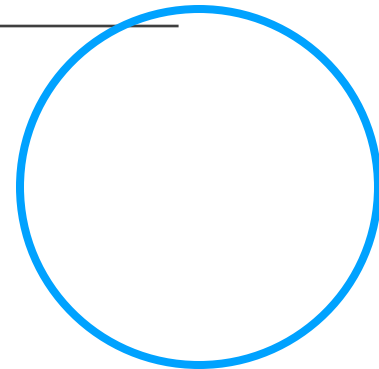


# Nudging the delivery of the EED through home-IoT and digital user interfaces

ECEEE Summer Study on Energy Efficiency

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June 11, 2021





# Nudging the delivery of the EED through home-IoT and digital user interfaces

Stratos Keranidis, PhD  
R&D Director - domX home-IoT technologies  
[stratos@mydomx.eu](mailto:stratos@mydomx.eu)

Filippos Anagnostopoulos  
Project Coordinator  
Institute for European Energy and Climate Policy (IEECP)  
[filippos@ieecp.org](mailto:filippos@ieecp.org)



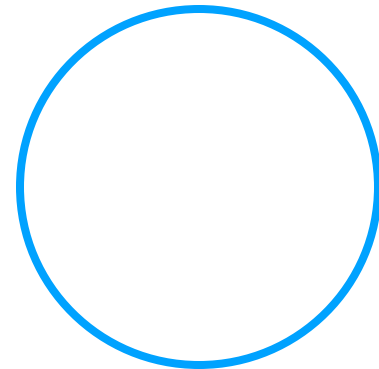
# EED Art.7: energy efficiency obligation schemes (EEOS) and alternative policy measures

The EED (2012/27/EU) requires MSs to achieve an **annual reduction of 1.5%** in national energy sales, in two ways:

- **EEOS** oblige energy companies to carry out measures which help final consumers improve energy efficiency
- **Alternative measures** are policy measures implemented as alternative or complementary measures to an EEOS.

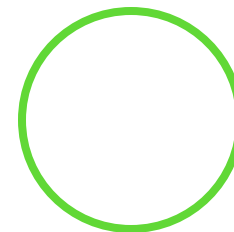
The **amending Directive** on Energy Efficiency (2018/2002)

- Extends Article 7 to 2030
- new savings equivalent to **0.8% annual final energy consumption**
- Emphasis in the importance of Monitoring & Verification [and more..]





# Energy Efficiency Obligation Schemes (EEOS)



EEOS are setting an obligation on energy companies (energy distributors or suppliers/retailers) to achieve energy savings targets.

Member States are flexible to specify

- the scope of the obligation
- how the targets can be achieved by the obligated parties,
- the methodology for monitoring energy savings,
- processes on verification and controls.

EEOSs are often comprising of building renovation, efficiency services, energy audits, public procurement rules.

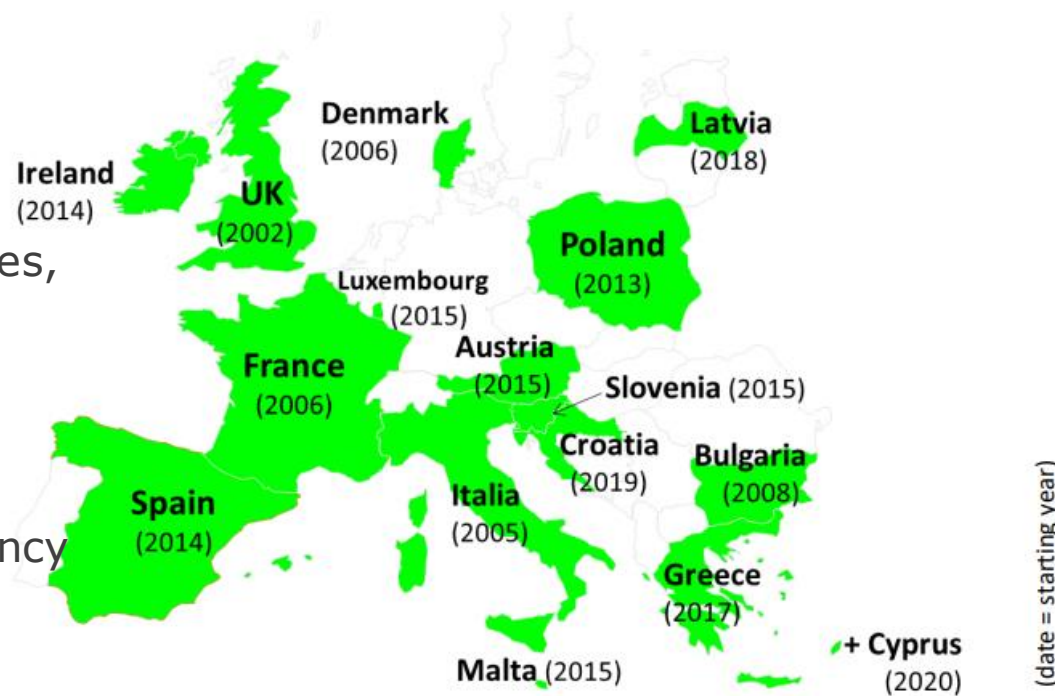


Figure 1. Map of the EEOS in Europe (as of end 2019).

Figure 1 is from the [ENSMOV project](#) and provides the starting date of the ongoing EEOSs

# Alternative Measures

Alternative Measures alone are used in 12 MSs (green) and comprise of:


- interest-free **loans** for energy saving projects in businesses (Czechia)
- Energy and CO2 **taxes** (Estonia)
- Energy Efficiency **Agreement** for Energy management (Finland)
- **Competitive funding** programme Energy efficiency and process heating from renewable energies in business (Germany)
- Education and advice **campaign** for behavioural measures (Lithuania)
- Long-Term **Agreements** on Energy Efficiency (The Netherlands)
- Multi-measure mix in transport, housing, industry (Portugal)





# Spotlight: Greece

## Energy Efficiency Obligation Schemes

- In the first period 2017-2020 EEOS covered 10% of the Art7 target
  - 29 Obligated parties can either to implement measures , trade with third parties or use the “buy out” option.
  - Penalties are foreseen
  - Savings in 2020-2030 are estimated to 20% of the NECP target
- 

## Alternative Measures to 2030

- Energy upgrade of residential, public, tertiary sector and industrial buildings
- Improvement of energy efficiency through energy service companies
- Energy managers in public buildings
- Energy upgrade of water pump stations and public lighting
- Development of infrastructure in the transport sector and promotion of alternative fuels

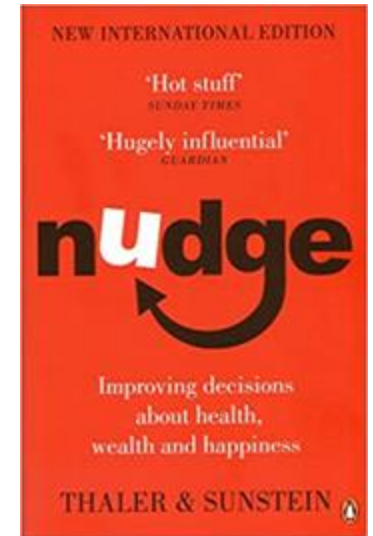
NUDGE project promotes the delivery of the EED through home-IoT and digital user interfaces



# Nudging of energy consumers

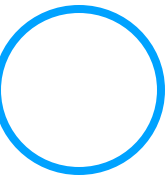


- The holy grail of energy efficiency demands drastic changes in the energy-related behavior of consumers
- Since the 1970s, monetary or in-kind incentives (e.g. discount plans and bonuses) have been used as motivation for affecting consumption decisions
- Recent studies have identified ways in which 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**
- In the energy domain, **behavioral interventions** have already been considered as a means to improve the energy-related behavior of end users



## NUDGE aims to combine:

- home-IoT equipment for energy monitoring and management
  - with digital user interfaces for user engagement
- and behavioural measures to promote consumer behavior change





# Objectives

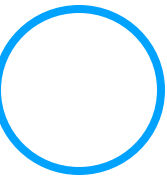


OBJ2: Execute extensive field trials that address multiple instances of consumer behavior, implementing different mixes of behavior-based and traditional interventions

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





# 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

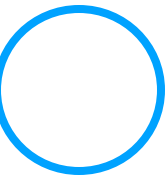
Optimization of EV charging with self-produced PV power in Germany

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



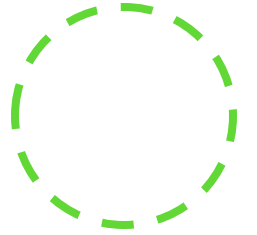
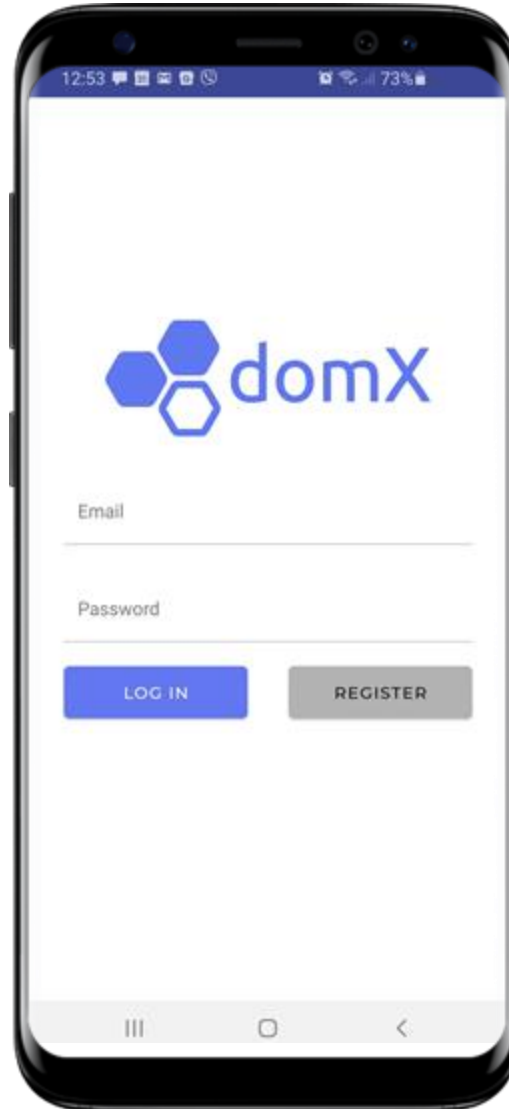
# Efficient control of heating and DHW preparation for Natural Gas boilers in Greece



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



Boiler attached with the heating controller

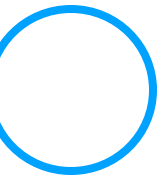


## Heating system benefits

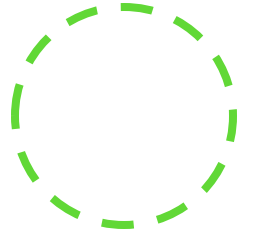
- Consumption Monitoring
- Remote control
- Scheduling - Weather adaptation
- Improved comfort
- Improved Energy efficiency (up to 35%)

## Indicative nudges:

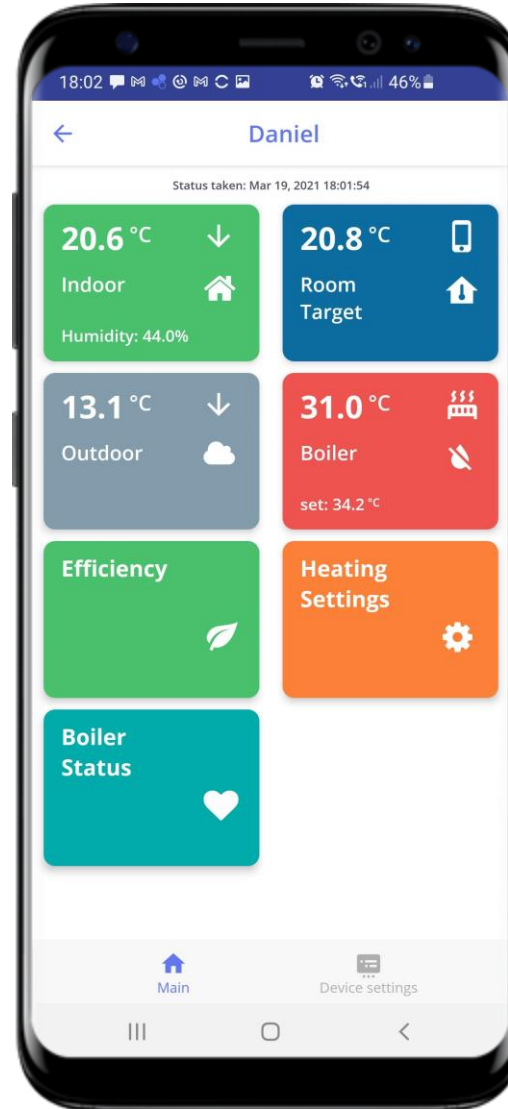
1. Prompt users to change the default temperature setting of available heating schedules
2. Visualize the environmental consequences of non-efficient actions (e.g. overheating)
3. Comparison with similar households in the same neighborhood, city, etc.



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



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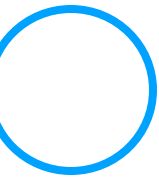


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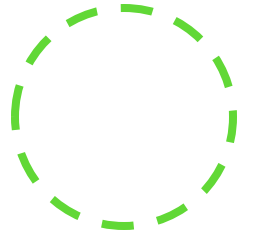
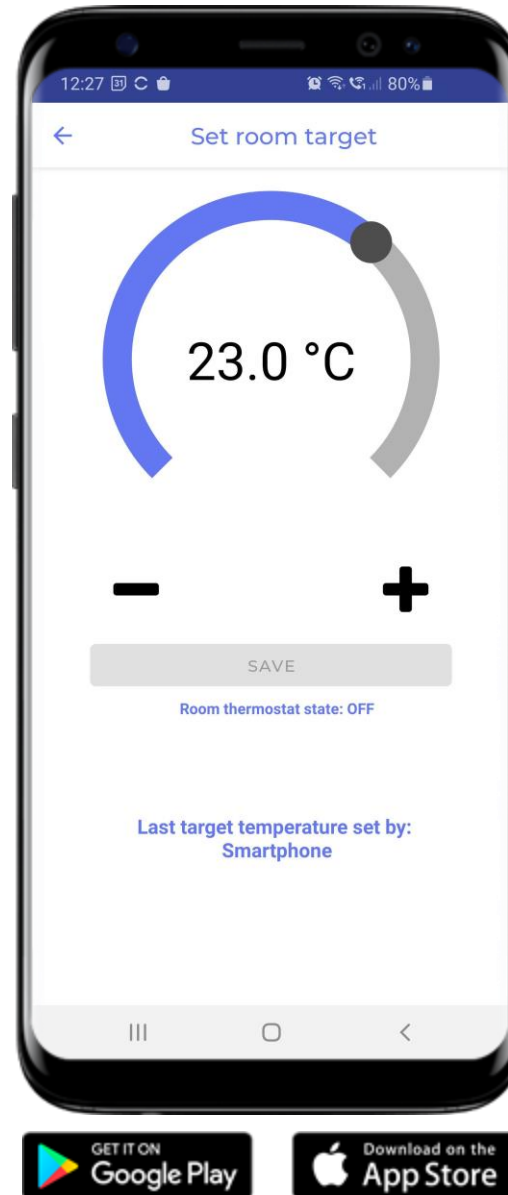
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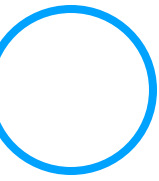


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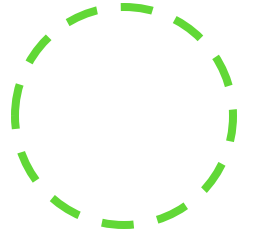
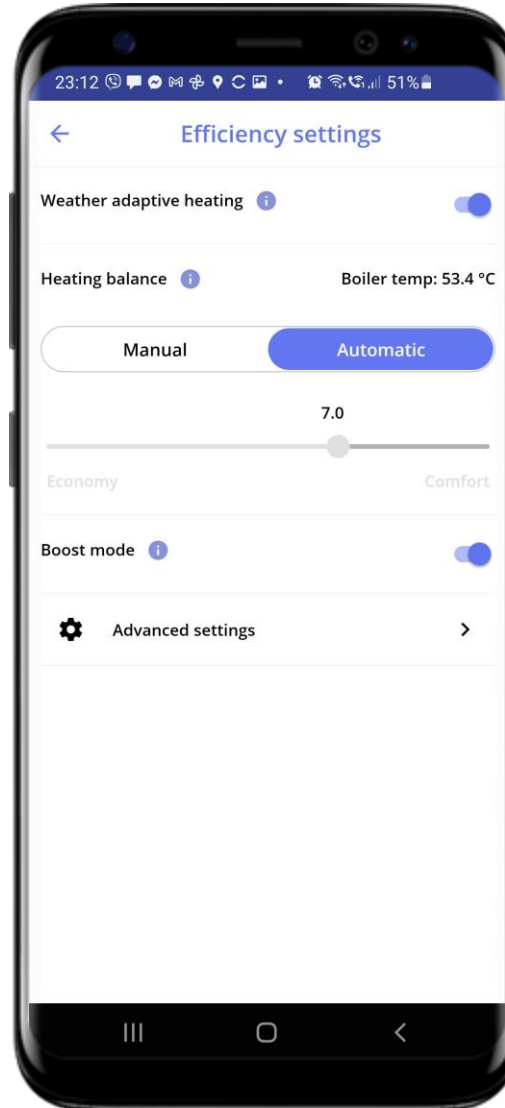
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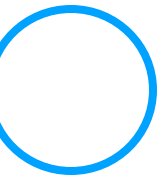


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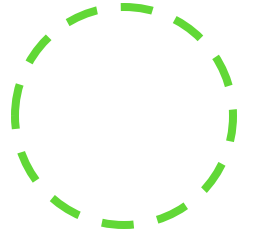
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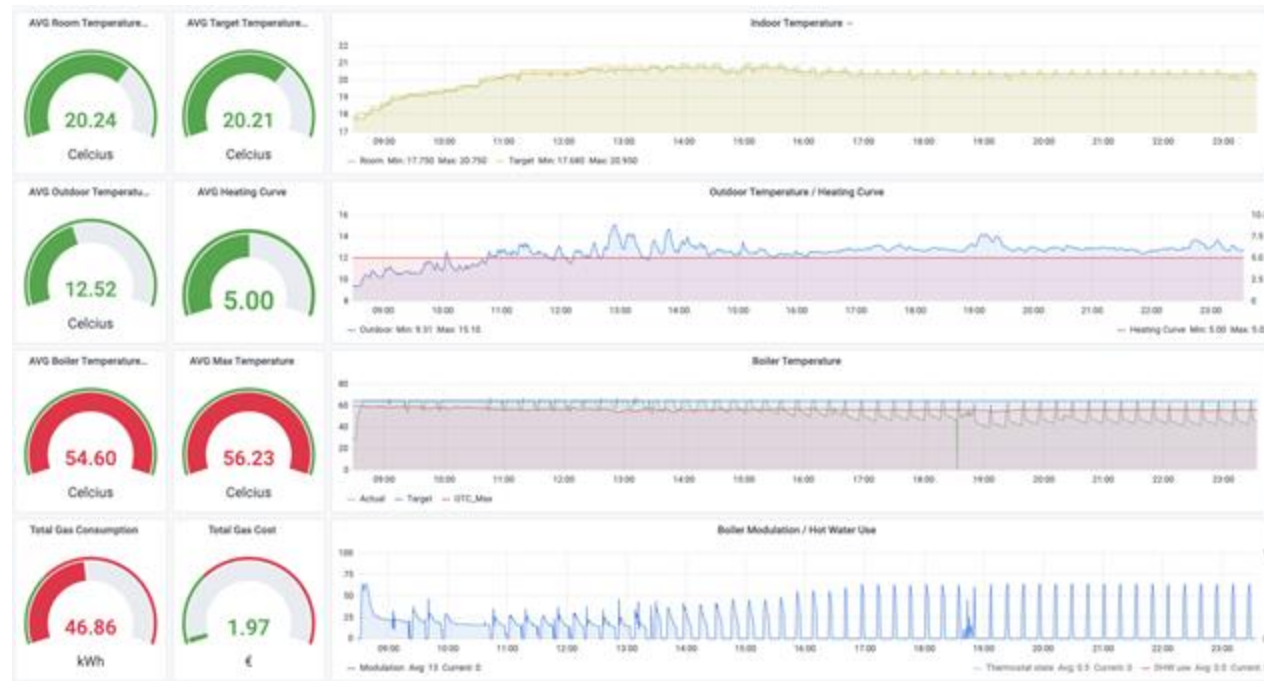




# Energy efficiency dashboard



Same home in Thessaloniki heated under two 24h periods in December 2020  
with similar outdoor temperature conditions (avg 12.52 °C and 12.44 °C)

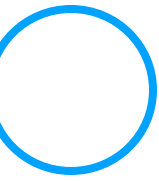


Fixed boiler temperature 65 °C  
Prioritized user comfort  
AVG boiler temperature 54.60 °C  
Estimated consumption 46.86 kWh

**27 %**  
Gas consumption  
reduction



Weather-adaptive boiler temperature  
Balanced user comfort and economy  
AVG boiler temperature 48.99 °C  
Estimated consumption 34.21 kWh


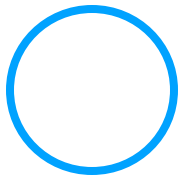







# Relevance with Article 7

NUDGE inspired methodology is able to deliver:

- improved energy efficiency for residential, public and tertiary buildings
  - valid energy savings monitoring methodology
  - long-term energy behavior change
  - Preliminary results suggest that the combination of **home-IoT** with **digital interfaces** and **nudging interventions** can help meet the updated EED requirements sufficiently, **should energy providers and the supporting ecosystem be prepared to deploy the offered solution to end consumers.**
- 
- 



Nudging the  
delivery of the EED  
through home-IoT  
and digital user  
interfaces



Thank you!

[stratos@mydomx.eu](mailto:stratos@mydomx.eu)

