INNOVATIONS IN RESIDENTIAL COMPLEXES

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Jesus Isoird – EU Innovation Programmes Manag
Some Words about Acciona
ACCIONA is one of the foremost business corporations located in Madrid, Spain. Leader in infrastructure, energy, water and services for sustainable development and social wellbeing.

It is staffed by over 30,000 professionals in more than 30 countries on all five continents.

It is economically solid (2010 year-end figures):
- Sales: $7,000 million
- EBITDA: $1,500 million

Over $100 million dollar investment in research and innovation in 2011.

ACCIONA is listed on some of the world’s major stock markets: IBEX-35, Dow Jones Sustainability World Index (DSJI World), Dow Jones Stoxx Sustainability Index.
OUR INTERNATIONAL PRESENCE

- Canada
- U.S.A.
- Mexico
- Chile
- Italy
- Poland
- Brazil
- U.A.E.
- Australia
- India

Infrastructures
Energy
Real State
Water
Importance of Energy Efficiency in Buildings in Europe
WHAT IS EUROPE IN TERMS OF ENERGY?

- \(\frac{3}{4}\) of EU Energy is consumption in cities
- \(\frac{3}{4}\) of \(\text{CO}_2\) emissions
THE EUROPEAN STRATEGY:

• Fight against Climate Change.
• Reduce Energy Dependence and imports from unstable countries.
• Create sustainable growth and jobs based on a green economy

Binding commitments by 2020:
- 20% energy efficiency
- 20% GHG emission reduction
- 20% share of renewables
- All new buildings must be zero energy

Today, Energy Efficiency is not on track!!!!
REDUCE GHG EMISSIONS AT THE LEAST COST

Fig 1: Global GHG abatement Cost Curve v2.1, Mckinsey, 2010.
KEY FACTS FOR BUILDINGS IN EUROPE

- Buildings use 40% of total EU energy consumption
- The built environment generates 1/3 of GHG in Europe
- Even new buildings are far from being all energy efficient
- Replacement rate is very small (1 to 2% per year)
- The renovation of the existing stock is a real challenge
- Many experiments are made but actual impacts are limited

**Business as usual is not an option!**
Innovation towards energy efficient buildings
Systemic approach for design, implementation, operation and maintenance -> high potential for multidisciplinary developments (i.e. ICT, RES, energy storage, envelope components, HVAC, lighting, grids, renewable heating and cooling networks...)

THE POTENTIAL AT BUILDING AND DISTRICT SCALE
USER-CENTRIC SOLUTIONS

Reduction of energy bill!

Need help?
Call 0845 000 123
Mon - Fri: 7am - 8pm
Sat - Sun: 8am - 6pm
Please have your customer reference number when you call us.

Your Gas & Electricity Bill
Please pay £283.68 by 31st July

Billing Summary
Bill period: 01 January to 31st March

Your last bill £193.32
Payment received on 29th December £193.32 credit
Balance before this bill £0.00
Energy you've used (estimated reading) £270.17
VAT at 5% £13.51
Please pay £283.68

We must receive your payment by 31st July

Additional information
Any information your supplier wants to show you will be placed here, including details of special offers or online account management.

User is key!!!
THE KEY CHALLENGES

CROSS-CUTTING CHALLENGES

HORIZONTAL ORGANISATIONAL ASPECTS
- Systems and Equipment for energy use (horizontal)
- Storage of energy
- Quality indoor environment
- Design - Integration of new solutions
- Envelope and components
- Industrialisation and mass customization
- Automation and control
- Life cycle analysis (LCA)
- Energy Management Systems
- Labelling and standardization
- Materials: embodied energy and multi-functionality
- Diagnosis and predictive maintenance (continuous commissioning)
- Systems and Equipment for energy production (horizontal)
- Diagnosis

HORIZONTAL TECHNOLOGICAL ASPECTS
- Relationship between User and Energy
  - Geoclustering
  - Value Chain and SMEs focus
  - Knowledge transfer
- Business models, organisational and financial models (including ESCOs)

ENERGY EFFICIENT DISTRICT/COMMUNITIES
- Systems and Equipment for energy production (district)
- Storage of energy (district): thermal, electrical or other
- District and urban design
- Retrofitting (district)

SYSTEMIC APPROACH TO EXISTING BUILDINGS
- Systems and Equipment for energy use for existing buildings
- Envelope for existing buildings
- Solutions for Cultural Heritage (including diagnostics)
- Systemic Approach for existing buildings

NEUTRAL/ENERGY POSITIVE NEW BUILDINGS
- Systems and equipment for energy use for new buildings
- Systemic approach for new buildings
EeB PPP as first wave of a Long Term Strategy in EU

Years 01 02 03 04 05 06 07 08 09 10

Wave 1
i.e. Retrofitting and reduction of energy use

Wave 2
i.e. Energy neutral buildings/districts

Wave 3
EeB PPP 2010-13
i.e. Energy positive buildings/districts

Continuous Research
RUNNING PROJECTS (1/2)

Demonstration of Energy Efficiency in Buildings
Building Energy Efficiency for Massive Market Uptake
Industrialised Energy Efficient Retrofitting of Residential Buildings in Cold Climates
School of the Future: Towards Zero Emission with High Performance Indoor Environment

Improving the Energy Efficiency of Historic Buildings in Urban Areas
Efficient Energy for Cultural Heritage

ICT for Energy-efficient Buildings and Spaces of Public Use
ICT4E2B Forum
Energy Efficiency and Risk Management in Public Buildings
Energy Efficiency for European Sport Facilities
Self Powered Wireless Sensor Networks for HVAC System Energy Improvement
Smart Energy Efficient Middleware for Public Spaces
ICT Platform for Holistic Energy Efficiency Simulation and Lifecycle Management

New Nanotechnology-based High Performance Insulation Systems
Development of Nanotechnology-based Insulation Systems
New Advanced Insulation Phase Change Materials
Development of a Novel Cost-effective Nanotech Coatings
New NANO-technology Based High Performance Insulation Foam System
Aerosol Based Composite Nanomaterials for Cost-effective Building

New Technologies for Energy Efficiency at District Level
New μ-CHP Network Technologies for Energy Efficient and Sustainable Districts
Energy-Hub for Residential and Commercial Districts and Transport

PPP Related FP7 Projects
Clean and Resource Efficient Buildings for Real Life
Development of a Clean and Energy Self-sustained Building
Multi-source Energy Storage System Integrated in Buildings
Resource and Cost-effective Integration of Renewables in Existing High-rise Buildings
Strategic Networking of RDI Programmes in Construction and Operation of Buildings
RUNNING PROJECTS (2/2)

Industrialised Energy Efficient Retrofitting of Residential Buildings in Cold Climates

Efficient Energy for Cultural Heritage

ICT4E2B Forum

Energy Efficiency for European Sport Facilities

Aerogel Based Composite Nanomaterials for Cost-effective Building

Energy-Hub for Residential and Commercial Districts and Transport

Introduction

There are numerous heritage sites in European cities, towns and rural areas. These heritage sites play a major role in the cultural identity of European heritage and society.

Historic buildings are at risk from climate change, as they are often located in areas that are prone to rising sea levels. Therefore, it is important to retrofit these buildings to improve their energy efficiency.

Objectives

SENCULT demonstration project

Introduction

It is widely recognized that energy efficiency is a key driver for sustainable development. The ICT4E2B Forum is a platform for stakeholders to exchange ideas and best practices in the field of energy efficiency.

Introduction

The European Sport and Building Stock accounts for 1.5% of the total energy consumption in the EU. The project aims to improve the energy efficiency of sports facilities.

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Introduction

A new type of energy infrastructure for a district including an advanced system for matching supply and demand of energy (heat, cold and power) and incorporating advanced heat storage technologies such as Thermo Chemical Materials. Full-scale demonstration of the technology is to be used in the district of Tweewaters, Belgium.
BENEFITS OF THE PPP - INDIRECT IMPACT

Job creation?
Economic impact?
PROGRAMME LOGIC - IMPACT GENERATION

Project Dimension

Inputs
- Finance
- People
- Infrastructure

Activities/Process
- R&D and innovation projects

Products/Outputs
- Technologies
- Publications
- Business models
- Prototypes
- Services

Intermediate Outcomes
- Technologies / materials adopted
- Houses insulated / energy neutral
- Construction processes adopted
- Reduced GHG emission

Final outcomes / Impact
- Incomes
- Employment
- Environment
- Climate change
- Public health
- Cultural heritage

Courtesy: TNO
Innovation in residential complexes
WE HAVE SOLUTIONS FOR NEW BUILDINGS (1/3)

Solar „passive houses“ save 90% of heating costs

Energy and material efficiency
WE HAVE SOLUTIONS FOR NEW BUILDINGS (2/3)

The Pearl River Tower in Guangzhou (Canton) in the South of China could become the first „zero energy“ skyscraper in the world (310m tall), using solar, wind, and needs 60% less energy than usual.

Architects: Skidmore, Owings, and Merrill (SOM)
Sant Cougat Zero Emissions District (SPAIN)
Is a residential building complex of 150 dwellings. The complex is self sufficient in energy, cero emissions with passive systems for reduce energy demand, and renewal generation by PV, geothermal energy and demand response management.
THE CHALLENGE – Renovating the existing stock

“The main contemporaneus challenge is to organiz the habitability of the human being in the planet”

Paulo Mendes da Rocha (Premio Pritzker 2020)
ACCIONA`S OBJECTIVE AND RESEARCH FIELDS

**Objective:**
- Reducing energetic cost while improving comfort.
- Developing simulation and prediction tools for building behaviour.
- Integration of efficient energy generation technologies to achieve zero energy & emissions buildings.

**Research fields:**
- Energy generation and distribution.
- Photovoltaic and solar thermal energy.
- Energy storage systems.
- Smart management systems.
- Modular façade for retrofitting.
- Advanced insulation materials.
**Cero Emmission tri-generation pilot plant.**

- First time combination of concentrated solar power and biomas for fully renewals building energy self sufficient design.

The hybrid tri-generation system is composed by:

- Thermal Parabolic Trough Collectors (PTC) for generation of steam
- Biomass boiler for generation of steam
- ORC for production of thermal (heat) and electrical energy
- An absorption system for cooling
- Control system to operate it

The pilot plant is under construction in Seville (Spain) and will be fully operating in January 2012. It will provide 100Kwt and 15Kwe. Able to supply the energy needs for an educational building.
Energy Building Control Center.
Combination of metereological prediction and building simulation for buildings energy management in a fully automatic and intelligent control center with capacity for 75 simultaneous buildings.

The system could be connected to any BMS available in the market. Obtain real time monitoring information for each building equipment linked with predictive maintenance. Predictive information obtained from dynamic simulations and meteorological prediction allow to prepare the operation protocols in advance with higher efficiencies.
EXAMPLES OF RESEARCH PROJECTS (2/4)

† Positive-Energy Buildings (PEB) or sites (2):
   – Consuming few energy at a global level, i.e. requiring few energy for their construction (grey energy), an few energy for the transport of their users/occupants.
EXAMPLES OF RESEARCH PROJECTS (3/4)

**Cost Effective and modular systems for envelope retrofitting.** Incorporating additional functionalities like: Indoor environment control, self cleaning, COe absorption, management of Thermal Inenertia, ...
1. Energy Demand reduction of the buildings.

- Using building simulation software, the demands for heating and cooling was optimized taking different possibilities of actuation (Insulation materials and thickness; Control of the openings; Overhang dimensions; Terrace design; Use of amount and right glass in different building areas; Thermal inertia of the whole building; Lighting).
- By dinamic simulation is possible to obtain the demand curves in order to dimension properly the energy supply and distribution systems.

2. Energy Generation and recovery.

- The criteria for the energy generation system is to maximize the use of RES at reasonable payback as well as recovering wasted energy.
EXAMPLES OF RESEARCH PROJECTS (4/4)

Smart approaches for designing, constructing and operating Zero Emissions Districts.

Energy Efficient Business models

Dependant on unstable energy prices!!

Building design, energy generation, operation and maintenance optimizations will have an increased added value for final clients.
ESCO – Energy Service Company Business Model

Current scenario:

- High risk
- Require intense and high quality engineering studies.
- Clear business are limited to large projects
- High dependency on political subsidies (some countries)
- Not clear energy savings are difficult to sell ḟ strong importance of previous energy audits and monitoring transparency.

Diagram:

- Bank (3rd party)
- ESCO
- Client

Bank provides debt finance to projects.
ESCO implements energy efficiency improvements.
Client pays a fee in exchange for the realized energy savings.
ESCO – Energy Service Company Business Model

Involved phases.

Development and construction are essential parts usually not covered or considered.

In Acciona we are working on covering the whole innovation cycle.
The Ambition – Systemic and integrated smart cities

- Energy Efficient Systems
- Sustainable Building
- Urban renovation
- Urban and regional sustainability
- ICTs for Smart transport systems
- Ageing population
- Sustainable mobility
- Heating and Cooling Networks
- Smart Grids and distributed RES
THANK YOU FOR YOUR ATTENTION

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