative techniques for monitoring one's own energy consumption. Personal energy advice will also be available on site. Then a survey is going to be conducted among the street festival public, through informal on site recruiting, with the group having received the information and a control group not having received it, to check whether these information had an impact on their energy consumption.

Intervention Matrix and RCT protocol

The aim of the planned intervention is to test the willingness of visitors to actively obtain information about certain energy efficiency topics via a QR code. A further consideration is that at the end, in addition to the information, visitors can register for further surveys via a landing page.

For this purpose, three posters with a QR code are going to be exposed. The content of the posters will be the topics investment, maintenance and behaviour adaptations. The aim is to test to which topic visitors react more.

It is still to be defined which variant we will use between:



1. the posters will all be put up next to each other at the same time. This way, visitors have a choice for which topic they want to inform themselves.

2. only one poster will be put up. The posters will be changed after a certain time.

We would like to find out which topic is retrieved more often. We hope to achieve a greater willingness to take the surveys via the topics. Subsequently, it will be evaluated which topic was accessed more frequently. The willingness to scan the QR code could also increase the willingness to participate in a survey.

2.6.4 Landesgartenschau

Every year, the State Garden Show takes place at a different location. It usually takes place from April to October. In 2018, the State Garden Show was in the city of Lahr and attracted a total of 800,000 people. In 2019, even two million visitors came to the Remstal State Garden Show.

The next State Garden Show will be held in Neuenburg am Rhein from 22.04.2022 to 03.10.2022. Badenova is involved in the State Garden Show as a premium sponsor which allows a participation in the ENCHANT project. Here we have the opportunity to survey a very broad spectrum of the population.

Intervention Matrix and RCT protocol

The aim of the planned intervention is to test the willingness of visitors to actively obtain information about certain energy efficiency topics via a QR code. A further consideration is that at the end, in addition to the information, visitors can register for further surveys via a landing page.

For this purpose, three posters with a QR code are going to be exposed. The content of the posters will be the topics investment, maintenance and behaviour adaptations. The aim is to test to which topic visitors react more.

It is still to be defined which variant we will use:

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2. only one poster will be put up. The posters will be changed after a certain time.

We would like to find out which topic is retrieved more often. We hope to achieve a greater willingness to take the surveys via the topics. We can also differentiate the groups here. Alternating between providing one group with information on sustainability and climate protection and asking the other group without prior information.

In order to increase the willingness to participate in a survey, it has still to be clarified whether we can hold a raffle, e.g. winning tickets or not. (Website: <https://www.neuenburg2022.de/>); Unfortunately, the page can only be translated into French).



3 Conclusions

In this document, we presented a summary of the planned behavioural intervention packages to be implemented, in collaboration and through the active and direct involvement of user partners in the ENCHANT project. It is important to underline that the implementation of the entire ENCHANT project is the result of a continuing and recursive discussion and co-creation process, arising from periodic meetings between the teams involved in the project.

In the present report, we also summarize the main features of the related research design and empirical protocols to be followed for evaluating the actual outcome of these planned interventions, following the RCT-based approach that we assume as the major overarching empirical framework within ENCHANT. The selection and definition of the intervention packages and the identification of the more appropriate RCT-based research procedures to evaluate the interventions was the result of joint collaborative effort between the WP leaders (not only of WP2 but also of other related WPs, such as WP4 and WP5), the project coordinators, and all the academic and user partners involved.

The identification of the main intervention strategies is also a follow-up of the activities conducted in the previous WP2 task (T2.1), where a systematic literature review allowed to identify the major strengths and weaknesses of the most common behavioural intervention experiences available in the energy-saving domain. For this reason, it should be acknowledged that some of the intervention types that will be focused on in the next phases of ENCHANT have already been studied in the past, not only in the energy behaviour domain. Thus, it will be interesting to carefully design the actual interventions (e.g., intervention messages, or social norms campaigns), with the aim of improving what has already been achieved in existing research and intervention experiences.

Another innovative aspect of the work that we will conduct in ENCHANT will be the measurement of important moderator and mediator variables implicated in the interventions' effects. Some potentially important moderators include for example taking into account factors such as individuals' baseline energy consumption rates (this aspect is relevant for example in the case of interventions based on social norms, feedback, and incentives).

Likewise, it will be important to consider the potential role of individual psychological factors such as people's general environmental concern, values, worldviews or other similar variables (these factors again are potentially very relevant for example in the case of interventions based on Social Norms, Feedback, and Incentives). In some of the cases studied we will also take into account more collective factors, such as group identification and feelings of membership into specific social or environmental groups (which could be highly relevant for interventions based on social norms), or factors such as personal, moral and group norms (which could be highly relevant norm-based, incentive-based, or commitment-based interventions).



Another important feature of our empirical assessment of the behavioural intervention strategies deployed within the context of ENCHANT will be the study of specific combinations of intervention strategies (e.g., using Social Norms interventions with or without information interventions). This will allow us to conduct proper statistical analysis of the possible interaction effects between single specific intervention elements, for example by comparing the outcomes of different groups assigned to different conditions such as “Social Norms only”, “Information only”, “Social Norms + Information”, “Control”. Or, in a similar way, it will be possible to compare combinations of other intervention types: such as “Feedback only” or “Commitment only” conditions vs. control conditions. To summarize, the empirical logic that will be applied in ENCHANT will eventually allow us to understand for example whether intervention element A has a stronger effect on a certain behavioural indicator when coupled with the simultaneous presence of intervention element B.

The intervention matrix and the RCT research protocols described here represent a fundamental preliminary step for the implementation of the empirical investigations aimed to verify and monitor the potentially effective strategies for changing energy-related behaviours towards a more sustainable direction. In order to highlight the determining variables, a series of RCT protocols have been designed and defined, and will be implemented at the partners of the ENCHANT project. Some of these behavioural intervention strategies that will be tested are more likely to be effective and have an impact on the promotion of more sustainable energy choice at an individual level, while some others are more likely to function through collective processes. In both cases, the ultimate purpose is to ascertain what actually works and what actually does not work to motivate people to make more sustainable behavioural choices in the energy domain.

As described in detail in the previous sections of the report, nine user partners were involved, in collaboration with the academic partners, in selecting and defining this RCT protocols and intervention matrix, including local institutions, NGOs, public and private sector companies, energy providers and no profit foundations. Each specific research design that is presented here has been tailored and defined taking into account the particular features, specificities, institutional missions, target populations, needs and practical constraints of the various user partners of ENCHANT. Also, the selection of the interventions, the definition of the experimental conditions and the choice of the specific behavioural indicators takes these specificities into account.

It is interesting to underline that, in general, the “information” strategy will be implemented in all the RCT-based interventions defined here, and this will also allow to acquire interesting knowledge about whether (and how) information strategies work across different specific local or national contexts in Europe, and on which different behavioural indicators.

In many cases, the information strategy will be associated with a so-called Social Norms strategy. The use of monetary incentives based strategies will be less frequent in



ENCHANT, also because of practical reasons (only one of the planned RCT-based interventions will implement this type of strategy).

To conclude, we briefly resume below the main features characterizing the planned intervention matrix:

- Simple and effective randomization criteria are used;
- large numbers of participants are involved in the case studies;
- real everyday life contexts are considered in the implementation of RCT designs, to reproduce situations of realistic and credible interactions between the partners of each case study and the participants involved;
- all case studies are characterized by an innovation purpose, both with respect to the business sector of the specific user partner involved and with regard to the implementation of the RCT-based procedures;
- the experimental designs vary from very simple predictor-criterion matrices to more complex ones where interaction effects will be specifically addressed and tested; also, the use of quantitative and qualitative methods is remarkable in one of the planned case studies.



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