D3.6 – A SET OF TAILORED ENGAGEMENT OPTIONS

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InBetween
ICT enabled BEhavioral change ToWards Energy EfficieNt lifestyles

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DISSEMINATION LEVEL

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DISCLAIMER

The work presented in this document has been conducted in the context of the H2020 of the European community project InBetween (n° 768776). The partners in the project are: Rina Consulting S.p.A., Acciona Construcción S.A., AIT Austrian Institute of Technology Gmbh, Develco Products, The Interdisciplinary Center Herzliya, Institute Mihajlo Pupin, Vilogia S.A, Sonnenplatz Großschönau Gmbh. The content of this report does not reflect the official opinion of the European Union. Responsibility for the information and views expressed in the therein lies entirely with the author(s).

EXECUTIVE SUMMARY

The goal of this report is to propose a set of tailored engagement options in response to consumers profiles (defined in D3.4) and according to consumer's preferences. The main instrument to engage the Tenants is the Mobile APP. For this reason, the report describes the engagement opportunities that the app will offer users, given the various deployment scenarios, the deployment of sensors and smart cables/ plugs and given the data available and the limitation of the app. Our approach is to allow users to self-tailor their own preferred engagement. During the trial period we will learn what the preferred options are, which interventions are the most sought after and by which users (in terms of socio-demographic characteristics), and - what are the impacts of the interventions on energy consumption. We estimate that the usefulness of the InBetween platform and app will be demonstrated by greater energy savings in cases in which actions can be taken remotely by using the app (semi-automated) compared to cases in which manual engagement is needed. That is because the platform increases not only the agency to act (provide the motivation to action) but also the capacity to act with minimal effort.

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1 INTRODUCTION

The goal of this report is to propose a set of tailored engagement options in response to consumers profiles (defined in D3.4) and according to consumers preferences.

'Tailored engagement' means that the app and the interventions are set up not only according to the technical demand reduction potential, but also according to the user preferences and interest. In other words, we do not assume that we know better than the users themselves, but rather offer each user to choose their most suitable interventions.

The user selections will be fed back to the project and allow us to:
(1) Learn which are the most favoured interventions (most selected);
(2) Search for correlations between technical and socio-demographic and other characteristics collected during the survey, and intervention preferences.

Further face-to-face interaction with the users will allow us to receive a more detailed feedback on the app, its user interface and user experience, and accordingly make amendments towards a better product. We will set-up a rough list of questions, and also give the tenants room for their own comments, feelings towards the app and suggestions for improvements. A Facebook group will be considered as well.

In D4.3 we described in detail the various sensors and equipment installed in VIL and SON.

- MLT – motion, light and temperature sensor.
- GW – gateway that collects data from all the sensors.
- EMI – Electric Meter Interface – interface installed on electricity meters which are already installed (pre-project) is used to collect the data and send the information to the gateway. This is done (a) to avoid the need to ask the electricity consumption from the electricity provider, and (b) to have real-time consumption reading.
- Smart Plugs and Smart Cables – collecting electrical consumption of specific devices and are actuators, meaning that the electricity can be switched on and off externally / with the InBetween App.
- Smart Radiator Valves – measuring temperature and controlling the radiators. The temperature point when to turn the Radiator on and off can be set externally / with the InBetween App.
- Window/Door-Contacts – sensing the status of the window/door: open or closed as well as the temperature.

Given these sensors, and as described D1.4, the InBetween project is developing a flexible platform, offering "advanced energy services" (i.e. profiling, optimization, performance evaluation) through three different deployment scenarios (use case scenarios, UCS):

(1) No sensors (but with an external meter interface (EMI) to harvest smart meter measurements) + advanced analytics (i.e. load disaggregation algorithm - NILM);
(2) Sensors (EMI, MLT, VOC, window/door contact, smart cables and smart plugs) + advanced analytics;
(3) Sensors + actuators (smart cables, smart plugs, smart radiator valves) + advanced analytics;

It is important to note that each scenario supports and allows for different engagement options to prompt user to act. For example, the app would be able offer the option of switching off/on only in UCS in which appliances / heating system are connected to smart plug or smart cables.

This report describes the sets of engagement options that will be offered in the menus.
The app will propose to the users the relevant engagement options they may select, according to their specific deployment scenario.

These menus will include:

(1) Various types of notifications that the app can send users regarding operation of appliances and that the users can act upon. For example, notifications about operation of heating system / lights in empty rooms. In these cases, if users want to save energy they will have to turn off heating / lights themselves. *Deployment scenario 1&2.*
(2) Various types of actions that the app can do for users if consent is provided. For example, turning off the heating system when the room is empty. *Deployment scenario 2&3.*
(3) Engagement / notification intensiveness options. For example, how many notifications users would like to receive, or how long the room should be empty before a notification is sent? *All scenarios*.
(4) Matrixes for displaying information. For example, providing information about energy saving in kWh / monetary / carbon terms. *All scenarios.*
(5) Option to set achievable reduction targets with relevant tips and notifications. *All scenarios, but different tips for each scenario 1, 2 &3.*
(6) Options for improving convenience and thermal comfort. For example, preheating room before arrival, and heating water just before use. *Scenarios 2&3.*
(7) A periodical summary of achievements in comparison to previous period / other people/ personal targets and against the KPIs. *All scenarios*.
(8) Option to provide feedback on the app and its features. For example, an option to simply comment (thumb up / down) on specific features, such as 'Did you find this feature helpful? Or option to select from the most appropriate answer from pre-set options.

During the trial period we will learn what the preferred options are, which interventions are the most sought after and by which users, and what are the impacts of the interventions on energy consumption. *All scenarios.*

The app will offer a pre-set default menu for those who do not want to set one for themselves.
For engagement interventions and notifications, the app will offer the following option: take action / dismiss / snooze / disable.

In our previous report (D3.2) we argued that the likelihood of an energy user to take action (in our case change behaviour) is associated with their levels of agency and capacity, where 'Agency' (A) refers to consumers' willingness and ability to make their own free choices regarding energy consumption and energy related behaviour, and 'capacity' (C) refers to users' ability to perform the choices they made. If levels of both agency and capacity are high – change is more likely to happen**. The main aim of the 'tailored engagement' is to provide users with means to improve their capacity to reduce energy consumption given their individual self-perceived constraints.**

2 USERS' CONSENT

As elaborated in D3.4 some of the engagement options involve semi-automatic control over appliances or heating systems. The app, like any other app, needs to include an explanation about the benefits and upsides of

automatic control, including the comfort, economic and environmental benefits, as well as the downsides, including the possible impact on comfort.
Users also need to understand and confirm that with their approval – they allow the app to (1) change the operation of their heating systems, or (2) switch off the appliances connected to smart plugs / actuators (and which appliances).

In addition, the option to override this permission locally or permanently will be offered and clearly presented – including instructions on how to override the app for each specific appliance/system.

Likewise, the option to cancel all the automated interventions as well as push notifications will be clearly offered.

3 INFORMATION PROVIDED BY USERS

3.1 ELECTRICITY RATE STRUCTURE

To provide tailored advice, which includes the economic and environmental implications of users' behaviour and behavioural change, users need to insert their rate structure. This task might be complicated for some (or many) users, due to the complexity of the tariff structure, for example in France.

This feature will be presented in the pilot, but not in the systems' roll out. This means that users themselves will not have to fill their electricity rates, and we will work with our partners in VIL and SON to pre-set it.

3.2 PERSONAL / CASE SPECIFIC INFORMATION

Tailor advice implies that the app provides advice while considering constraints, such as number of people in the household and occupancy patterns.

In cases where data is not already stored in the ontology, users will insert information about number of people in the household, as well as general occupancy patterns during working days and weekend. Likewise, the non-residential building will have to notify about working patterns (e.g., school).

Before holidays (external information), the app will proactively send users a survey to see if they plan to be away, and send energy saving advice accordingly (e.g., turn heaters down/off, unplug Multimedia devices, provide appliance schedule for any controllable device on day-of-the-week). Note that we will not use information from personal calendar (e.g., google calendar).

A general (non-holiday related) absent menu will be offered, in which users can enter the dates they will be absent from their homes. The app will send energy saving advice (similar to the holiday option, above).

Note that due to safety issues and privacy concerns, people may be hesitant to provide this information.

4 GENERAL ADVICE MENUS

The app can use external and general information to provide non-tailored advice that users might find useful. For example, the app could offer a weekly tip, such as "Did you know that lowering the thermostat setting by 1 degree C results in X% savings in energy, money and emissions?"; "Did you know that using the dishwasher during off peak hours (between X:00-Y:00) saves you €X per operation?" (a list of tips will be provided by each deployment site according to the site-specific characteristics).

We will also use trigger events (e.g., the first time the heater was turned on) to send general advice about saving energy. Or, in cases of unexpected and/or drastic change of weather, the app will send messages such as "The weather forecast for tomorrow is …, make sure that ….".

In the future the app will also direct users to websites that compare between different utilities according to their electricity rates.

5 TAILORED MENUS

Two general notes regarding menus related to appliances (but not the heating systems): The app can only control appliances which are connected to smart plugs/ cables. While we installed the cables and plugs on specific appliances, users can change the connected appliances if they wish, without needing to ask for our permission. In addition, the NILM cannot detect small loads, hence the advice in deployment scenario 1 depends on if the appliance load is detectable or not.

Each menu will open with a general 2-3 lines of introduction to the feature and its advantages. For example, "You can save energy, money and carbon emissions by making small changes in the way you use your heating system. The InBetween app can help you do this by…".

As stated above, after a message or a notification appears, the app will present the options to act /snooze/dismiss/disable it.

5.1 HEATING SYSTEM

5.1.1 Energy saving

Select whether you choose to receive notifications and advice on how to save energy and money for each of the following features:

5.1.2 Open window

Notify me when the heating is turned on and the window is open

Select the period of time after which you would like to receive the notification:

After 5 / 10 / 15 minutes

For the relevant UCS in which the app can remotely control heater/radiator valves / thermostat:

Allow the app to turn off the heating after 5 / 10 / 15 minutes

5.1.3 Empty room

Notify me when the heating is turned on and the room is empty

Select the period of time after which you would like to receive notification:

After 10 / 15 minutes

For the relevant UCS in which the app can remotely control heating / thermostat:

Turn off the heating.

5.1.4 Thermostat / heating controllers

Notify me when the temperature reaches X°C

For the relevant UCS in which the app can remotely control heating / valves / thermostat users will be able to insert their preferred comfort zone (a default will be set by the system), and the following will be offered:

If the temperature is within the comfort zone

Turn off the heating system

5.1.5 Comfort

For the relevant UCS (in which the app can regulate the main heating source of the measured room/building) we can offer additional services:

Would you like the app to offer to run an energy saving heating plan?

If yes – the platform will offer a menu in which users insert their weekly schedule and will offer automatic heating demand management.

Would you like the app to turn on the heating system before my arrival?

If yes – the platform will preheat the room prior to arrival.

Note that selecting the latter option will result in use of more energy (heating empty room).

5.2 SAFETY

For the relevant UCS we can offer the following safety notifications:

Notify me when the house is empty for more than [SELECT 5/10 min] and a window is open.

5.3 BOILER

Assuming that the boiler is set to operate during Off-peak hours.
Select whether you choose to receive notifications and advice on how to save energy and money for each of the following features:
Turn off the boiler when I am absent from home for more than one day.
Notify me if the boiler is not functioning well

5.4 APPLIANCES

Select whether you choose to receive notifications and advice on how to save energy and money for each of the following features:

In VIL there are TOU tariffs. If appliances are operating during off peak hours, users can save money.

Notify me when the following appliances are operating during peak hours (expensive tariff).

Dishwasher

Washing machine

Tumble dryer

In SON the users are paying a flat rate. In the non-residential buildings, appliances include anything connected via the smart plugs/smart cables/smart valves – for example stand-by energy from Xerox-machine, coffee-machine, etc.

Notify me when the following appliances (*select*) are turned on while the room is out of business hours (for commercial buildings) or empty (only relevant for load detectable by the NILM):

TV-set and Multimedia
SAT-receivers
Copy-machine

Notify me after (select 15/30 minutes) when the following kitchen appliances (*select when applicable*) are on while the room is empty:
Coffee machine

For the non-residential under the relevant UCS in which the app can remotely control appliances:

Allow the app to turn off appliances (*add here specific appliances*) after [INSERT HOURS]
Allow the app to turn off appliances / unplug appliances (*add here specific appliances*) during weekends and holidays

5.5 VENTILATION

For the relevant UCS:
Opening the window for ventilation in the winter should be limited to wide openings for short periods of only a few minutes at a time. Select if you would like to receive notifications on open windows:

Notify me when the window is open for more than [SELECT 5/10/15 min] long.

5.5.1 Air Quality

When data from air quality sensors is available, the app can send notifications to open the windows when air quality reaches threshold.

Notify me when the air quality is poor.

5.6 MONTHLY REPORTS

Any change in behaviour results in a relatively small (and sometimes even negligible) energy saving, but these savings become significant over time. A periodical report which adds the small savings to make them visible is important for positive reinforcement of behaviour. The app will provide economic and environmental justifications for saving energy, as well as positive reinforcement messages encouraging energy saving behaviour.

Once a month all users will receive messages that provide information related to the KPIs, such as:

- Every kWh you save reduce X g of CO_2 emissions per operation

- This month you operated your washing machine only (mostly) during low tariff hours and as a result saved €X on your electricity bill and saved Z kg of CO_2 emissions
- % of your neighbours operated their dishwashers during off-peak time
- In the last month your PV cell generated X kWh of clean and Zero-emissions electricity

Information about the carbon content of the electricity in each country, as well as other general information will be taken from certified websites such as the IEA.

6 CONCLUSIONS

The above describes in more detail the engagement opportunities that the app will offer users, given the various deployment scenarios, the deployment of sensors and smart cables/plugs and given the data available and the limitation of the app. Our approach is to allow users to self-tailor their own preferred engagement. During the trial period we will learn what the preferred options are, which interventions are the most sought after and by which users (in terms of socio-demographic characteristics), and what are the impacts of the interventions on energy consumption.

In the future (not during this project duration), after data is gathered to set a baseline, the app can provide individual energy saving targets (compared to previous period) for those who are interested. If achieved, users will earn points. The app will notify users if they managed to achieve the target. The points will serve as a basis for comparison between users.

The likelihood of an energy users to act and save energy is associated with their levels of agency and capacity. The main aim of our 'tailored engagement' approach is to provide users with means to improve their capacity to reduce energy consumption given their individual self-perceived constraints and individual motivations.

We estimate that the usefulness of the InBetween platform and app will be demonstrated by greater energy savings in cases in which actions can be taken remotely by using the app (semi-automated) compared to cases in which manual engagement is needed. That is because the platform increases not only the agency to act (provide the motivation to action) but also the capacity to act with minimal effort.