EU project ChArGED: Cleanweb Gamified Energy Disaggregation

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Project Identity

Coordination

- European Dynamics Belgium SA., BE

Tech providers

- Wattics Ltd., IE
- Plegma Labs SA., EL
- Prosyst Software GmbH, DE
- the peak lab., DE

Pilot Users

- Catalan Energy Institute, ES
- City of Athens IT Company, EL
- National Museum of History and Art, LUX

Socio-economic Modelling

- Athens University of Economics and Business, EL

EE11 - New ICT-based solutions for Energy Efficiency

Budget: 2.2 M Euro
Grant: 2.2 M Euro
Start: 1 Mar 2016
End: 28 Feb 2019

Wattics
Innovating Energy Management

European Dynamics

Musée national d'histoire et d'art Luxembourg
MNHA

Generalitat de Catalunya
Institut Català d'Energia

ProSyst Bosch Group
the peak lab.

ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS
Pleg.ma Labs
DAAEM
CITY OF ATHENS - IT COMPANY

Problem Statement

- Buildings responsible for 40% of the final energy consumption in the EU and 36% of CO_2 emissions.
- More than one third of this demand: non-residential buildings (offices, factories, schools, hospitals or hotels).
- EU supports improvement of energy performance of buildings for many years (legislative and financing mechanisms and instruments).
- Still important barriers exist especially for public buildings:
  - a) lack of expertise that leads to blind energy consumption (electricity, heating/cooling)
  - b) lack of time and interest
  - c) lack of incentives
  - d) hesitant introduction of smart metering devices.
- Target: energy savings through behavioral change

Challenges (I)

- **No interest from energy consumers**
  - Occupants not the buildings' owners
  - They don't pay bills.
  - Little concern about energy spending.
- **Long return on investment**
  - Although continuously increasing, electricity bills in public buildings compare low with industrial settings.
  - Expensive and thorough monitoring solutions deployed in energy-intensive buildings not commercially viable for public buildings
  - Payback (Investment Return) too long.
- **'Culprits' go unnoticed**
  - In industrial environments people are assigned to machines or areas - easy to associate waste/savings to a particular team or person.
  - In public buildings, many people share areas and equipment (e.g. open offices) - difficult to associate energy spending to end-users.
  - It is easy to pass on energy saving opportunities and inefficient patterns go unnoticed.

Challenges (II)

- **Major energy consuming units not accessible to building occupants**
  - Major energy reduction will come from a reduced set of machines, typically heating, cooling, ventilation and lighting.
  - Such equipment usually out of reach for building occupants / under a facility manager supervision.
  - Individual energy saving actions have lower impact - Aim at the overall (aggregated) impact of all actions combined.
- **No reward incentives**
  - Employees do not generally receive rewards from their institutions for environmentally responsible actions.
  - Poor user engagement and failure of energy awareness campaigns.
  - Various mechanisms such as rewards and energy goals can support engagement with sustainability practices among employees.
- **Privacy intrusion**
  - For many, monitoring energy can lead to privacy intrusion.
  - Provides immediate insights on user presence, space occupancy and periods of activity for people operating machines.
  - Many companies are in a position where they do not want to engage with intrusive solutions that raise data privacy/protection issues.

User behavior addressed in Charged

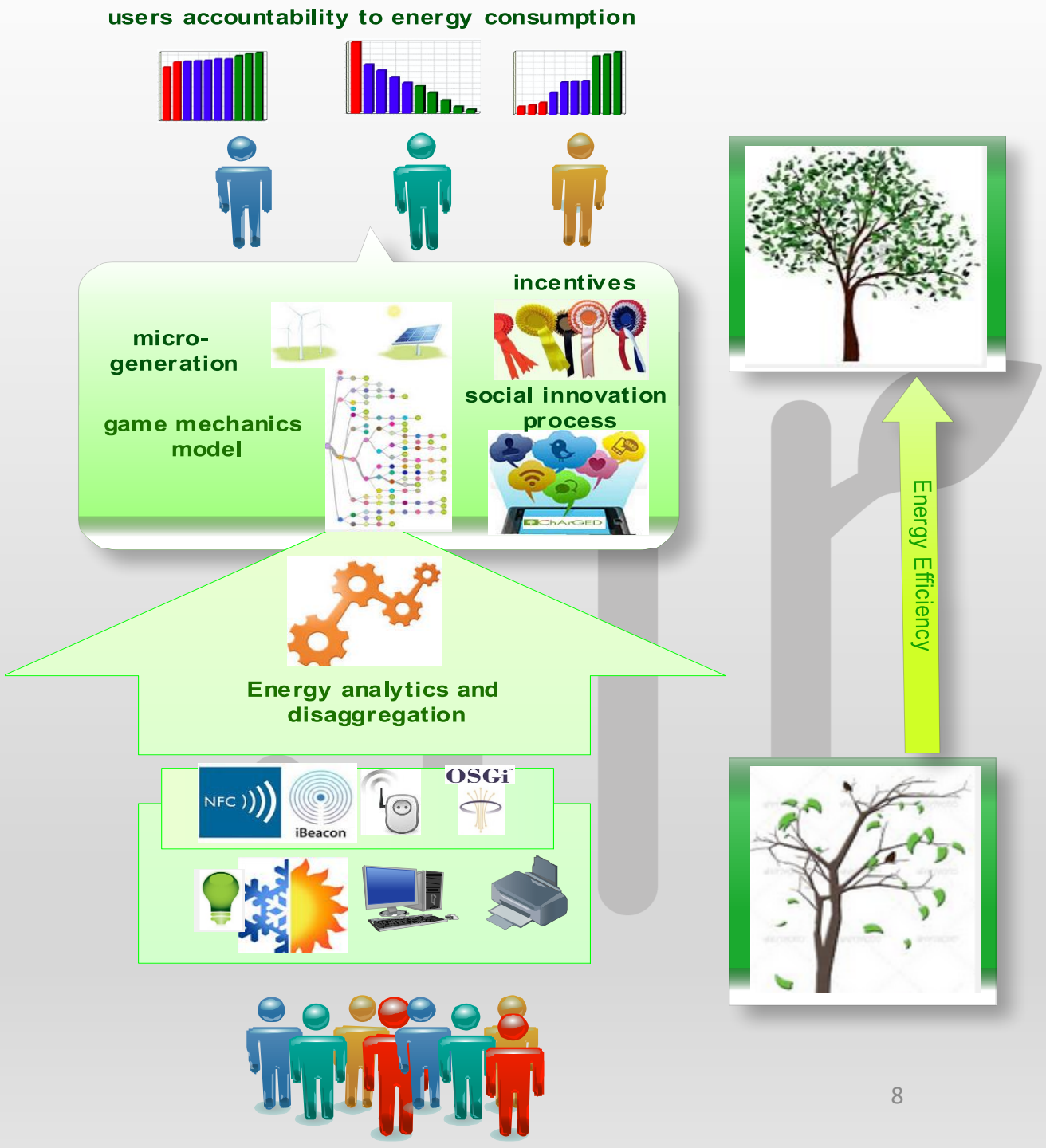
- A major driver towards the ChArGED goal: user behavior.
- Example: Poor occupant behavior on electricity consumption during non-occupied hours
  - 56% of the energy consumed by the buildings used outside working hours
  - lights and equipment are left on at the end of the day
  - poor zoning and controls.
- Behavior change spreads through social networks as a ‘social contagion’,
  - the behavior of friends and others influences choices, often on a subconscious level.
- Social networks play an important role in supporting participatory approaches
  - by linking communities and groups to generate opportunities for “getting involved”.

Core Objectives

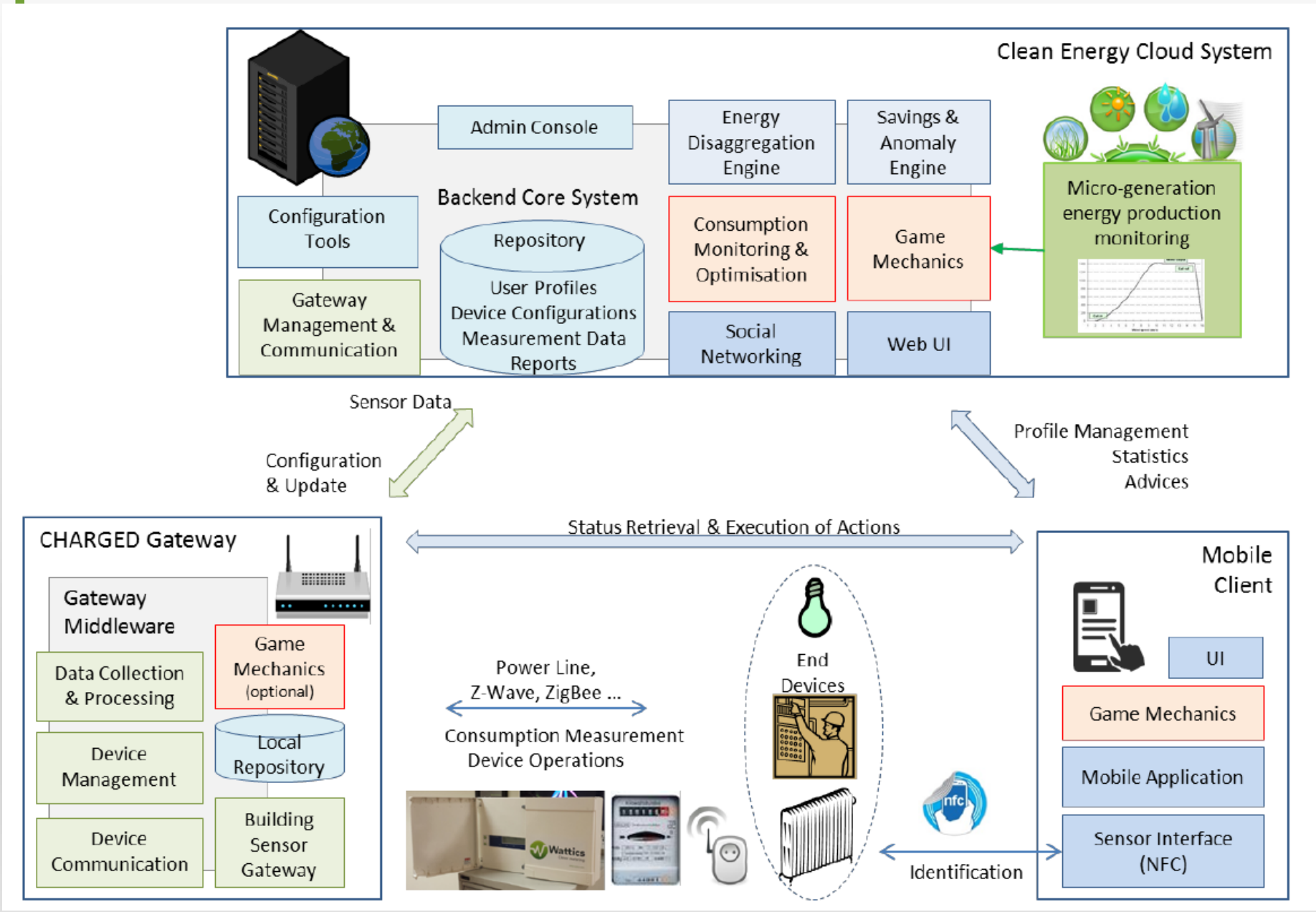
- Address the energy consumption in public buildings
- Propose a framework for achieving greater energy efficiency and reductions of wasted energy.
- Improve energy disaggregation mechanisms at the device, area and end user level with **IoT enabled, low-cost devices.**
- **Generate** personalized real-time recommendations to each individual end user using a **Gamified application**.
- Follow a **cleanweb approach and implement a novel social innovation process** based on human incentives factors to help users understand the environmental implications of their actions.
- Enable social interaction and competitions to contribute to the user engagement **and commitment to generate savings in the long term.**
- Educate users on energy efficiency actions and their impact beyond the actual public building.
- Predict consumption and optimize use of the **micro-generated (renewable) energy** through the gamified application.

High-Level Concepts

- **Multi- level energy disaggregation** using commercial smart meters, smart plugs, sensors
- An **IoT-based, SOA** and OSGi technology to interconnect subsystems
- **Cloud-based backend system,** on commercially available cloud infrastructures
- A **cleanweb gamified application for portable / mobile devices** with novel concepts for attracting and engaging users



Conceptual Architecture



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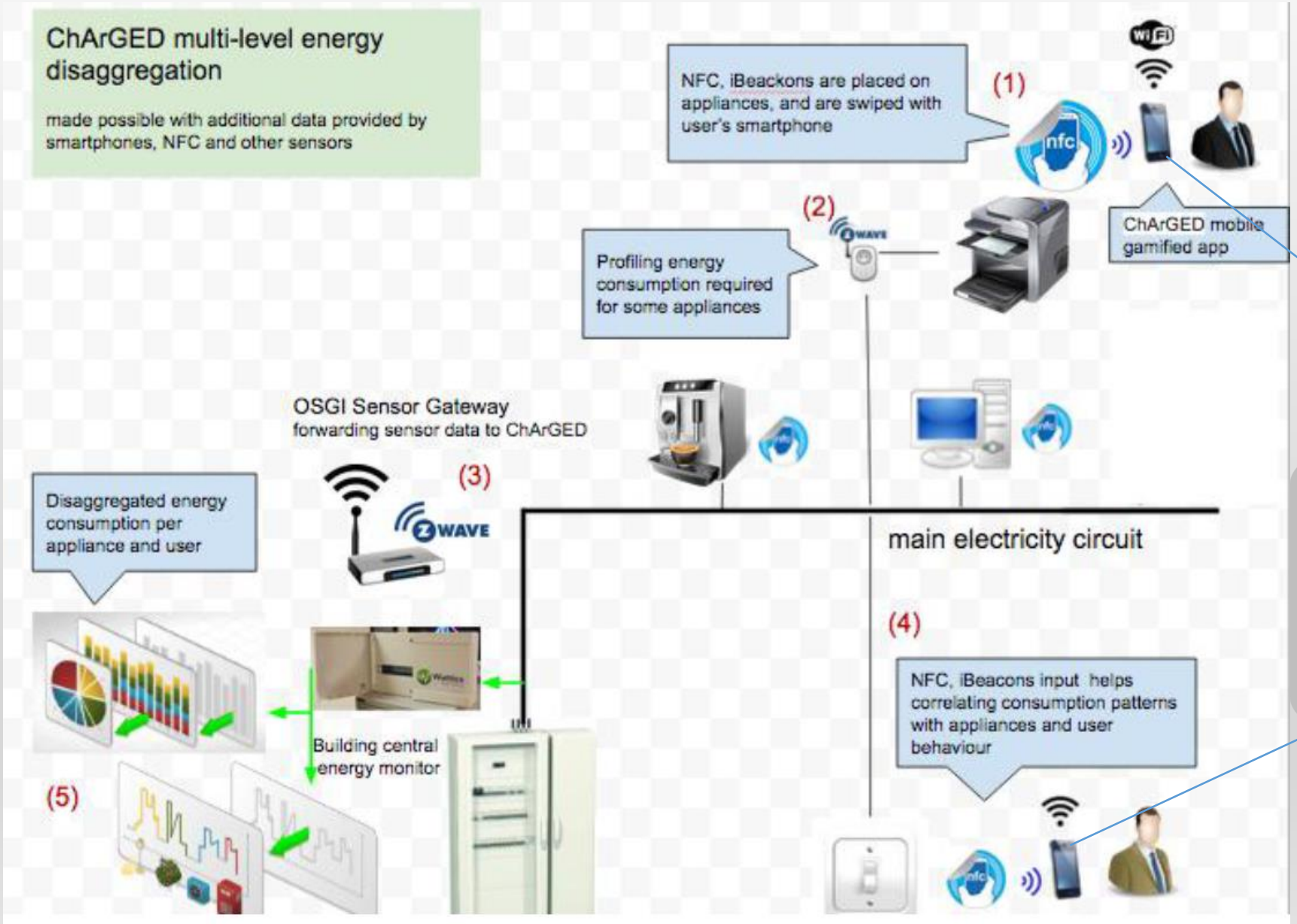
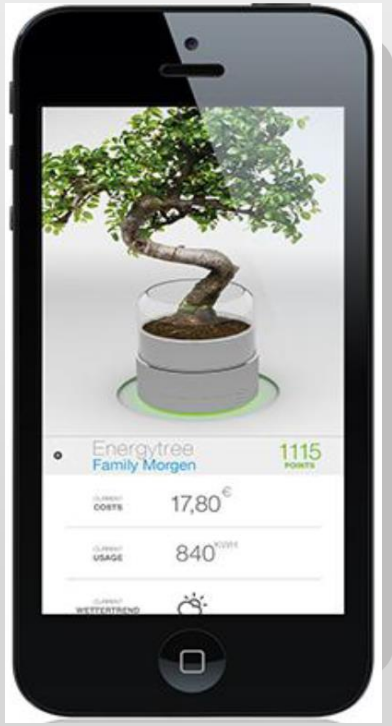
Charged disaggregation & feedback loop



Aim: associate consumption to users (identify energy consumption behavior)…



… and motivate users to adjust their behavior

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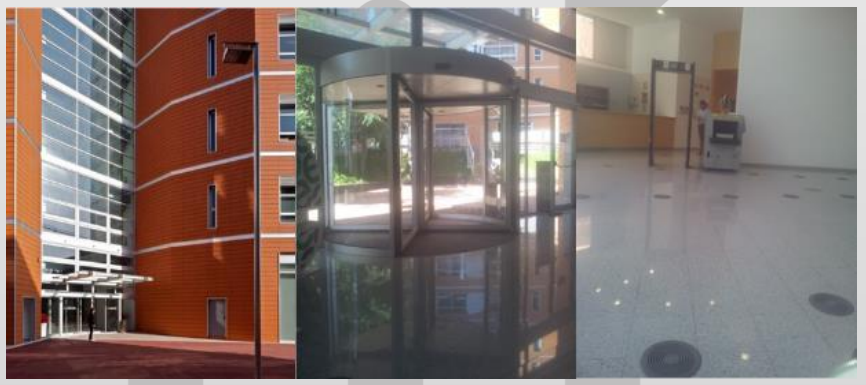
Pilot Sites

- **City of Athens IT Company**
  - 1 Floor/60 employees
  - *Typical Office Floor Layout*
  - *Will deploy solar micro-generation system*
- **Barcelona EcoUrbanBuilding, Catalan Institute of Energy**
  - 1 Floor / 60-80 employees
  - *Open Space Office Floor Layout*
  - *Available energy metering infrastructure*
- **Luxembourg National Museum of History and Art**
  - 2 buildings/ 60 employees
  - Personnel Offices and exhibition rooms
  - *Restrictions on environmental conditions in exhibition rooms (e.g. humidity ≥ 40% to preserve the art works) and on lighting (e.g. for the exhibits' presentation and protection).*



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ChArGED Exploitable Results

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expected outcomes

EXPLOITATION METHODS

new research

market penetration

science and education

Policy regulations

STAKEHOLDERS

- Public building occupants
- facility managers
- energy advisors
- researchers
- general public
- public sector bodies
- energy suppliers
- electronics manufacturers
- IT industry, etc.

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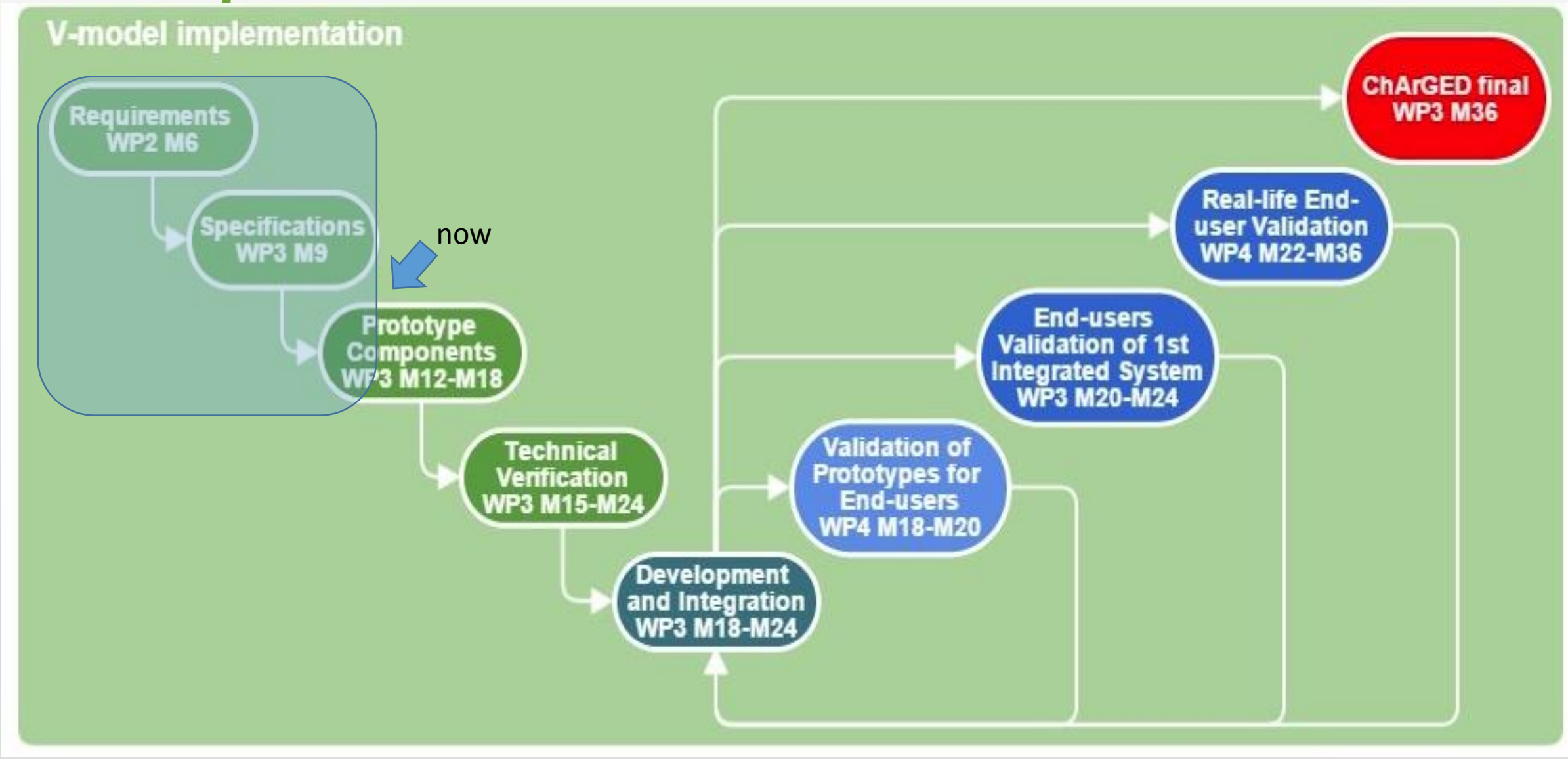
Project Timeline



Thank you for your attention

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ChArGED project Group

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