



MOBISTYLE

ENERGY HEALTH
INDOOR ENVIRONMENT

MOBISTYLE project's progress & intermediate results

Report of the work in the first 2 years of the project

This project has received funding from the European Union's H2020 framework programme for research and innovation under grant agreement No 723032





Structure and objective of this presentation

Within this presentation, the project consortium team would like to reveal the MOBISTYLE achievements during the first 24 months working on the project. Therefore, the slides include presentation of the work packages (WP):

WP1 – The MOBISTYLE challenge and objectives - vision

WP2 – Project inception: Mapping of information and communication needs for different types of users

WP3 – Multidisciplinary holistic MOBISTYLE methodology involving various scientific expertise resulting in the behavioural action plans per demonstration case

WP4 & WP5 – Development of ICT tools and MOBISTYLE Open Platform

WP6 – Demonstration and validation for the 5 cases



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MOBISTYLE challenge and objectives

Current EU approach towards energy efficiency (EE):

Energy efficiency at the heart of EU transition to sustainable future

MOBISTYLE approach:

Understanding user behaviour as a prerequisite to achieve EE targets



Let's change perception from
'Buildings consume energy'...

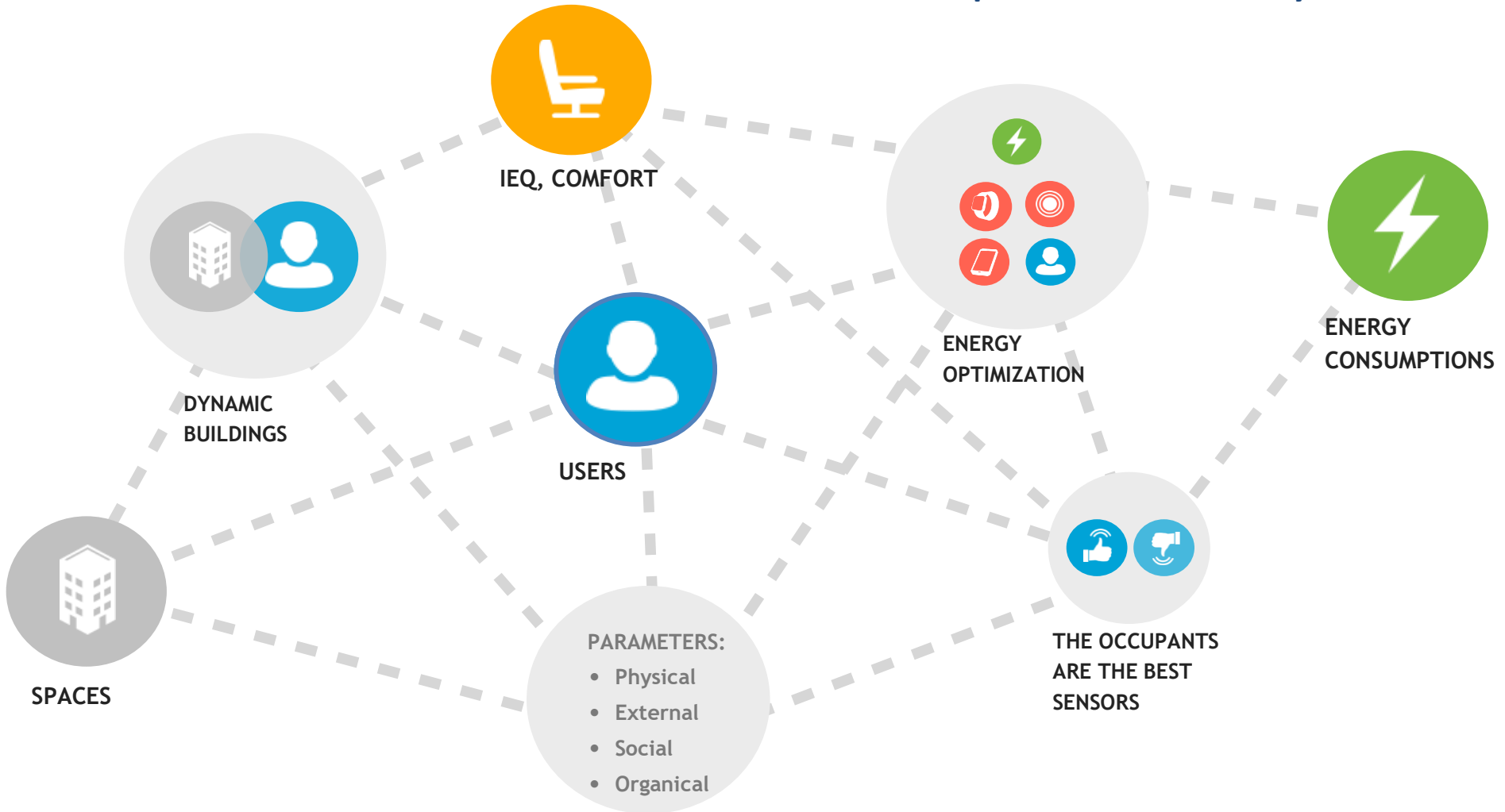


...to the fact that
'People use energy.'



Building ecosystem

is efficient if all the components are mutually conscious.





'People use energy.'



MOBISTYLE

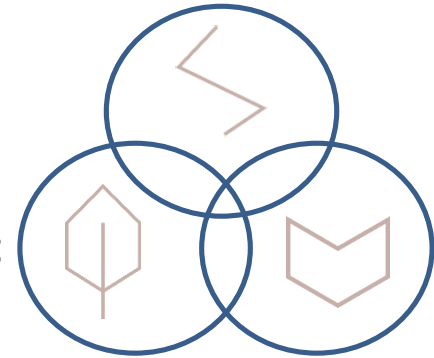
is a 42-months European project focusing on motivating end users' behavioral change through ICT based personalized information on user's energy usage, indoor environment and health.

Duration: October 2016 – March 2020



MOBISTYLE objectives

1. To present **understandable information** on: **energy**
indoor environment
health
2. To motivate **behavioral change** of consumers/energy end-users by combined and personalized modular information on energy use, health and lifestyle.
3. To develop **easy to use, desirable ICT-based tools** which will make energy monitoring a well-accepted and attractive 'daily activity'.
4. To motivate **a prolonged change of consumers habits'** by modular personalised information on energy, health and lifestyle.
5. To **foster new business models** and applications for future development.





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Project inception

Mapping of communication and information needs
for different types of end-users





MOBISTYLE approach

integrating social science aspects into occupant behavior research

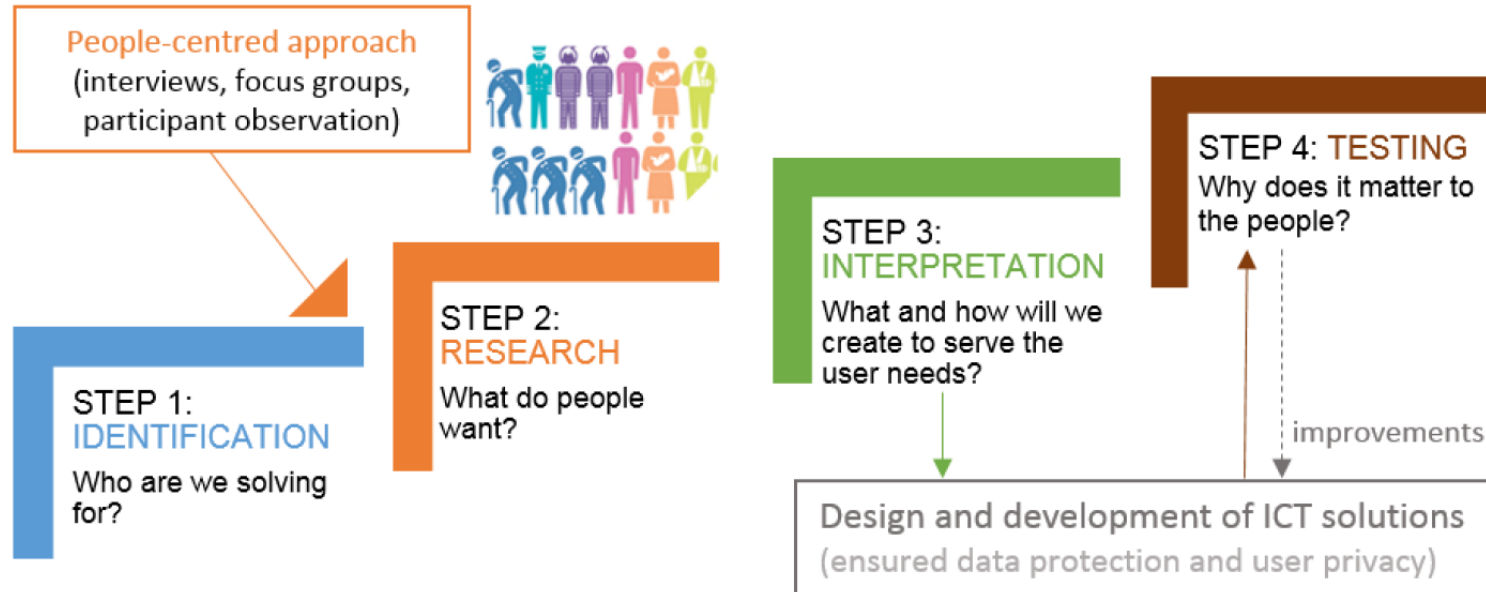


Figure 1: MOBISTYLE approach integrating social science aspects into occupant behavior research.
Developed by Podjed, D., IRI-UL: dan.podjed@iri.uni-lj.si





Occupant behaviour

- One of the major factors influencing building energy consumption.
- Contributing to uncertainty between energy use prediction and reality.

→ We should *understand* the users and their needs → anthropology experts



MOBISTYLE demonstration cases with different user groups:

- 2 residential building areas (PL, DK)
- University buildings (SI)
- Apartments in a hotel (IT)
- Office environment (NL)

2 MAIN MOBISTYLE RESEARCH QUESTIONS?

- What is the motivating factor for users to change their behaviour?
- How do they use existing ICT based solutions? What is needed to make these solutions user-friendlier?



MOBISTYLE Focus groups

Focus groups, supplemented by participant observation, have proven to be a useful research technique for studying users' habits, motivations, needs and expectations in the MOBISTYLE project since they allow researchers to study people in a less structured conversation pattern than typically occurs in an ethnographic interview.

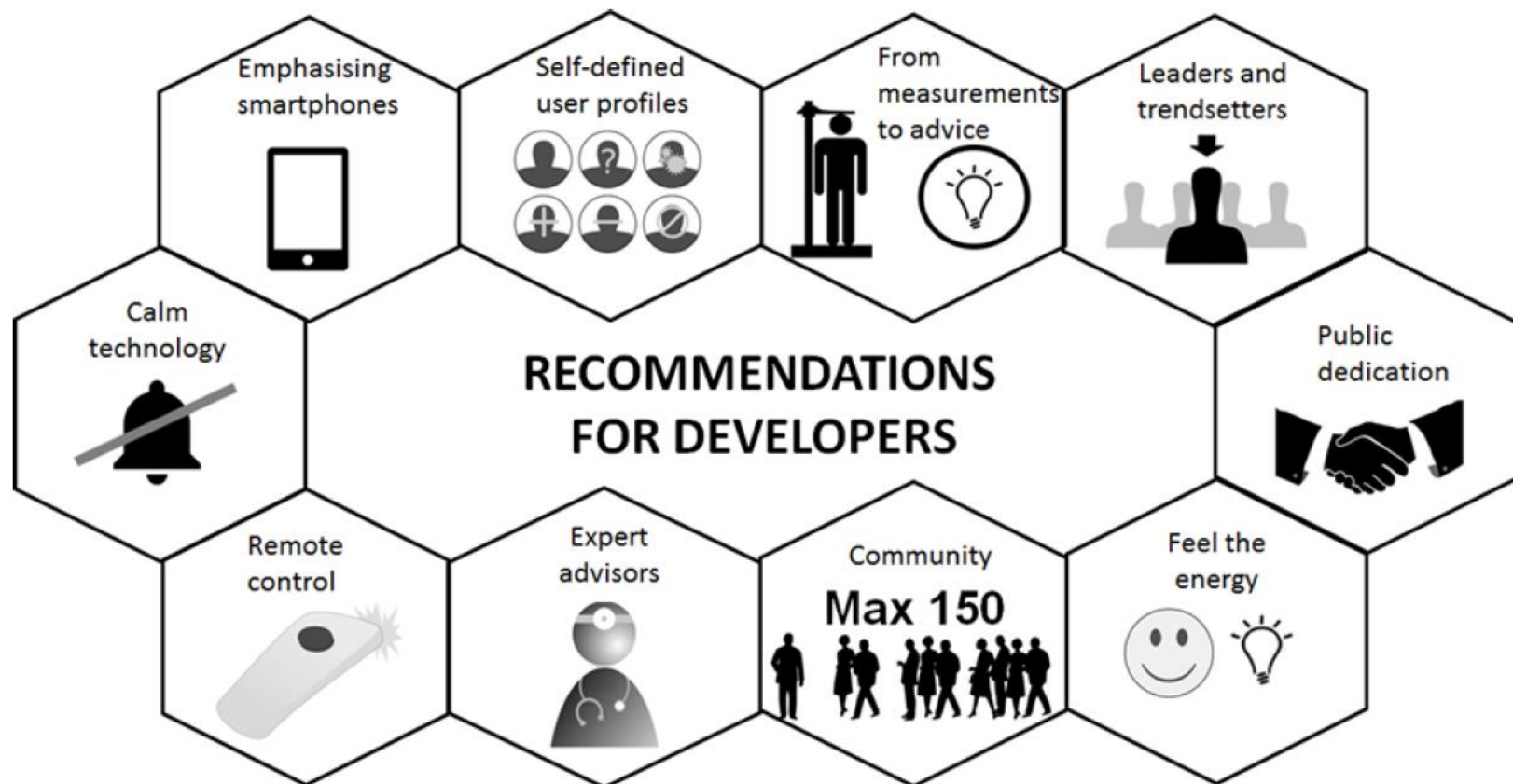
For each demo case, one focus group involving 5-8 people users per case, was carried out on:

- ✓ Danish demonstration case: 21 March 2017
- ✓ Polish demonstration case: 12 April 2017
- ✓ Slovenian demonstration case: 13 April 2017
- ✓ Italian demonstration case: 31 May 2017
- ✓ Dutch demonstration case: 27 June 2017





MOBISTYLE recommendations for the ICT developers based on the focus groups findings



*D2.3: MOBISTYLE recommendations for the ICT developers based on the focus groups findings (M9)



WP2 Focus groups statements: Getting closer...

“When we receive the bill at the end of the year, everyone gets really upset.”

“Health is not a relevant motivation for younger generations.”

“I would turn off the lights if the savings would be 5€ per month.”

“I no longer use the technology [a smart watch], since it makes me nervous.”

“You should do the things you like. I think that is the most important thing for being healthy”

“My father used to say: if there is sun shining outside, turn off the lights!”

“I changed my habits because of the electricity bills.”

“My parents always told me to turn off the lights.”

“My parents never told me to turn off the lights, because they lived in a block of flats.”





Multidisciplinary holistic MOBISTYLE methodology

involving various scientific expertise resulting in the behavioural action plans per demonstration case



Methodological framework in steps



STEPS



KEY QUESTIONS



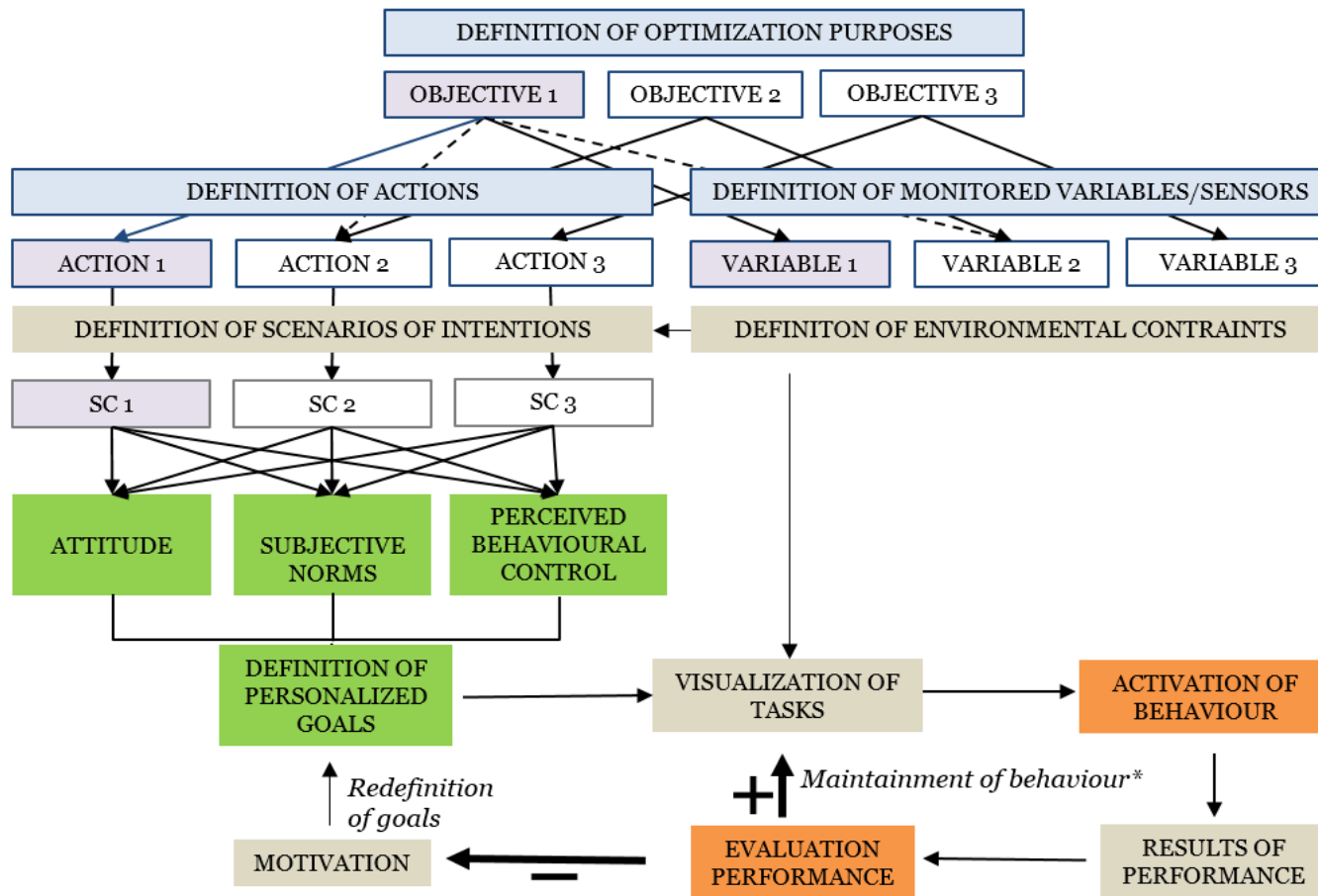
TOOLS

1	PARAMETERS DEFINITION	Which data should be collected?	Analysis of the specific characteristics of the several intended uses involved in the project
2	DATA COLLECTION	How should the data be collected?	Fixed sensors, wearable sensors, mobile application
3	DATA ANALYSIS	What does the data tell us?	Elaboration of raw data
4	DEFINITION OF KPI'S	How can the data help us to evaluate energy savings and comfort of the occupants?	Statistical modelling
5	AWARENESS CAMPAIGN	How can the KPI's be easily understood by the occupants?	Mobile application, serious games, advertisements, newsletters





MOBISTYLE Behavioral action plan



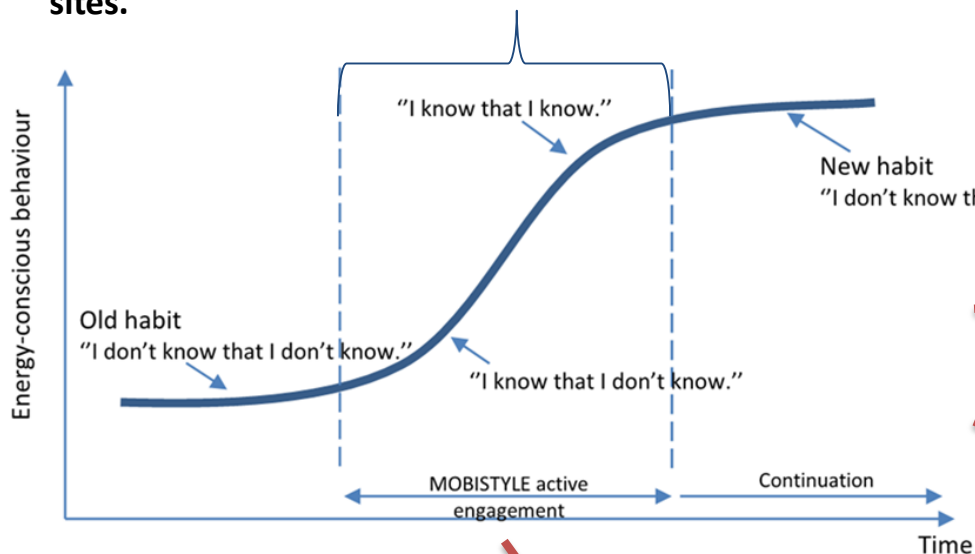
Task 3.4 Elaboration of methodologies to turn monitoring data into knowledge for the end users





Supporting MOBISTYLE awareness campaigns

Information disclosed via tailor-made ICT solutions and supported by the awareness campaigns on the demonstration sites.



MOBISTYLE Open Users Platform (information bundles)

The interface displays 'Sensorized entities' with a list of items:

- Status: Unknown
- Name: Giulia's wearable
- Serial number: 123456
- Status: Unknown
- Name: Apartment 4C
- Serial number: 4C

Accompanying images include a user profile icon and a room interior. A mobile app interface is shown with buttons for 'HEALTH', 'HOME', 'ENERGY', and 'METEOROLOGICAL OVERVIEW'.

Storyboards

The storyboard consists of 15 panels showing a user's experience over time on Sun, 15 March:

- 07:00: User in a room with a thermostat set to 16°C.
- 07:30: Thermostat set to 18°C.
- 08:00: Thermostat set to 20°C.
- 08:05: User sitting on a sofa, thermostat at 20°C.
- 08:06: User interacting with a control panel, thermostat at 20°C.
- 08:45: User looking at a smartphone displaying the MOBISTYLE app.
- 08:46: User interacting with a control panel to 'Change Temperature'.
- 08:49: User looking at a control panel showing energy usage statistics.
- 10:05: User riding a bicycle.
- 10:05: User interacting with a control panel to turn a device 'OFF'.

Feedback to the user

MOBISTYLE app alerts



GAMIFICATION

FACE TO FACE PRESENTATIONS



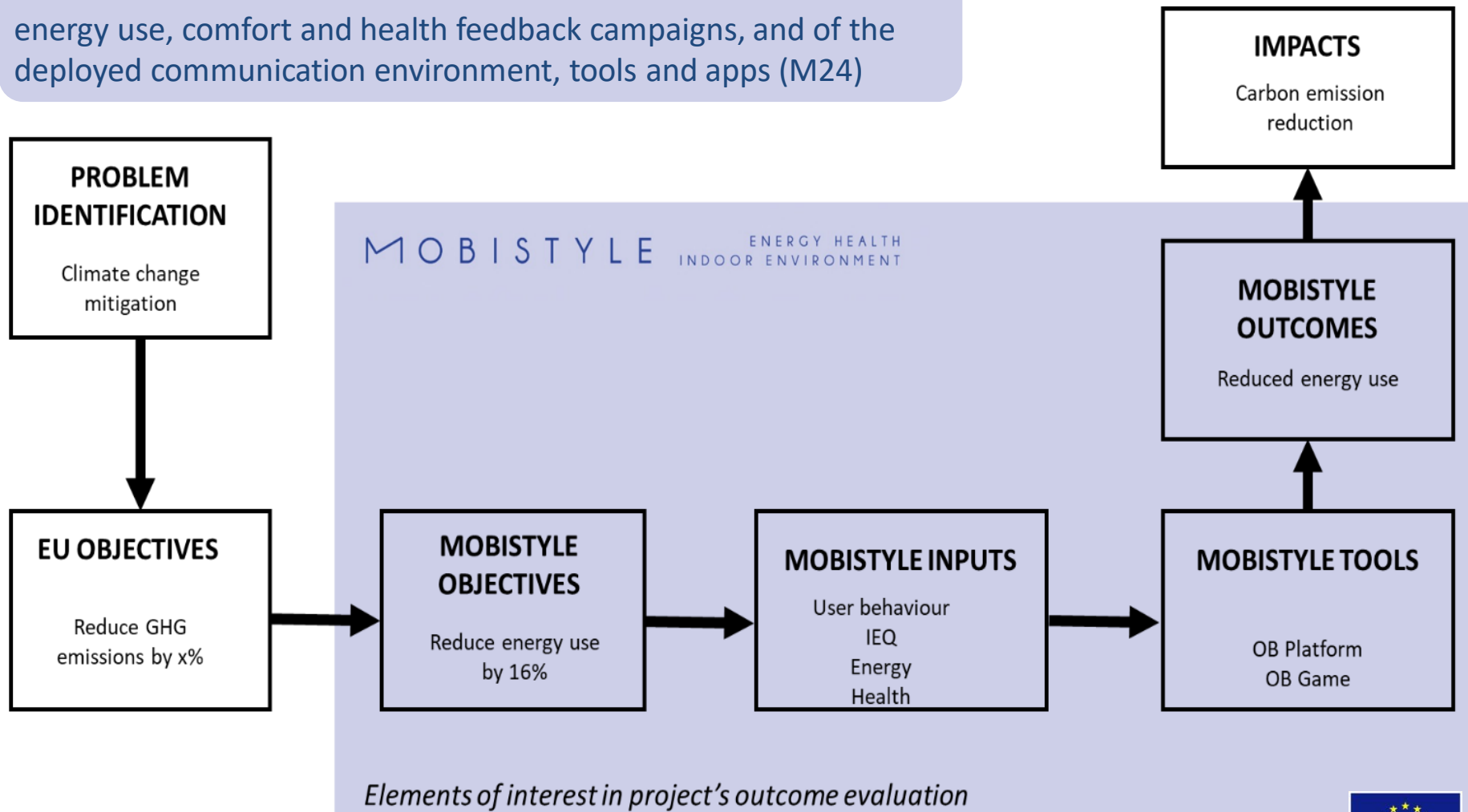
ADVERTISEMENTS, NEWSLETTERS





MOBISTYLE Evaluation methodology

D3.3 - Evaluation method to test the effectiveness of the combined energy use, comfort and health feedback campaigns, and of the deployed communication environment, tools and apps (M24)





MOBISTYLE Evaluation strategy

MONITORING PERIODS

Initial monitoring (M0)

Feedback provision (M1)

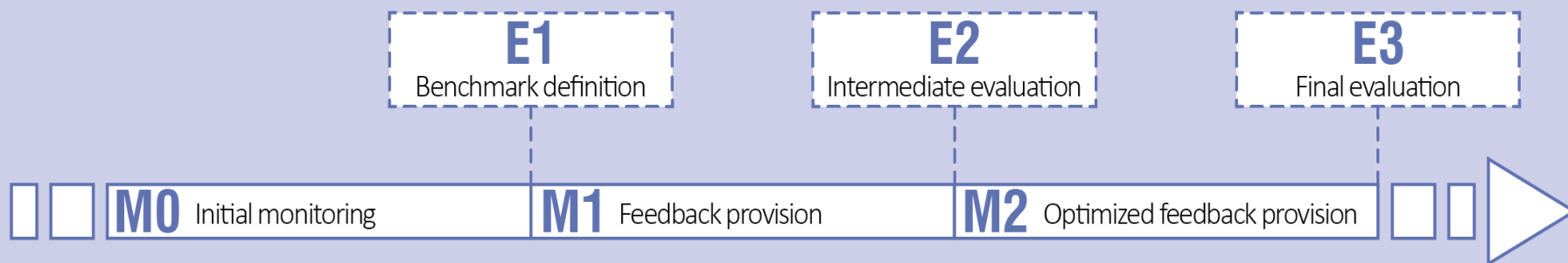
Optimized feedback provision (M2)

EVALUATION STEPS

Benchmark definition (E1)

Intermediate evaluation (E2)

Final evaluation (E3)





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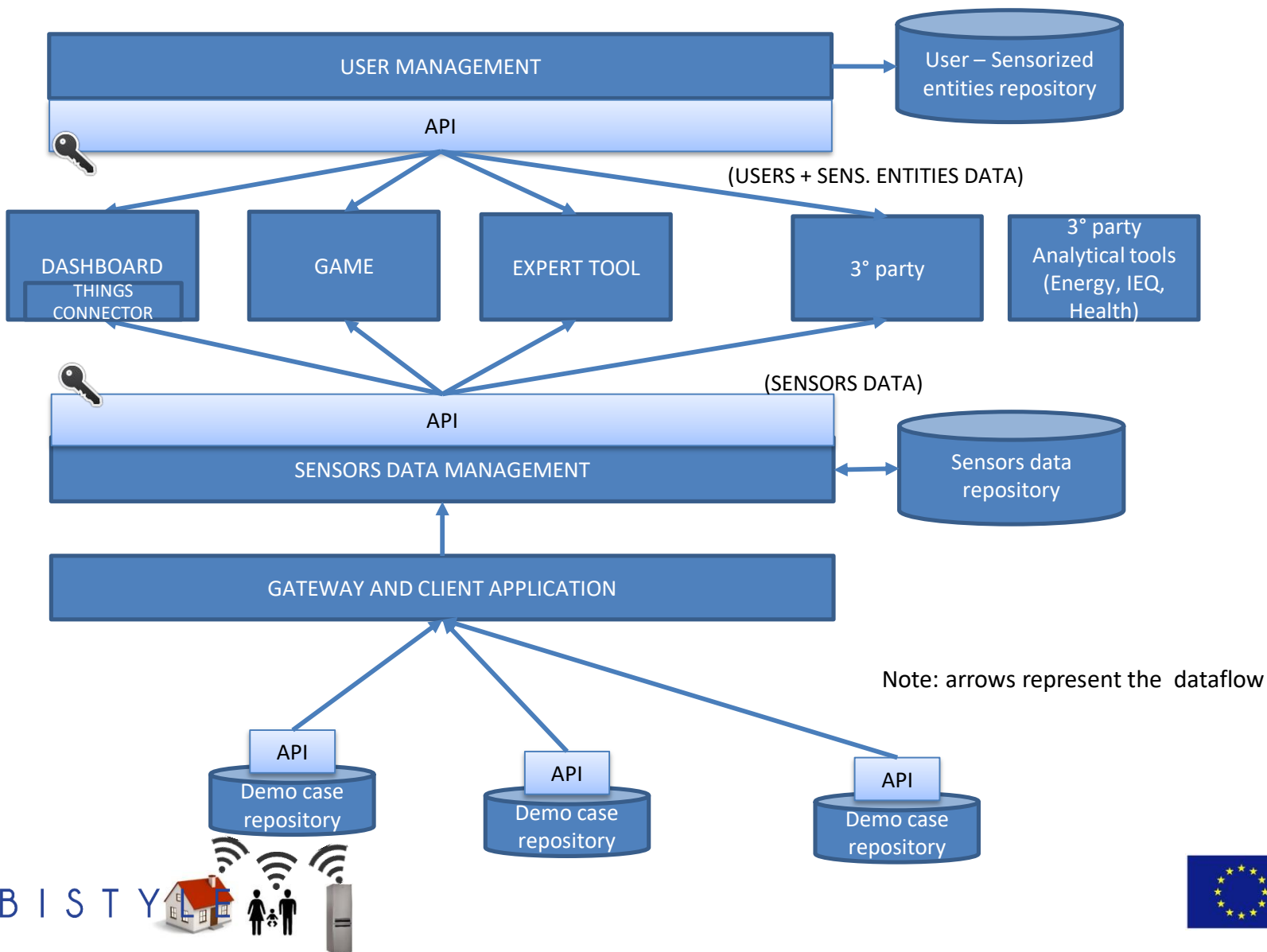
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Development of practical ICT based tools and modular information services



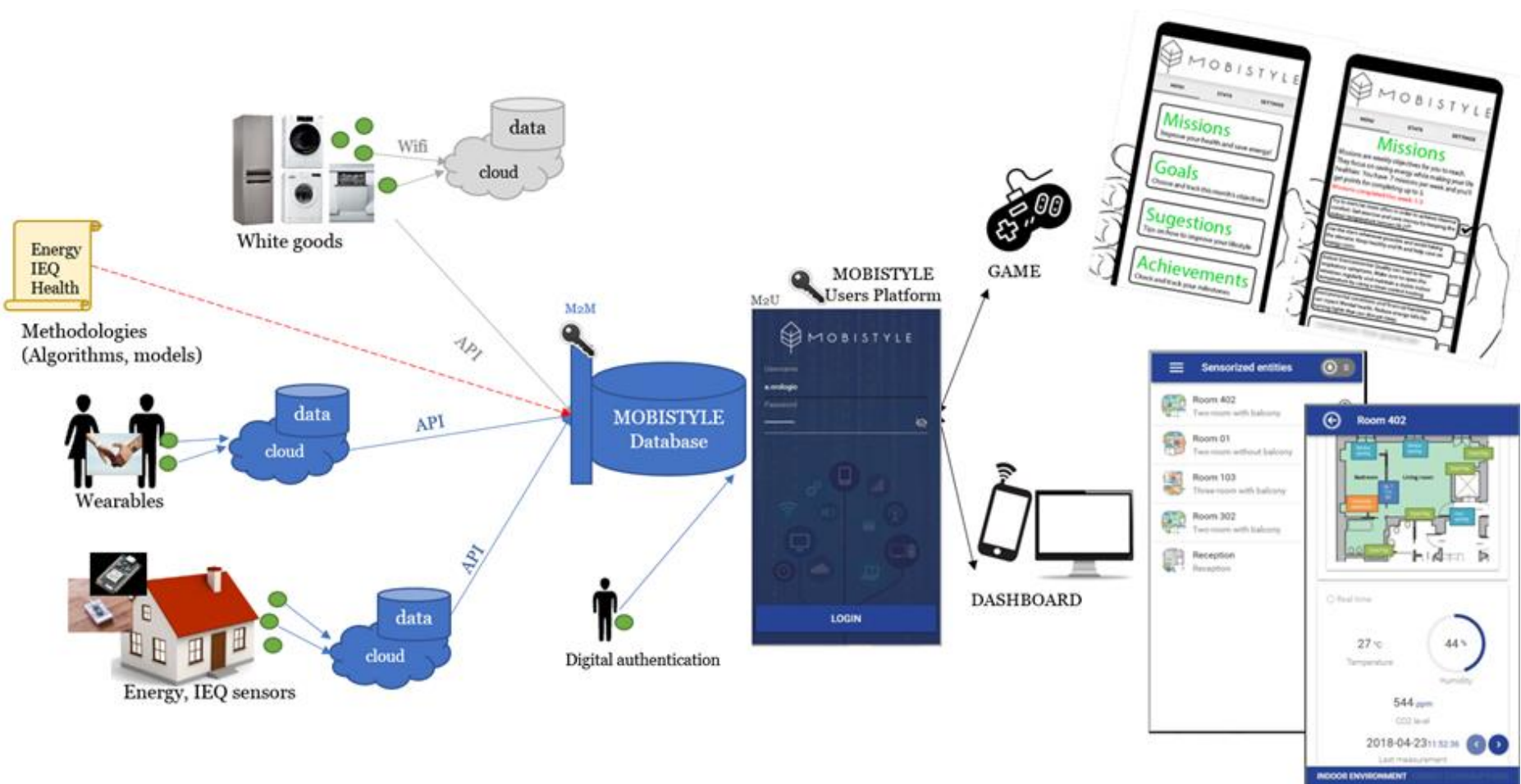


MOBISTYLE data flow and system architecture





MOBISTYLE data acquisition & information disclosure





Disclosure of information to end users

	MOBISTYLE Dashboard	MOBISTYLE Game	MOBISTYLE Expert tool
What is it?	An application for non experts that visualizes end-users data on energy use and IEQ (buildings performance) which are based on measured parameters. Visualisation can be customised for different roles (e.g. building occupant or building manager) Through alerts/push messages recommends specific user certain actions that may avoid excessive energy use and/or improve indoor environmental conditions.	A mobile application, that based on defined objectives for preferable user practices, nudges user to change practices in a fun way and is able to track the effect of changed practices on energy use and indoor environment over time. It provides scores to users for recommended practices and desirable changes. It uses “nudges” (based on the sensors data available), complemented by healthy “tips”.	It will be available in a desktop version. The expert tool has 3 main purposes. The first one is data management. The expert has access to the data and can validate, check, filter them. The second purpose is to enable the expert to calculate basic KPI and modify parameters and algorithms. The KPIs are related to energy, comfort and health and are made available to the end user through the dashboard. The last purpose of the expert tool is to support data needs of third party tools.
For which purpose?	Monitoring & Raising awareness	Behavioral change & Raise awareness	Data management, calculation of KPI, support data needs of third party tools.
For whom?	Building manager & Occupants	Residential users (have most control of their environment)	Experts
Where is it tested?	Non residential buildings	Residential buildings	Not applicable
In which demo cases?	Slovenian case & Italian case	Polish case & Danish case	Not applicable





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Demonstration and validation of the MOBISTYLE approach





Demonstration and validation

Overall MOBISTYLE objective:

- To demonstrate a sustainable behavioral change towards significant reduction of energy use in different real environments by deploying and validating the developed solutions and services.

MOBISTYLE methodology:

- The developed services and ICT-based solutions and tools will be tailor-made, deployed and monitored for five selected demonstration cases, in five different climatic regions, covering different building types, different types of energy end-users and different scales (buildings, district).
- Feedback will be provided to further develop approach, tools and services.

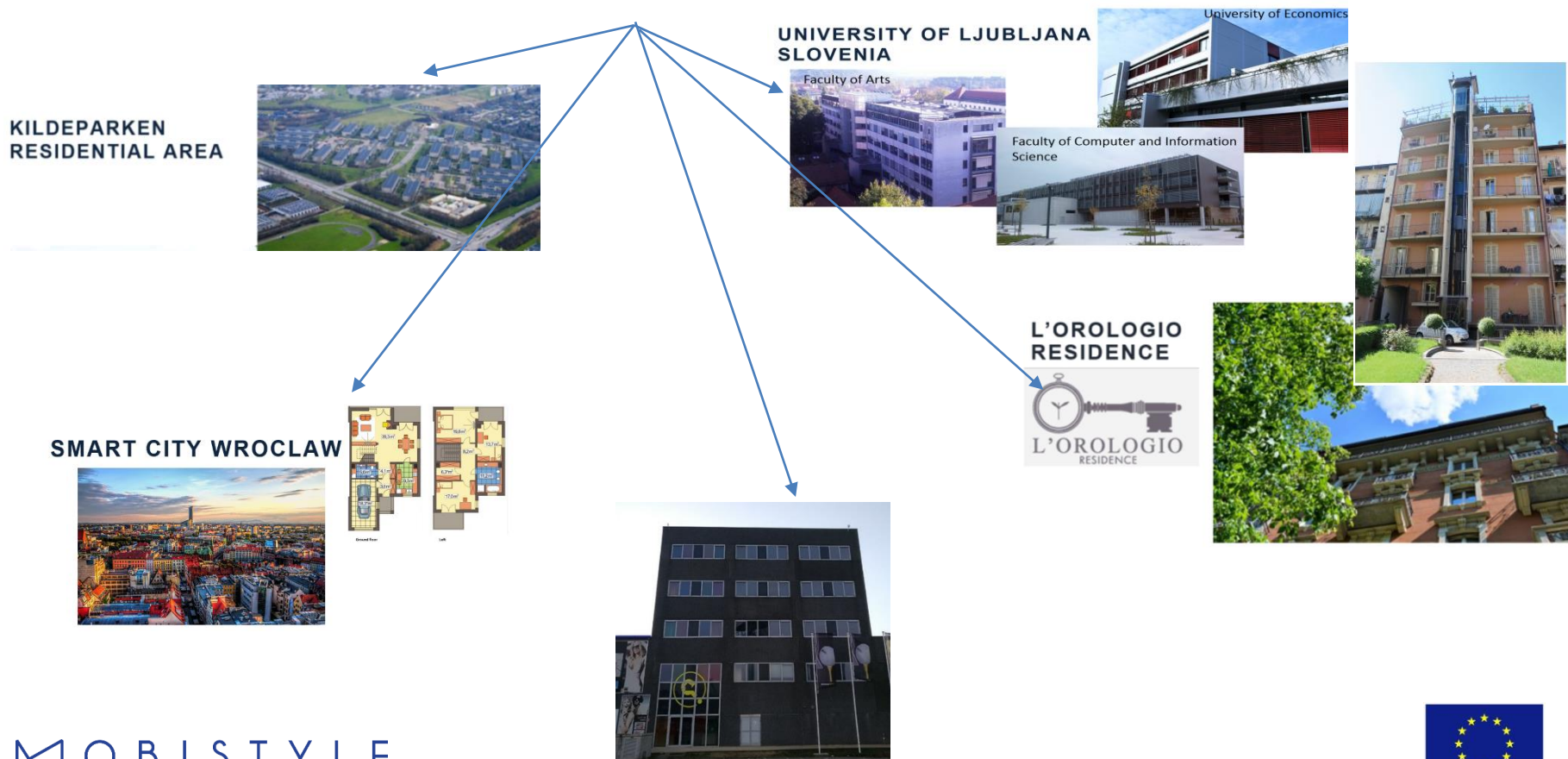
Monitoring covers different real life environments.





The demonstration cases – central part of the project

5 selected demonstration cases used to present real life situation in five different climatic regions (geo-clusters) covering different building types, different types of end-users and different scales (building, district).





Introduction to demonstration cases

The project includes five different demonstration cases:

1. Residential building complex Kildeparken: Aalborg, Denmark

18 residential apartments in 10 different two-story apartment blocks

Geocluster: Northern

2. Faculty buildings at the University of Ljubljana: Ljubljana, Slovenia

8 office rooms in 4 faculty buildings

Geocluster: Continental Central

3. Hotel residence apartments L'Orologio: Turin, Italy

4 hotel guest rooms/apartments and reception

Geocluster: Mediterranean

4. Office building Qeske and Brightlands, Limburg, the Netherlands

Open plan offices in 2 multiple storey office building

Geocluster: Western Central

5. Smart City Wroclaw: Wroclaw, Poland

1000 residential units (detached & multi-family houses, apartment blocks)

Geocluster: Eastern





Building Description

Case	Type	Target Area	Area/Occupancy	Technical Systems/ User interaction
Case 1 Kildeparken	Residential	18 apartments	Area: 67-130 m ² , 1- 5 persons/apartment	Heating(setpoint), DHW use, window opening
Case 2 University of Ljubljana	Office	8 offices	Area: 15 - 60 m ²	Solar shading, window opening, lighting, HVAC setpoints
Case 3 Hotel Residence L'Orologio	Hotel	4 hotel apartment, reception area	Area: 36-39 m ² , 2-3 rooms/apartment	HVAC (setpoint), window opening, appliances
Case 4 Qeske and Brightlands	Office	Open plan offices	Area: 200 m ² , 8 persons/office	-
Case 5 Smart City Wroclaw	Residential	1000 units	Area and persons/residence: Varying	Window opening, lighting, appliances





MOBISTYLE Case specific Objectives

Case	Reduce energy use	Improve IEQ	Improve Health	User practices
Case 1 Kildeparken	Heating, DHW	Reduce overheating, improve IAQ	By better sleeping quality at night, reduced humidity levels in apartment	Heating setpoint, window opening, DHW use
Case 2 University of Ljubljana	Indirectly, energy use reduction estimated	Reduce overheating, avoid glare, improve IAQ, lighting quality, view to outside	By providing motivation	Improve user interaction with building systems
Case 3 Orologio Living Apartments	Electricity for HVAC and appliances	Reduce overheating, improve IAQ	By improve the sense of wellbeing in relation to indoor environment	Fan- coil setpoint, window opening, appliances and electric devices
Case 4 Qeske and Brightlands	Indirectly, energy use reduction estimated as a results of reduced heating setpoints		By exposing occupants to different temperature conditions	Perceived acceptability of varying temperatures
Case 5 Smart City Wroclaw	Electricity for appliances and plug loads	Reduce overheating, improve IAQ, reduce humidity levels	By improving IEQ	HVAC setpoints, window opening,





Case 1: Kildeparken, Aalborg, Denmark

Target area:

3000 residences in 3 built areas
renovated before 2020:

Blåkildevej in 2015,
Ravnkildevej in 2016
Fyrkildevej in 2017

1000 new residences will be built and
infrastructure updated

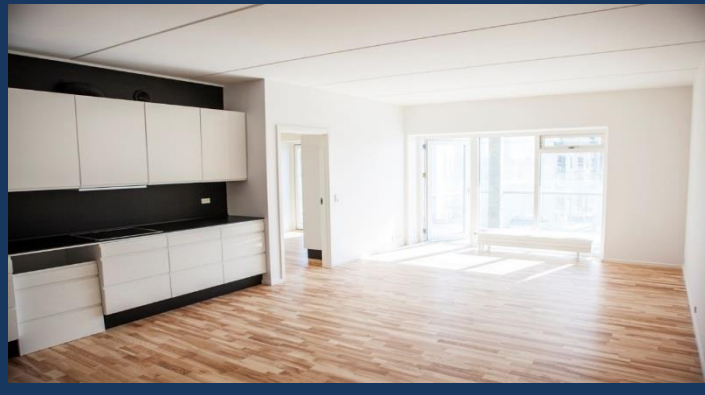
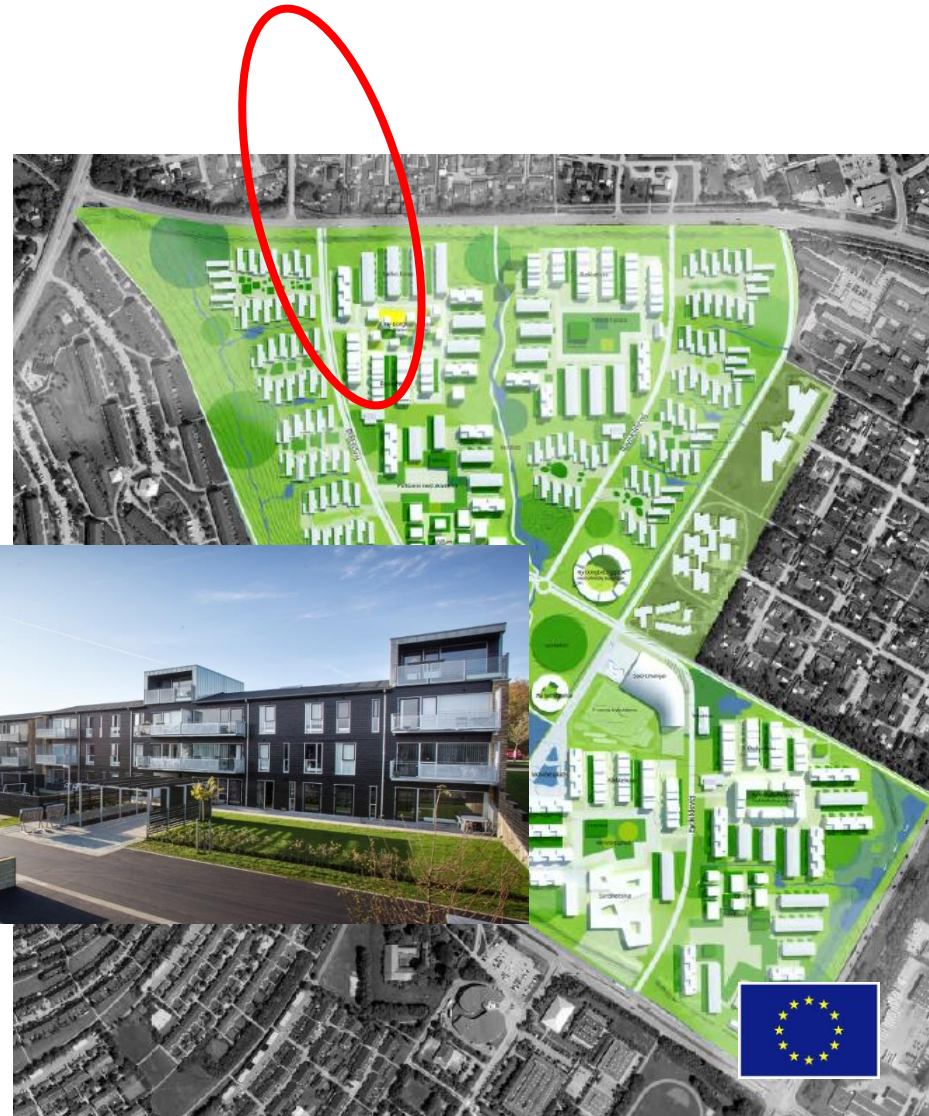




Case 1: Kildeparken, Aalborg, Denmark

Demonstration focus: Blåkildevej

18 residential apartments in 10 two-story apartment blocks





Case 1: Kildeparken, Aalborg, Denmark

Demonstration focus:

Residential apartments (67-130 m²)
for families: 1 – 5 members

Objectives:

- Reduction of energy use for heating and domestic hot water (DHW)
- Improvement of IEQ
- User practices: Thermostat, window opening, DHW





Case 2: University of Ljubljana, Ljubljana, Slovenia

Target area: 4 faculty buildings

Offices for teaching staff, researchers,
administrative and technical staff





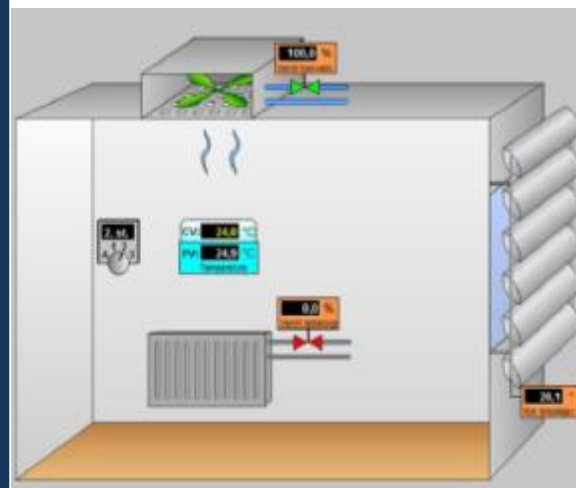
Case 2: University of Ljubljana, Ljubljana, Slovenia

Demonstration focus:

2 x 4 occupied office rooms (15-60m²)

Objectives:

- Improvement of IEQ
- User practices: Interaction with building systems (solar shading, window opening, lighting, HVAC setpoints)



Signals available from SCADA:

- Valve position convector cooling [%]
- Valve position radiator heating [%]
- Daily regime [Off/ comfort standby/ saving]
- Hysteresis heating for 3 different regimes [°C]
- Convector ventilator speed [0-3]
- External shading position [°]
- Occupancy from access [0/1]
- Daily regime setting from schedule
- Set point temperature [°C]
- Active set point temperature [°C]
- Actual set point temperature [°C]
- Set point temperature - offset [°C]
- Set shading angle automatic [°]
- Convector ventilator switch status [A/0/1/2/3]
- Room air temperature [°C]
- Temperature regime [Heat/Cool/Off]
- Window switch [0/1]
- No cooling media available [0/1]

Lights use for each circuit [0/1]



Case 3: Orologio apartments, Turin, Italy

Target area: Apartment hotel

4 guest rooms and reception

Apartments fully equipped with appliances: fridge, dishwasher, electric oven, microwave, electric stove, washing machine and TV





Case 3: Orologio apartments, Turin, Italy

Demonstration focus:

Residential: 2 or 3 room hotel apartments (37-39 m²)

Objectives:

- Reduction of energy use for heating, cooling and appliances
- Improvement of IEQ
- User practices: Thermostat, window opening, appliances





Case 4: Qeske and Brightlands, The Netherlands

Target area: 2 Office Buildings

Open plan offices





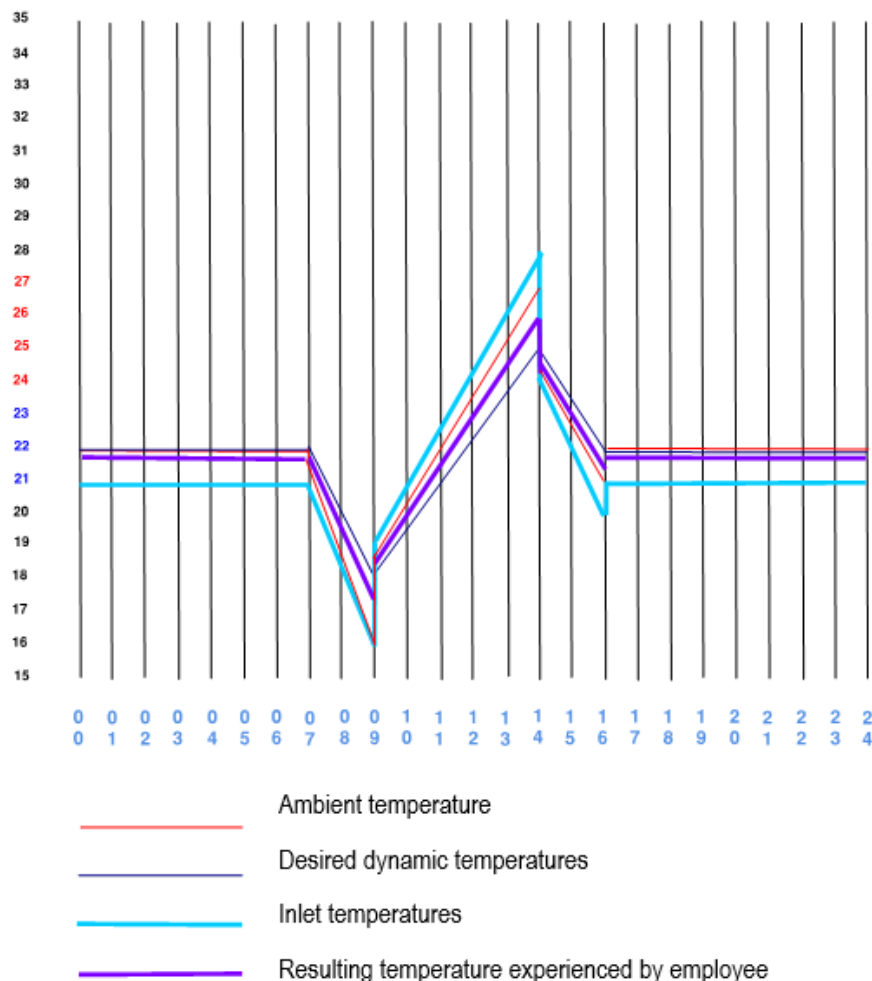
Case 4: Qeske and Brightlands, The Netherlands

Demonstration focus:

2 - Open plan offices (200 m²)

Objectives:

- Assess user's perception of dynamic temperature profile
- Investigate how different generated indoor environment situations affect occupants health related parameters, well-being, comfort, acceptance and habituation
- Educate occupants on why dynamic conditions are healthy for them

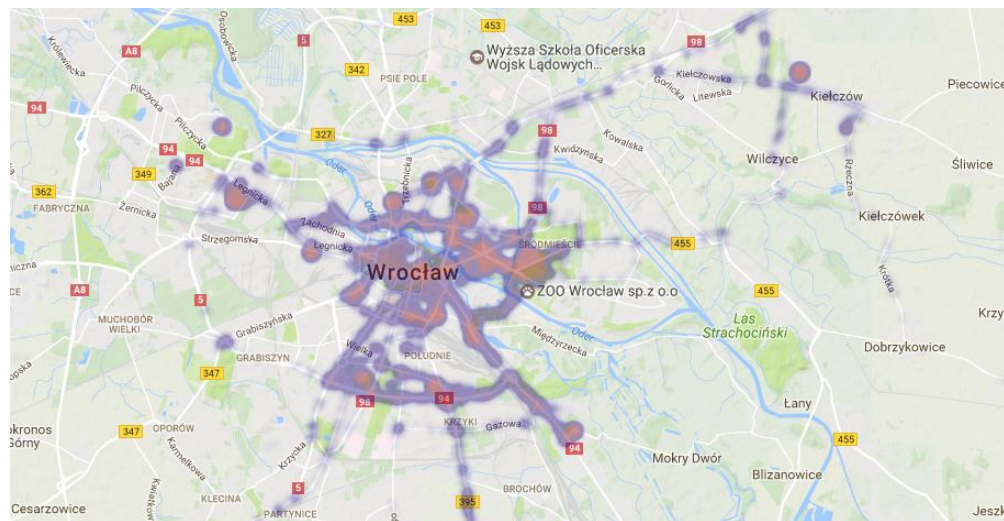




Case 5: Smart City Wroclaw, Wroclaw, Poland

Target area: Apartments and single family houses

1000 residential units in different areas of the city (detached houses, multi-family houses, apartment blocks)





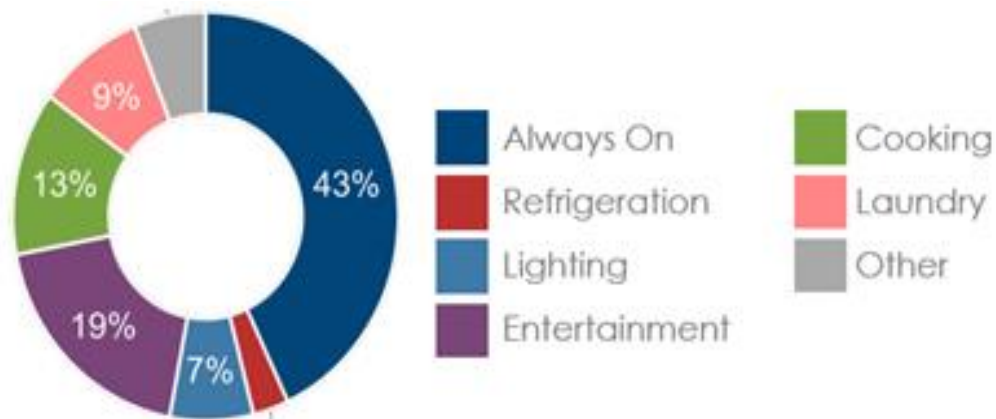
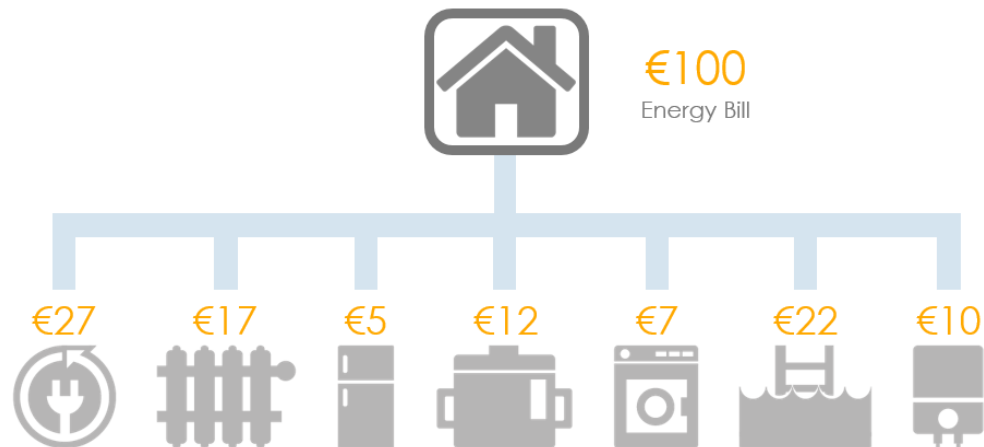
Case 5: Smart City Wroclaw, Wroclaw, Poland

Demonstration focus:

Residential:

Objectives:

- Reduction of electric energy use for appliances and plug loads
- Improvement of IEQ
- User practices: HVAC setpoint, window opening, appliances





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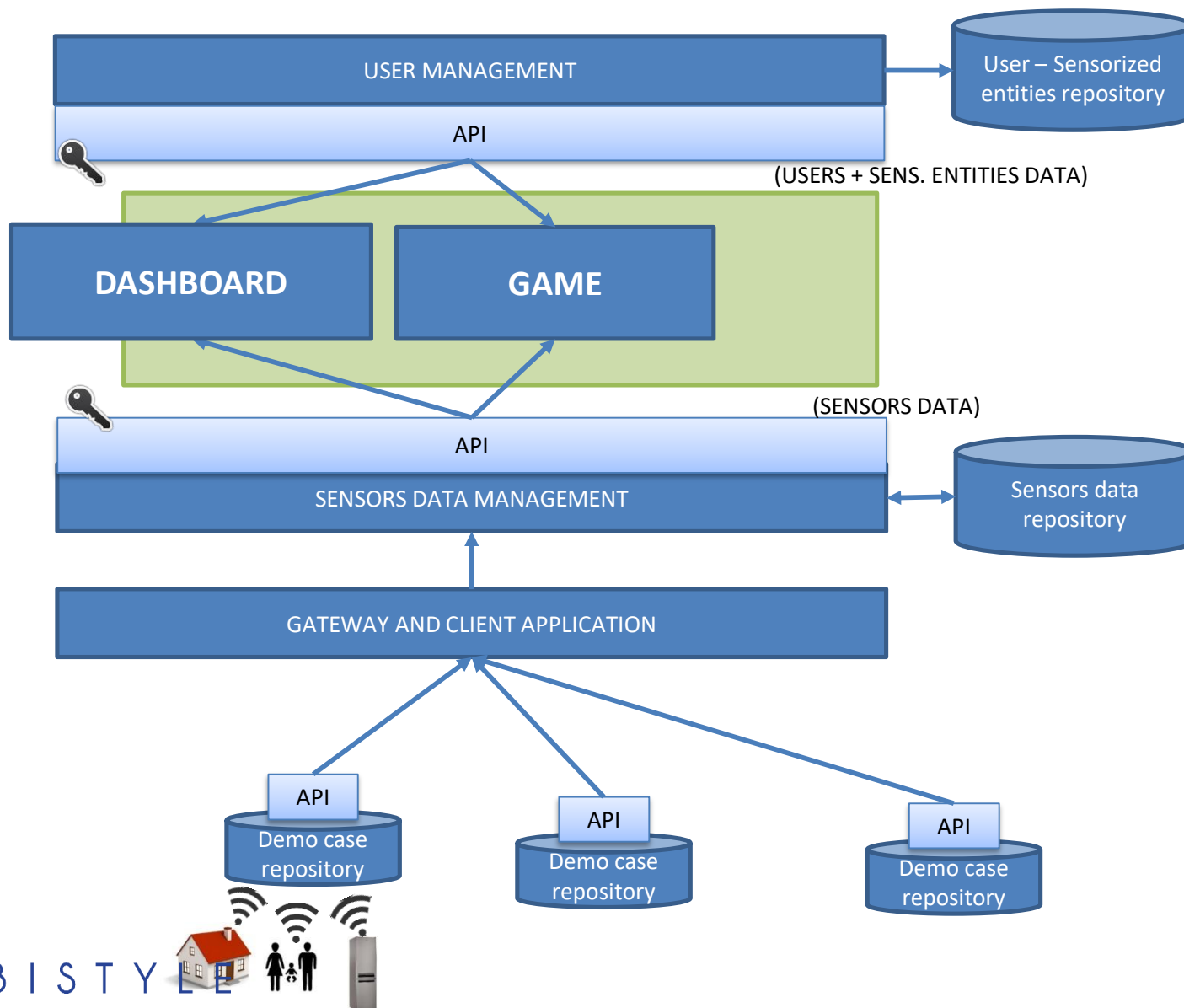
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Demonstration of the MOBISTYLE solutions





Demonstration of the first versions of ICT solutions





The MOBISTYLE Dashboard

Description of the dashboard:

- The dashboard is a tool that allows different user types to visualise data (energy usage, IEQ, health, appliances, etc.) and derive information about the buildings they interact with.
- Different actors interact with the dashboard according to their role.
- Information can be given through simple data monitoring, historical trend analysis, specific widgets, ad hoc suggestions.

Purposes of the dashboard:

- Raise awareness on energy consumption;
- Motivate change in the behavior;
- Stimulate reduction of energy usage and IEQ improvement;
- Provide intuitive and customised presentation of data and KPIs.





The MOBISTYLE Dashboard

Desktop application:

- Web application developed in HTML and Javascript
- Aimed to both consumers and company managers
- Used primarily to configure rooms and suggestions

MOBISTYLE

ACCOUNT

- Organization
- Licenses

MONITORING

- Room types
- My rooms

SUGGESTIONS

- Suggestion types
- My suggestions
- Report

Dashboard Configuration Handover Suggestions

Two-room with balcony - 402

Avatar Real time

21.5°C Temperature

66.0% Humidity

711.5 ppm Indoor CO₂

58.911 CO₂ impact

Electricity consumptions

10.0 kWh Room

0.0 kWh TV

0.0 kWh Washing machine

0.0 kWh Microwave

2.0 kWh Dishwasher

Suggestions

Room 402

PLEASE OPEN A WINDOW!

HUMIDIFY YOUR AIR ONCE IN A WHILE!

20:00 00:00 04:00 08:00 12:00 16:00 20:00 00:00 04:00 08:00 12:00 16:00 20:00 00:00 04:00 08:00 12:00

Sun 7 October Mon 8 October Tue 9 October Wed 10 October

HUMIDIFY YOUR AIR ONCE IN A WHILE!

The air around you is very dry. Dry air in your home has been known to aggravate respiratory problems and is claimed to make you more likely to catch a cold or the flu. For example, you could let your clothes air-dry or put bowl(s) of water on windowsills.

Room Room 402

Start date 2018-10-06 19:16:26

End date 2018-10-07 13:46:18

Duration 18h 29m 52s

ENDED





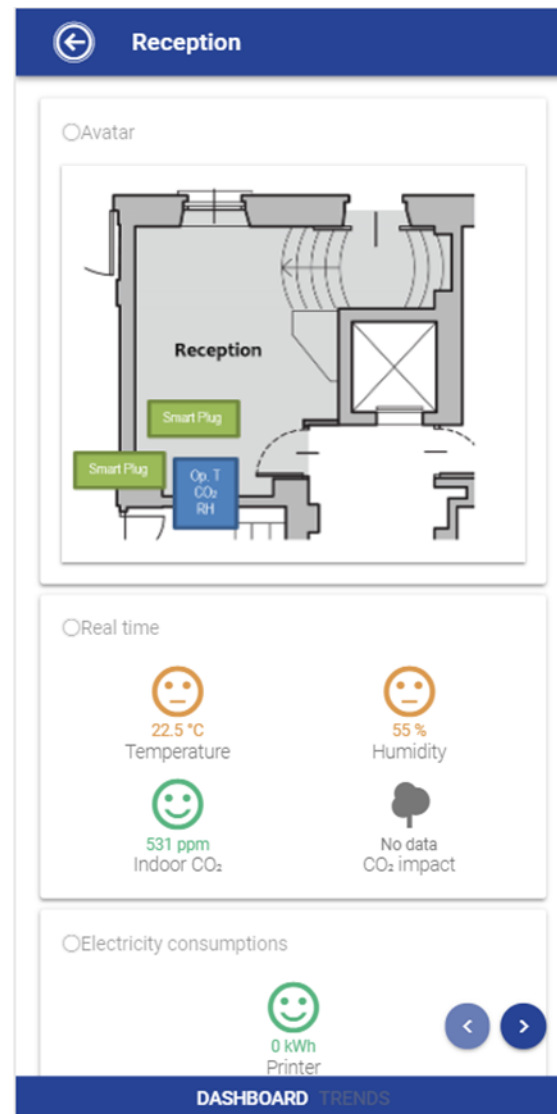
The MOBISTYLE Dashboard

Mobile application:

- Android only ATM
- Same dashboard as desktop application
- Published as open beta version on Google Play
- Aimed to consumers only

APPLICATION LOGIC

- Organizations
- Rooms and room types
- Handovers
- Manager and user dashboard
- Suggestions and suggestion types
- Notifications





The MOBISTYLE Dashboard

Users Structure:

MOBISTYLE users: people, connected to the solution, able to download the MOBISTYLE tools

Buildings users: owners and employees of rooms/apartments/buildings that are connected to the MOBISTYLE solution, able to manage what is shown to users.

ADMINISTRATORS → SuperUsers, ICT experts, able to create new users, new buildings, manage licences, accesses, permissions, create entity types per each kind of building, etc.

BUILDINGS MANAGER → Users with management permissions, able to take decisions on their buildings:

- Create single sensorized entities starting from created sensorized entity types;
- Create and modify specific dashboards (i.e. one for the moderator and one for the users);
- Allocate MOBISTYLE users to the sensorized entities (rooms/apartments/buildings) and relative dashboards;
- Create new suggestion types for each sensorized entity type;
- Allow and remove access permissions of users to rooms/apartments/buildings information.

USERS → They can access MOBISTYLE users dashboard and visualize all the sensorized entities data he/she is connected to.





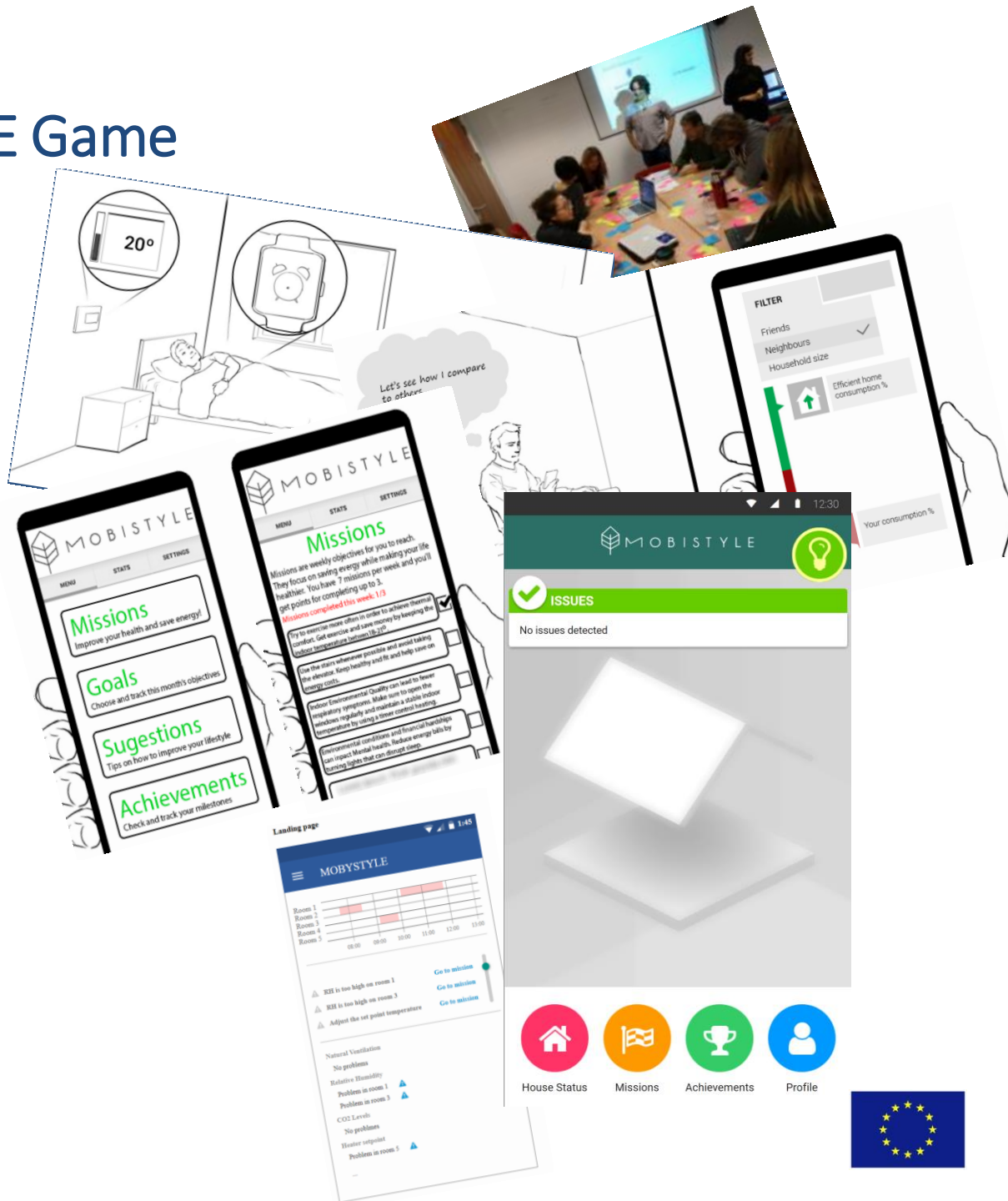
The MOBISTYLE Game

Description of the game:

The MOBISTYLE Game is a mobile application that uses “nudges”, complemented by “tips”, to change user behaviour based on the sensors available in the residence.

Targeted users for the game:

Residential users are the key target users as they have most control of their environment.





Energy efficiency at the heart of EU transition towards sustainable future.
Energy efficiency not at the heart of building users.



People use energy for its everyday practices but most often resulting energy use remains unnoticed.



First we need to understand the current user behavior and make its energy demand visible to users.

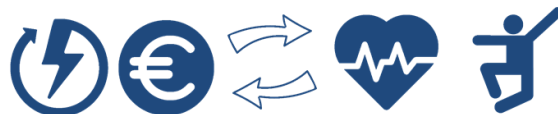


Interdisciplinary work between engineers and social scientists can help understanding users.



We start steering new behaviors by promoting practices with multiple benefits.

Promote solutions and services where goals on energy efficiency, good IEQ and health overlap.





Interested to join the MOBISTYLE Consumers Advisory Board (MCAB)?

By joining the MCAB you will be able to get more insights in the results of the MOBISTYLE:

Also, we are looking forward to discuss with commercial companies interested in the project potential business collaboration opportunities.

For more information contact

MOBISTYLE Ambassador: Andrei Vladimir Lițiu (litiu@kth.se)

MOBISTYLE Coordinator: Ana Tisov (a.tisov@huygen.net)





Thank you for your attention!

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Contact me!
info@mobistyle-project.eu

MOBISTYLE IS THE WAY OF LIFE.
LET ME TELL YOU WHY.

Getting tailored information on how my daily actions affect:

- building's energy usage
- generated indoor environment
- my personal health

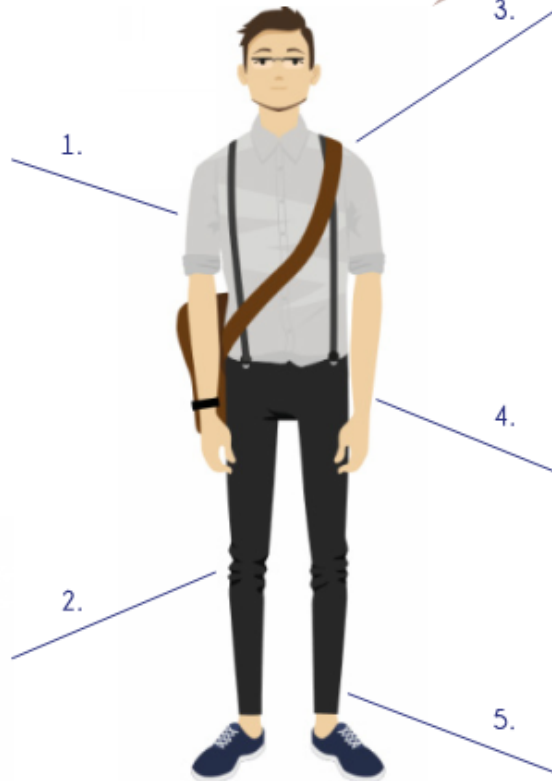
make me want to do and be better.

This is possible due to the modular MOBISTYLE ICT based services where data coming from multiple devices is combined in one environment:

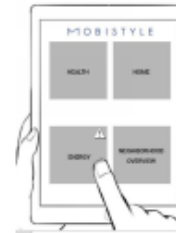
MOBISTYLE Open Users Platform.



The best is that I can decide which data I want to



3. Regularly I receive MOBISTYLE action tips based on my current behaviour that let me know what is in my power to improve my lifestyle.



Did you know that lowering indoor temperature not only leads to energy savings but can also improve your health?

I learned that thanks to MOBISTYLE.

4. My achievements this year in comparison with the results from last year.



5. Do you also wanna keep in style? Then learn more by following MOBISTYLE.

@MOBISTYLE_EU





Thank you for your attention!



Contact MOBISTYLE team.



info@mobistyle-project.eu



www.mobistyle-project.eu

Join us on Twitter.



[@MOBISTYLE_EU](https://twitter.com/MOBISTYLE_EU)

COLOPHON

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