ENABLE.EU Transition Workshop Background Brief

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1. ENABLE.EU: aims and scope of the project

What drives the energy choices we make? What motivates individuals, organisations and countries to adopt and encourage more sustainable energy behaviours? ENABLE.EU embraces a bottom-up approach to changing energy behaviour: empowering consumers and citizens to make freer and better-informed energy choices - choices that reflect what they truly want.

The project is developed within the framework of the Energy Union Framework Strategy[1], designed to foster a cost-efficient energy transition able to deliver secure, sustainable and affordable energy to all European consumers. The Energy Union Framework Strategy aims at a citizen-oriented energy transition based on a low-carbon transformation of the energy system. The successful implementation of the Energy Union will materialise in a change in energy production and energy consumption choices.

ENABLE.EU will:

- ✓ Identify the **key factors of energy choices in three areas**: transport, heating and cooling, and electricity;
- ✓ Better grasp the **interactions between individual and collective energy choices** and the regulatory, technological and investment prerequisites of the Energy Union transition pillar;
- ✓ Look at the **social acceptability of energy transitions** using a participatory foresight and assessment process engaging key stakeholders and selected households;
- ✓ Increase the **knowledge of governance and social mobilisation practices** that encourage collective energy choices in line with the Energy Union objectives;
- ✓ Provide **strategic policy recommendations** to increase the social acceptability of energy transitions.

Concept and methodology

The key socio-economic drivers of individual and collective energy choices will be determined by analysing the interrelation between various factors, such as social norms, belief systems, everyday practices and economic aspects. This analysis will be enhanced through a cross-country comparison in 11 countries, to better comprehend the factors that drive or impede everyday routines and practices. This improved understanding of people's motivations will increase social acceptance, making citizens active participants in the consumption and production of energy.

The main outcomes will be:

- ✓ A literature review of existing qualitative and quantitative studies;
- ✓ An investigation of technological, economic and social factors affecting individual energy choices and behaviours, as well as social mobilisation and governance factors that influence the social acceptability of the energy transition;
- ✓ Participatory foresight exercises, focusing on how to change energy choices and behaviours to support the full-scale transition to a low carbon economy;
- ✓ Reference and policy scenarios, assessed using quantitative modelling and compared with the current long-term energy targets of the EC;
- ✓ A series of policy recommendations formulated and disseminated to policy makers.

[1] https://www.eesc.europa.eu/en/our-work/opinions-information-reports/opinions/energy-union-strategic-framework

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Who benefits from ENABLE.EU?

- ✓ Policy makers and planners at the European, national and local level will receive valuable recommendations and scenarios, including measures that can help them achieve their energy transition objectives;
- ✓ The research community will receive ENABLE.EU's findings, to contribute to a better understanding of the drivers of energy choices;
- ✓ Other EU-funded projects will benefit from an improved understanding of energy choices and increased scientific knowledge on the effectiveness of policy interventions;
- ✓ Key information will be given to national and international business and branch associations, interest groups and non-governmental organisations regarding investments in sustainable energy and the challenges to their implementation;
- ✓ Awareness will be raised among the general public, so that they can fully participate in and shape the transition to clean energy.

ENABLE.EU Partners

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2. The foresight process: aims and results

What is participatory foresight?

With an uncertain future on the horizon, many of us wonder how our actions today might impact our world in the short and long term. Can our choices really determine what will happen ten, twenty, or thirty years from now? Foresight is a way for us to understand our options, and how the choices we collectively make will impact us. It is not a crystal ball, showing us a definitive future, but a tool that allows us to explore a number of possible futures. It can help us identify what will affect our lives over the next few decades and envisage potential changes in policies, strategies and behaviours, creating roadmaps that detail what we need to do today to shape our tomorrow.

Take part in ENABLE.EU's participatory foresight transition workshops

ENABLE.EU is using foresight to understand how to encourage people to make better and more sustainable energy choices. Its **three transition workshops** will bring together experts and citizens to create a realistic roadmap for the future. To begin with, 60 experts will be asked to envision future energy scenarios. Then, citizens from 80 households will refine these scenarios based on their experiences, offering their feedback on enablers and barriers to adopting sustainable energy behaviours. Finally, we will bring these experts and citizens together to create a roadmap for the future.

This participatory vision will be built in three phases, culminating with three workshops:

- Transition Visioning Workshop in Sofia, Bulgaria in June 2018 (for experts)
- Transition Practice Backcasting Workshop in Rome, Italy in November 2018 (for citizens)
- Transition Roadmapping Workshop in Rome, Italy in February 2019 (where citizens meet experts)

The workshops

The Transition Visioning Workshop will be a two-day (one afternoon followed by one morning) workshop held on 14-15 June 2018 in Sofia, Bulgaria. Interactive work in small groups will allow all participants to speak and share their knowledge. Taking into consideration the targets set by Europe 2020 and the Energy Union Initiative, the workshop will address the following questions:

- What are the desired end results or functions of energy practices?
- What are the emerging actions and practices that are considered marginal but could shape our energy behaviours in the future?
- What are the most promising actions related to technologies, policies, and behavioural changes that will have the highest impact on individual and collective energy practices in the future?

The Transition Practice Backcasting Workshop will be another two-day workshop held in November 2018 in Rome, Italy. Interactive work in small groups will allow all participants to speak and share their knowledge. Taking into consideration the scenarios, the workshops will discuss the following questions:

- Which aspects of the energy scenarios do you consider most appealing? How can these aspects be improved?
- What are the main enablers and barriers for implementing practices that can support sustainable transitions toward the scenarios?

The Transition Roadmapping Workshop will be held in February 2019 in Rome, Italy. Participants

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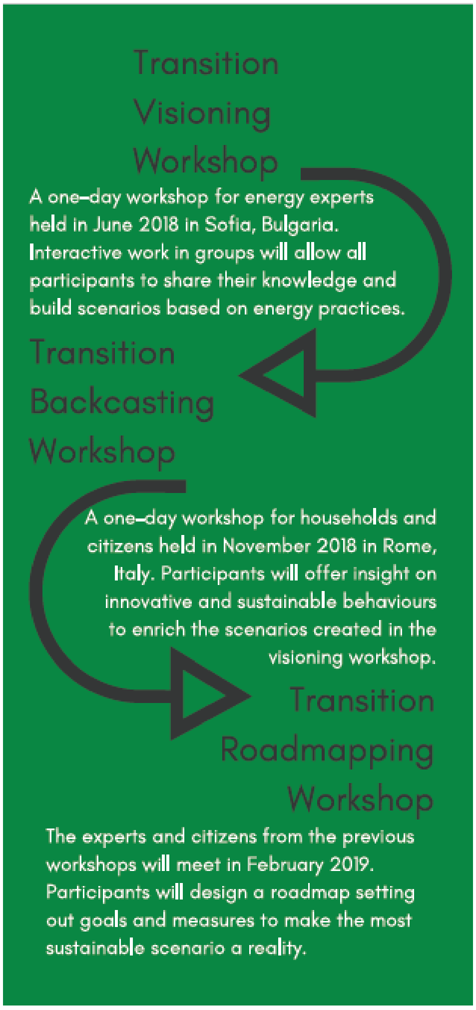
will be invited to draft policy recommendations to promote the adoption of sustainable behaviours for each of the ENABLE.EU fields. The most effective complementary policy interventions (e.g. economic tools, voluntary codes of practices, design and building regulation), education and engagement activities, new business models (learning programs, ICT-enabled peer-peer sharing initiatives), and research and development strategies will be examined, and participants will debate how the identified sustainable practices might be implemented to move toward the low carbon scenarios.

Objectives of the transition workshops



- ✓ Inspire a debate among European stakeholders aimed at identifying practices and possible behavioural shifts to promote the transition from a "business as usual" scenario toward a more sustainable one;
- ✓ Build energy scenarios by interpreting existing trends, drivers, and practices that influence individual and collective energy choices;
- ✓ Get input from European households on the most important enablers and barriers that could help them move toward more sustainable scenarios and practices;
- ✓ Refine the energy scenarios by evaluating possible changes in energy behaviour and looking at the wider implications of these changes;
- ✓ Engage European experts as well as households in a constructive debate to identify the most important policies, strategies, and measures to promote sustainable practices;
- ✓ Create a roadmap for the energy scenarios, setting out goals and measures to get us where we want to be in 2030, in 2040, and in 2050.

Combining the top-down approach of the initial visioning phase with the bottom-up approach of the practice phase, the final roadmapping phase will lead to the identification of policy, commercial, and educational measures, creating a coherent strategy to promote the transition to low carbon energy.

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3. Setting the scene: mapping drivers of individual and collective energy choices

Lead project partner: Jacques Delors Institute

In the project's literature review[2], we analysed research led to date on the drivers of energy choices, pointing out their contributions as well as their limits. This review testifies to the abundance of explanatory elements and findings through various disciplines. It first explores the economic and socio-behavioural drivers of individual energy choices, then analyses governance choices, and takes stock of the overarching models of energy choices in the literature.

Economic drivers of energy choices

Price-based interventions are a more appealing solution than **imposed standards** in encouraging consumers to reduce their energy consumption. Nonetheless, they do not necessarily stimulate high-return energy efficiency investments, as outcomes can differ depending on the manner in which households reduce their consumption and on the choice of instrument (e.g. carbon tax). **Underinvestment in energy efficient technology** is often explained in the literature by market failures (e.g. asymmetric information, liquidity constraints) and behavioural anomalies (e.g. consumer inattentiveness, bounded rationality).

Context is critically important when examining consumer responses to energy prices. The wide range of demand elasticities reported in the literature reflects the numerous methodologies, geographies, fuels and sectors considered. The measurement of price responses can be improved through randomised controlled trials and smart metering.

Low responsiveness to energy prices may be due to inefficiently low energy prices which do not fully take environmental externalities into account, or regulatory mechanisms resulting in prices not fully reflecting production costs. A range of **behavioural biases and management failures** may also impede information processing and ultimately result in sub-optimal decision making.

Socio-cultural, demographic and behavioural factors influencing energy choices

Energy choices are also shaped by **social, cultural, demographic and behavioural** aspects. This approach can be useful in attempts to predict people's behaviour in a particular situation and to identify a specific group that might be more responsive to certain policies.

Culturally determined social dynamics can affect not only people's response to specific policies, but also their daily routines and practices. The social risks of not complying with the established norm can often be more important than new technology in shaping behaviour. New technology can, however, redefine social conventions. Such drivers played a decisive role in the diffusion of cars and air conditioning, which moved from desired novelties to normal objects of mass consumption.

Demographic variables like income and age affect energy behaviours differently, depending on the energy service and the empirical setting. **Income,** considered a determinant of social status, strongly shapes households' energy behaviours, but based on **different motivations** – e.g. improving one's comfort, affording basic energy needs or producing one's own energy. It appears that early adopters of new technologies come mainly from higher income groups. Last but not

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[2] The literature review can be found on the project's website in the "Downloads and deliverables" section. http://www.enable-eu.com/downloads-and-deliverables/

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least, **gender** is given particular attention within ENABLE.EU as research shows that the motivations for and barriers to taking up energy-saving technologies can be gendered.

Behavioural aspects tend to be neglected in the study of energy choices. Yet, the routinized nature of many energy behaviours might make them difficult to change. Successful habit-breaking strategies can use policies that involve direct experience, such as trial periods. Furthermore, **consumers' engagement with electricity generation** might also lead to the increased visibility of this consumption, and this could positively affect household energy practices. Finally, **environmental awareness and values** have an uncertain impact on behaviour as there are often discrepancies between people's attitudes and their actual energy behaviour.

Drivers of energy-related governance choices

There are also several drivers and bottlenecks at the governance level. A low carbon energy transition requires disrupting the current energy system. This raises the challenge of consistent policy-making based on a **long-term strategy** that cannot be easily overturned in the future and that takes into account obstacles to the **liberalisation of markets, path dependency, regulatory barriers to technological diffusion, support for R&D, the active engagement of stakeholders and consumer acceptance.**

Synthesis of factors driving energy choices

Although it is difficult to generalise the findings and draw an accurate picture of the drivers of energy choices based on a portion of the literature, our review attempts to highlight points of consensus and areas where findings have been mixed. For instance, strategies like social comparison and the **targeting of specific groups** seem to positively influence energy conservation, while studies differ on the impact of different types of information provision. That said, the **combination of several strategies** (e.g. information provision and social norms) can be particularly effective. Nonetheless, beyond the effectiveness of a specific strategy, the design of a policy should not neglect several essential aspects, such as **synergies between factors and strategies, policy cost, timing, consistency with other policies and the institutional context.**

ENABLE.EU's empirical approach builds on the existing theories and findings, as well as on identified gaps and problematic areas in the research to date in order to maximise its added value. The project approaches the question of what drives energy choices through the lens of several energy services and activities, namely electricity consumption, mobility, heating and cooling, and prosumers.

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4. The case studies

Economic factors influencing household electricity consumption

Lead Project partner: Westfaelische Wilhelms-Universitaet Muenster (WWU)

a) Aims

With the energy transition towards a low-carbon system, the integration of renewable energies into the energy market is becoming increasingly important. In order to avoid overloading the grid, the supply of electricity must always correspond to demand. Fluctuating generation and grid feed-in from renewable energies combined with relatively rigid demand present problems that can be addressed with various options on both sides. This **case study deals with the demand for energy services by private households**. By understanding the drivers of electricity consumption, policies can directly target these drivers and implement corresponding strategies. Adding **flexibility to electricity demand avoids grid overloads, as it can be adapted to the supply-dependent feed-in.** Lower energy consumption allows a higher share of renewable energies in total electricity consumption. However, these opportunities go hand in hand with the question: "What factors influence household behaviour related to electricity demand?".

We are trying to identify the effect of different policy interventions on electricity consumed. The countries involved in this case study are: Bulgaria, Serbia, UK and Germany. Each of the countries focusses on a different intervention that best suits its needs:

- In Bulgaria, the research question is: "What is the effect of appliance-specific real-time consumption feedback on electricity consumption?" Utility bills are often difficult to understand and consumption is only presented as an aggregated measure. By providing a **cost breakdown for different appliances**, households are able to understand their consumption. As a consequence, consumers are empowered to adopt energy saving measures.
- Because the Serbian energy market is not liberalized and energy prices are the lowest in Europe, **information provision**, rather than financial incentives, was selected as a potential policy intervention. In particular, the research aims to shed light on whether **energy saving instructions** are a fruitful strategy to incentivise a reduction in electricity consumption. The study is being conducted in cooperation with the national electricity supplier EPS Supply. For EPS Supply, energy saving instructions are a measure to provide support as a socially responsible business, which includes the education of consumers.
- In the UK, the **maximization of smart meter adoption** was selected as a potential policy intervention. The smart meter rollout is perhaps the single biggest energy policy initiative in the UK at present. The government has mandated that every household should be offered a smart electricity and gas meter by 2020. This would require installation of 53 million gas and electricity meters. Currently the total installed is less than 5 million. Therefore, researchers are working with a large energy company (more than 5 million customers) to design and implement a robust study aimed at maximising smart meter adoption.
- The payment of electricity consumption usually occurs some time after consumption has taken place. In Germany the time lag is particularly severe: consumption is immediate, whereas billing occurs once a year. This lag has two consequences: future costs are discounted when making decisions and information on consumption behaviour is given only once a year. Technological progress in the form of **smart meters** would allow for real-time billing. However, the benefits of real-time billing have not yet been explored. The research aims to

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disentangle and estimate the effects of real-time billing on energy consumption.

b) Methods

The case study is being implemented in the form of **randomized controlled trials (RCTs),** also known as A/B Testing. A RCT is a quantitative method that allows the identification of the causal effects of inventions by instrumenting randomization. Participants are randomly placed in either an intervention or a control group, and only the intervention group has access to the intervention (e.g. the energy-saving instructions). Because of this randomization, the participants in both groups are expected to be equal in all of their observable and unobservable characteristics, except of the intervention. By using randomization, instead of relying on before and after comparisons, also time effects, such as a change in the weather, are controlled for. This is how the causal effect of the intervention can be isolated, without the contamination of any other characteristics. To measure household electricity consumption, it is usually necessary to cooperate with an electric utility.

c) Preliminary results

The case studies in the different countries are either currently running or are to be implemented shortly. The first results are expected in autumn 2018.

The shift to low-carbon mobility

Lead project partner: Asociacion BC3 Basque Centre for Climate Change (BC3)

a) Aims

The aim of the Low-Carbon Mobility (LCM) case study is to investigate what facilitates the use of low-carbon shared mobility options in urban areas across Europe. A specific focus has been given to the carsharing and electric carsharing options.

Moreover, the study puts forward a comprehensive analysis in which carsharing options are compared with other transport modes. Thus, it also focuses on how the use of this option is related to the ownership of a personal vehicle (past and future) and other transport alternatives such as public transport.

b) Methods

The LCM case study consists of semi-structured in-depth interviews with both carsharing users and stakeholders in Hungary, Italy, Norway, Poland and Spain. In each country, specific users have been identified by age, gender and whether or not they have children. Moreover, a preference towards electric carsharing was considered, if possible, according to each country's level of carsharing development.

Interviews with stakeholders have been conducted with representatives of the business sector, the public administration and associations. In all cases, flexibility towards the specific national context was granted and comparability of methods has been ensured.

c) Preliminary results

- Carsharing can be a driver of the transition **from property-based to access-based mobility**; it can complement a lack of **public transportation** and give access to new and **alternatively fuelled vehicles**, especially electric vehicles.
- Carsharing services seem to be more popular among young, medium-highly educated and medium-high income people.

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- Carsharing is mainly used for short leisure trips, especially on weekends or at night.
- The main motivations for using this service are:
  - **Convenience**: Carsharing is highly valued for its flexibility and speed compared to public transportation.
  - **Economic advantages**: It allows users to avoid the purchasing and maintenance costs of a vehicle and pay based on their use.
  - **New technology**: The service is appreciated for its innovative aspects, its new, technologically advanced electric vehicles and app-based systems.
  - **Environmental awareness**: For electric vehicles, many users cited environmental aspects as relevant, although maybe less important than convenience and economic advantages.
- Users appear in general to have a good opinion of electric vehicles and have a preference for carsharing services that provide such vehicles.
- Carsharing services seem to **help users live without a vehicle** or limit the number of vehicles in a household.
- From a societal point of view, carsharing is considered to be a **good complement to public transportation** and a good **way to promote electric cars** and electro-mobility.
- In all participating countries, carsharing appears to be a developing and increasing sector, in which the electrification of vehicles is present or expected for the future depending on the level of technological development.
- **Free-floating** (one-way) and **station-based** are the two **main carsharing business models**, along with **peer-to-peer carsharing**, which are platforms where users can share their private vehicles. The free-floating model allows vehicles to be picked up and parked in any place within a certain area, it is normally paid per minute of use and it targets trips within the city. Station-based carsharing requires the vehicle to be picked up and parked in a specific area, it is normally paid by the hour and targets daily trips outside the city. Free-floating carsharing often involves electric vehicles, while station-based carsharing seems to be sticking to conventional or hybrid ones due to higher requirements for vehicle autonomy.
- Both free-floating and station-based carsharing bring **benefits for low-carbon mobility**: the former model allows for the reduction of the number of conventional vehicles in urban areas and let users experience electro-mobility; users of the latter model seem to use more public transport (metro/tram, bus and taxi) in their daily routine, complementing this with carsharing when they need to go outside the city.

This is a preliminary summary of the results, focusing on the common methodology and results, although other insights may depend on the specific national contexts.

Factors influencing decisions related to heating & cooling

Lead Project partner [Rekk Energiapiaci Tanacsado KFT (REKK)]

a) Aims

Exploiting the huge energy efficiency potential represented by residential buildings depends not only on the availability of appropriate technological solutions but also on the investment decisions and energy-saving behaviour of households, which depend on their socio-economic conditions, habits, attitude, norms and values. The aim of this case study is to **gain insight into the**

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heating/cooling habits of households, their motivation and experiences related to energy efficiency improvements, their views on the barriers to reducing heating and cooling energy use, and their ideas on the possible regulatory measures and policies that could help overcome those barriers.

b) Methods

The case study builds on the **methodology of focus group** discussions combined with **participatory systems mapping**. Focus group discussions were conducted in France, Germany, Hungary, Spain and Ukraine, composed of homogenous groups in terms of expertise, location or social status. The method provided an opportunity for the **involvement of citizens in generating ideas and devising recommendations** on how to decrease heating and cooling energy consumption and related energy costs.

c) Preliminary results

The following 11 problems and possible solutions were identified in most of the participating countries:

1. There is a need for easily understandable, clear information related to simple everyday measures, such as how to set thermostats, proper ventilation and how to avoid mould formation, the hydraulic adjustment of radiators, etc.
   Possible solution: Communication strategies on energy consumption and everyday good practices developed by public authorities. Organising discussion groups by local authorities or civil society organisations to help the exchange of good practices among people facing similar problems.

2. It is challenging to provide information on renovation and heating system refurbishment, as information sources often contradict each other and there is a lack of trust in renovation professionals.
   Possible solution: Information exchange on platforms related to energy efficiency is helping to identify reliable professionals and independent experts. Good practices for renovation could be shared through an EU platform, e.g. one linked to the EU Energy Poverty Observatory.

3. Information provided on bills is complicated and not easily understandable. Some consumers already find there is too much information.
   Possible solution: Energy savings could be expressed in monetary terms on the bill. Easily understandable, eye-catching graphs comparing consumption to that of other time periods and/or neighbours could induce energy saving.

4. Conflicts exist among neighbours when heating needs take neighbouring tenants into consideration, especially when it is not possible to control the heat individually, as in the case of district heated dwellings.
   Possible solution: Installing controllable heating equipment and individual meters to ensure the just division of costs.

5. District heating is not necessarily more efficient, due to the bad quality of heat distribution systems, high room temperatures because of non-controllable radiators and the resulting need for more ventilation by opening windows.
   Possible solution: Installing controllable heating equipment and individual meters to ensure the just division of costs. Refurbishment of heat pipelines.

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6. It is difficult to find solutions to the tenant/owner problem: conflicting interests hinder renovation activities.
   Possible solution: Incentives should be provided for owners to improve the energy efficiency performance of the dwellings they own. It is a question whether incentives or obligations would work better.
7. Questions related to comfort: There is a difference in the behaviour of household members regarding the appropriate temperature (e.g. thermostats set high, wearing T-shirts instead of putting on warmer clothes).
   Possible solution: Education on how to program thermostats, making wearing warmer clothes at home fashionable, and making the right behaviour 'trendy'. An awareness-raising campaign regarding healthy indoor temperatures. Presenting calculations on how much energy/money citizens can save by lowering the temperature by 1 degree Celsius.
8. Distorted prices for final consumers and/or subsidising energy bills for the disadvantaged decrease the motivation to save energy.
   Possible solution: Consumers pay more attention to their level of consumption if they are made at least partially responsible for their energy costs. Higher prices lead to more energy savings.
9. Cost awareness is not always connected to environmental awareness, and the desire to decrease costs may also result in unsustainable practices (e.g. heating with lignite or garbage).
   Possible solution: Information campaigns on beneficial and also on unsafe/polluting energy-related practices could raise awareness among citizens. Education should combine economic and environmental thinking.
10. Old, damp houses in historic districts are difficult to renovate, as there is a risk of ruining the architectural style. In rural areas, especially in Eastern Europe, the bad condition and low housing values compared to the cost of renovation makes refurbishment economically unfeasible.
    Possible solution: There is a need for solutions that enable the improvement of the energy performance of old houses. There is also a need to subsidize the renovation of old houses and help disadvantaged people move to modern buildings.
11. There is a lack of initial capital, even where available subsidies cover some part of the overall costs of renovation.
    Possible solution: Information should be provided on how to find and how to apply for funding and support. Funding should be offered to help low-income people renovate their flats.

From consumer to prosumer

Lead Project partner: Cicero Senter Klimaforskning Stiftelse (CICERO)

a) Aims

This case study addresses the process of transformation in households that go from being **conventional electricity consumers and invest in solar technology systems in order to produce their own electricity and sell the excess electricity produced back to the main electricity grid**. The objective of this case study is twofold: 1) Provide a mapping of prosumers and

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related gender ideologies in the case study partner countries of Italy, Norway, Serbia, UK and Ukraine; 2) Provide an analysis of prosumers' motivations, experiences, and energy use. The purpose of this analysis is to understand gender relations, and how and why energy practices and behaviours differ within and across households as well as societies, and the implications this may have in the countries involved. This case study emphasizes the importance of **forward-looking policymaking and planning to understand and promote prosumption and people's choice to opt for environmentally friendly energy solutions.**

b) Methods

This analysis of the case study is based on **qualitative methods**. The mapping of prosumers and related gender ideologies is based on a selection of campaign material for household solar PV systems; media articles and interviews with prosumers; and media articles on policies and prosuming regulations. The material was found by searching in national or international databases for news articles and through Google searches. The analysis of prosumers' motivations, experiences, energy use and the significance of gender relations is based on in-depth semi-structured **interviews with households**. The material was gathered from both rural and urban areas across the countries to the greatest possible extent. Interviews were scheduled with women and men separately (with a few exceptions) so that all adult members of the household would have an equal opportunity to inform the researchers about their motives, experiences and gender relations. Most households also kept **journals** detailing their everyday energy use and practices, as well as energy-related negotiations within the household during the week prior to the scheduled interviews.

c) Preliminary results

There is great variation in the contexts of becoming a prosumer among the samples from the different countries. The UK and Italy have a long history of incentive tariff schemes, which has resulted in high uptake of PV systems in private homes. In Ukraine and Norway, on the other hand, the number of prosumers is still relatively low - between 1000-3000 - and subsidies and incentive tariffs are more recent and/or lower. In Serbia, the regulations regarding prosumers have not yet been harmonized, and no households and persons fit the definition of prosumers (selling excess produced electricity back to the main grid). Estimates indicate that about 385 households in Serbia are producing electricity for their own needs from PV systems.

What prosumers in all countries have in common is that they are predominantly **middle to upper class and at least 30 years old**. In the UK, Norway and Italy, the majority of prosumers are above 50, while in Ukraine and Serbia the majority are between 30-50. Most also own their own house and live in suburban or rural areas, meaning they have the financial means to invest in their own solar PV systems. In Norway, Italy and Ukraine, the sample shows that prosumers often have a higher level of education and work in the energy sector or a similar area.

Another thing that all countries have in common is that **prosumers, with very few exceptions, have only had positive experiences of becoming prosumers**. Some noted that the bureaucracy and lack of subsidies are a problem, for example, one family in Serbia had a security issue due to a system malfunction. In Norway, there is a lack of skilled enterprises in certain regions, which makes the process more difficult. In the UK, many interviewees mentioned that their installer or other installers in their area had gone bankrupt or quit the solar sector, making it more difficult to obtain guarantees and build trust.

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Prosumers' motivations also vary. In Italy, the UK, Ukraine and Serbia, investing in solar PV systems is driven by **financial reasons**. In Ukraine, some households have opted for this instead of saving, as this would provide a 'passive income'; for others this entails lower energy consumption costs. In Norway, the upfront costs are still too high (even with a national subsidy scheme) to be seen as a good economic investment, but many stressed that if and when electricity prices go up they will be in a good position and the repayment period will be significantly shortened. In all countries, **environmental reasons are seen as an important motivation** (along with financial reasons), though many in the UK, Ukraine and Serbia are only motivated by financial reasons. In Norway and Ukraine, several of the prosumers interviewed became prosumers because of **professional or technological interests**. Both this study and a previous study of prosumers in Norway show that a significant number of them work in the energy sector. In Serbia, most of the prosumers interviewed live in or have second homes in rural areas where there is no central grid and therefore few other options for electricity. It is difficult to **discern any particular gender** difference in motivation, though there are indications that women are more concerned with environmental aspects, while men focus on technological or financial aspects.

This case study **focused particularly on gender and gender relations** concerning the process of going from consumer to prosumer. For most prosumers, the decision to invest in solar PV was taken jointly by husband and wife, but, more often than not, the husband or male relatives in all country samples drove the process (in terms of research, practicalities and bureaucracy). In Norway and Ukraine, a significant number of prosumers work in the energy sector or are professionally interested in the technology and therefore had higher levels of motivation, interest and skill than their spouse. In Norway, two of the prosumers working in the energy sector are women (and they drove the process), while six are men. In Norway and Serbia, some prosumers did the installation themselves and consulted with male family or networks in this process. In the Norwegian sample, two of the prosumers interviewed - who also work with household PV systems - noted that when the upfront costs are high, family members weigh the investment in solar PV systems against other priorities and therefore it is necessary to engage women as well when selling such systems.

Over the course of interviews and the collection of journals, this case study looked at how household space and household work is gendered and how this influences decisions regarding the implementation of new technology in the household. Most households stressed that they perceive themselves as **gender equal, though some would point to the washing room (for washing clothes) and kitchen as female spaces and workshops as a male space**. Several also see solar technology as a 'male' thing as men are perceived as more interested in technology, or because household renovation is seen as their responsibility. The journals illustrated that it is predominantly women who do the cooking and washing of clothes, but that men also frequently perform in these tasks.

Several prosumers noted that they had changed their energy consumption habits after becoming prosumers. They now **monitor their production and consumption more closely and have shifted their load to daytime energy use as much as possible to use the electricity they produce**. Still, as noted in the UK and Norway, prosumers can be categorised into identifiable groups: Either the prosumers are unwilling to modify their habits, or they are already very energy-conscious and use energy carefully, making it difficult to achieve additional savings. In the first situation, the households decided to become prosumers mainly in order to accommodate their habits and make them cheaper. This is also the case for the prosumers in Italy, Serbia and Ukraine.

The preliminary findings of the case study indicate that **incentive tariff and subsidy schemes are vital to scale up PV solar systems for domestic use (and the business sector) in Europe**. The

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case study also indicates that gender relations play an important role in this, as women often do not take an active part in the process of becoming prosumers. If **women lack 'ownership' in these processes it is likely that they will prioritise other investments.**

5. Scenario and model development

The literature review, surveys, randomized control trials and participatory foresight exercises produce findings about the economic, behavioural, cultural and socio-demographic factors that drive the take up of energy technologies, which in turn give us an insight into the types of policies that could influence these drivers. On the basis of these findings, CE is developing an outline for a series of models that **will assess macro-level outcomes from micro-level scenarios, which will be developed as part of the transition visioning workshops**.

Changes in individual behaviour lead to changes in individual energy demand. To model the economy-wide (macro) energy demand from changes in individual demand, we need to aggregate the energy demands of individuals. Data on individual demand is not available, so our modelling approach focuses on the take up of specific technologies in each of the four areas under investigation in the ENABLE.EU project (mobility, electricity consumption, heating and cooling, and prosumers), from which reductions or increases in aggregate energy demand can be derived.

To do this we will develop a suite of technology diffusion models based on our in-house **FTT (Future Technology Transformations)** model**. Certain aspects of the model will be altered to reflect the decision process of individuals**. For example, some individuals may not be well-informed about the long-term economic and environmental benefits of a technology or may attach a negative bias to the future revenue of energy technology investments. They would therefore be far less likely to invest in the technology than, say, someone who is very environmentally aware.

FTT: Power is a technology diffusion model initially developed by J.-F. Mercure, for the power sector. It is the first a family of FTT models; FTT: Heat and FTT: Transports. It models the decision making process of investors/consumers wanting to invest in new technology but face a number of different decisions and constraints

Based on what we know from the research carried out as part of ENABLE.EU, we can design policies to influence these drivers and assess the impact on the take-up of a technology/technologies. In other words, the modelling scenarios will be developed to influence the behavioural characteristics (or other important factors) of individuals that have a strong positive effect on energy technology take up. **A different combination of policies or higher levels of the same policy can be put together to gain a comprehensive set of results, which we can then compare in the final stages of the project to enable critical analysis and policy recommendations**.

The take-up of these technologies and the resulting changes to aggregate energy demand have significant socio-economic impacts. A higher take-up of EV vehicles could reduce oil imports in many economies, but at the same time there may - under certain conditions - be some job losses in the car manufacturing industry of Europe, for example. The massive rollout of solar panels can result in considerable energy savings for households, but further socioeconomic benefits for the economy depend on where the solar panels are being manufactured.

Such impacts will be assessed in a second phase of the modelling, when the results from the

E3ME is a computer-based model of the world's economic and energy systems and the environment. It was originally developed through the European Commission's research framework programmes and is now used globally for policy assessment, forecasting and research purposes.

technology diffusion modelling will be used to provide inputs to CE's E3ME model and REKK's energy market models (EEMM and EGMM). This will provide insight as to the role economic, sociocultural, demographic and behavioural factors play in meeting the goals of the Energy Union and will allow for a quantitative assessment of the outcomes of the scenarios against the goals of the Energy Union.

The European Electricity Market Model (EEMM) is a power market analysis tool. The model simulates the workings of 35 European electricity markets, assuming perfectly competitive market operation. The bottom-up model considers the production of 3000 power plants for 90 characteristic hours, and generates a merit order curve for each analysed country.

The European Gas Market Model (EGMM) has been used since 2010. The model simulates the workings of 33 European markets, considering network infrastructure constraints, long term contracts, domestic production, international LNG (liquified natural gas) markets and underground gas storage markets.

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