Application of a KPI-driven protocol for sustainability assessment

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CITYFiED
RepliCable and InnovaTive
Future Efficient Districts and cities

CARTIF

SUSTAINABLE PLACES 2017 JUNE 28 – 30, 2017 MIDDLESBROUGH, UK

Sustainable Places 2017, June 28-30. Middlesbrough, UK.

Application of a KPI-driven protocol for sustainability assessment

- Few words about CITyFiED
- Why a novel procedure?
- Sustainable procedure at-a-glance
- Application in Torrelago
  - Energy asssement
  - ICT tools
  - Quality control of interventions
  - Social acceptance
- Conclusions

Few words about CITyFiED

- **Full title:**

  "RepliCable and InnovaTive Future Efficient Districts and cities"

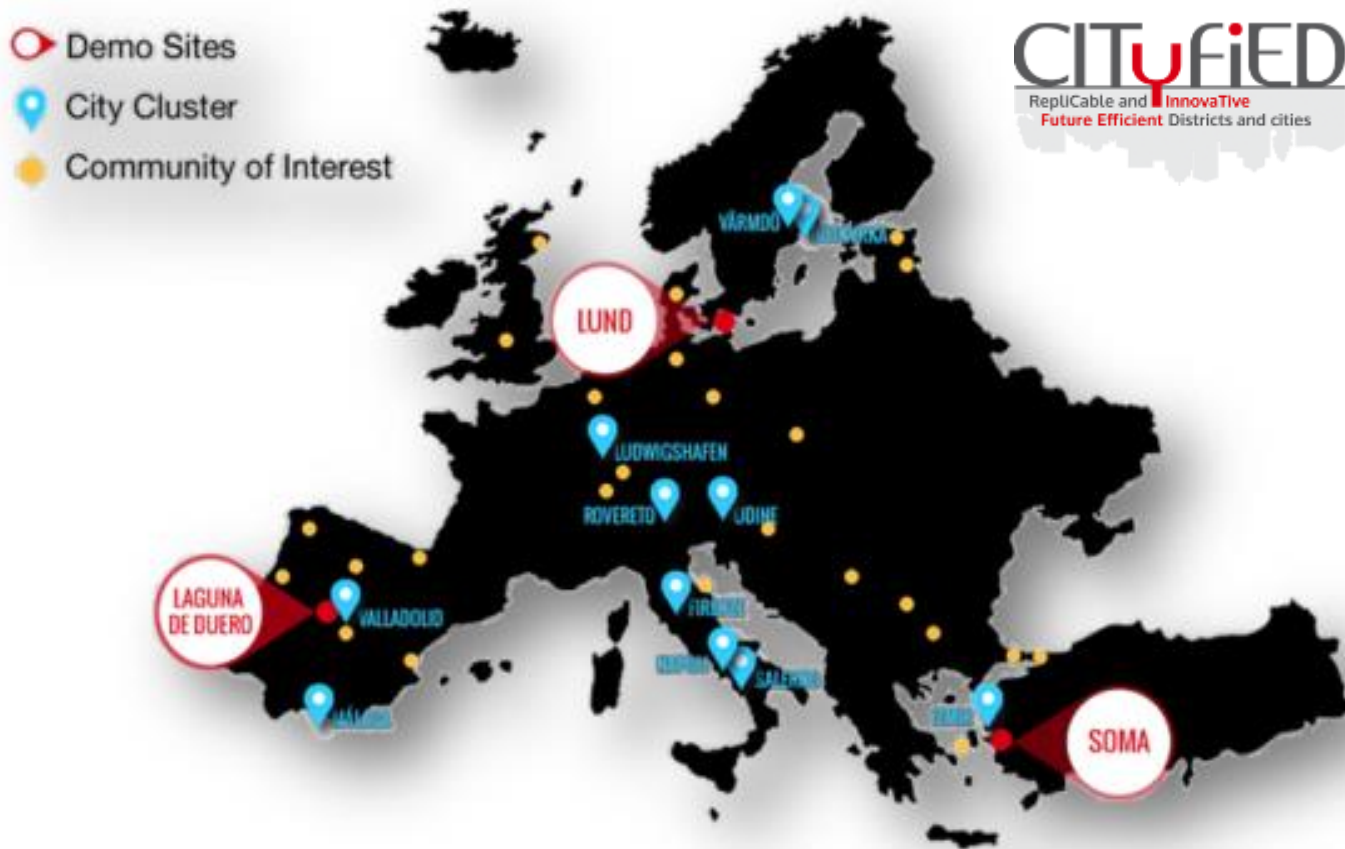- **Grant Agreement** *# 609129*

- **Aim:**

  *Development of **a replicable, system and integrated strategy** to adapt urban ecosystems into the smart city of the future, focusing on **reducing the energy demand and GHG emissions** and increasing the use of **renewable energy sources** by developing and implementing innovative technologies and methodologies for **building renovation, smart grid and district heating networks** and their interfaces with **ICTs***

Few words about CITyFiED

CITyFiED Community

Demo Sites
City Cluster
Community of Interest

CITyFiED
RepliCable and InnovaTive
Future Efficient Districts and cities

LUND

VÄRMDÖ / BOTKYRKA

LUDWIGSHAFEN

ROVERETO / UDINE

LAGUNA DE DUERO / VALLADOLID

FIRENZE

SALERNO

MÁLAGA

IZMIR / SOMA

April 2014 – March 2019

46.04 M eur

25.83 M eur

21 partners

29% SMEs

Expected impacts

260.000 m² of living space

73% reduction energy use

2213 dwellings involved

Demonstration sites

Laguna de Duero 50%

Soma 7-8%

Lund 15%

Botkyrka | Firenze | Izmir | Ludwigshafen | Málaga | Napoli | Rovereto | Salerno | Udine | Valladolid | Varmdo

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Why a novel procedure?

- Sustainability concept involves **new models of socio-cultural relationships**

- **Challenge** in terms of urban environments
  - New trend in certification of buildings
    - Current protocols and standards
    - Difficult to implement
    - Require experts for the certification
    - Benchmarking is time-consuming
    - Increase the cost in their implementation
    - Missing important pillars: end-users, ICTs and LCA

- **Two main standards**
  - BREEAM
  - LEED

Why a novel procedure?

- **Benefits of the new approach**
  - Based on simple KPIs for the evaluation instead of credits
    - Objective vs subjective

  - Real measurement data
    - Avoiding simulation

  - Inclusion of LCA and ICT tools evaluation
  - Widen the scope into Smart Cities, not only buildings
  - Considers the end-user in the loop

Sustainable procedure at-a-glance
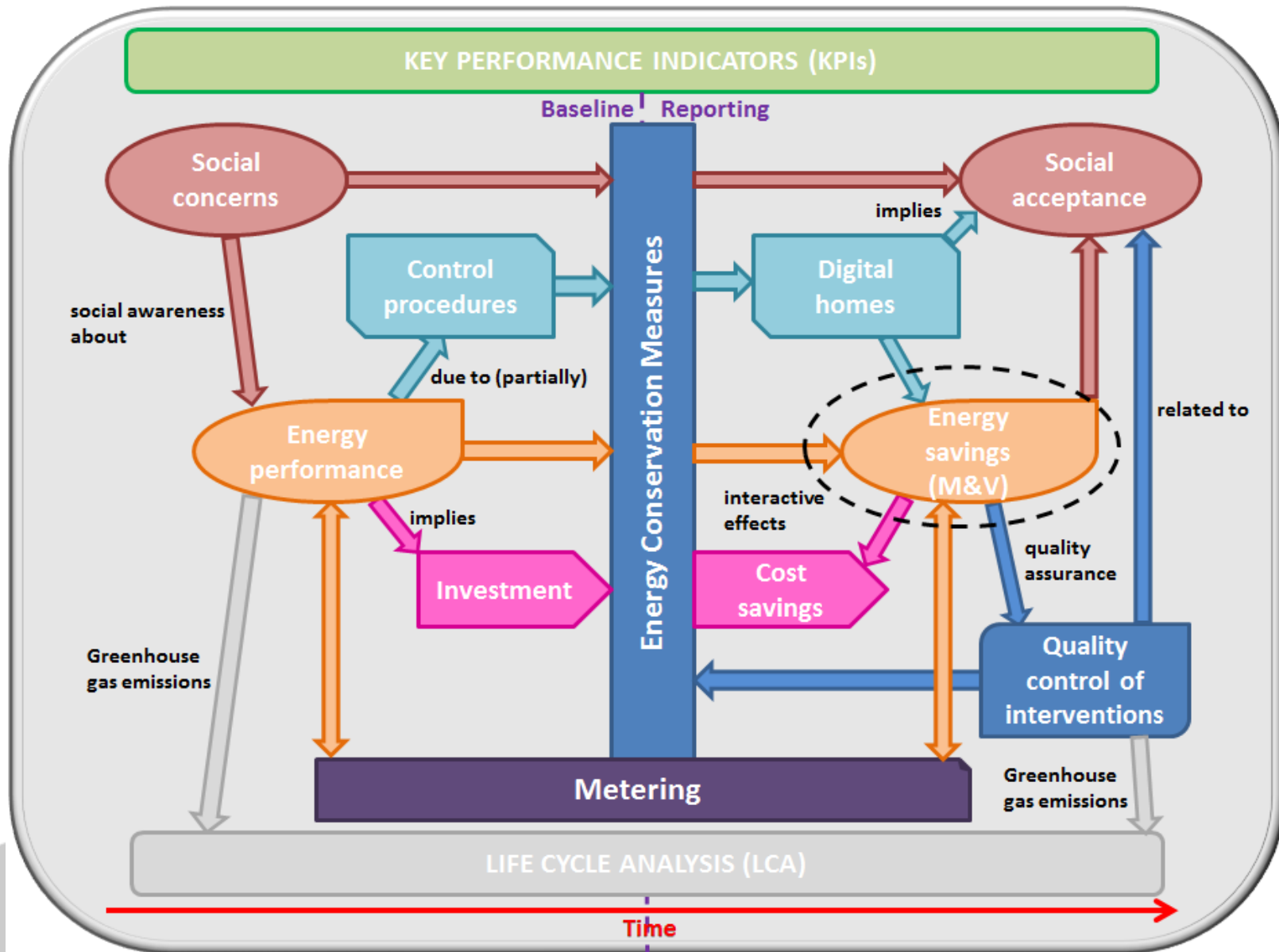
Demostration in Torrelago_ Laguna de Duero

■ **Pre-Intervention:**

- ■ Conditioned area 143,000 m^2
- ■ 31 buildings with Brick façades
- ■ Gas-fired district heating
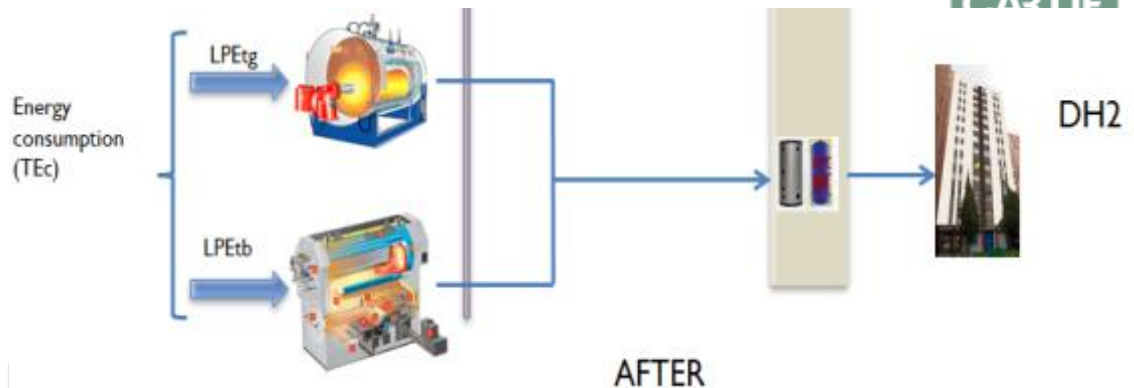

■ **Post- Intervention**

- ■ ETICS with U-value of 0.34 W/m2K
- ■ Biomass district heating
- ■ HEMS, BEMS, DEMS

Energy assessment
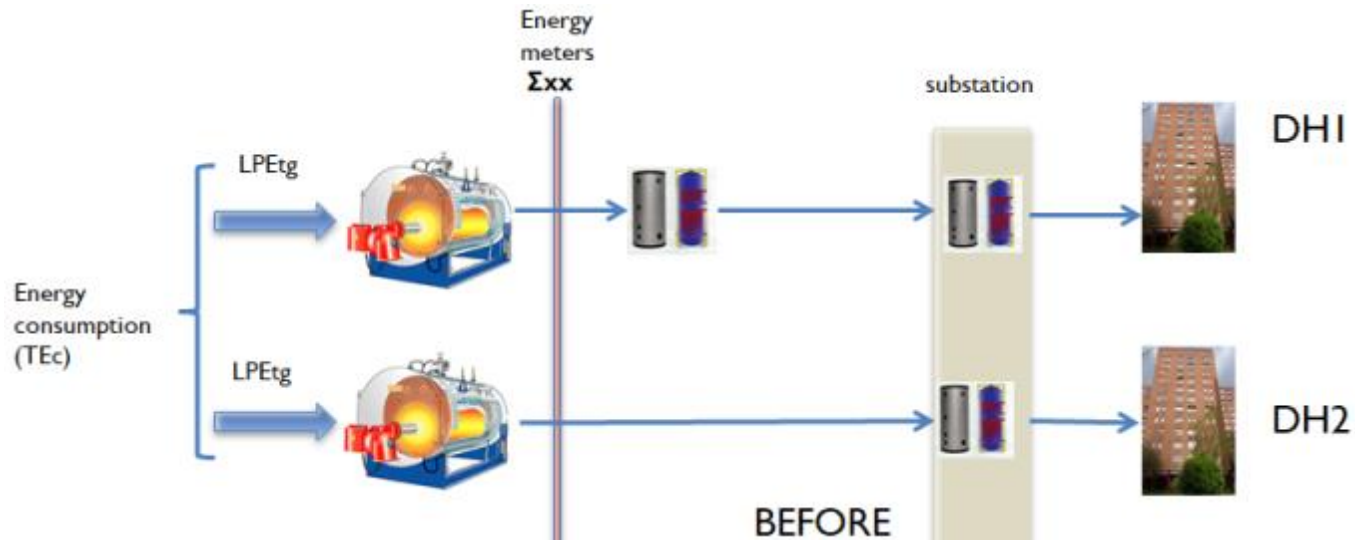
- **IPMVP option C**
  - Crossed effects
  - KPI-based evaluation

Quality control of interventions

■ **Objective:** Ensurance of the quality of construction works

- ■ Based on BREEAM and LEED
- ■ KPIs on the construction site (0-100% ranking)
    - ■ Noise
    - ■ Dust
    - ■ Recycling
- ■ Verification and validation
    - ■ Documentation
    - ■ Blower door
    - ■ Thermography
- ■ Handover
    - ■ BIM

Social acceptance

- **End-users** need to be **involved** in the loops
- **Survey-based evaluation**
  - Including log book
- **Different dimensions**
  - *Social*
    - Related to the citizen satisfaction and participation degree
  - *Environmental*
    - How the behaviour of end-user has been influenced
    - Improvements from subjective perspective vs objective values
  - *Economic aspects*
    - How the bill reduction affects end-users
  - *Technical*
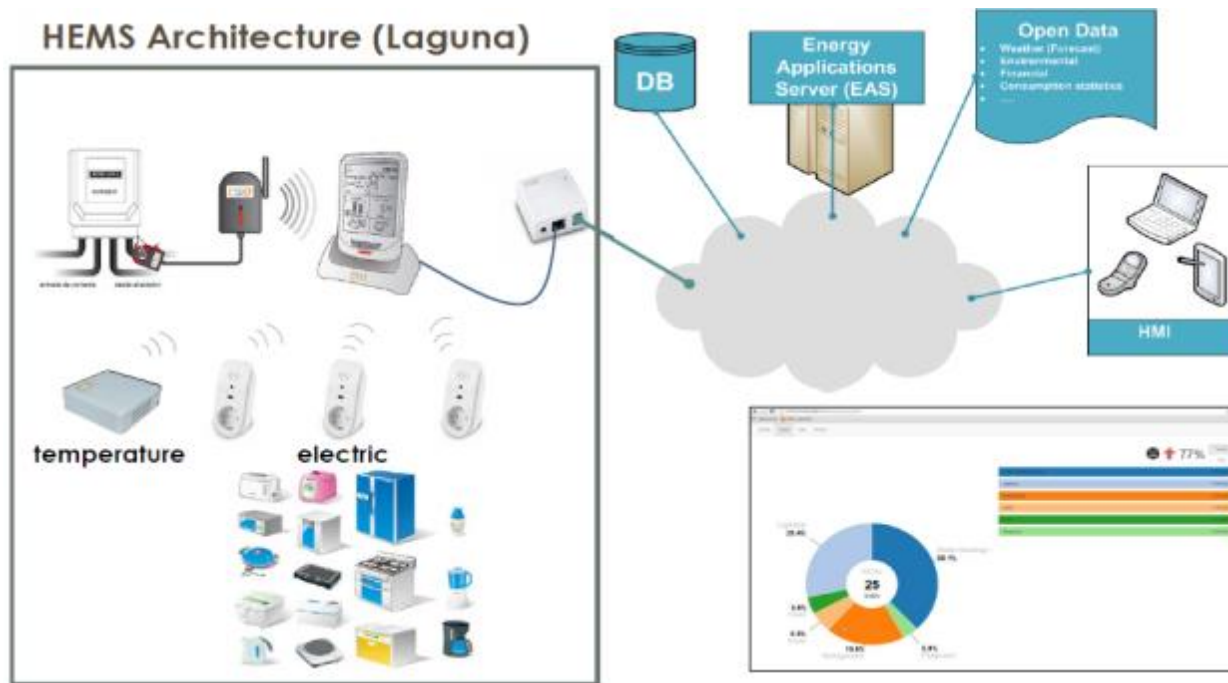   - Final quality of the renovation project

Energy assessment

HEMS Architecture (Laguna)

- **Three levels**
  - HEMS
  - BEMS
  - DEMS

- **Metrics**
  - Effects in the energy efficiency (impact of control algorithms)
  - Impacts in the social awareness
  - Increase of the technology integration (# of IoT devices)

Conclusions

- **Sustainability evaluation**

- **Existing standards**
  - BREEAM/LEED

- **Some lacks**
  - Social part, ICT and LCA not applied
  - New proposal procedure
    - Replicable
    - Adaptable
    - Scalable

Thank you for your attention!

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