NUDGE

6th European Conference on Energy Efficiency and Behaviour Change

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NUDging consumers towards enerGy Efficiency through behavioral science

H2020 EU Research Project

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NUDGE Introduction - Overview

Introduction

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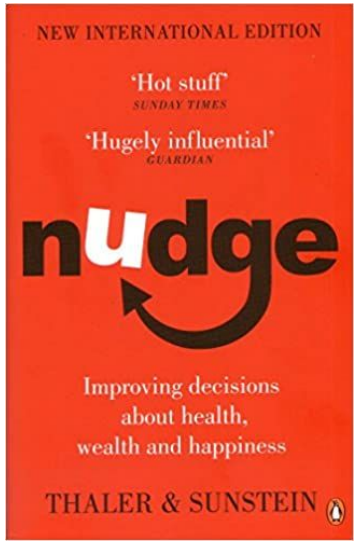
Introduction

- The holy grail of energy efficiency demands drastic changes in the energy-related behavior of consumers
- It is critical to better understand all those factors that determine the consumers behavior and the decisions they make about energy consumption matters
- Since the 1970s, monetary or in-kind incentives (e.g. discount plans and bonuses) have been used as motivation for affecting consumption decisions
- Recent studies have identified ways in which behavior can be affected **without resorting to financial provisions or incentives of any kind**
- By far the most influential of these studies, the work of **Richard Thaler** and **Cass Sunstein in 2008** introduced the notion of **Nudging**, as:



"any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any option or significantly changing their economic incentives"

Challenges and Aim

- In the energy domain, **behavioral interventions** have already been considered as a means to improve the energy-related behavior of end users

- However, the potential of **nudging techniques** for energy efficiency has not yet been extensively investigated, mainly to the 5 following limitations that have been typically followed in the application of behavior interventions:
  - are not tailored to the specific psychological or contextual features of individual consumers
  - tend to be behaviorally informed rather than behaviorally tested through real trials
  - are not complemented or compared with traditional incentive schemes (e.g., discounts)
  - do not follow a solid methodology for statistically assessing the results out of trials
  - are not linked with policy making actions

- The NUDGE consortium has identified the aforementioned application gaps as an opportunity that defines the main project aim:

NUDGE aspires to systematically assess and fully unleash the potential of behavioral interventions towards achieving higher energy efficiency, paving the way to the generalized use of such interventions as a worthy addition to the policy-making toolbox

Objectives

OBJ2: Execute extensive field trials that address multiple instances of consumer behavior, implementing different mixes of behavior-based and traditional interventions

OBJ3: Develop a systematic research protocol to continuously measure the impact of the implemented behavioral interventions

OBJ1: Tailor the design of behavioral interventions to individual psychological and contextual variables, by leveraging digital platforms, energy data and data analytics

OBJ4: Consolidate the findings of pilots into recommendations reaching out to policy makers and relevant stakeholders

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Consortium

The NUDGE consortium consists of a **multidisciplinary team of 11 partners with different backgrounds and expertise**, i.e. 4 R&D institutions, 2 policy experts, 1 energy supplier, 2 technology developer SMEs, 1 consumer association, 1 energy cooperative and 1 education expert, striking a good balance between expertise in the **design of behavioral interventions** and **capacity to implement** and operationalize these interventions.

Pilot implementation

DOMX, MVV, Beegy, INEGI, SPRING-STOF, ZEZ

Policy design

IEECP
FRAUNHOFER

Behavior science

IMEC
AUEB
FRAUNHOFER

Stakeholder consultation & outreach

CA
FRAUNHOFER
IEECP

WPs and leaders

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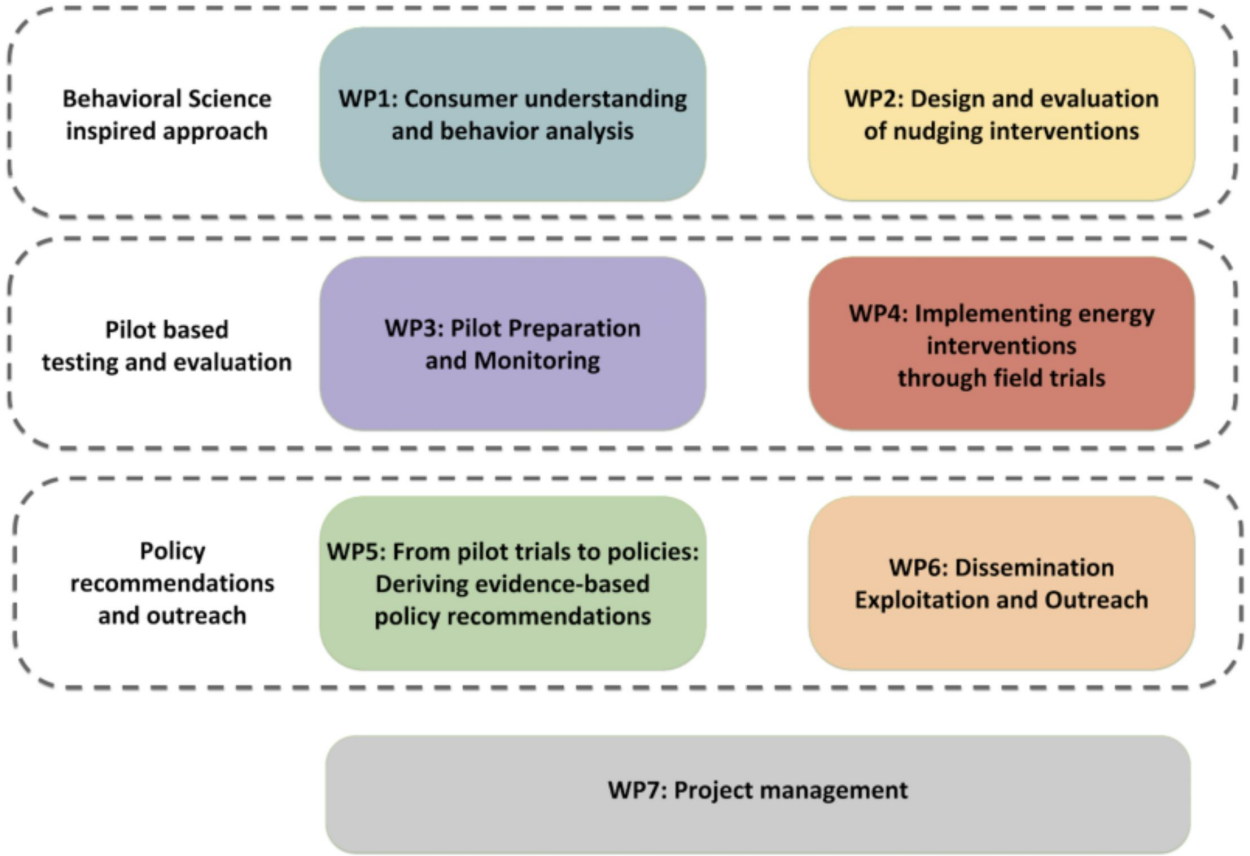

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ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

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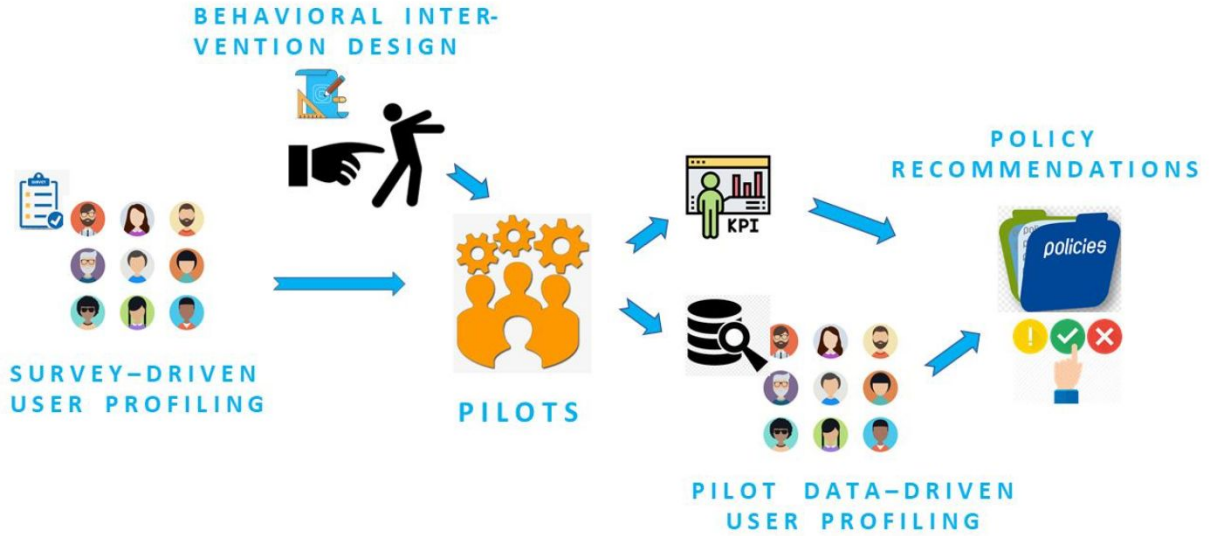
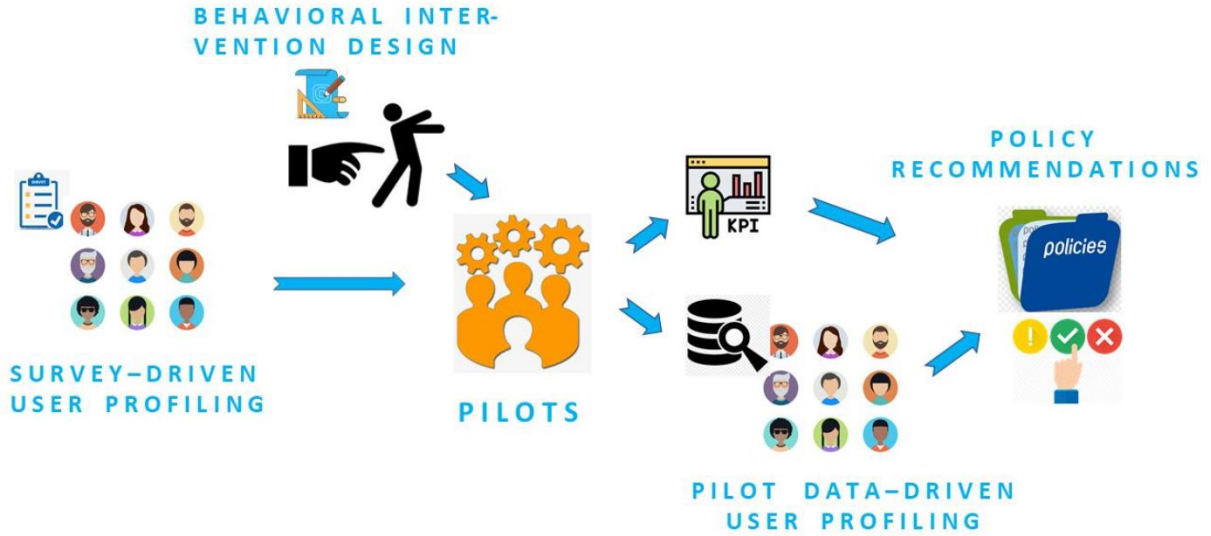
Methodology (1/2)



- **<u>Pre-pilot phase mechanisms and tools:</u>**
  - Survey-driven user profiling: profile consumers taking into account a broad set of psychological and contextual variables
  - Design of pilot focused behavior-based and traditional interventions
  - Install energy monitoring and management tools (eg. smart meters, thermostats)
  - Employ digital user interfaces (eg. mobile applications, dashboards) to enable energy consumers to actively monitor and efficiently manage energy flows
  - Deploy a central pilot data platform to automate collection and monitoring of pilot data

Methodology (2/2)



- **<u>Pilot phase mechanisms and tools:</u>**
  - Randomized controlled trials (RCTs) including control-treatment groups
  - Time phasing of multiple interventions within and across pilots
    - Pre-interventions phase (M10-M14)
    - Testing phase (M15-M32)
    - Post-interventions phase (M33-M36)
  - Mixed approach combining surveys and field trials to assess the effectiveness of interventions
  - Automated monitoring of responses and adoption of tested interventions
  - Automatic calculation of pilot KPIs for performance comparison within a pilot and across pilots
  - Evaluation of behaviour change across tested interventions and consumer profiles
  - Design of stakeholder and user profile specific policy recommendations

Pilots

- Five heterogeneous pilots have been carefully planned to experiment with consumers:
  - in five different EU states (Greece, Belgium, Germany, Portugal and Croatia)
  - in different environments (residential, energy communities, schools)
  - belonging to different age groups (young children as well)
  - and income classes (low, medium, high)
  - being served by different energy carriers (electricity, natural gas)
  - including residential prosumers and EV drivers,

  on top of which we apply a broad set of behavioral interventions.

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

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

Healthy homes for long-lasting energy efficiency behavior in Portugal

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

Promoting distributed self-production for local Energy communities in Croatia

Indicative nudges per pilot

Efficient control of heating and DHW preparation for Natural Gas consuming boilers in Greece
• **Facilitating:** Prompt users to change the default temperature setting of available heating schedules • **Deceive:** Visualize the environmental consequences of non-efficient actions (e.g. overheating) • **Social Influence:** Comparison with similar households in the same neighborhood, city, etc.
Interdisciplinary project-based education on home energy consumption for children in Belgium
• **Facilitating:** Provide easy, understandable information on own household consumption • **Social Influence:** Social comparison with households of classmates • **Confront:** Define impact of a certain action in monetary or environmental measures
Optimization of EV charging with self-produced PV power in Germany
• **Facilitating:** Suggest alternative periods for EV charging • **Reinforcement:** Point out that EV charging is advised during periods of high PV production • **Reinforcement:** Provoke feelings of environmental responsibility to drive efficient EV charging
Healthy homes for long-lasting energy efficiency behavior in Portugal
• **Social Influence:** Prompt users to follow individual targets towards improving health conditions for their family • **Facilitating:** Suggest alternative means for improving indoor environment conditions that take into account the impact on overall energy use (e.g. ventilation to reduce indoor pollutant concentrations when outdoor temperature/humidity conditions permit) • **Fear:** Inform parents that prevailing outdoor air quality is not optimal for energy-efficient house ventilation
Promoting distributed self-production for local Energy communities in Croatia
• **Social Influence:** Social comparison with members of the cooperative • **Social Influence:** Leverage commitment of individuals to common goals of the cooperative • **Social Influence:** Invoke feelings of reciprocity by advising members to consume when PV energy is available

Expected Pilot impact

- Direct engagement of at least 450 households in the 5 countries (> 1000 consumers)
- At least 2 different interventions will be tested in each pilot. (> 10 in total)
- More than 200 public officers, private actors and other stakeholders engaged
- Energy savings and investments

Pilot	Saving (%)	Final energy Savings in kWh/a	Investment
DE1	7.5% (525kWh/a)	525*100 households=52,500kWh/a	
DE2	35% (2,450kWh/a)	2,450 * 50 households = 122,500 kWh/a	32,000 E*50 = 1,600,000 Euro
BE	5% (175kWh/a) electricity/ (750kWh/a) gas	(175 +750)* 50 households = 46,250 kWh/a	100E *50 = 5,000 Euro
PT	7% (257 kWh/a) el/ (55 kWh/a) gas	(257+55)* 100 households = 31,200 kWh/a	100E* 100= 10,000 Euro
GR	15% (1,350kWh) 5% (450kWh)	1,350*100 households +450*50 additional = 238,000 kWh/a	100 *150 Euro =15,000 Euro
HR	5% (150kWh)	150kWh *100 households = 15,000kWh/a	PV: 1,200 E/kWh*100*4= 480,000 Euro
Total		**505,450kWh/a**	**2.11 m Euro**

Expected Replication potential

- Replication potential expected to impact a total of 15,000 households
- Expected energy savings and investments

Pilot direct engaged populations and estimated replicants		Estimated Energy savings (MWh/a)	Estimated Investment
Pilot	Potential replicants (households)		
DE	**3,500**	3,500*2,450kWh/a=8,575MWh/a	32,000E*3,500=112m E
BE	**5,000**	5,000*925kWh/a=4,625MWh/a	100E*5,000=0.5m E
PT	**300**	300*312kWh/a=93.6MWh/a	100E *300 = 0.03m E
GR	**5,000**	5,000*1,800kWh/a=9,000MWh/a	100E*5,000=0.5m E
HR	**1,270**	1,270*150kWh/a=190.5MWh/a	1,200E*4*1,270=6.09m E

NUDGE Survey

- Help us to reach a broader audience for studying the **energy consumption within households and opinions on energy issues**:
    - https://ghentunipss.eu.qualtrics.com/jfe/form/SV_0BNIaYZmySIeWRD?Q_Language=EN

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Thank you!

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