INNOVATIONS IN RESIDENTIAL COMPLEXES

2011 EU – US Frontiers Of Engineering Sympsium

Irvine, California, 3rd of November 2011

Jesus Isoird – EU Innovation Programmes Manag

Some Words about Acciona

KEY FIGURES

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.**

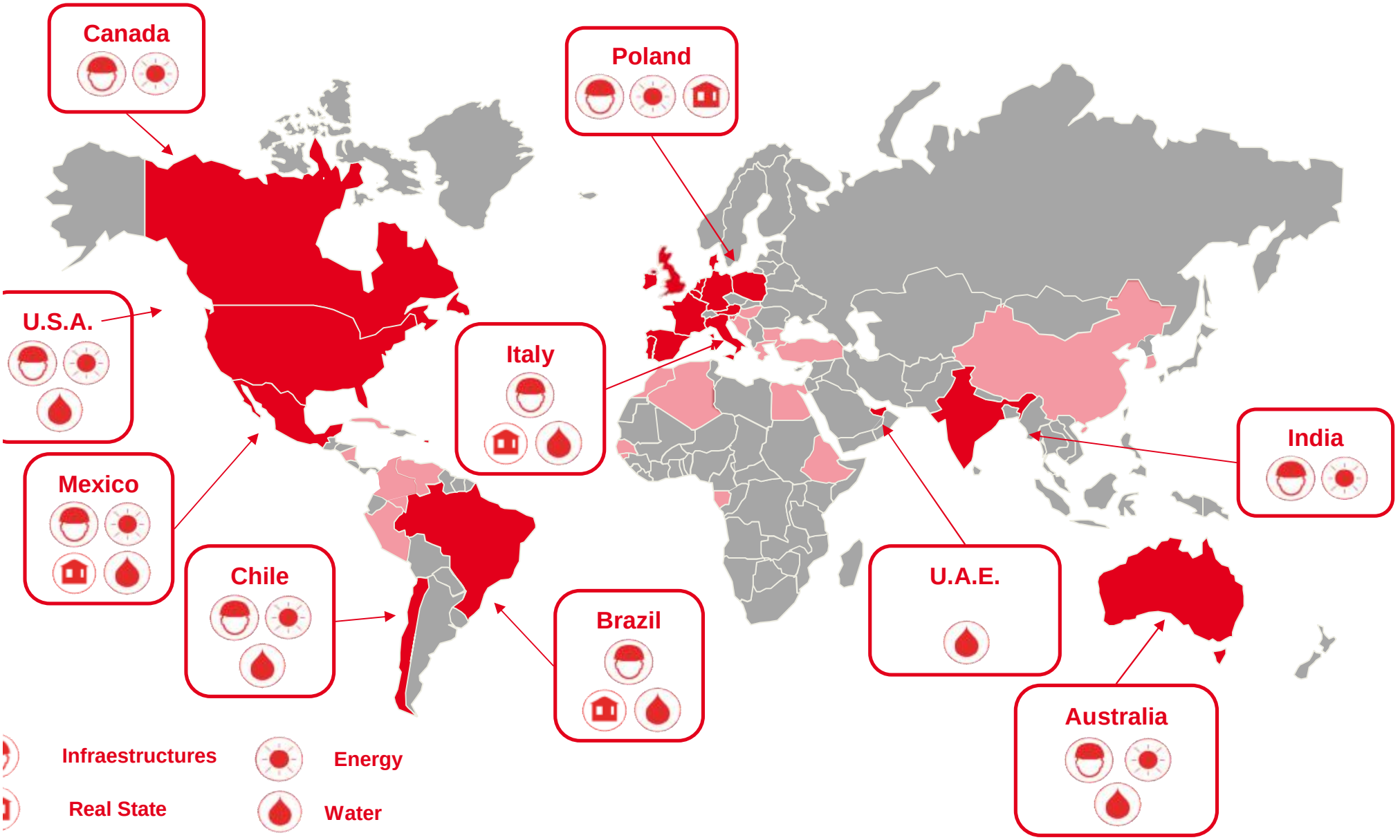
It is **economically solid** (2010 year-end figures):

- 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.

)UR INTERNATIONAL PRESENCE

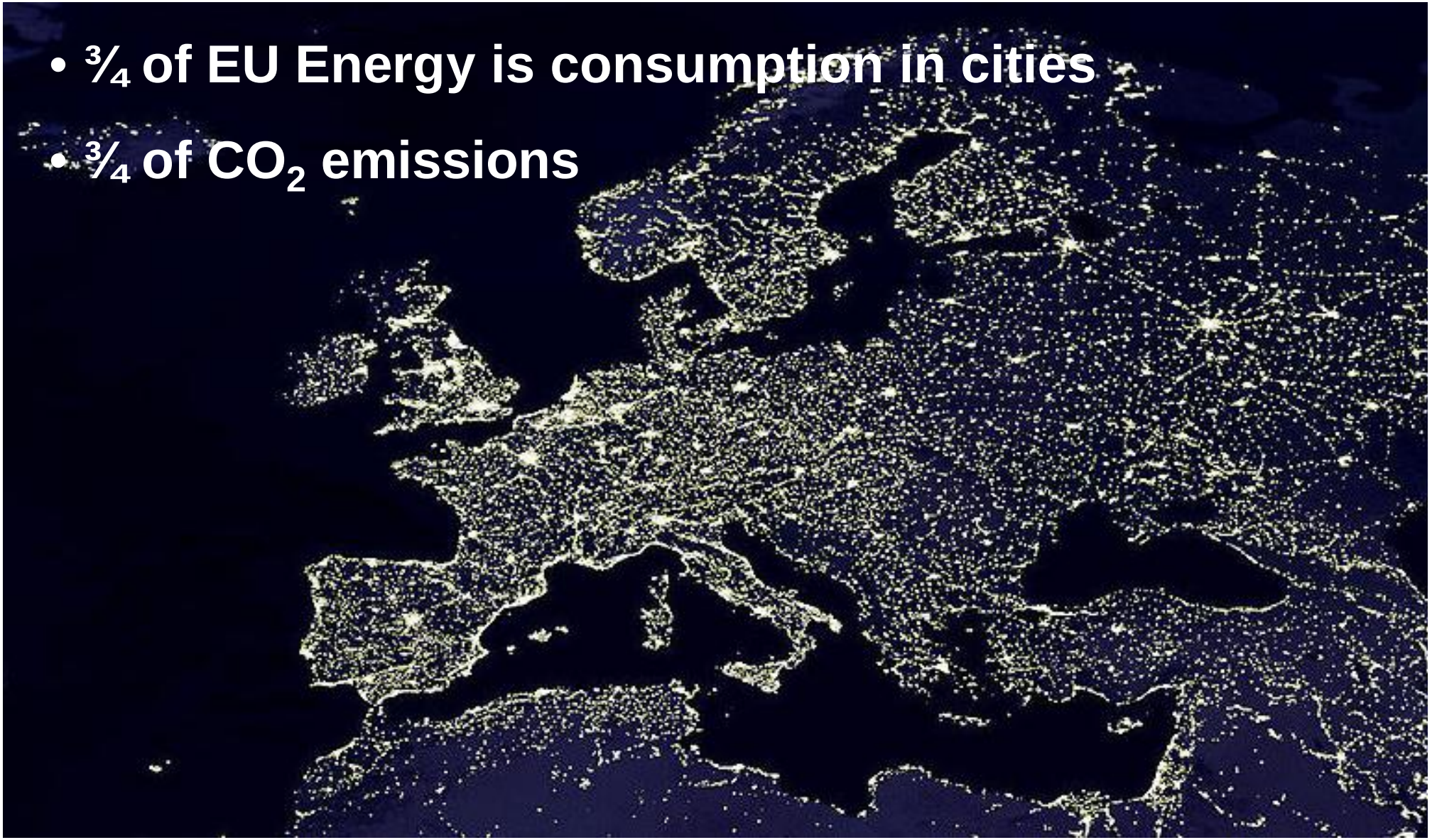


echnology & Innovation Division

accion

Importance of Energy Efficiency in Buildings in Europe

WHAT IS EUROPE IN TERMS OF ENERGY?



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

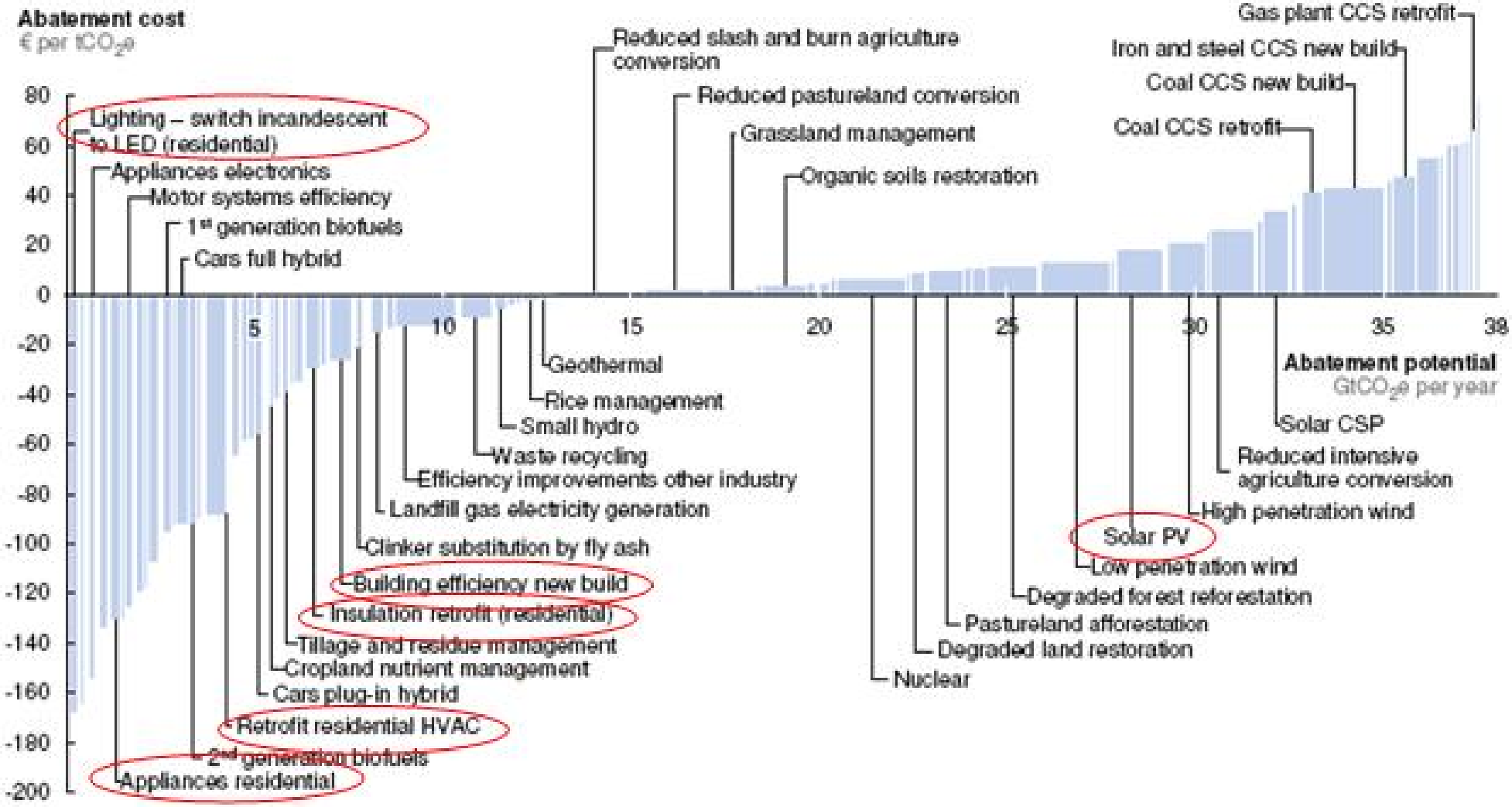


Fig 1: Global GHG abatement Cost Curve v2.1, Mckinsey, 2010.

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

THE POTENTIAL AT BUILDING AND DISTRICT SCALE

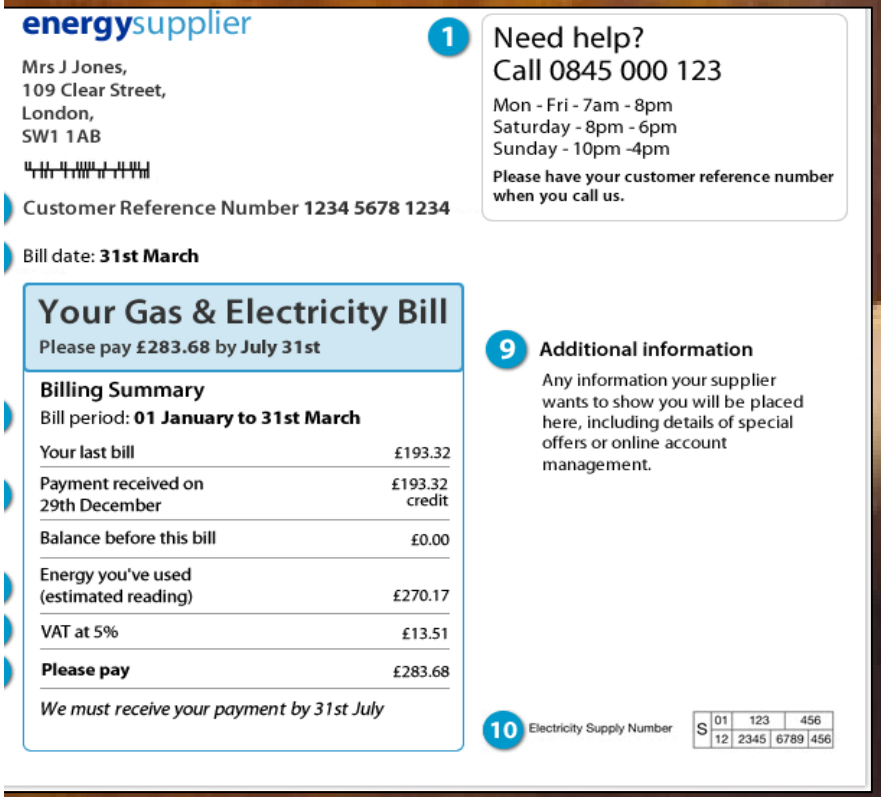
Systemic approach for design, implementation,operation and maintenance -> high potential for **multidisciplinary developments** (i.e. ICT, RES, energy storage, envelope components, HVAC, lighting, grids, renewable heating and cooling networks…)

GEOCLUSTERS

echnology & Innovation Division

USER-CENTRIC SOLUTIONS

Reduction of **energy bill!**



energysupplier

Mrs J Jones,
109 Clear Street,
London,
SW1 1AB

Customer Reference Number **1234 5678 1234**

Bill date: **31st March**

Your Gas & Electricity Bill

Please pay **£283.68** by **July 31st**

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

1 Need help?
Call 0845 000 123

Mon - Fri - 7am - 8pm
Saturday - 8pm - 6pm
Sunday - 10pm -4pm

Please have your customer reference number when you call us.

9 **Additional information**

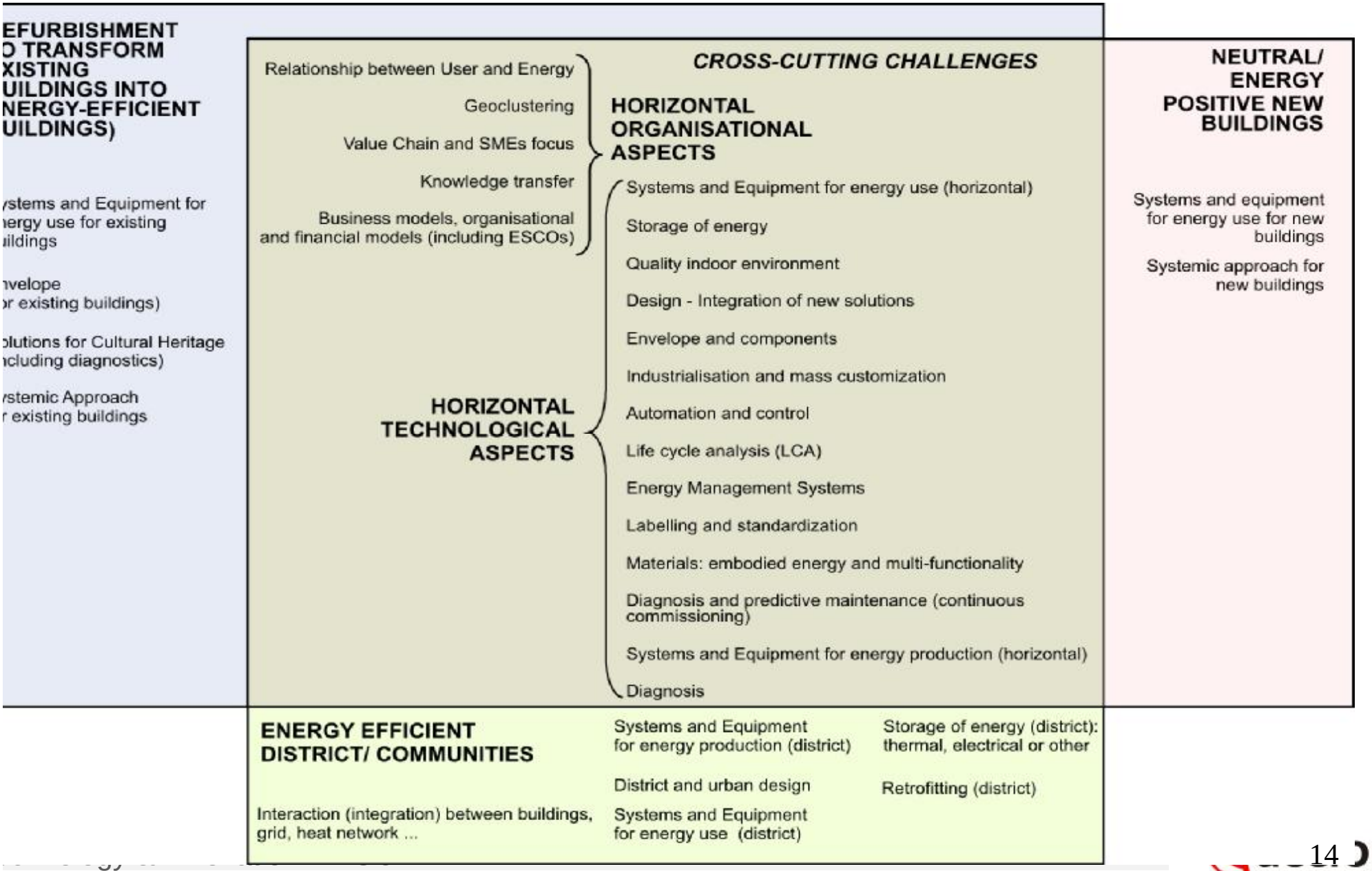
Any information your supplier wants to show you will be placed here, including details of special offers or online account management.

10 Electricity Supply Number

S	01	123	456
	12	2345	6789	456

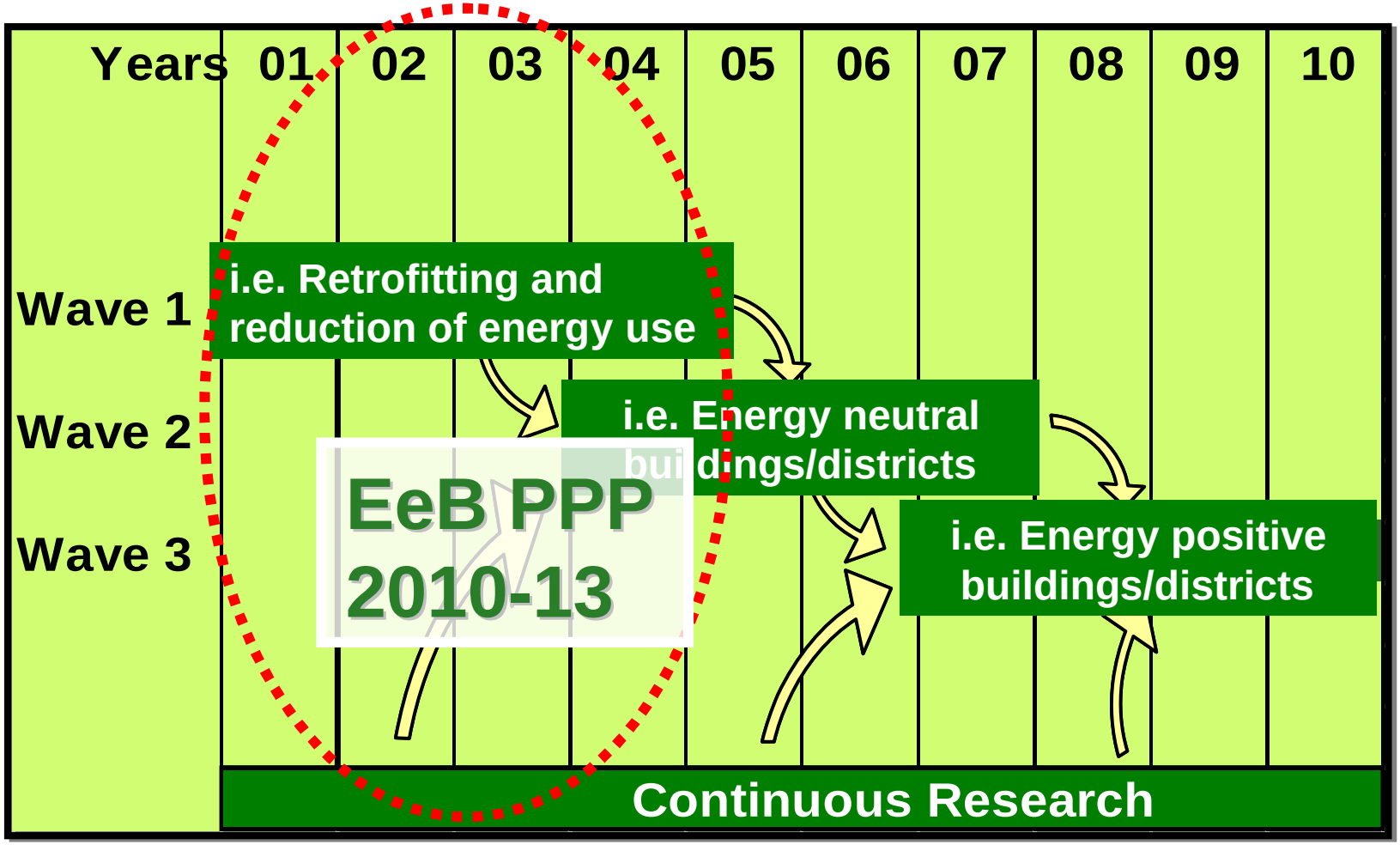
User is key!!!

THE KEY CHALLENGES



A LONG TERM RESEARCH PPP PROGRAMME

EeB PPP as first wave of a Long Term Strategy in EU



RUNNING PROJ

JULY 2011

Prepared by

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 Network 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

Aerogel 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

Introduction

There are numerous his
in European cities, tow
Historic centres and qu
uniqueness to our cities
living symbol of Europe
heritage and diversity.

Historic buildings are a
the high level of energy
is contributing to a hug
of greenhouse gas emi
climate change posing
urgent threat to people
and historic buildings, i
to have an improved ap
refurbishment.

Objectives

3ENCULT demonstrator

ICT4E2B Forum

Introduction

It is widely recognised t
energy saving potential
technologies should be
over the whole life-cycle
environment. However,
of ICT technologies and
possible uses, means it
consider which ones to
identify the most cost ef
promising technologies

Having identified this ne
Forum bases its roadma
on the REEB project (Ro
for ICT enabled energy
buildings), a project that
high-level roadmap on I
and technology for ener
buildings. ICT4E2B Foru
this work and makes use
building activities. The p
promote a better unders

Energy Efficiency for European Sport Facilities

Introduction

The European Sport and
Building Stock accounts
1.5 Million buildings in E
represents a significant
overall building stock an
a disproportionate amou
(6-8%). Sports facilities
qualities including:

- Their energy demand
and peaks
- Usage patterns: long
use and then short pe
use sporting event
- Comfort and ventilatio
- Facility characteristics

Aerogel Based Composite Nanomaterials for Cost-effective Building

Introduction

In the current context of
climate control policies,
the energy efficiency of
represents a great poter
savings. The thermal re
insulation layer in the bu
can be enhanced by sig
increasing its thickness.
approach is decreasing
conductivity of the insul
new superinsulation con
materials.

Aerogels are light weight
solids perfect for therma
with the lowest thermal
ever known (λ < 0.012 W
ambient conditions. AE

Energy-Hub for Residential and Commerci Districts and Transport

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

Introduction

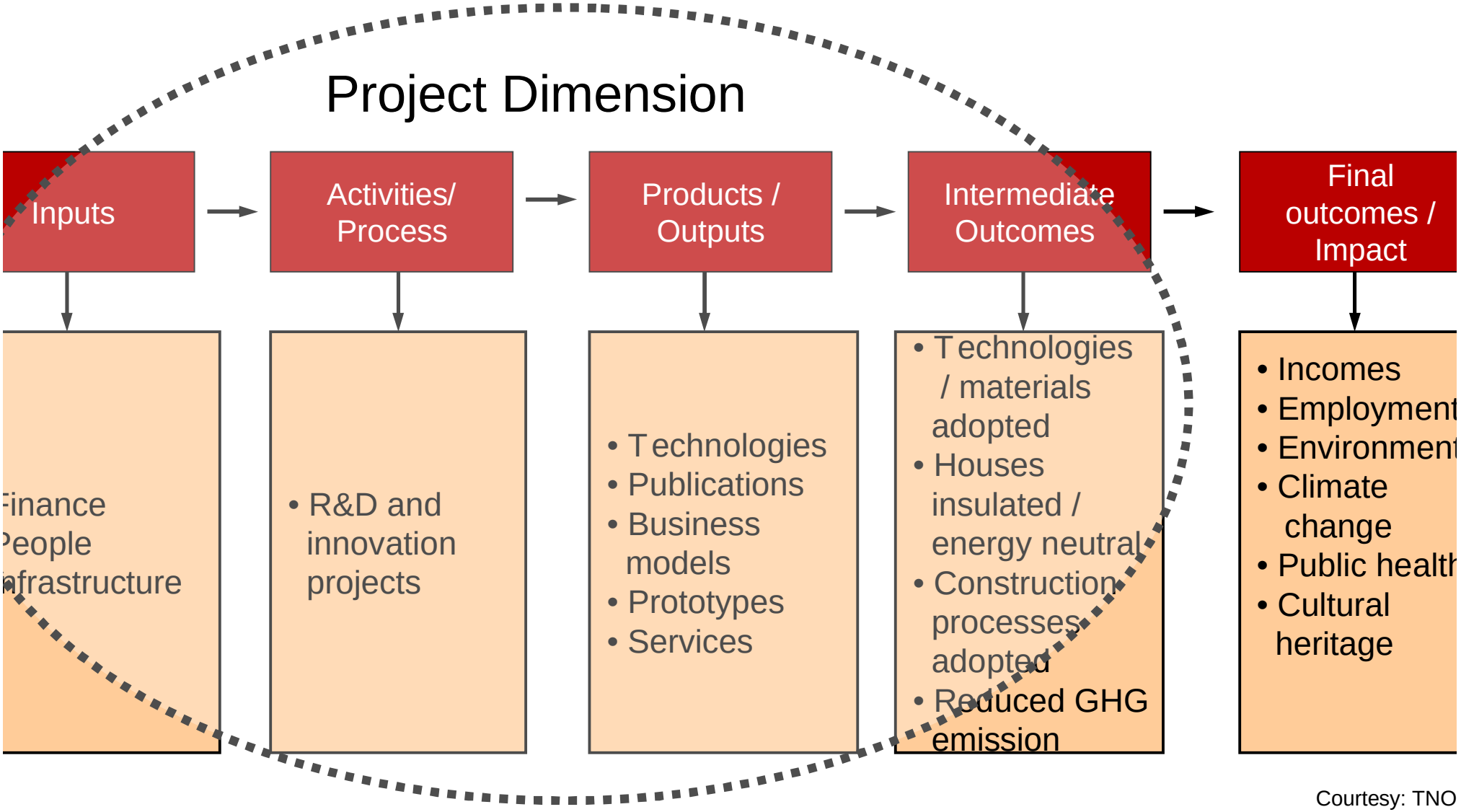
The contribution of renewable energy on district level is still modest and can presently be accommodated in the existing energy infrastructure without great problems. In cases where the contribution of renewables is the same as the contribution of fossil fuels eg when using (large) wind turbines, a particular problem is the fluctuating character of the energy supply, with the effect that it does not match the energy demand.

This may occur in the short term, when peak electricity production by PV cells occurs around noon, while

echnology & Innovation Division

BENEFITS OF THE PPP - INDIRECT IMPACT

PROGRAMME LOGIC - IMPACT GENERATION

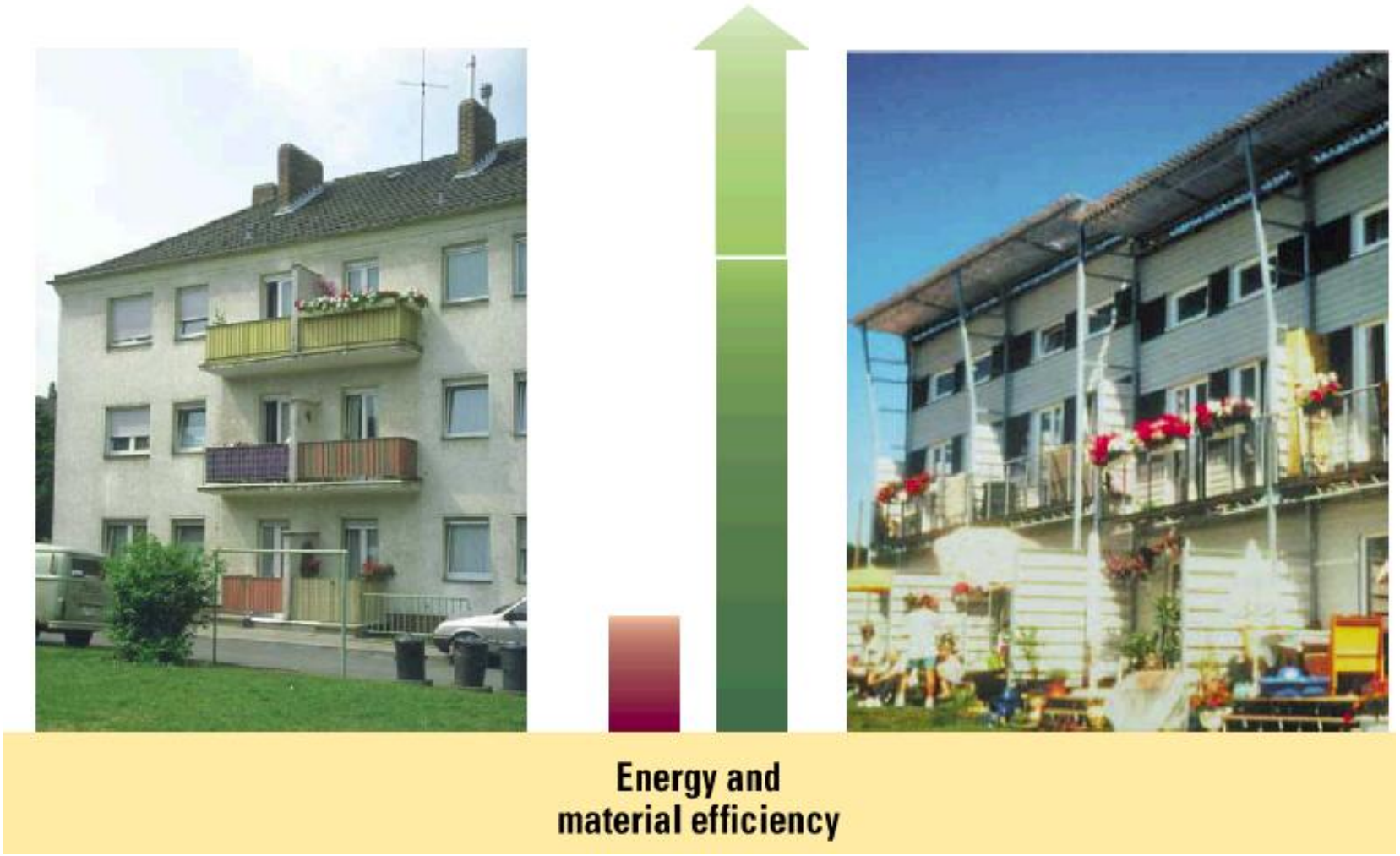


Courtesy: TNO

Innovation in residential complexes

WE HAVE SOLUTIONS FOR NEW BUILDINGS (1/3)

Solar „passive houses“ save 90% of heating costs



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)

WE HAVE SOLUTIONS FOR NEW BUILDINGS (3/3)

Zero Emissions District

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 2

ACCIONA`S OBJECTIVE AND RESEARCH FIELDS

Objective :

- Reducing energetic cost while improving comfort.
- Developing simulation and predeiction tools for building behaviour
- Integration of efficient energy generation technologies to achieve zer energy & emmissions buildings.

Research fields :

- Energy generation and distribution.
- Photovoltaic and solar thermal energy
- Energy storage sysmtems
- Smart management systems
- Modular façade for retroffiting
- Advanced insulation materials

EXAMPLES OF RESEARCH PROJECTS (1/4)

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) fo generation of steam

• Biomass boiler for generation of steam

• ORC for production of thermal (heat) an electrical energy

• An absorption system for cooling

• Control system to operate it

The pilot plant is under constructtion in Seville (Spain) and will be fully operating in January 2012.

It will provide 100Kwt and 15Kwe. Abble to suply the energy needs for a educational building.

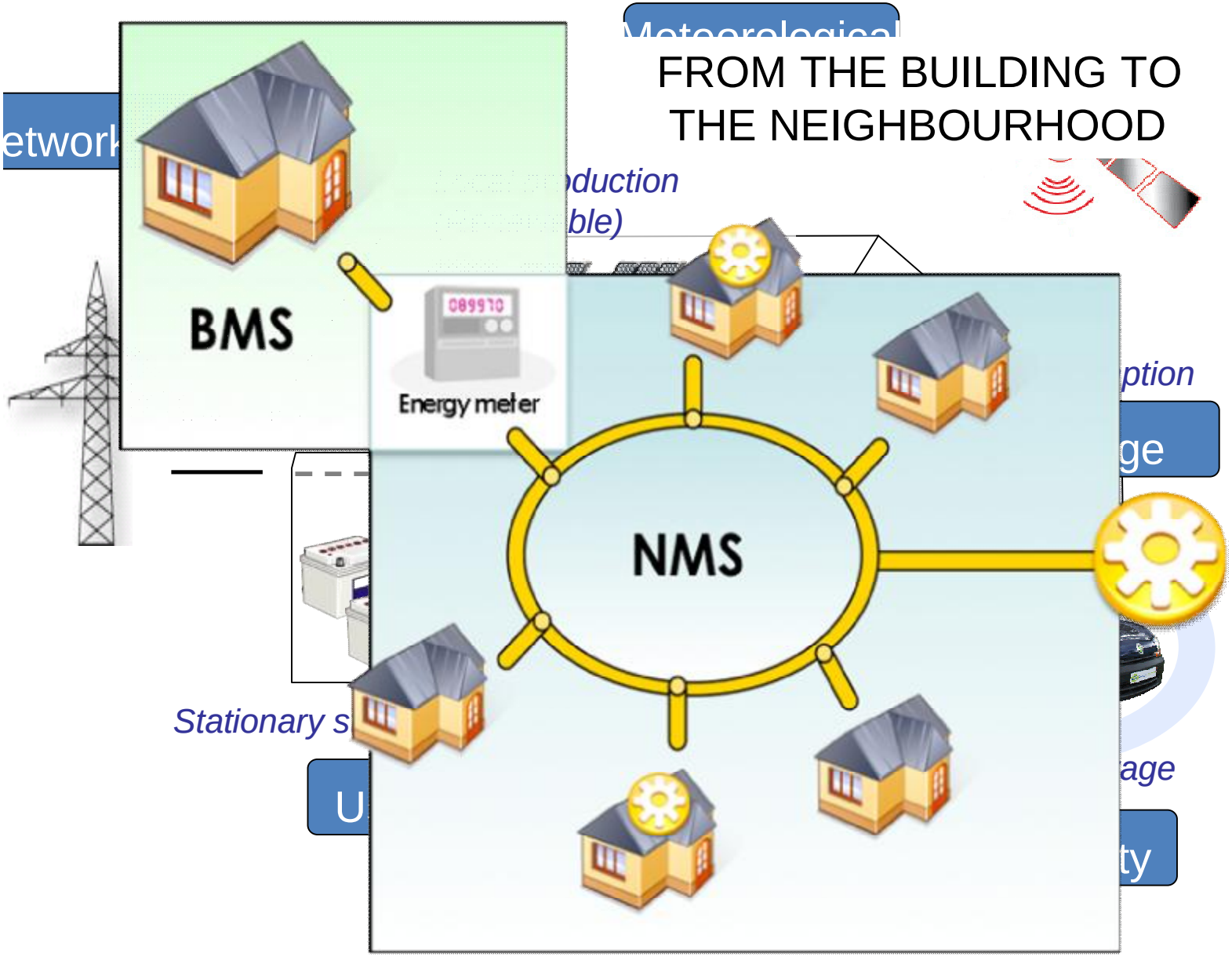
accion

EXAMPLES OF RESEARCH PROJECTS (2/4)

Energy Building Control Center.
Combination of metereological prediction and building simulation for buildings energy management in an fully automatic and intelligent control center with capacity for 75 simultaneus buildings.

The system could be connected to any BMS available in the market.
Obtain real time monitoring information for each building equipment **à** linked with predictive maintenance.
Predictive information obtained from dinamic simulations and metheorological prediction allow to prepare the operation protocols in advance with higher efficiencies.

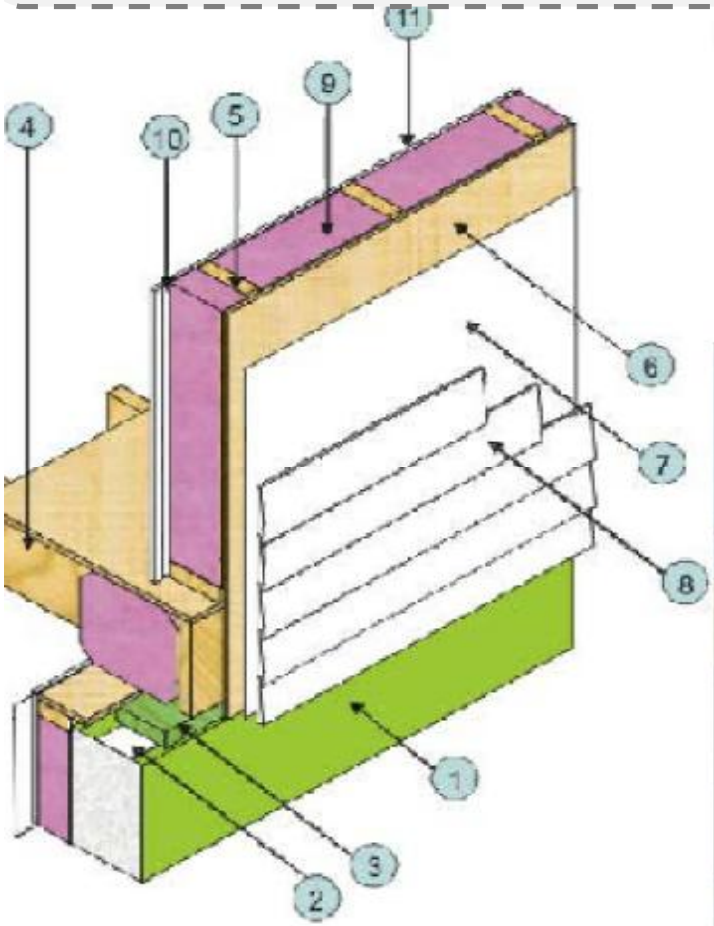
EXAMPLES OF RESEARCH PROJECTS (2/4)



- **à** Positive-Energy Buildings (PEB) or sites (2):
  - Consuming few energy at a global level, i.e. requiring few energy for their constructio (*grey energy*), an few energy for the transport o their users occupants

EXAMPLES OF RESEARCH PROJECTS (3/4)

Cost Effective and modular systems for envelope retrofitting. Incorporating additional funcionalities like: Indoor environment control, self cleaning, COe absorption, management of Thermal Inenertia, ...



EXAMPLES OF RESEARCH PROJECTS (4/4)

hart approaches for designing, constructing and operating Zero Emissions Distr

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.

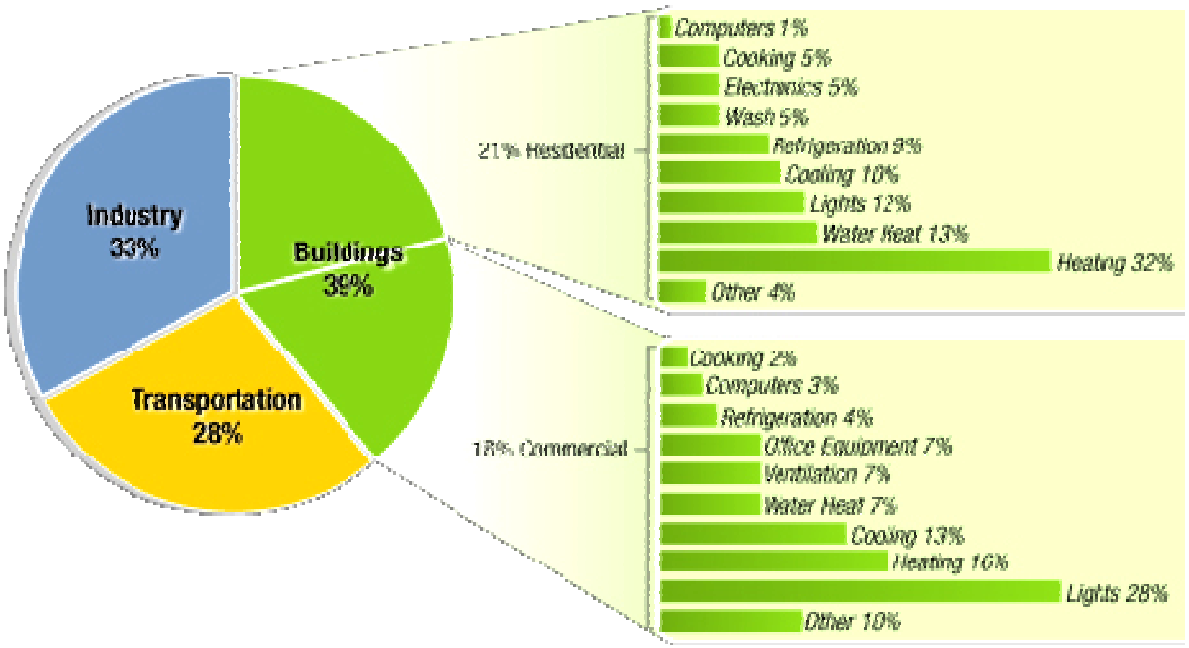
2. Energy Generation and recovery.

- 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)

hart approaches for designing, constructing and operating Zero Emissions Distr

Energy Efficient Business models

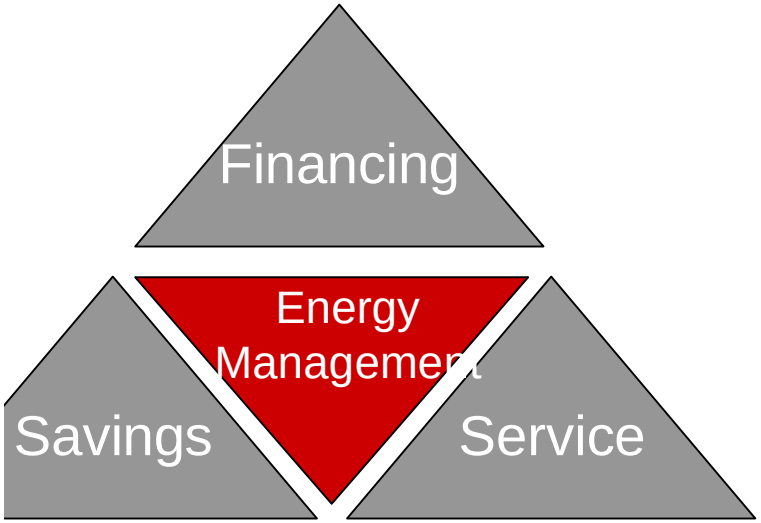


Dependant on unstable energy prices!!

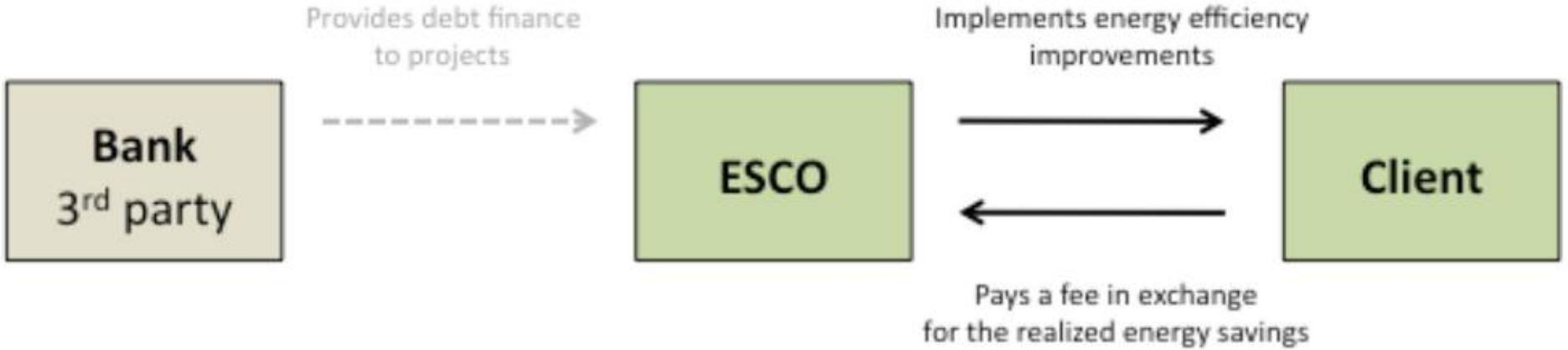
Building design, energy generation, operation and maintenance optimizations will have an increased added value for final clients.

ESCO – Energy Service Company Business Model

Current scenario:

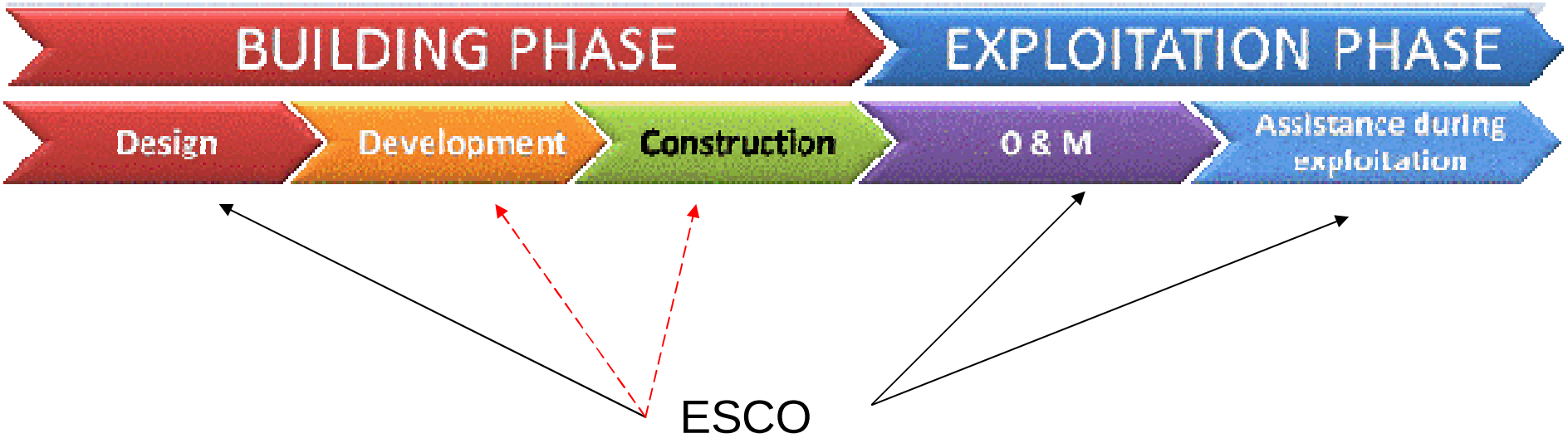


- High risk
- Require intense and high quality engineering studies.
- Clear business are limited to large projects
- High dependency on political subsidies (some countries)
- Not clear energy savings are difficult to sell **à** strong importance of previous energy audits and monitoring transparency.



ESCO – Energy Service Company Business Model

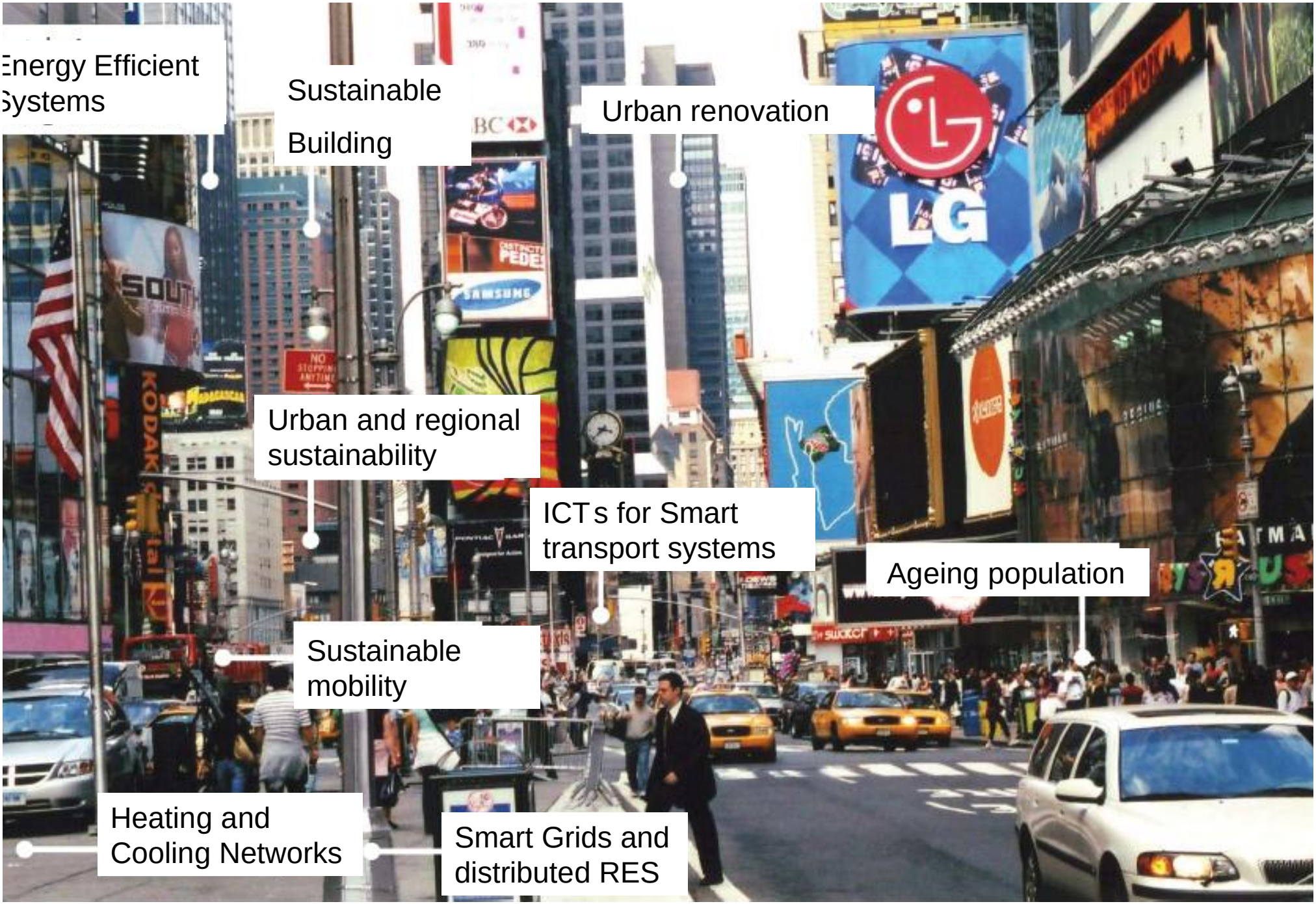
Involved phases.



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

In Acciona we are working on covering the whole innovation cycle.

The Ambition – Systemic and integrated smart cities



acciona

Pioneers in development and sustainability

THANK YOU FOR YOUR ATTENTION

2011 EU – US Frontiers Of Engineering Sympsium

Irvine, California, 3rd of November 2011

Jesus Isoird – EU Innovation Programmes Manag