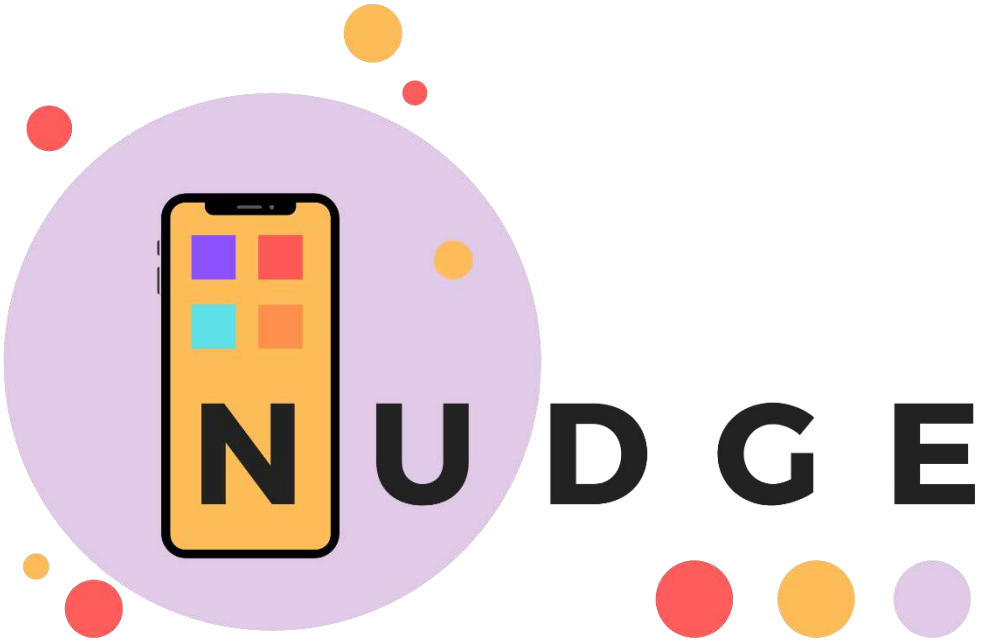


Nudging consumers towards energy efficiency through behavioural science

# Deliverable 5.4

# Compilation of policy briefs

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# Project information

| | |
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# Legal Notice

NUDGE

Nudging consumers towards energy efficiency through behavioural science

## About

Efforts to induce energy-friendly behaviour from end-users through behavioural interventions are characterized by a lack of customer personalization ("one-size-fits-all interventions"), a partial understanding about how different interventions interact with each other and contrasting evidence about their effectiveness, as a result of poor testing under real world conditions.

NUDGE has been conceived to unleash the potential of behavioural interventions for long-lasting energy efficiency behaviour changes, paving the way to the generalized use of such interventions as a worthy addition to the policy-making toolbox. We take a mixed approach to the consumer analysis and intervention design with tasks combining surveys and field trials. Firmly rooted in behavioural science methods, we will study individual psychological and contextual variables underlying consumers' behaviour to tailor the design of behavioural interventions for them, with a clear bias towards interventions of the nudging type.

The designed interventions are compared against traditional ones in field trials (pilots) in five different EU states, exhibiting striking diversity in terms of innovative energy usage scenarios (e.g., PV production for EV charging, DR for natural gas), demographic and socio-economic variables of the involved populations, mediation platforms for operationalizing the intervention (smart mobile apps, dashboards, web portals, educational material and intergenerational learning practices).

**The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957012.**

## Project partners

IEECP – Institute for European Energy and Climate Policy

beegy – the energy manager

imec

Οικονομικό Πανεπιστήμιο Αθηνών – Athens University of Economics and Business

inegi – driving science & innovation

Fraunhofer ISI

ZEZ – Zelena Energetska Zadruga

domx – IoT Technologies

Spring-Stof

Nudging consumers towards energy efficiency through behavioural science

# Table of Contents

# Foreword

The NUDGE project delivered a large variety of scientifc and applied results,which have already been and will further be exploited commercially and acemically, as pointed out in Deliverable 6.5.

At the same time, the results can play a major important role in informing policymakers on their way to desiging policies in a way that takes different types of energy consumers, their preconditions as well as behaviour insights into account. To this extend during the course of the project policy briefs have been develeoped. These policy briefs provide a condensed and easy to access entry point for policymakers and other stakeholders to the results from the NUDGE project. The following four policy briefs have been developed to provide evidence-based input to ongoing policy debates:

- Policy Brief #1: Profiling and nudging energy consumers to heat efficiently
- Policy Brief #2: How to nudge households effectivley and in a targeted manner to unlock hard to reach energy efficiency and flexiblity potentials
- Policy Brief #3: NUDging consumers towards enerGy Efficiency through behavioural science (NUDGE)
- Policy Brief #4: Empowering energy consumers by increasing their energy literacy

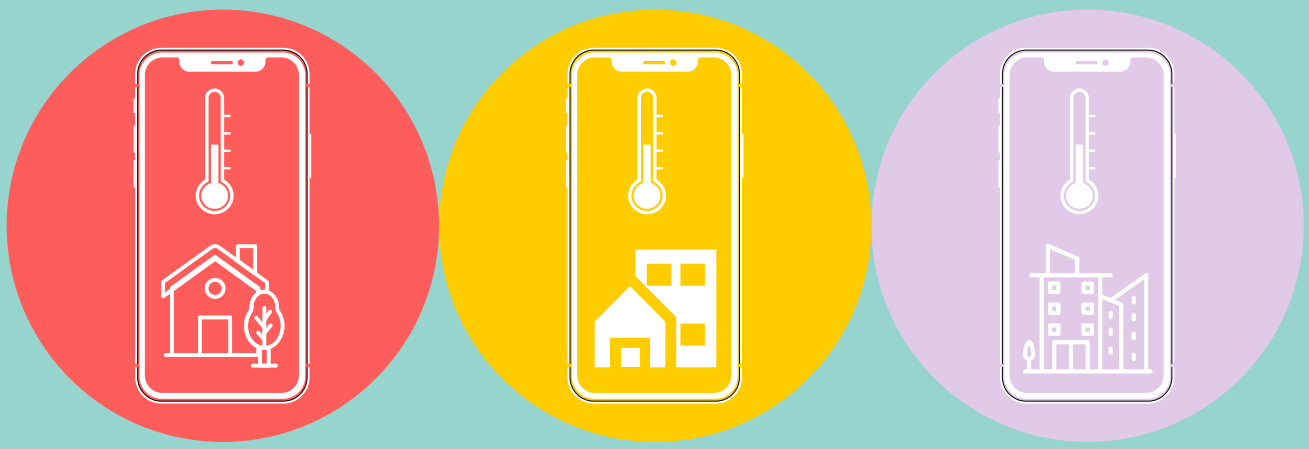
This deliverable compiles the four developed policy briefs to show how they have been and will be originally distributed to the policymakers and other stakeholders. A more in-depth provision of the derived policy recommendations can be found in Deliverable D5.3.

# Policy Brief #1: Profiling and nudging energy consumers to heat efficiently

NUDGE
Nudging consumers towards energy efficiency through behavioural science

# POLICY BRIEF

## Profiling and nudging energy consumers to heat efficiently



**NUDGE is set up to analyse people's behaviour, design and test nudging interventions in five EU Member States in households, energy communities and schools. All interventions are rooted in fundamental principles of behavioural science.**

**In NUDGE, a broad range of methodologies, tools and approaches are used: field experiments and surveys, qualitative and quantitative research methods, stakeholder consultation as well as automated and manual collection of pilot data. Most of the research and experimentation is focused on the design of policies and the formulation of recommendations specific to each country.**


**Authors:**

**Niklas Reinfandt and Heike Brugger, Fraunhofer ISI**


**January 2023**


This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 957012. The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither CINEA nor the European Commission are responsible for any use that may be made of the information contained therein.

# Heating demand plays a major role in Europe's GHG emissions and energy dependency

The **largest share of the household energy consumption** across Europe is **space heating**, with an average of 63% in the European Union (largest share at national level: 81% in Luxembourg). Even in countries with a majority Mediterranean hot-summer climate, such as Portugal, it represents a significant share of final energy consumption (30%).[1]

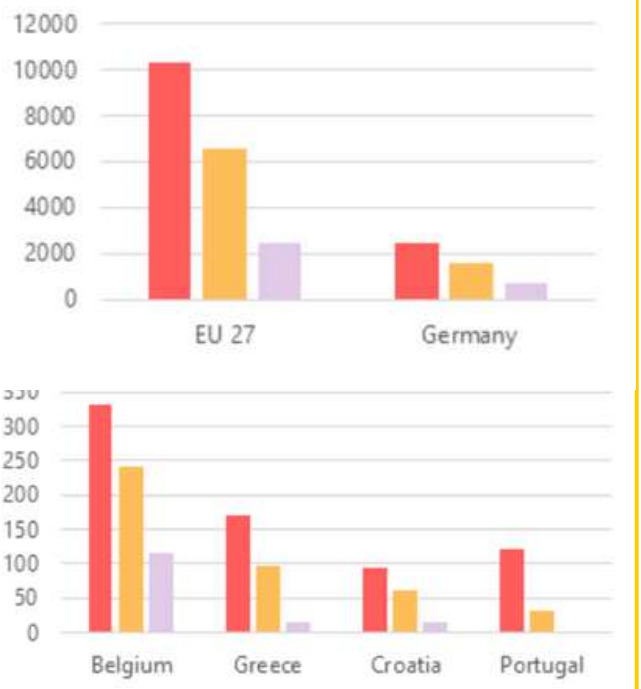
After local climate, the **second most important factor determining energy demand** (even more important than building characteristics) is the **behaviour of household occupants**. This is especially important in terms of heating and cooling. Thus, in order to fully exploit the potential for limiting building energy consumption, an understanding of occupant behaviours is essential.

Considering the fact that **households** as a whole are **responsible for 25% of greenhouse gas (GHG) emissions**, reducing heating-related energy consumption is an important task which contributes to Europe's overall efforts to reduce GHG emissions. Due to the high energy consumption of space heating described above and the **large share of natural gas** for space heating (EU 38%, Hungary 84,2 %, the Netherlands 84.9 %, Italy 59.5 %), the issue addressed here is also closely interwoven with the consequences of the Russian invasion of Ukraine. Thus, besides the reduction of GHG emissions, the reduction of space heating related energy consumption can also contribute to further highly pressing challenges:

- reducing dependence on Russian gas/fossil fuels, thus supporting the REPowerEU plan[2]
- helping households adjust to high energy prices and save energy to avoid high energy bills this winter

Therefore, aside from measures such as using more energy-efficient appliances or renovating homes, **understanding and changing user behaviour** (e.g. what motivates to turn down the heat) is an essential and impactful part of reducing energy consumption and is the **primary focus of this policy brief.**

Figure 1: Overview of the space heating-related energy use in Europe and the NUDGE-Project countries.




Final energy consumption in households 2019
Final energy consumption for space heating
Amount of natural gas in the final energy consumption for space heating [PJ]

Further remarks: the EU highly depends on natural gas imports from Russia: 75 % of natural gas in the EU residential sector used for space heating and 39 % of the extra-EU imports of natural gas in 2021 (share of trade in value) came from Russia (Eurostat, 2022). [3]

1. *Energy consumption in households - Statistics Explained (europa.eu)*
2. REPowerEU: affordable, secure and sustainable energy for Europe | European Commission (europa.eu)
3. *EU imports of energy products - recent developments - Statistics Explained (europa.eu)*

# What drives behaviour change in people's heating consumption?

One goal of the NUDGE project is to explore which (technical) interventions can motivate the **change of energy consumption behaviour** in households **without the use of financial incentives**. This can be achieved through so-called nudges. **Nudges** are a **way of influencing behavior through interventions and indirect suggestions** (such as push notifications, social comparisons, etc.).

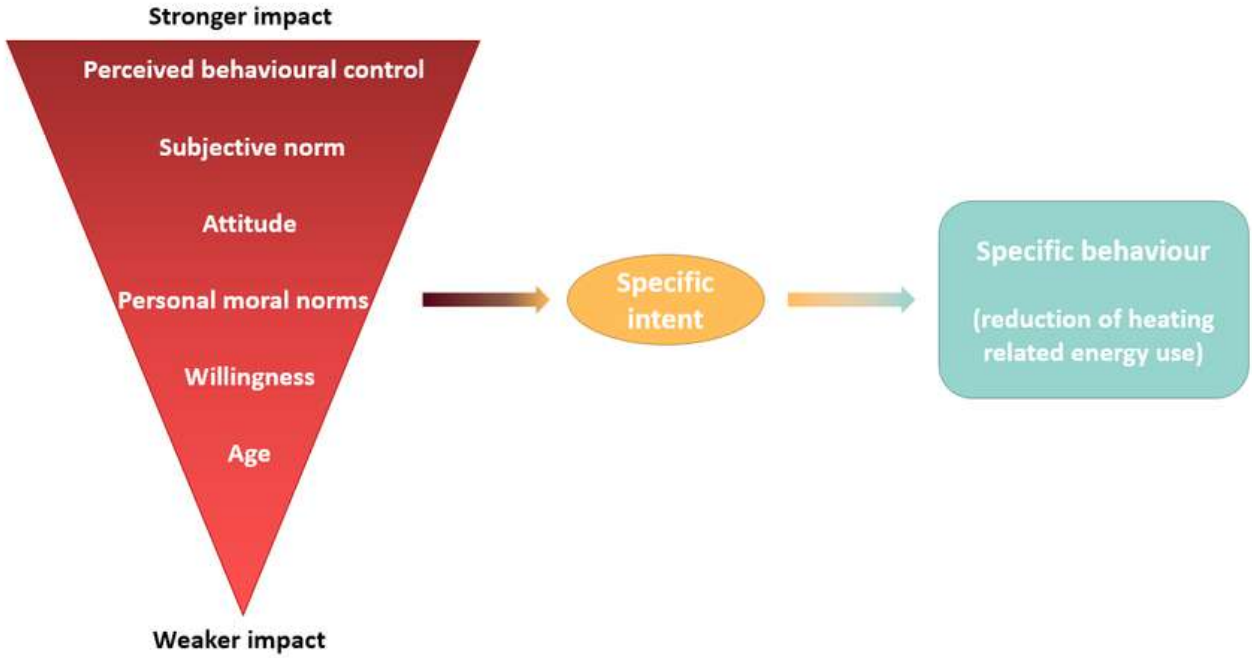
To design effective interventions/nudges, it is necessary to understand **which factors determine people's intent to reduce heating-related energy consumption**.

As a result of a large survey with 3129 respondents from 29 European countries, **6 important factors** could be identified and ranked according to their impact (see figure 2):

**Perceived behavioural control** (perceived ability to perform an activity), along with **subjective norm** (perceived social pressure to engage in an activity), are the two most important factors to consider if we want to understand and predict the intent to reduce heating-related energy consumption and to develop effective measures.

**Attitude** (impacted by financial concern, loss of comfort, energy knowledge and environmental concern), as well as **personal moral norms** (positively influenced by both the awareness of the consequences of an action for society and ascription of responsibility) and **willingness** (how positive is the perception of a person who performs the activity, and how similar to this person do you consider yourself to be) also contribute to intent, albeit to a lesser extent, while **age** has a small but negative impact on the intent.

Figure 2: Factors determining people's intent to reduce heating-related energy consumption



# How can policies address changes in heating behaviour?

On this basis, some general implication on how to design effective nudges or related policies to have an impact on the most relevant factors can already be obtained:

## Improving perceived behavioural control

Designing **information campaigns** and policies that directly address the customers is important to increase the perceived behavioural control (e.g., enabling easy and low-threshold access to information on **how to** achieve a specific goal; encouraging action by **showing examples** and enabling customers to take informed decisions). Additional suggestions of concrete and practical measures such as lowering the temperature by one degree,[4] switching off heating in unused rooms etc. can have a positive impact on habit formation and thus facilitate behaviour change.

If the European and national level is too far away from the customers to have a decisive influence, it is essential to use policy measures to **address intermediary actors** (such as energy service companies or energy utilities) and to hold them responsible, where practicable, to increase the perceived behavioural control of customers. Possible measures could include **additional information on invoices** or promoting the introduction of **smart meters**.

To allow customers to make informed decisions, **consumption data must be available to them in a timely and accessible manner** so that they can directly observe the impact of the energy saving measures they take.

Therefore, the status of information requirements, which allows consumption data to be reported as rarely as on an annual basis, should be altered through policies.

## Improving the impact of subjective norms

Emphasising the saving behaviour of others when attempting to reduce individual consumption can be an important component of possible measures. The current efforts to reduce Europe's energy dependency and to handle the high energy prices offer an opportunity to **closely link energy-saving behaviour with the individual's contribution to this goals**. Showing survey results, such as what percentage of people think energy conservation is important now, could be an important lever to reinforce the intent to reduce heating-related energy use.

## Improving attitudes

The results suggest that strategies to positively influence environmental and financial issues can have a positive impact on attitudes toward reducing energy consumption. However, care must be taken to **address fears of a loss of comfort** – it is important to ensure that consumption reductions affect comfort as little as possible.

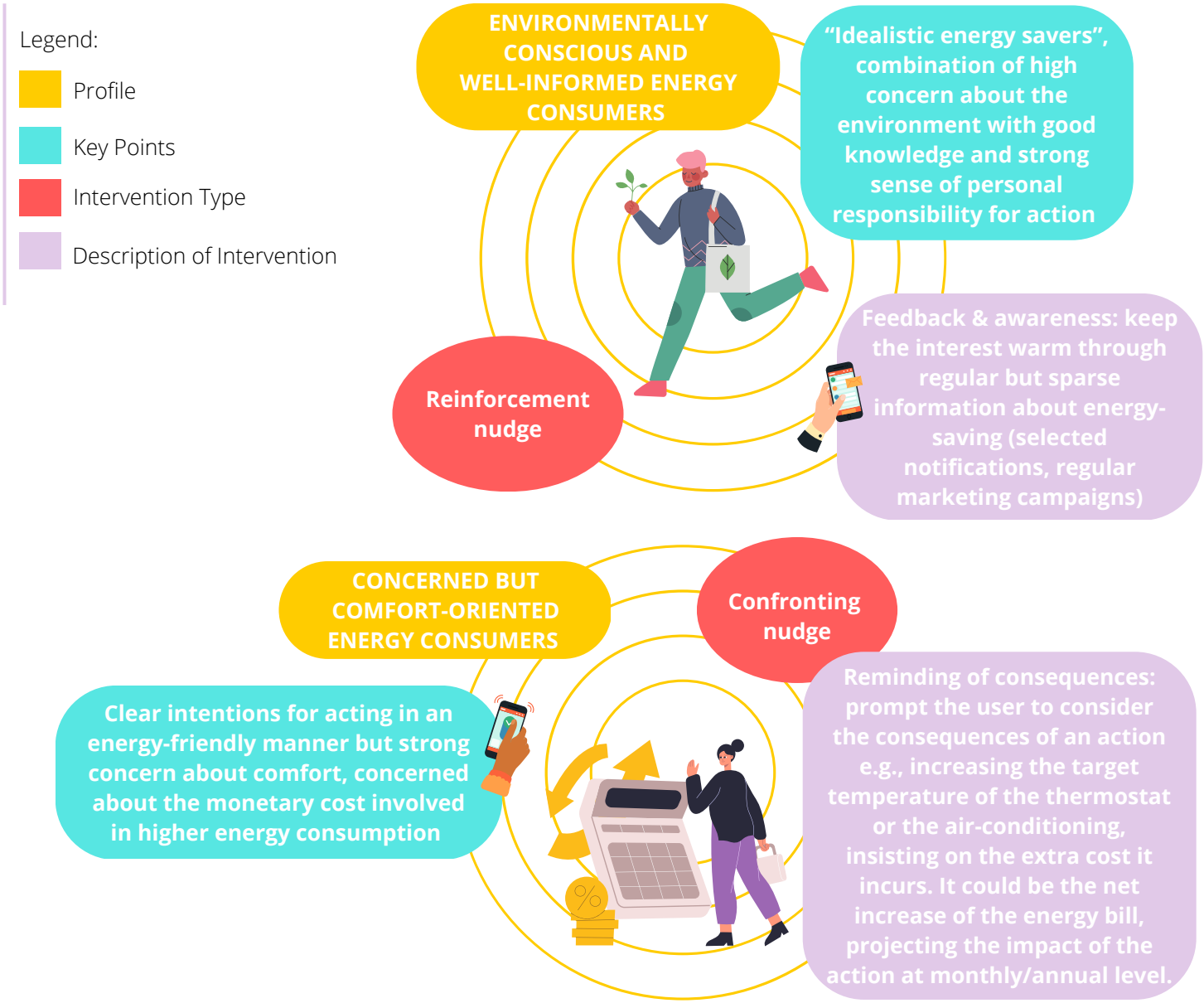
4. Playing my part (europa.eu)

# How can people be nudged towards heating efficiently?

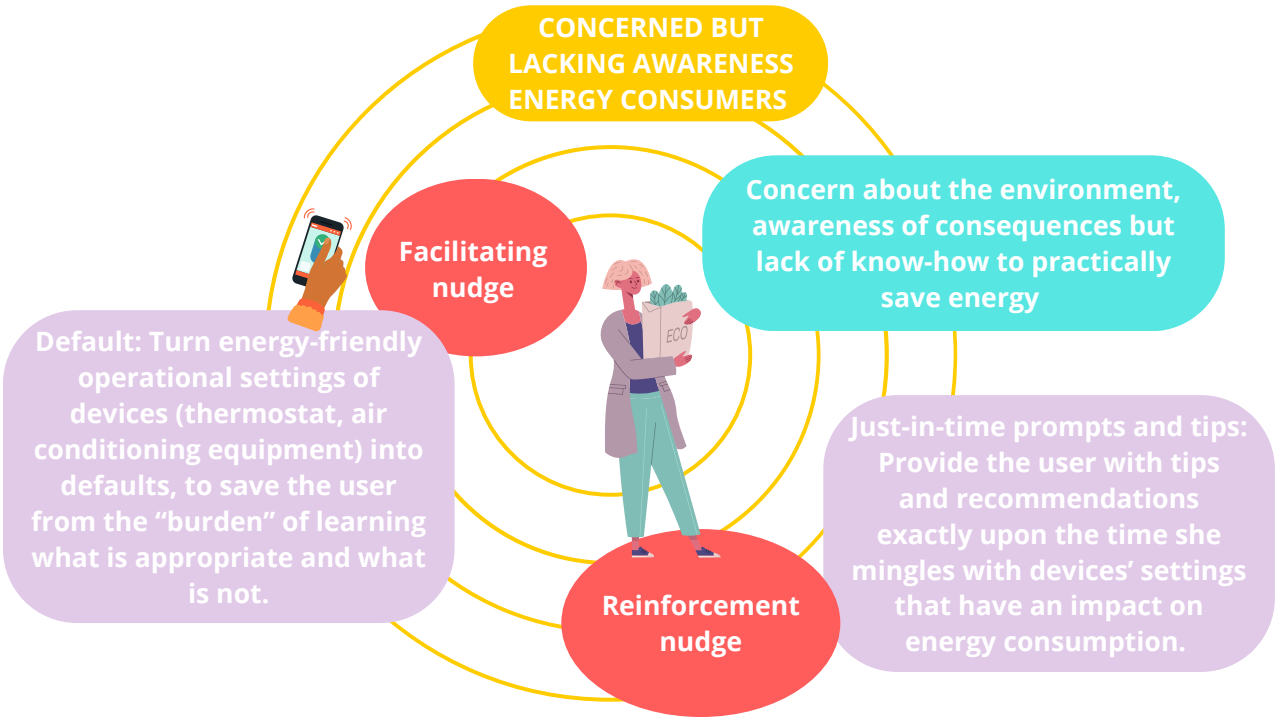
Due to the complicated **interplay of the six factors**, resulting in different profiles of energy consumers, a wider range of intervention types is needed to address all of them and to ensure successful nudges and design effective policies. Therefore, the creation of **energy-user profiles** and the mapping of users to those profiles would allow the creation of **different interventions tailored to users' behaviour**.

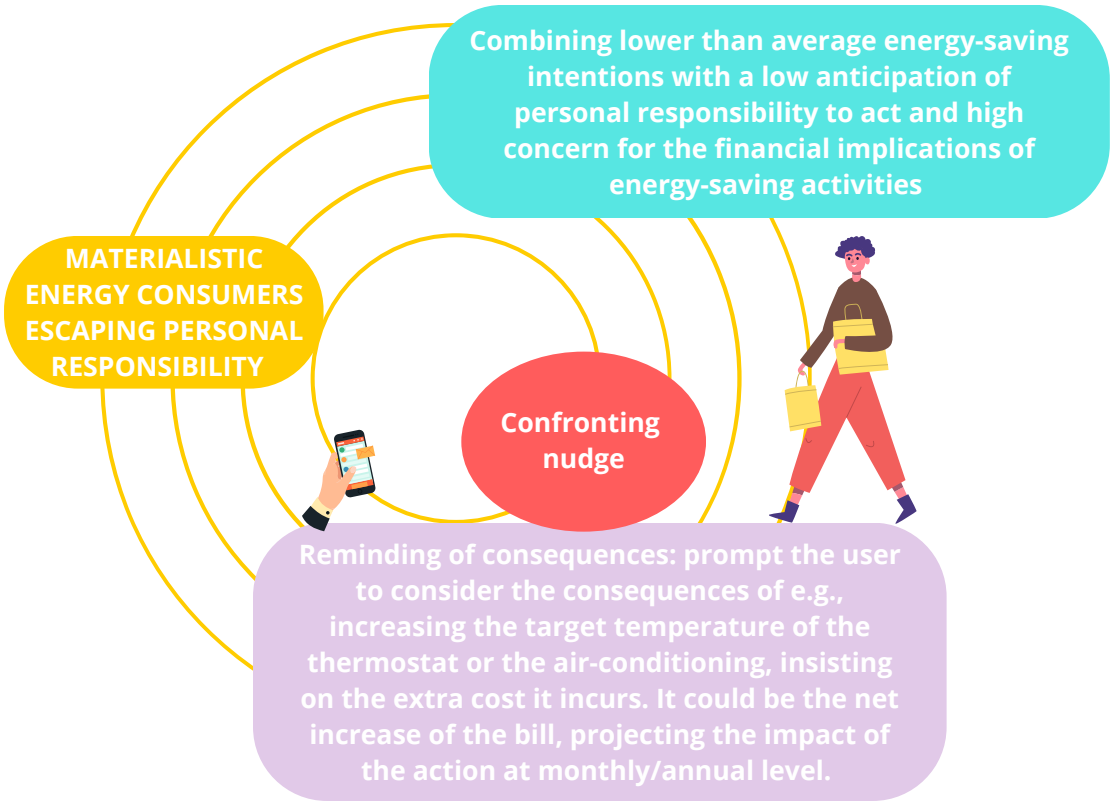
In the following, the six different types of energy users who were identified in the project are introduced, along with types of intervention that are likely to have an effect on their behavior.
Based on this, a **balanced policy mix** can be established, which can successfully contribute to a reduction of heating-related energy use with the help of nudges.

Figure 3: Adapted from NUDGE Deliverable D1.1, Profiling of energy consumers: psychological and contextual factors of energy behaviour, September 2021.



# How can people be nudged towards heating efficiently?



# How can people be nudged towards heating efficiently?

**PRONE TO SOCIAL INFLUENCE ENERGY CONSUMERS**

Low intentions for heating-related energy saving behaviour but strong sense of subjective norms, no distinct differentiation in other features.

**Social Influence nudge**

Goal setting & commitment: get the consumers to sign a formal commitment to reduce the energy they consume, many times in return of some (nonmonetary) reward.

Enabling social comparison: leverage different means (from written text and diagrams printed on a paper to online social platforms and dynamic query response systems) to facilitate the comparison with other peers (friends, neighbors, consumers of similar demographic characteristics).

**INDIFFERENT ENERGY CONSUMERS**

Low perception of self-efficacy and possible impact of personal action, low concern and awareness about environmental matters.

Feedback & awareness: use tips, notifications, marketing campaigns, to sensitize this group of users and overcome their reservations about the efficacy of their behaviour.

**Reinforcement nudge**

**Facilitating nudge**

Hedonic goal: stress the big picture and the impact on big things, possibly with some exaggeration, to render energy-saving a goal.

Default: Turn energy-friendly operational settings of devices (thermostat, air conditioning equipment) into defaults, to save the user from the "burden" of learning what is appropriate and what is not.

# Key learnings from studying behaviour changes in heating consumption

| | |
|---|---|
| **The behaviour of household occupants is the second most important factor determining energy demand (even more important than building characteristics).** | **People differ in their energy using profiles (including their motivations to use or safe energy) and therefore require different approaches to nudge them towards energy efficiency.** |
| **People's motivation to change behaviour depends on the following six factors: Perceived behavioural control, subjective norm, attitude, personal moral norms, willingness, age.** | **Policy design shall make an assessment of the impact of policies on the various types.** |

## Further Reading

- Nudge • Nudging consumers towards energy efficiency through behavioural science (nudgeproject.eu)

- NUDGE Deliverable D1.1, Profiling of energy consumers: psychological and contextual factors of energy behaviour, September 2021

NUDGE

Nudging consumers towards energy efficiency through behavioural science

## NUDGE PARTNERS

## FOLLOW THE PROJECT

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www.nudgeproject.eu

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# Policy Brief #2: How to nudge households effectively and in a targeted manner to unlock hard to reach energy efficiency and flexiblity potentials

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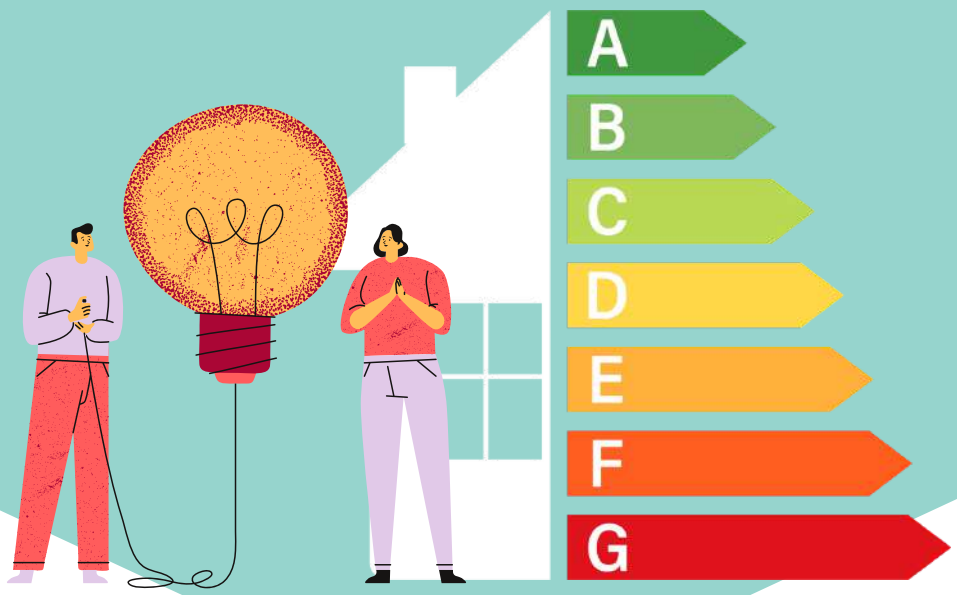
Nudging consumers towards energy efficiency through behavioural science

# POLICY BRIEF

## How to nudge households effectively and in a targeted manner to unlock hard to reach energy efficiency and flexibility potentials

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**co-author:**
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**November 2023**

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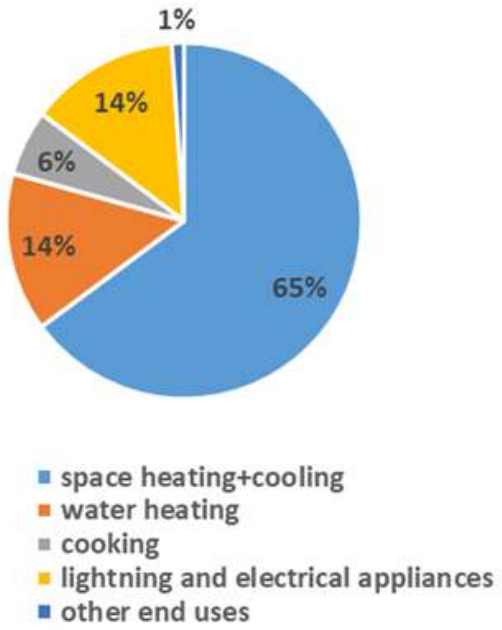
# What is the issue and why is it important?

In order to successfully implement the energy transition, households will have to play an essential role. In 2021, **households** accounted for **27% of final energy consumption** in the EU [1]. The distribution among the different end-uses is shown in Figure 1.

**Figure 1:** The distribution among the different end-uses.
*Source: Eurostat: Energy consumption in households - Statistics Explained (europa.eu).*




However, the housing sector poses a **major challenge** due to its complexity, its diversity across the EU (e.g., strong differences in the respective shares of different energy carriers as well as the shares of different end uses) and its dependence on the behaviour of household occupants.

After local climate, the **second most important factor determining energy demand** (even more important than building characteristics) is the **behaviour of household occupants**. This is particularly important in relation to heating and cooling, the predominant energy-consuming activities in households.

Another significant level of complexity is added by the **increasing number of prosumers**. Prosumer households are households that produce their own energy (mostly via photovoltaics) and use this energy directly for their own energy needs. This can offer new opportunities in terms of a more flexible energy system and the integration of more renewable energy sources, but also poses new challenges in terms of grid stability or the implementation of appropriate regulatory conditions.

**Overall, behaviour can have a significant impact and address several urgent needs:**

- Reducing energy demand and greenhouse gas emissions in the residential sector.
- Unlocking hard-to-reach flexibility (for prosumers) and energy saving potentials.
- Helping households adapt to high energy prices and tackle energy poverty.

[1] Energy consumption in households - Statistics Explained (europa.eu)

On a large scale, behaviour can be influenced through regulations or financial incentives. However, a more targeted influence on behaviour, without the use of intensively discussed regulatory or financial instruments such as bans or higher prices, is also possible via so-called nudges. **Nudges** are a way of influencing the behaviour of energy consumers through (technical) interventions and indirect recommendations (e.g., default settings, social comparison, provision of information), making subtle changes to the choice architecture **to guide people towards better decisions** (without forbidding any option or significantly changing their economic incentives).
Unfortunately, **delivering such nudges in a targeted and effective way is very difficult** and faces several challenges:

External conditions (legal framework, market conditions (prices, etc.)) with much stronger impact (potential).

High heterogeneity in behaviour/profiles of energy consumers, including different levels of self-motivation, knowledge about and interest in energy matters, thermal comfort

Difficulties in consistently monitoring and evaluating their effectiveness.

The important question is therefore:

**How can nudging be used to best support the achievement of climate and energy policy goals in households?**

# What we did in the NUDGE project

The NUDGE project focuses on three main areas, the results of which serve as the basis for the recommendations in this policy brief:

**Understanding the behavioural factors that influence energy consumption.**

NUDGE has **conducted surveys, interviews, and focus groups** with end users to understand the factors that influence their energy consumption. It has taken a mixed approach to the consumer analysis and intervention design with tasks combining surveys and field trials. Firmly rooted in behavioural science methods, it has been studying individual psychological and contextual variables underlying consumers' behaviour to tailor the design of behavioural interventions.

**Designing nudging interventions**


NUDGE **designed a variety of nudging interventions** that can be used to encourage people to use less energy. These interventions have been based on the tools and insights from behavioural science, such as defaults, framing, and social norms and can be delivered through different channels (smart mobile apps, dashboards, web portals, educational material and intergenerational learning practices).

## Evaluating the effectiveness of nudging interventions

NUDGE has **evaluated the effectiveness of the nudging interventions** in **five different field studies** across Europe. The settings involved several different targets of the nudges:

Interdisciplinary project-based education on home energy consumption for children in Belgium

Efficient control of heating and DHW preparation for Natural Gas consuming boilers in Greece

Optimization of EV charging with self-produced PV power in Germany

Healthy homes for long-lasting energy efficiency behaviour in Portugal

Promoting distributed self-production for local energy communities in Croatia

# What did we learn? What can policy makers do?

Based on our research and the relevant scientific literature, several recommendations can be derived in response to the question: "How can nudging be used to best support the achievement of climate and energy policy goals in households?"

## How to nudge efficiently

### Be aware of different energy user profiles (...or there is no one-size-fits-all nudge!)

People differ in their energy consumption profiles (including their motivations to use or save energy) so that different approaches may be appropriate to nudge them towards energy efficiency. Therefore, it is always important to implement a mix of several different nudges to be able to target all energy consumers. More details on this issue are given in NUDGE's first policy brief.

### Be aware of the bigger picture (...or don't miss the forest for the trees!)

To design effective nudges, it is essential to understand the interplay between energy-saving behaviour, the respective nudges and external conditions such as the regulatory framework (see below). This understanding is also important to be able to adapt to changing circumstances regarding the energy system (e.g., new technologies or changing external conditions). During the NUDGE project this was the case due to the corona pandemic and the increasing energy prices, which both had a large impact on people's energy consumption behaviour [2].

[2] In general, it can be observed in the project that the magnitude of the effect of nudges is in the range of 0.4 to 3.5%, while, for example, the influence of rising energy prices and the associated public discussion in 2022 had significantly stronger impacts (effect overlaps). Behavioural changes could be observed e.g., in the German pilot project (increased investment behaviour in PV panels). As a result, the explanatory power of the models increases substantially after controlling for general differences across households and time periods.

### Offering users real-time insights into their energy consumption (...or don't leave energy consumers in the dark!)

Real-time feedback on energy consumption is one of the most important building blocks for raising energy consumer awareness and empowering consumers to understand and adjust their consumption behaviour [3]. One way to implement this are digital infrastructures such as smart meters and other smart sensors, which would even allow personalized information and interventions based on the energy consumption behaviour. It is therefore essential not only to accelerate the roll-out of smart meters across Europe (see also Monitoring), but also to make the data available to end users as close to real time as possible.

### Use default settings and/or naturally occurring situations to nudge people as efficiently as possible (...or keep it simple!)

Energy consumers highly differ in their motivation to save energy or even to deal with the topic. In addition, for most people it is hard to find time in their day-to-day life to approach new topics. Therefore, it is important to deliver nudges in as low-threshold, easy, and time-saving manner as possible [4].

This can be done by using naturally occurring situations (energy bills, heating maintenance, etc.) or already existing channels to implement nudges instead of preparing additional new channels [5]. Also default nudges with easy opt-out/opt-in options (see ethical aspects) are a potentially efficient way to approach this issue [6]. An important tool to implement efficient default nudges is the digital infrastructure. Especially smart meters and other smart sensors would be able to implement energy saving settings as a default (opt-out) or easy opt-in option and to deliver low-threshold just-in-time interventions as reminder for certain energy saving behaviour based on the respective energy consumption behaviour. However, this approach also relies on hardware such as smart meters, further underlining their importance.

[3] Within the framework of the project, this was implemented by installing smart meters and providing corresponding apps and dashboards for data analysis. The user data showed that the acceptance/use of this information provision was highly dependent on the user-friendliness of the corresponding platforms.

[4] Usage of the tools typically spikes at the beginning of the interventions, but then levels off quickly. Those users who only open the app once at this intitial point could be treated more effectively with a default nudge (which is also effective if they don't use the tools frequently), because the window of opportunity for catching their attention is very short.

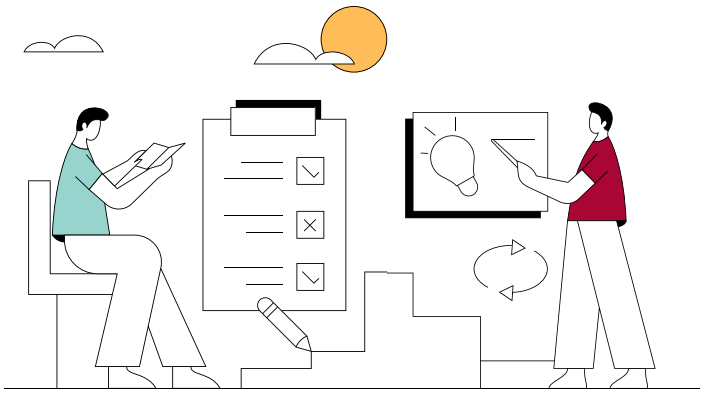
[5] Not all pilot participants were eager to interact with the mobile apps that were used to deliver the nudges. Instead,part of the pilot participants ranging from 5% up to 25% (in the Greek pilot) did not interact at all with the mobile app, despite downloading it and installing it on their smartphones. In the same pilot, several pilot participants counterintuitively preferred to manually set the thermostat temperature rather than use the app to tune it.

[6] 75% of the eligible users activated the opt-in feature in the German pilot, which is higher than the overall usage of the nudge tools on average. This could be even increased by the use of a by default activated opt-in option (but with easily accessible opt-out actions)

### Nudges are more effective when new behaviours are formed instead of improving existing ones (...or the early bird gets the worm!)

Behavioural interventions, as integral components of energy policy, should not remain static but evolve in tandem with the emerging technological landscape. This adaptability is crucial for ensuring that these interventions retain their relevance and effectiveness over time. Thus, it is important that policy makers take responsibility for anticipating and proactively preparing for these changes. This forward-looking approach requires a comprehensive understanding of **new technologies, market dynamics and consumer behaviour**. Such insight enables policymakers to formulate policies that are not only effective today, but also resilient and adaptable for the future.

More specifically, this suggests e.g., implementing nudges while EVs and other electrified residential technologies are still emerging and new routines are created around them [7]. As these emerging technologies already have a digital interface, nudges could also be integrated at low cost.



### Consider ethical aspects (...or don't act paternalistic!)

Ethical considerations, consumer protection and data protection are of paramount importance and include issues such as informed consent, transparency and respect for autonomy. These principles are essential to ensure that individuals are fully informed about the interventions, their purpose and the data collection procedures involved, and to avoid possible negative reactions, e.g., due to interventions that may be perceived as too paternalistic.

## How to monitor the impact of nudges

### Strong link between nudge and energy-saving rationale (...or keep it simple again!)

The project results show that, due to the often small effect sizes, it is important to ensure a strong and direct link between the intervention and the observed (energy-saving) behaviour. When considering more indirect effects or longer chains of intervention effects, a clear attribution of the identified effect on the monitored parameter to the intervention will most likely not be possible (due to (too) small effect sizes and (too) many other, external influencing factors). It is therefore important to be aware of realistically achievable effect sizes and to select accordingly the appropriate KPIs to be monitored [8].

[7] In the German field experiment, we could measure energy savings in the order of 11-13% thanks to higher use of self-generated energy for EV charging, with a default nudge that was oriented to EV owners. This is substantially higher than the increase of self-generated consumption we achieved in the general case.
[8] Evidence for the importance,of appropriate saving rationals and KPI's is given by the Belgium and Portugese pilots. See also: D2.3

## Use of digital infrastructure to allow long-term monitoring (...or stay interested, even in the long run!)

Continuous long-term monitoring of energy consumption behaviour is essential to better understand different behaviour patterns and their possible adaption towards nudging (including possible rebound effects)[9] and other (external) circumstances (e.g., regulatory conditions, prices) [10], but also to find the best timing to deliver different nudges to different target groups [11].

Smart meters are a key building block here and are also essential for many other aspects of nudging (see above). It is therefore important to promote the roll-out of smart meters, but also other relevant digital devices or applications. For smart meters, recent data show an annual increase of 24% between 2014 and 2020. A continuation of this trend would mean that the EU would not reach 100% penetration until close to 2030, which would be far too slow to enable timely grid digitisation and effective implementation of behavioural interventions [12].

## Collaboration and knowledge sharing (...or combine your efforts and utilise synergies!)

Collaboration and knowledge sharing between government bodies, energy providers, technology firms, and consumer associations are essential components of successful behavioural interventions in complex and fast evolving regulatory and external conditions. Especially (anonymized) data sharing between different stakeholders is essential to understand consumer behaviour and its interplay with nudging and external/regulatory conditions.

## Monitor not only positive but also possible negative effects (..or be critical!)

In order to understand all dimensions of the impact of different nudges, it is important to monitor not only positive but also possible negative effects. This is particularly relevant in the case of potentially conflicting objectives (e.g., energy saving ovs. comfort) [13], to avoid unexpected negative consequences and to increase the acceptance and effectiveness of the nudges by adjusting them if necessary.

[9] Whether rebounds in energy consumption are environmentally detrimental is not clear and needs more research. For example, in the Croatian pilot, households increased their energy consumption either by using air-conditioning for heating (i.e., through ineffficient energy use), or by investing in heat pumps (climate-friendly electrification).
[10] The energy consumption patterns in the pilots are highly volatile in the short-run and driven by a seasonal pattern throughout the year. To get credible estimates that allow for a deeper exploration of these patterns, multi-year designs would be needed. For example, in the Greek and Portuguese pilots, even with a 1.5 year project, only 2 heating seasons are covered, of which the 2nd one was affected by the energy crisis.
[11] Depending on the chosen nudges and target groups, the different pilots in the project showed a clear dependency of the nudging effects on the time frame studied (e.g. effects of holiday seasons, effects of weather conditions, ...).
[12] Electricity | ECNO (climateobservatory.eu)
[13] Examples of such conflicting objectives are investigated in the Portugese pilot (energy saving vs. healthy homes).

## How to consider external conditions such as regulatory frameworks

**Nudges are effective in reinforcing policy-based incentives but not reversing disincentives (…or don't go/nudge against the flow!)**

If the external incentives (e.g., financial incentives through energy prices or regulatory aspects) and the nudging incentives are aligned, positive, reinforcing effects can be observed. However, misaligned regulatory conditions or comparable external aspects can offset nudging effects. As a result, it is important to….

**… Align behavioural interventions / nudges with external conditions. Therefore, it is essential to understand the impact of the regulatory framework and other external conditions (e.g., prices) on energy saving behaviour (…or know your setting!)**

Due to the effect size of nudging interventions and the fact that they can be easily shallowed up by external influences it is essential to understand the interplay between these different aspects and to identify possible negative [14] as well as positive interactions.

Only with this understanding can nudges be designed that are effective in targeting otherwise hard-to-reach energy saving or flexibility potentials, and that allow for positive spill-over effects between the behavioural intervention and external conditions by making sure that they are aligned and push for the same objective [15].

**Accompanying regulatory frameworks with digital tools and information can have a positive impact (…or explore co-benefits!)**

As nudges are effective in reinforcing policy-based incentives, they can be used to deliver to consumers information on important regulatory conditions with regard to energy consumption [16]. As a result, it could be shown, that people changed their respective behaviour. An important example could be to e.g., communicate information about the regulatory conditions with regard to energy consumption and self-consumption/production through smart meter apps or energy management systems.

[14] Both behavioural interventions and regulatory frameworks - or even their interplay - can have unexpected negative impacts on the energy consumption behaviour. As a result, it is important to identify such unexpected negative aspects with the aim to remove them either by adapting the respective framework or the relevant behaviour.

[15] Using the Croatian pilot, the interplay between regulatory conditions and behavioural interventions could be investigated. In Croatia, the regulatory framework (which has since been changed) led to financial disadvantages when PV electricity production was higher than electricity consumption. This had a significant impact on user behaviour and the effect of the nudges. In concrete terms, this led either to higher consumption or to a shutdown of the PV system (lower production). As a consequence, there were both positive (e.g. investments in heat pumps to increase electricity consumption and to be able to use the self-produced electricity more efficiently) and negative effects (increased (inefficient) energy consumption, limitations in the potential for generating renewable energy).

[16] The information delivered in the nudge project (e.g., in the Croation pilot) created a new level of transparency and easier control over the regulatory status for each participant. Therefore, nudging and similar information schemes can have a positive co-benefit: transparency.

# Conclusion and key findings

**Behavioural interventions** should be viewed as **integral components within broader energy policy frameworks**, as this approach enables a comprehensive and synergistic approach to energy conservation.

Here it is important to make sure that the **enabling conditions are set right to deliver and monitor behaviour change** (smart meters, channels to distribute energy knowledge and potential nudges, availability of data and knowledge about energy consumption behaviour).

By seamlessly **integrating behavioural insights with technological advancements**, policymakers can harness the full spectrum of tools at their disposal **to drive substantial and enduring energy savings**.

However, subtle interventions **require supporting regulatory, technical, and digital conditions**.

The other way around, restrictive self-consumption regulation, unappealing digital interfaces, and mal-functioning flexible technologies can easily overrule the small, positive nudging effects.

At the same time, if nudges are thoughtfully aligned to these conditions, they can **unlock hard-to-reach efficiency and flexibility potentials** [17].

## Further reading/ Literature

Knowledge-hub • Nudge (nudgeproject.eu)

[17] Orchestrating a grid-friendly operation of large consumption technologies, such as EVs and heat pumps, is a promising future case for nudges in light of emerging flexibility markets, digitalization and other grid regulations.

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# Policy Brief #3: NUDging consumers towards enerGy Efficiency through behavioural science (NUDGE)

NUDGE

Nudging consumers towards energy efficiency through behavioural science

# POLICY BRIEF

## NUDging consumers towards enerGy Efficiency through behavioural science (NUDGE)


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**November 2023**


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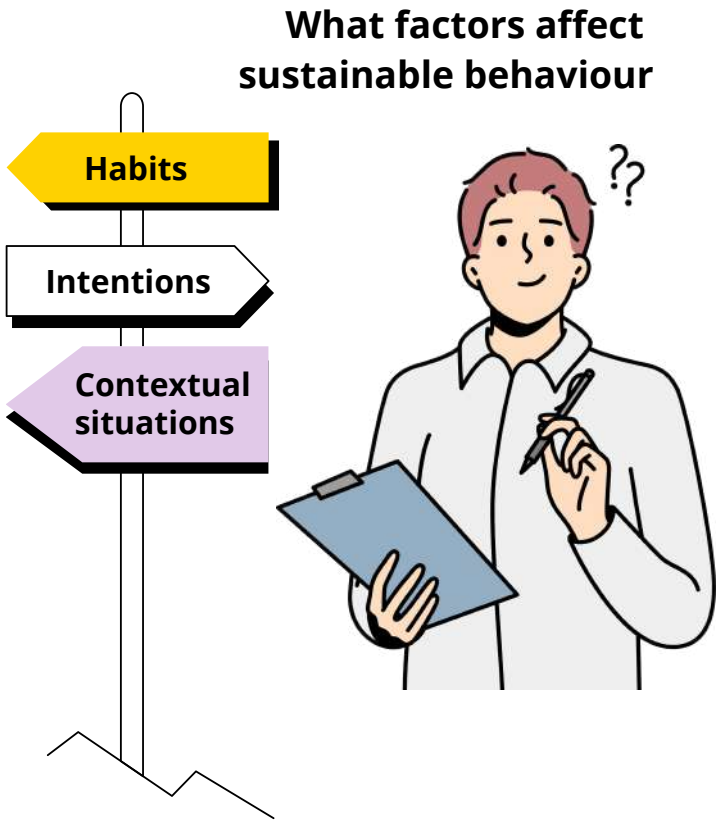
# Introduction

The promotion of sustainable behaviour in the field of housing energy saving is a complex issue influenced by several factors. **Behind every sustainable behaviour there are, in fact, influences stemming from both global and cultural factors as well as more distinctly individual factors. These include habits, intentions and contextual conditions.** In the field of energy saving, therefore, the provision of socially appropriate infrastructures for the realisation of a certain behaviour or the development of incentive policies are intertwined with the intentions of individuals towards sustainability issues, which are themselves **influenced by attitudes (certainty of results and evaluation of results), social factors (roles and norms) and affective factors (perception of self and loved ones) and established habits (frequency of past behaviour) in the field of energy consumption.**

The project **'NUDging consumers towards enerGy Efficiency through behavioural science' (NUDGE)** was conceived to unlock the potential of behavioural interventions for lasting behavioural changes in energy efficiency, paving the way for the widespread use of such interventions as a valuable addition to the policy toolbox.



To this end, a Europe-wide survey (available in 15 languages and filled in by more than 3,000 people in 29 countries) was first carried out with the aim of **gaining a better understanding of energy consumers' behaviour in relation to energy efficiency and the factors that act as barriers or facilitators to energy saving.**

The survey identified six different consumer profiles and based on their distinct characteristics, the most appropriate nudges were defined, which are described below.

**Table 1 : Energy consumer classes**

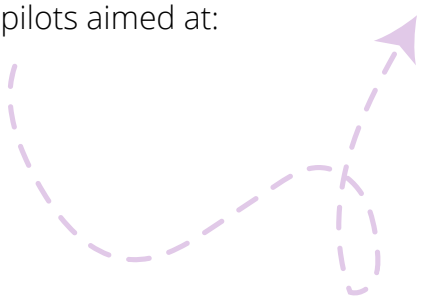
| Consumer profile | Type of Nudge | Description |
|---|---|---|
| Environmentally conscious and well-informed energy consumers | Reinforcement | Feedback and awareness: maintaining interest through regular but infrequent information on energy saving |
| Concerned but comfort-oriented energy consumers | Comparison | Remind of the consequences: Invite the user to consider the consequences of an action, e.g. raising the temperature of the thermostat or air conditioning, insisting on the additional cost involved. |
| Concerned but unaware energy consumers | Facilitating | Default: turn the energy-saving settings of devices (thermostats, air conditioning systems) into asettings, to spare the user the 'burden' of learning what is appropriate and what is not. |
| | Reinforcement | Real-time hints and tips: provide users with hints and tips exactly when they interact with device settings that have an impact on energy consumption. |
| Materialistic energy consumers who shirk their personal responsibilities | Comparison | Remind of the consequences: Invite the user to consider the consequences of an action, e.g. raising the temperature of the thermostat or air conditioning, insisting on the additional cost involved. |
| Energy consumers prone to social influence | Social influence | Enabling social comparison: using different means to facilitate comparison with other peers (friends, neighbours, consumers with similar demographic characteristics). |
| | Social influence | Target setting and commitment: getting consumers to make a formal commitment to reduce the energy they consume, often in exchange for a (non-monetary) reward. |
| Indifferent energy consumers | Facilitating | Default: turn the energy-saving settings of devices (thermostats, air conditioning systems) into default settings, to spare the user the 'burden' of learning what is appropriate and what is not. |
| | Reinforcement | Feedback and awareness: use suggestions, notifications, marketing campaigns, to raise awareness among this group of users and overcome their reservations about the effectiveness of their behaviour. |
| | Reinforcement | Hedonistic goal: emphasise the big picture and the impact on the big issues, possibly with some exaggeration, in order to turn energy saving into a goal. |

*Source: NUDGE - "Profiling of energy consumers: psychological and contextual factors of energy behaviour*

The results of the survey were used in the subsequent phases of the project, which involved the design and implementation of five field initiatives (pilots) to test a wide range of energy-saving behavioural interventions.

The interventions targeted consumers in **5 different EU countries** (Greece, Belgium, Germany, Portugal and Croatia), in **different environments** (residential, energy communities, schools), belonging to **different age groups** (including young children), belonging to **different income classes** (low, medium, high), served by **different energy carriers** (electricity, natural gas), with the inclusion of prosumers and drivers of electric vehicles.

Specifically, the pilots aimed at:



- Increasing self-consumption (Germany, Croatia);
- Improving energy knowledge (Belgium);
- Optimising the charging of electric vehicles with self-generated photovoltaic energy (Germany)
- Reducing heating-related consumption (Belgium, Portugal and Greece)
- Reducing electricity consumption (Portugal)
- Improving indoor air quality (Portugal).

Three nudging interventions were tested in sequence in each of the four pilot projects, excluding the Belgian one which provides educational nudges through courses during the school year. Most of the pilot projects started with nudging interventions that provided feedback on participants' consumption and aimed to increase their awareness. These were followed by more interactive nudges, particularly those with push notifications, just-in-time prompts, gamification or goal setting.

**Table 2 : Overview of Nudges**

| | Germany | Croatia | Belgium | Portugal | Greece |
|---|---|---|---|---|---|
| **Nudge 1** | Feedback and awareness | Stimulating empathy | Educational nudges and pupils as multipliers for two school cohorts | Feedback and awareness | Feedback and awareness |
| **Nudge 2** | Gamification and goal setting | Feedback and awareness | | Push notifications | Just in time' suggestions |
| **Nudge 3** | Default | Gamification and goal setting | | Push notifications, feedback and awareness | Push notifications |

*Source: NUDGE - "Final report on the evaluation of nudging interventions through pilot data*

The results of the pilots show some positive cases of energy savings ranging from 0.4 to 3.5 per cent and as high as 15 per cent in the case of nudges aimed at smart charging of electric vehicles.

# Evidence and recommendations

The promotion of new behaviour is an obstacle course whose outcome is never a foregone conclusion: even when the strategies adopted succeed in changing a person's attitude on a certain issue, this change is not always matched by the adoption of new behaviour. Furthermore, even if a strategy is successful in promoting sustainable behaviour in one group of people, it is not certain that the same strategy can be generalised to other groups of people or that it will be effective in the long term.

Although the experiments of the NUDGE project, through the pilots carried out in the five countries indicated, for the reasons already described, do not provide certain indications regarding the effects of the nudges used in terms of a substantial change in energy consumption behaviour, we feel we must reiterate the importance of continuing to support and implement actions and projects that go markedly in this direction, taking into consideration the criticalities that emerged both from the survey and from the pilots. Attention should be paid to the following critical issues:

**Lack of adequate environmental awareness and low awareness of the impact that one's behaviour can have on the environment.**

In fact, environmental issues are often part of highly complex systems, characterised by slow and gradual phenomena that are difficult to perceive in everyday life.

This leads people to see them as not very 'real' problems, hindering the process of internalising a true awareness of one's own environmental impact. This phenomenon is even more evident when it comes to energy: the extent of our daily energy consumption is mostly invisible both to us and to the people around us, and the environmental impact of our behaviour is hardly perceived. This applies to consumers belonging to the classes identified by the survey as: concerned but unaware consumers, materialistic energy consumers and indifferent energy consumers.

Our recommendation to the European institutions and those of the Member States is to **continue investing in information and awareness-raising activities on the issues, as a fundamental prerequisite for the acquisition of greater awareness of environmental issues among citizens.**

**It will be important to act in coordination between the European and national levels with the participation and involvement of associations representing citizens - including consumer associations, environmental associations, etc. - to make the action itself more widespread and effective.**

### Lack of specific knowledge on the particular topic.

In our opinion, also drawing on the experience of the Belgian pilot, regarding the direct relationship between increased knowledge in the energy field and the adoption of new behaviours, it is certainly from an initial awareness of this issue that the next steps can take place. Once new information and knowledge about a behaviour has been provided, it is repositioned in the set of values, beliefs and attitudes that represent the basic structure of our acting in the world.

It therefore becomes crucial to structurally provide, within school courses, **training initiatives for a better understanding of energy issues.** Investing in children will make them 'ambassadors' of issues and behaviours to be adopted not only by their families but also, and mainly, by the communities they are part of, through so-called 'peer education', which is very effective in transferring knowledge and skills (and thus behaviours) among children.


### Lack of perception that people have regarding the ability to make a difference through their specific behaviour.

Implementing an intervention strategy based on increasing knowledge about effects means providing information about the impact that a specific behaviour can have on the surrounding reality.

An example of information aimed at increasing knowledge about effects could be: "if you lower the temperature of the thermostat by two degrees, you can save 15%". Increasing knowledge about the potentially positive effects of one's behaviour can be a relevant strategy to increase the sense of personal efficacy of those you want to intervene on.

**The recommendation for regulators and energy suppliers** is to promote the dissemination of information on how to use the tools available to everyone to monitor their consumption (e.g. simplifying bills, implementing smart-meters and setting up other devices that can provide data on consumption and related expenditure in real time).

### Consumption profiles, as highlighted by the survey, are different and require different approaches depending on the type of consumer.

Barriers to the adoption of sustainable behaviour may arise from the coexistence of conflicting motivations in the individual, with non-environmental motivations taking over at the action stage. For example, with respect to the possible behaviour 'to lower or not to lower the temperature of one's home during the winter months', one might find that no matter how motivated a person is to adopt a sustainable lifestyle, they might be inclined not to lower the temperature of their home in the winter because their contextual motivation to promote their personal comfort is more intense.

As effective as the adoption of multiple intervention strategies can be in changing a person's value structure and in promoting the intention to implement energy-saving behaviour, it is necessary to support their motivation also in the actual action phase, in order to prevent contextual motivations from prevailing.

The recommendation for energy service providers is to **consider a prior consultation process to explore users' knowledge gap** in order to facilitate the adoption of energy-saving behaviour.

In addition, training actions aimed at citizens, designed and managed with multi-stakeholder involvement on each territory, would be effective. This approach would be effective with 'adult' citizens. On the other hand, in the case of young citizens, the structuring of educational pathways (as proposed above) from an early age would help reduce the gap between "intentions" and "actual actions" that currently occurs among adults.

## The power of prior habits

Habits predict future behaviour better than intentions because they are linked to unconscious maintenance mechanisms that are very difficult to intervene in. In fact, as reported in the document “Policy Brief how to nudge”, nudges are more effective when creating new behaviours instead of improving existing ones.

The recommendation in this regard is **the valorisation of feedback: the behaviour can be followed up with feedback**. They may vary according to timing, frequency and content. About timing, generally speaking, the shorter the time between action and feedback, the more effective the feedback is. As far as frequency is concerned, the higher the frequency, the more effective the feedback. With regard to the content of the feedback, those specific to one's own personal consumption pattern are more effective than feedback containing general information; those involving a comparison between one's own performance and that of others would appear to be more effective than just individual data; those that focus only on information related to the economic benefit are ineffective and potentially counterproductive as the amounts related to energy savings are generally small and may lead people to think that they are not worth it.

## Technological infrastructures available to citizens

As the experiences within the pilots show, participating households were equipped with applications, interfaces, devices, etc. to monitor their consumption. Citizens, equipped with the appropriate tools, were able to consciously change their consumption habits.

The recommendation is to **ensure the accessibility of tools (such as smart meter and other equipment capable of reporting consumption in real time)** for everyone in order to avoid that conscious consumption behaviour is only available to those in the medium-high income groups and not to those who would need it the most in order to curb the economic outlay related to energy consumption (see energy poverty).

## Data confidentiality

The survey "Profiling of energy consumers: psychological and contextual factors of energy behaviour" reveals that

The majority seems unwilling to share the detailed energy data, i.e, on a daily to real-time basis". The recommendation concerning this aspect is to **provide consumers with adequate information and evidence on how their data are processed in accordance with the legislation in their respective countries and to protect their right to privacy.**

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# Policy Brief #4: Empowering energy consumers by increasing their energy literacy

NUDGE

Nudging consumers towards energy efficiency through behavioural science

# POLICY BRIEF

## Empowering energy consumers by increasing their energy literacy


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# What is the issue and why is it important?

Energy-related issues are becoming increasingly important in the public debate and often lead to polarising discussions. At the same time, it is essential for the success of the green transition that consumers are empowered to make sustainable and informed decisions about their energy consumption. This is particularly important regarding the acceptance of new technologies or energy-related regulatory conditions. Accordingly, it is necessary to **promote an objective, non-polarised discourse on the relevant topics in the public**. An indispensable building block contributing to this is the highest possible level of energy literacy (and related financial literacy) among the population.

The term energy literacy describes **the general knowledge regarding issues connected to the production and consumption of energy, particularly in regard to sources of energy, the scale of production and consumption, prices, and influence on the environment** (Białynicki-Birula et al. 2022). Therefore, increasing energy literacy can contribute to several important objectives:

- Empower consumer to understand their own energy consumption (e.g., in households) and to save energy
- Empower consumer to understand the pricing of energy and/or the effect of new tariffing scheme (Reis et al. 2021)
- Tackling energy poverty
- Raise awareness on important energy related topics and increase acceptance

However, energy consumers (e.g., in households) often lack knowledge about energy (van den Broek 2019; Martins et al. 2020) and are not able to situate different points of view in the public discourse or important aspects that affect their own energy consumption (e.g., appliance purchase decisions (Blasch et al. 2019)). Since already internalised behaviours and habits are much more difficult to change and influence than newly learned behaviours, **the promotion of energy literacy is particularly important for children and pupils as the energy consumers of tomorrow.**

# What we did in the NUDGE project

The Horizon 2020 project NUDGE has conducted **surveys**, **interviews**, and **focus groups with consumers** to understand the factors that influence their energy consumption.
It has taken a mixed approach to the consumer analysis and intervention design with tasks combining surveys and field trials.

Firmly rooted in behavioural science methods, it has been studying individual psychological and contextual variables underlying consumers' behaviour to tailor the design of behavioural interventions and to evaluate their effectiveness.
In this context, one field trial investigated interdisciplinary project-based education on home energy consumption for children in Belgium.

By expanding the **existing teaching material, installing smart meters in the children's homes and schools, and using dashboards to visualise the collected consumption data**, the aims were to:

- Improve the children's understanding of the impact of different daily choices on household energy consumption,
- Promote intergenerational learning, and
- Create opportunities to replicate the acquired knowledge.

# What we learnt

- In general, the **energy knowledge** of the pupils was very **limited** (e.g., most children have no idea how their house is heated, no knowledge about the different dimensions and magnitudes of energy consumption).

- **Public debate** of energy-related topics (e.g., energy prices) fostered interest in the subject.

- **Gamification** (e.g., energy knowledge tests) and **social comparison** were quite popular. The children liked comparing their consumption with the others and with means, both for water and for energy.

- A **tool to measure home energy consumption automatically (digital**) including a comprehensive visual dashboard is essential to allow pupils (but also all other household residents) to follow their own consumption, to compare it, and to understand the impact of different daily decisions.

- **Intergenerational learning** can have positive effects but is hard to assess/evaluate.

# What can policy makers do?

**Teaching on energy, energy consumption/measuring and energy efficiency should be strengthened in public schools and other education places.**

To improve energy literacy, energy and energy consumption should be taught as a compulsory subject in public schools. An important aim here is to ensure that as many children as possible know how homes are heated/cooled in general and in practice, that they have a rough idea of how it works and what it costs, and that they are aware of different heating options as well as the impact of their behaviour on the general energy consumption. In addition, it is also important to use not only schools but also other educational places. This can help to reach also parents or other people to increase energy knowledge across the whole population and support replication potentials.

**Pushing the smart-meter roll-out and ensure that easy to understand and easy to use dashboards are included to visualize the measured energy consumption.**

Giving access to a tool to follow the energy consumption at home is key to raise awareness on the topic of energy consumption and to enable people to understand their own consumption as well as the impact of their behaviour and habits.

**Encouraging actions for different energy user profiles of children and parents to save energy (see also the other policy briefs of the NUDGE project).**

**Investigating and understanding energy literacy levels among different population groups to address them appropriately (there is still a lack of common understanding as well as specific data on this topic).**

**Use also non-educational channels to raise awareness and empower consumers to understand their own energy consumption.**

Understanding and being aware of one's own energy consumption is key to being able to change related behaviour. This awareness also helps to raise acceptance and understanding with regard to new technologies or new regulatory conditions. Therefore, also non educational channels should be used to foster energy awareness and literacy. This could include regularly occurring situations such as heating system maintenance or energy bills, including all relevant information on the energy consumption, the respective prices and/or energy saving potentials in a way which is visually appealing and easy to understand.

**Encourage interpersonal communication within households about energy consumption/ production to foster intergenerational learning and knowledge replication (e.g. by public information campaigns).**

# Conclusion and key findings

Bringing energy topics and the related knowledge, which is particularly relevant for everyday life, closer to the end consumer is an essential task of politics.

**A particular focus here should be on children and schoolchildren** as the energy consumers of tomorrow.

Nevertheless, it is also important to **address and include all other population groups** in order to exploit replication potential and increase energy literacy throughout society.

Here, the approaches chosen must always be adapted to the target group and the corresponding channels.

To be able to do so:

**It is important to investigate and understand energy literacy levels among different population groups.**

In any case, it is of the utmost importance to provide users with insights into their energy consumption, preferably in real time (e.g. via smart meters and corresponding visual energy consumption dashboards that are intuitive to use and as easy to understand as possible).

In the NUDGE project, the focus was on teaching energy topics to schoolchildren. Thus, **the field study in Belgium can serve as an example of how these topics can be taught in practice**.

An important factor here is the **freely accessible teaching material in several languages** that was created as part of the project. The material can be used as a basis for implementing the relevant lessons quickly with as few barriers as possible and integrating them into various curricula.

# Teaching material

5 **open-source booklets** to teach abouts:

- gas consumption,
- electricity consumption at home,
- water consumption,
- electricity outside the home and
- nudging (with a quiz based on questions the children made).

Please note the booklets have been developed for Belgian students, and might therefore need to be adapted to other countries' specificities.

The content is meant for cognitively strong children from grade 5 and 6 and suitable for all children / teenagers in secondary school.

# Further reading/ Literature


- Knowledge-hub • Nudge (nudgeproject.eu)
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# Policy Brief #5: Policy recommendations - Enhancing energy efficiency in Croatia

NUDGE

Nudging consumers towards energy efficiency through behavioural science

# POLICY BRIEF

# Policy recommendations - Enhancing energy efficiency in Croatia


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# Introduction -

## Evolving landscape of Croatia's energy policy

**Croatia's energy policy has been evolving dynamically, especially since the regulatory changes introduced in 2021 and again in 2023.**

These changes signify a commitment to **renewable energy** and its **sustainable consumption**. This approach aligns Croatia with broader European trends, exemplified by countries like Austria, which have developed effective models for energy communities.

Croatia's legal framework distinctly separated 'self-consumption' for households and public institutions from the 'final customer with own production' model for other customer categories. However, the practical implications of this approach, especially for households, led to significant shifts in **investment returns** and **consumer behavior**. In response, the Croatian government amended its policy in July 2023. **From 2024, households will not lose their self-consumption status if they have surplus of exported energy and all households who already lost their self-consumption status due to surplus of exported energy, will be switched back to the self-consumption model.**

**The self-consumption model** will be available for new consumers until the end of 2025, and the Ministry aims to formulate the new system by March 31, 2025, initiating its application on January 1, 2026. This change, aimed to be fully implemented by 2026, **opens new avenues for sustainable energy practices in Croatia**.

**The Austrian model,** with its focus on Renewable Energy Communities (RECs) and Citizen Energy Communities (CECs), offers valuable insights.

Austria's integrated and community-focused approach supports not only individual self-consumption but also collective energy management and sharing. **Drawing inspiration from Austria, Croatia can further refine its regulatory system to enhance the economic viability and sustainability of renewable energy consumption.**

## The importance of user engagement and incentives

**Effective engagement in energy-efficient practices hinges on users perceiving tangible benefits, especially financial.** Past regulatory frameworks led to counterproductive behaviors like shutting down PV systems or installing excess capacities that fed into the grid rather than serving local needs. To address this, the regulatory framework must align with user interests, **offering incentives for efficient energy use and local consumption.**

## Policy recommendations: enhancing Croatian energy communities

Despite legal recognition of energy communities within its framework , Croatia has yet to see the formation of energy communities, largely due to operational uncertainties and barriers. These include **restrictive definitions of eligible entities, complex regulatory environments, high financing costs, and diverse membership and education needs.**

In contrast, Austria's energy community model is more facilitative, offering flexible legal structures and economic incentives. To emulate this success, Croatia should consider the following steps, described in Table 1.

***Table 1. Comparison of Energy Community Frameworks: Austria and Croatia***

| Aspect | Austria | Croatia |
|---|---|---|
| **Expand Legal Definitions** | Offers a flexible legal framework allowing various organizational forms, including associations and cooperatives, to form energy communities. This inclusivity fosters diverse participation. | Currently, the legal framework is more restrictive, limiting the types of entities that can form energy communities. Amending the law to include a broader range of entities, similar to Austria, could enhance community formation. |
| **Simplify Operational Processes** | Has streamlined processes for establishing and managing energy communities, reducing bureaucratic hurdles and making it easier for communities to operate. | Faces significant administrative barriers that hinder the formation and management of energy communities. Adopting a simplified approach like Austria's could encourage the development of these communities. |
| **Provide Financial Support and Incentives** | Offers economic incentives, such as reduced grid fees, making it financially viable for communities to participate in energy sharing and production. | Currently, high financing costs and a lack of incentives are major impediments. Introducing financial schemes similar to Austria's could lower costs and risks, promoting the establishment of energy communities. |
| **Educational and Support Programs** | Likely has initiatives to educate and support potential members, contributing to the successful implementation and operation of energy communities. | Needs to develop comprehensive programs for educating potential members and providing operational support, which would help in overcoming the current knowledge and experience gaps. |

In the realm of energy communities, the approaches of Austria and Croatia present an interesting contrast. Austria has notably set a benchmark in supporting these communities. **The Austrian Distribution System Operators (DSOs) play a crucial role, offering reduced grid fees and efficiently allocating energy among community members.** This significantly lowers operational costs and streamlines energy distribution.

Moreover, **Austria's administrative process is commendably efficient, characterized by clear guidelines and simplified procedures that facilitate the registration and operation of energy communities.** On the other hand, Croatia faces several challenges in this domain. One of the primary issues is the unclear role of DSOs in supporting energy communities. Unlike Austria, where DSOs actively contribute to the growth and efficiency of these communities, **Croatian DSOs lack specific provisions or incentives, which hampers the establishment and smooth operation of energy communities.**

Administratively, Croatia's framework is mired in complexities. **The process of registering as an energy community involves multiple steps and often unclear requirements.** This complexity can deter the formation of new communities, a stark contrast to the Austrian model. Furthermore, Croatian regulations stipulate that **energy communities must operate under non-profit regulations and include a full-time qualified worker,** adding to the operational challenges, especially for smaller communities. **Financial hurdles** are another significant challenge in Croatia. Energy communities often struggle with high financing costs, facing difficulties in accessing loans or funding due to the perceived risks by financial institutions. This financial burden significantly hampers the viability and sustainability of these communities.

To align Croatia's approach more closely with Austria's successful model, several steps could be beneficial.

1

**Enhancing the role and responsibilities of DSOs** in Croatia to mirror Austria's supportive approach would be a significant step. This could include introducing incentives similar to Austria's reduced grid fees and technical assistance.

2

**Streamlining the registration process for energy communities** in Croatia, making it more transparent and straightforward, would also be advantageous. This change would ease the path for new communities to form and operate, removing the administrative barriers that currently exist.

3

Another recommendation for Croatia is to **reconsider the requirement for a full-time employee in each energy community. Allowing more flexibility in operational structures** would enable smaller or emerging communities to sustain themselves more easily.

4

Finally, improving financial accessibility is crucial. **Working with financial institutions to offer more accessible loans and lower interest rates, and introducing financial assistance programs,** would help overcome the financial barriers faced by Croatian energy communities.

# Policy Recommendations

## for enhancing energy efficiency in Croatian energy communities

The challenge of nudging users towards energy efficiency, particularly in energy communities like those in Croatia with oversized photovoltaic (PV) systems, requires a nuanced approach. The aim is to encourage behaviors that maximize the use of renewable energy while minimizing wasteful practices. Here are specific **recommendations tailored to the Croatian context and its energy communities**:

### Mandating real-time energy data access:

Enforce policies requiring Distribution System Operators (DSOs) to provide real-time energy consumption and production data to end-users. This step is crucial for enabling users to make informed decisions about their energy use, particularly for those with oversized PV systems, avoiding additional investments in external smart meters.

### Dynamic tariff and feed-in policy structuring:

Adjust energy tariffs to encourage energy self-consumption and make feed-in policies more attractive for surplus energy within energy communities.

### Establishment of energy sharing mechanisms:

Implement legal and technical frameworks to facilitate energy sharing within communities. This approach allows users with excess energy to share or sell it to others, promoting community-wide energy efficiency and collaboration.

### Flexible distribution key implementation:

Advocate for the creation of adaptable models for distributing energy within energy communities. Such a system would facilitate a more effective and equitable allocation of energy, tailored to the real-time usage patterns of community members. As an illustration, while Austrian regulations permit various types of energy sharing keys within communities, in practice, DSOs typically provide just a static and a dynamic key. In contrast, Croatian DSOs have yet to establish a defined sharing key system.

# Conclusion

**In Croatia, adopting Austria's successful energy community model means enhancing DSO roles, simplifying regulations, and providing financial and educational support**. This would help overcome barriers to forming sustainable energy communities and benefit citizens with oversized PV systems in self-consumption models. Key strategies include enabling real-time energy data access, developing dynamic tariff and feed-in policies, establishing energy sharing mechanisms, and introducing flexible distribution keys. **These measures would promote informed energy usage, foster self-consumption, and encourage efficiency.**

However, it's crucial to address broader challenges that have been observed in the Austrian model, such as **limited economic benefits, challenges in data accessibility, and uncertainties regarding network structure and access.** A more integrated approach, including sector coupling, is necessary to ensure the long-term viability of energy communities without an excessive reliance on subsidies.

To effectively navigate these complexities and tailor solutions to the Croatian context, it is recommended that the Ministry recognize the importance of **establishing a dedicated working group.** This group should consist of energy community experts, stakeholders, and policymakers who can collaboratively develop strategies and solutions that are not only feasible but also beneficial for Croatian citizens beyond 2026. **This collaborative approach will ensure that the policies and frameworks developed are well-suited to the specific needs and circumstances of Croatia, paving the way for a sustainable and efficient energy future.**

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