E2B
Energy Efficient Buildings

an initiative by:

ECTP
EUROPEAN CONSTRUCTION TECHNOLOGY PLATFORM

Energy Efficient Buildings
E2B Association and PPP EeB

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ECTP/E2BA Secretary General
FEUP, Porto, September 18, 2014

PPPS IN HORIZON 2020

Joint Technology Initiatives	Contractual PPPs
• Innovative Medicines (IMI) • Clean Sky • Single European Sky ATM Research (SESAR) • Fuel Cells and Hydrogen (FCH) • Electronic Components and Systems (ECSEL - old ARTEMIS + ENIAC) New: • Bio-based Industries (BBI)	• Factory of the Future (FoF) • Energy-efficient Buildings (EeB) • Green Vehicles (EGVI) • Future internet (5G) New: • Sustainable Process Industry (SPIRE) • Robotics • Photonics • High Performance Computing

Rationale of the EeB PPP

- The construction sector is the **largest EU single activity** (€1,2 trillion, 9.6% of GDP) and biggest industrial employer (14,6 million direct jobs).
- The sector is **highly fragmented** and 95% of the 3,1 million enterprises (EU-27) are SMEs. Turnover has decreased significantly during the crisis.
- Buildings account for **40 % of total energy use** and 1/3 of Greenhouse Gases in Europe.
- Very low replacement rate of the **existing stock**. Energy-efficient solutions are found at present too expensive by homeowners. Novel approaches can be optimised with research at EU scale.

Contractual arrangement

- **Main roles in a contractual PPP**
  - Private sector partners advise the Commission on R&I priorities for the Horizon 2020 work programmes
  - Implementation via Commission WPs for R&I using Horizon 2020 Rules for Participation and with comitology
- **Content of the document:**
  - Scope and Specific Objectives,
  - Activities, investment and outputs,
  - Governance and openness,
  - Specific commitments of each side,
  - Monitoring and Key Performance Indicators,
  - Duration and review
  - The Multi-annual roadmap is an Annex

The contractual PPP approach

- **What is the same as in normal Horizon 2020:**
  - The financial rules are those of Horizon 2020
  - Final responsibility for the Work Programme stays with the European Commission and is subject to Comitology
  - Implementation remains with the Commission: selection of proposals, negotiation, review of progress and payments
- **What is different from normal Horizon 2020:**
  - Long-term commitment by Commission to support the field
  - Long-term commitment by industry to invest, with a need to demonstrate its fulfilment (monitoring & KPIs)
  - Roadmap-based strategy. Close interaction in the Partnership Board to prepare the content of the calls.

Indicative EC funding

H2020 funding	NMP RTD	ICT CNECT	Transport RTD + CNECT	Energy RTD + ENER	Environment RTD	TOTAL M€
FoF	700	450	-	-	-	**1,150**
EeB	400	-	-	75+75	50	**600**
EGVI	70	-	600+80	-	-	**750**
SPIRE	700	-	-	50+50	100	**900**
TOTAL	**1870**	**450**	**680**	**250**	**150**	**3,400**

FROM AN END-USE DRIVEN APPROACH…

REFURBISHMENT TO TRANSFORM EXISTING BUILDINGS INTO ENERGY-EFFICIENT 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

CROSS-CUTTING CHALLENGES

HORIZONTAL ORGANISATIONAL ASPECTS

Relationship between User and Energy

Geoclustering

Value Chain and SMEs focus

Knowledge transfer

Business models, organisational and financial models (including ESCOs)

HORIZONTAL TECHNOLOGICAL 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-functiona

Diagnosis and predictive maintenance (continu commissioning)

Systems and Equipment for energy production

Diagnosis

NEUTRAL/ ENERGY POSITIVE NEW BUILDINGS

Systems and equipment for energy use for new buildings

Systemic approach for new buildings

ENERGY EFFICIENT DISTRICT/ COMMUNITIES

Interaction (integration) between buildings, grid, heat network ...

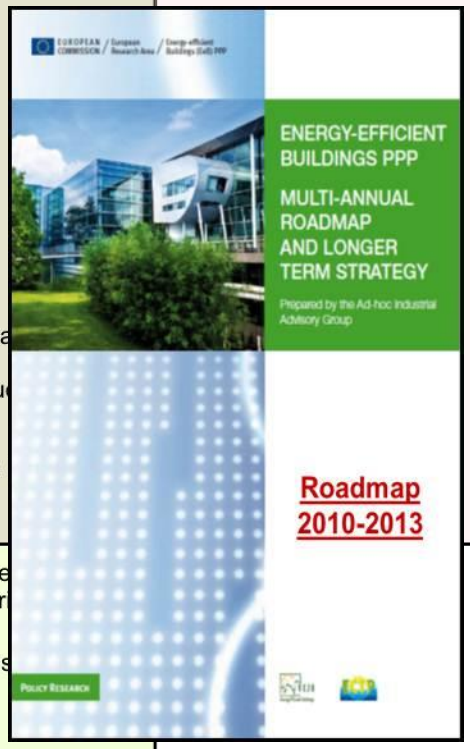
Systems and Equipment for energy production (district)

District and urban design

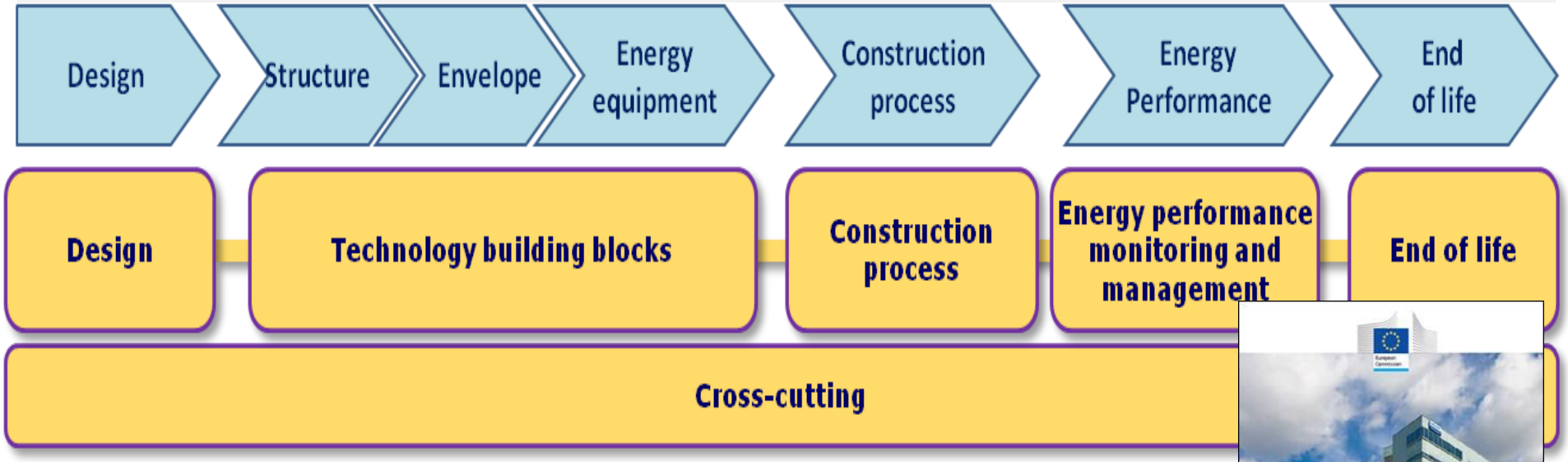
Systems and Equipment for energy use (district)

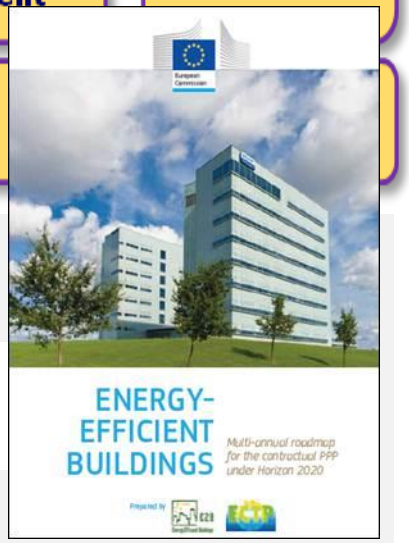
Storage of ene thermal, electr

Retrofitting (dis



…TO A VALUE CHAIN AND «CHALLENGE BASED» APPROACH





Roadmap 2014-2020

NEED OF A SYSTEMIC APPROACH
MULTIDISCIPLINARITY AND CROSS-SECTORIALITY

Active role of architects, designers, users and clients in retrofitting/ refurbishment projects

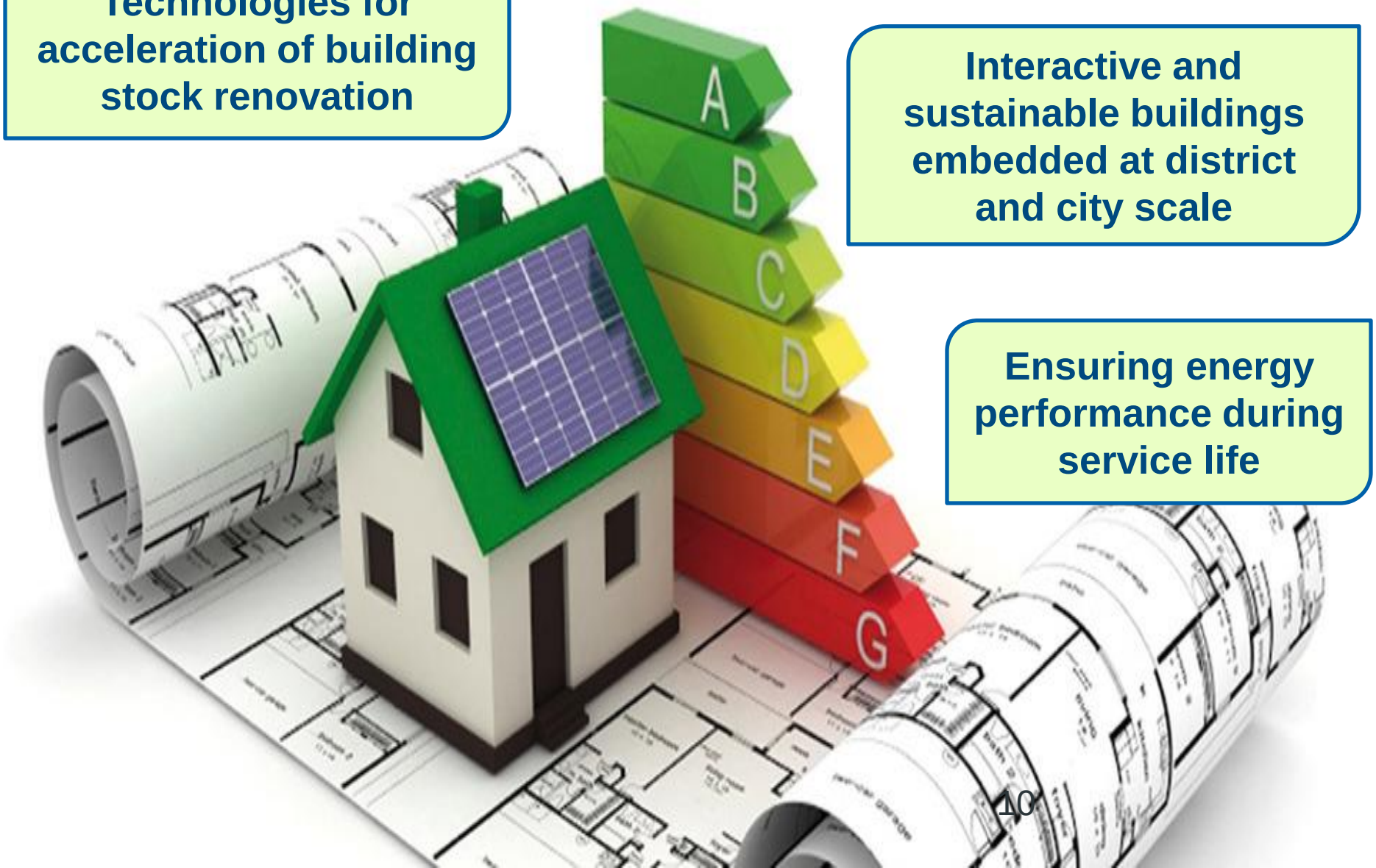
THE DISTRICT DIMENSION

KEY RESEARCH AREAS

Technologies for acceleration of building stock renovation

Interactive and sustainable buildings embedded at district and city scale

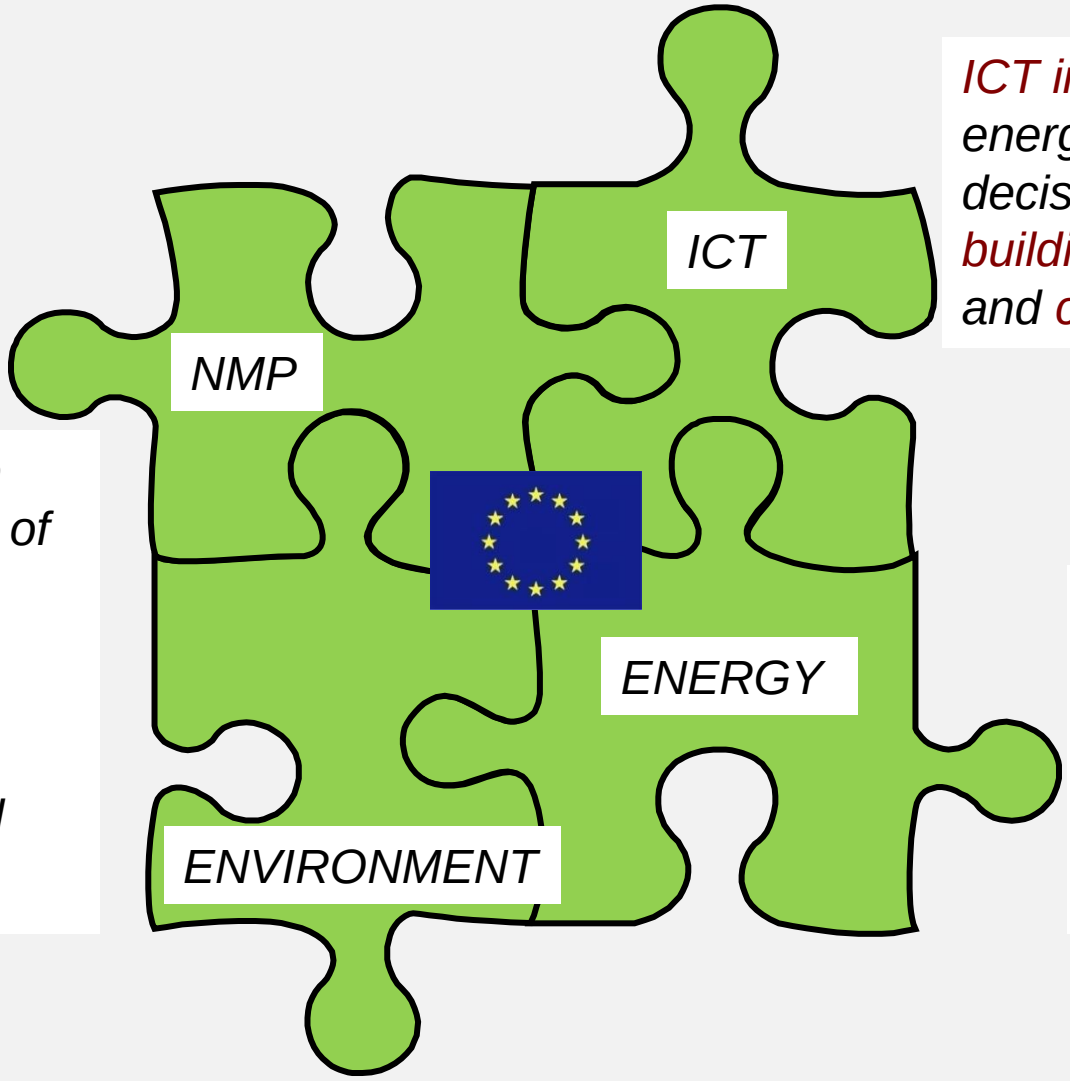
Ensuring energy performance during service life



PRIORITIES

Core area	Priority	Short Term (2014-16)	Medium term (2017-18)
Design	Integrated (holistic) design	x	x
	Tools to disclose existing knowledge and technologies (e.g. ICT BIM)		x
Structure	Sustainability, adaptability and affordability of structures		x
Envelope (incl. finishes)	Energy and environmental performance of the full envelope	x	x
	Prefabrication		x
	Multifunctional and adaptive components, surfaces and finishes	x	x
Energy equipment	Thermal storage	x	x
	Distributed/decentralised energy generation on a district level		x
	Advanced heating and cooling, domestic hot water including RES & heat recovery	x	x
Construction process	ICT aided construction		x
	Improving delivered energy performance	x	x
	Automated Construction Tools	x	x
Performance monitoring	ICT systems interoperability	x	
	Open data standards		x
	Prediction = reality (incl. occupancy modelling)	x	x
End of Life	Innovative solutions and decision-support on renovation or new building		x

MORE THAN 100 PROJECTS SO FAR SUPPORTED BY THE EC AND INDUSTRY THROUGH PPP EeB in FP7 (2010-2013 calls)



ICT integration for effective energy management and decision making from buildings to neighborhoods and cities

Fostering the development of new technologies and their integration in buildings and districts

Large scale demonstration of most promising solutions and their contribution to future smart cities

DEVELOPMENT OF NEW TECHNOLOGIES

Nanotechnology Coatings
Phase Change Materials
Nanotechnology based insulation

Sustainable, Innovative and Energy-Efficient Concrete

Multifunctional and nanotechnology supported materials/products

Measurable/controlable products

Lower energy consumption and GHG emissions

Safe, healthy and comfortable

Optimisation of material combinations

Textile Membranes, Plasters & Coatings for Retrofitting

Bio-based products

Lower embodied energy and better durability

Easier installation and maintenance

Indoor monitoring tools and systems

High Performance Bio-Composites for Buildings

Integrated Air Quality Sensors
Tools to Improve Comfort

Methodologies

Integration of wastes

Recycling

Operational Guidance for Life Cycle Assessment Studies

ICT FOR ENERGY-EFFICIENT BUILDINGS

Energy Management

Platforms for Public Authorities
Decision Support Systems
Predicting Energy Demand (region, city, operator, household)
Innovative use of acoustics

Building Information Modelling (BIM)

Integrated Design
Responsive Monitoring
Able to Learn Systems

Sensor and Appliances Networks

Powering Sensors
Fault Detection
Energy Management
Low Power Units
Wireless Technology
Adaptive Technology

Airports, Metros, Campus…

Smart Cities

Tools (District Level) for Design, Intelligent Control, User Awareness, Decision Support, Energy Management

Common metrics

Standardised Self Learning Architecture

INTEGRATION AND DEMONSTRATION OF TECHNOLOGIES FOR ENERGY EFFICIENCY

New Processes and Business models

Economic, Organisational & Social Innovation
Business Performance-Based Models
Interaction wih Real Flagship Projects

Building Interaction & Integration with Energy Networks at District Level

Micro-CHP & SOFC
Waste Solutions
Thermo Chemical Storage
External Insulation
Renewable Energies
Matching Supply & Demand
Integrated Concept of Interconnectivity

Building Retroffiting

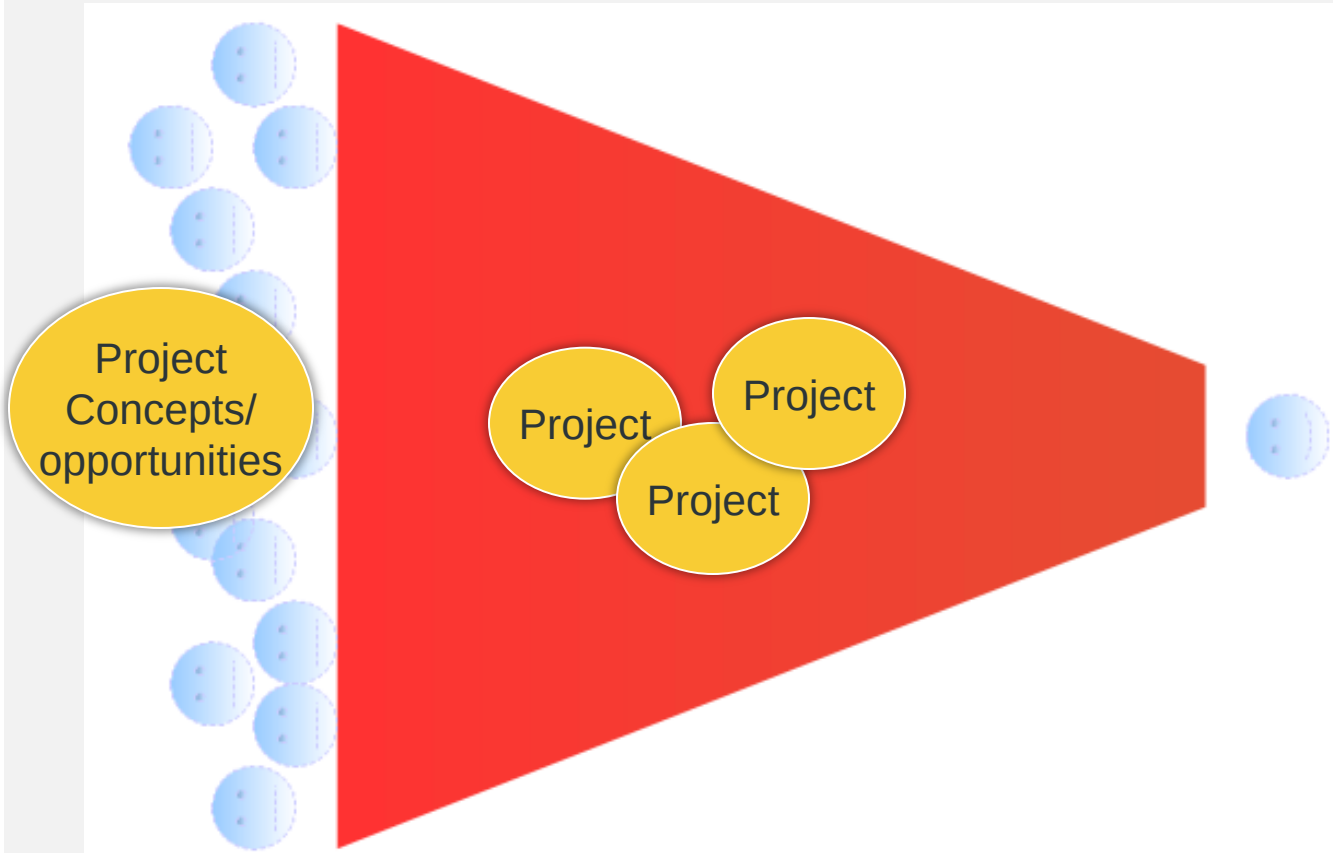
Systemic Renovation Packages
Prefebricated Elements
Integration Supervision & Evaluation
SME Friendly Procedures for selecting Best Solutions

Demonstration

Cultural Heritage

Solutions for Specific Issues
Guidelines/Tools for Analysis & Design

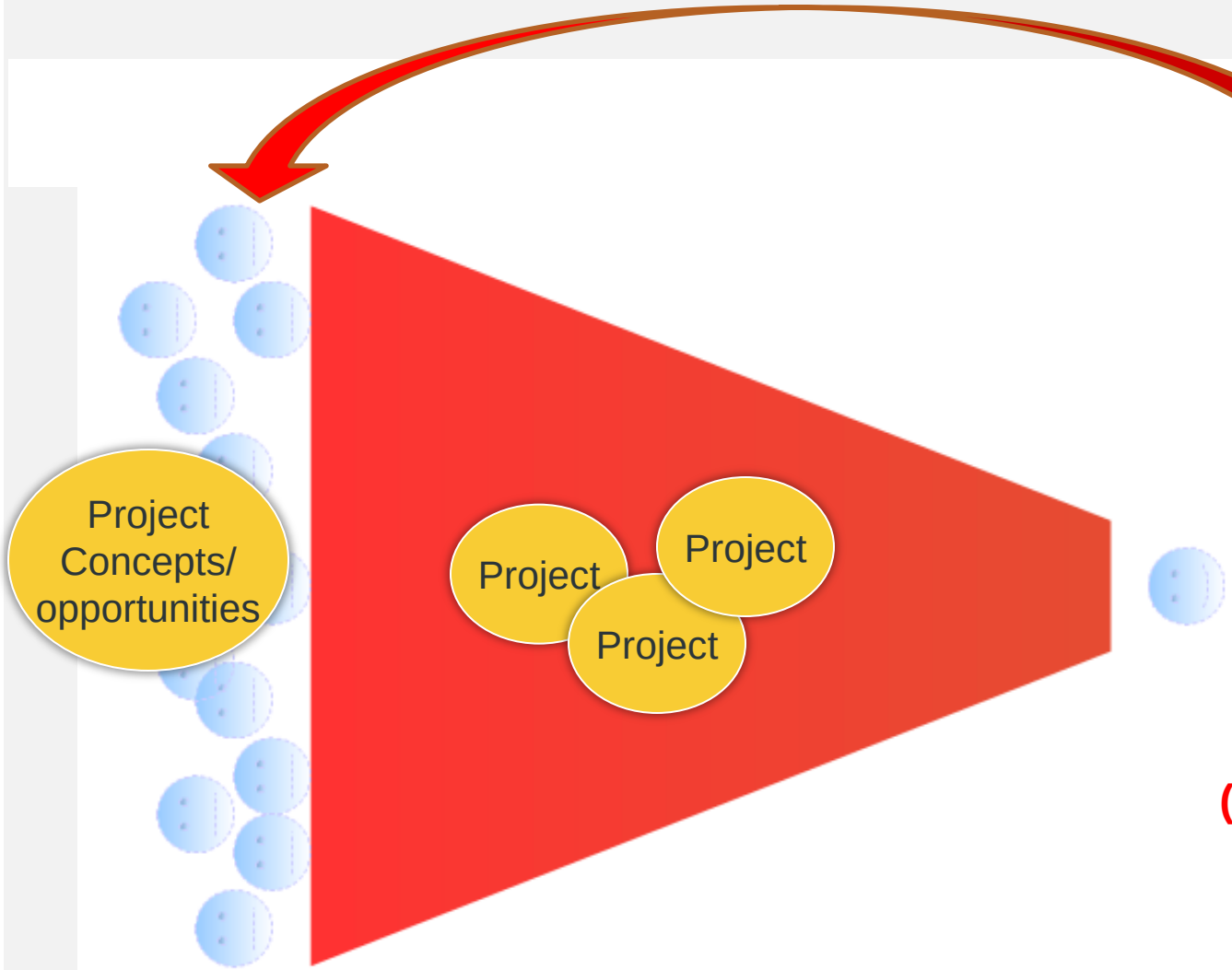
IMPACT: CONVERT IDEAS AND RESEARCH ENDEAVOURS INTO “SUSTAINABLE” APPLICATIONS



Front End > Development and Demonstration > Replication and Deployment throughout EU and beyond

>>>> E2B STRATEGY AND LONG TERM ROADMAP >>>>

Synergies with key initiatives like Intelligent Energy, …



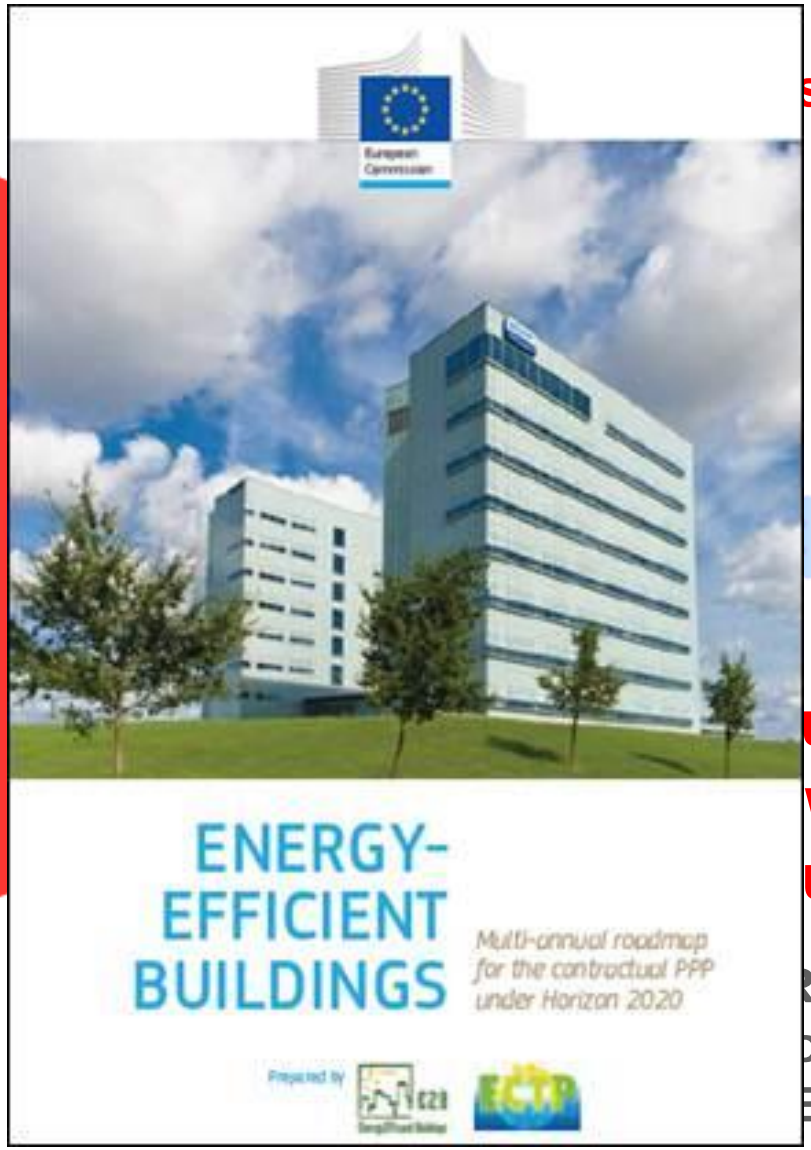
Non technological barriers and cross-cutting issues (Biz models, Standards, Public procurement, Training, Safety …)

Front End > Development and Demonstration > Replication and Deployment throughout EU and beyond

>>>> E2B STRATEGY AND LONG TERM ROADMAP >>>>

s (Concerto, …)

Project Concepts/ opportunities



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Front End >

Replication and
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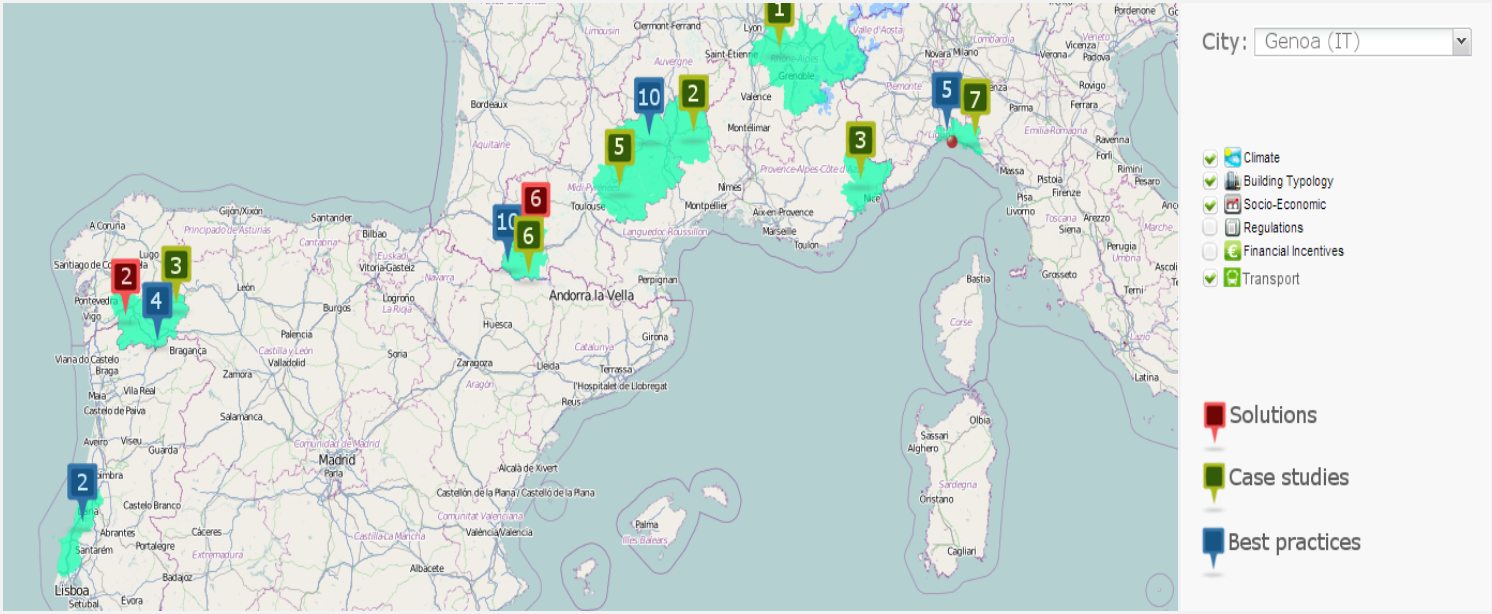
EU and beyond

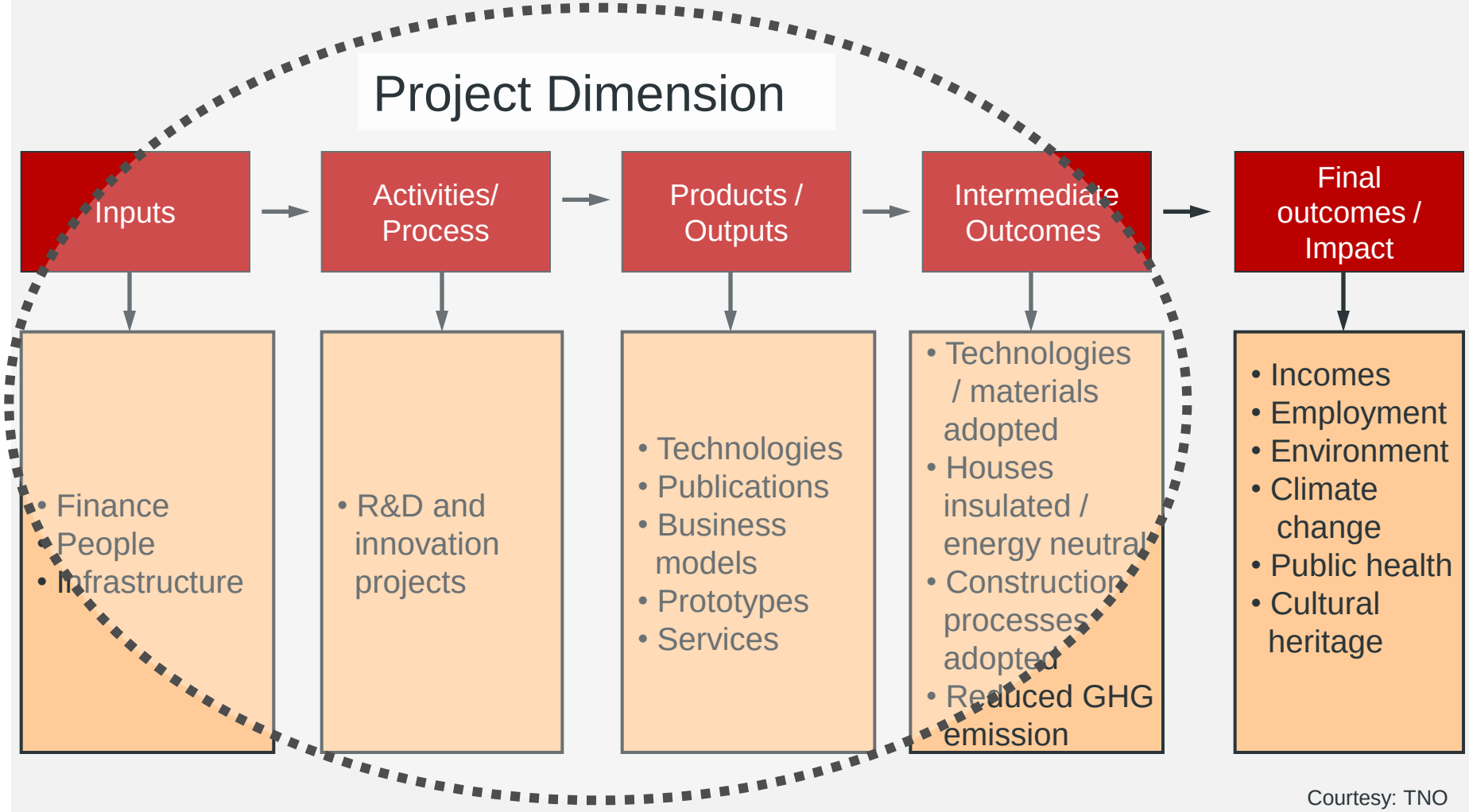
>>>> E2B STRATEGY AND LONG TERM ROADMAP >>>>

TARGETING MARKETS FROM A DIFFERENT PERSPECTIVES: GEOCLUSTERS



- Global solutions locally optimised
- Connecting global players with innovative SMEs
- Local impact – exploitation of cohesion funds

PROGRAMME LOGIC
IMPACT GENERATION



Courtesy: TNO

CURRENT ACHIEVEMENTS

Energy and CO_2 Savings

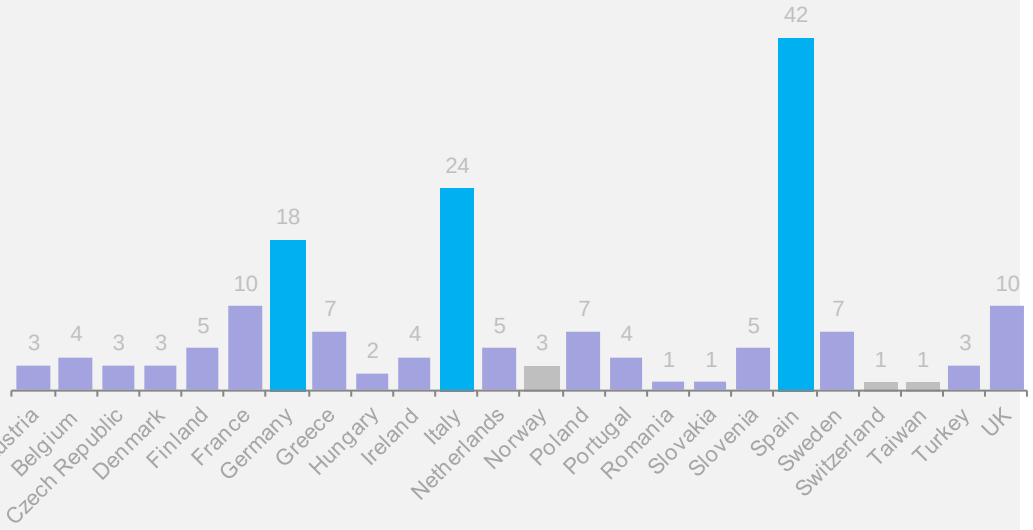
Average reduction in energy use: 39%
Annual savings in CO_2 : 4Mt

Investment

€429 million invested so far

Demonstrators

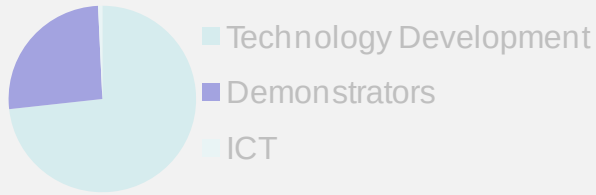
A total of 242 demonstrators located in 24 countries



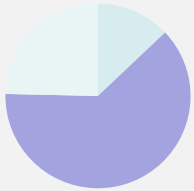
CURRENT ACHIEVEMENTS

Areas Improved (buildings and districts)

Total New Build
683,000m^2



Total Renovated
781,000m^2



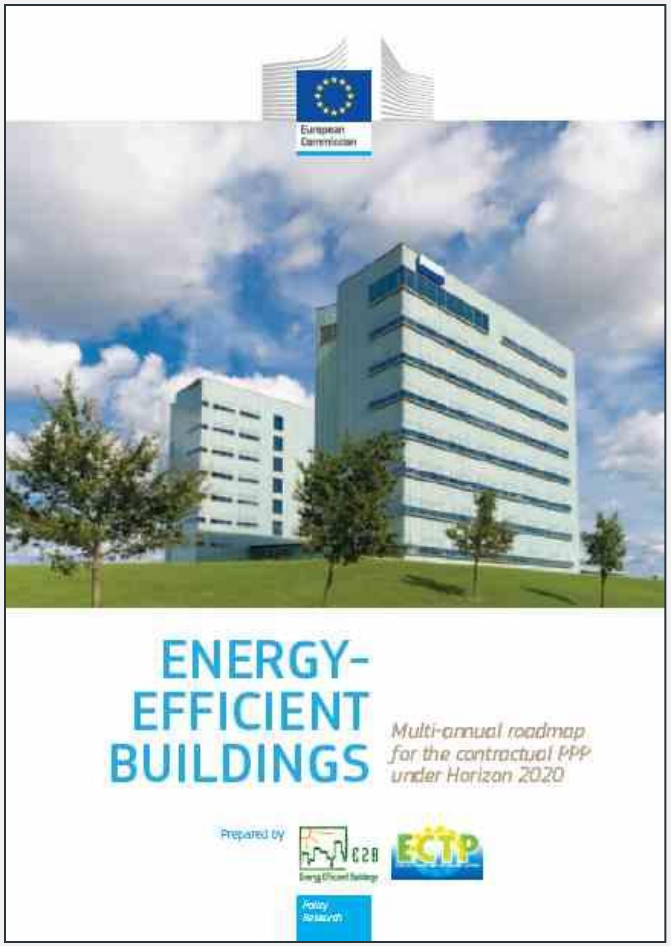
Engagement

- Over 70,000 end-users engaged and 15,300 dwellings improved.
- 5 offices, 2 sports complexes and 3 transport hubs involved in projects.
- 22 educational institutions (1 nursery, 8 schools, 13 university buildings)
- Potentially thousands more engaged – from airports etc.
- 132 SMEs engaged.

4.9 million reached through dissemination activity

8 900 individuals trained

THANKS FOR YOUR ATTENTION



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EeB PPP
Call topics for 2015

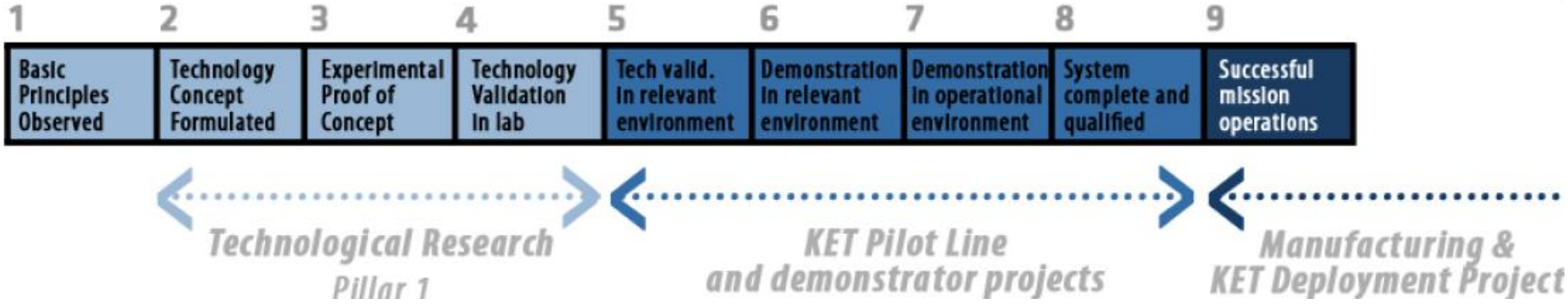
EeB - Call topics for 2015

- **Total EC funding: €73 million**
  - NMP (64 M€)

    3 topics IA + 1 RIA
  - Energy (9 M€)

    1 topic IA
- **Common deadline:** originally planned 9 December 2014
  delayed to early 2015
- **Areas covered include:** design tools for refurbishment; thermal energy storage; energy performance assessment; retrofitting of residential buildings; and design for new high energy performing buildings
- **Each proposal should:**
  - Include **outlined** exploitation and business plan;
  - Show active seeking for funding opportunities in other programmes.

Application of the Technology Readiness Levels



Where a topic description refers to a TRL, the following definitions apply, unless otherwise specified:

TRL 1 – basic principles observed
TRL 2 – technology concept formulated
TRL 3 – experimental proof of concept
TRL 4 – technology validated in lab
TRL 5 – technology validated in relevant environment (industrial relevant environment for KETs)
TRL 6 – technology demonstrated in relevant environment (industrial for KETs)
TRL 7 – system prototype demonstration in operational environment
TRL 8 – system complete and qualified
TRL 9 – actual system proven in operational environment (competitive manufacturing for KETs)

EeB 5 – 2015 Innovative design tools for refurbishment at building and district level

Specific Challenge:

- Major innovations in the **design tools, construction methods and management practices** to allow **integration at district level;**
- A renovated building should be **part** of a **global energy system;**
- **Interoperability** tools and solutions suited to collaborative multi-disciplinary refurbishing work

Scope (1):

Focus on design at building and district level including:

- Adjacent systems: **district heating/cooling** and **decentralised thermal energy generation** and other interactions with the neighbourhood, giving **priority to local renewable resources**.
- Holistic methods and tools;

EeB 5 – 2015 Innovative design tools for refurbishment at building and district level

Scope (2):

- Geo-clustered data sets
- Operational info / knowledge based design -> input for management systems

IA 70%

TRL 5-7

Expected Impact:

- More effective refurbishment at building and district level.
- Optimised design of integrated energy-efficient buildings enabling actors to take validated and quantified choices for the refurbishment at building and district level.

Significant participation of SMEs with R&D capacities is encouraged

EeB 6 – 2015 Integrated solutions of thermal energy storage for building applications

Specific Challenge:

- **Storage** plays a pivotal role in **synchronising energy demand** and **supply**, both on a short and long term (seasonal) basis.
- Transformation of our existing building stock towards **very low energy buildings** and **nearly zero energy** and **Plus-energy** buildings requires effective integration and **full use of the potential yield** of renewable energy.

Scope (1):

- **Advanced solutions** to reduce: thermal losses, pressure drops, improve heat exchange in and between storage material and heat carrier .
- **High energy density storage materials:** - long term multi-cyclic stability at tuneable temperature levels - **regeneration t°** in the range below 100°C - **energy storage capacity** at least 6 times the water one;

EeB 6 – 2015 Integrated solutions of thermal energy storage for building applications

Scope (2):

- Storage reactor components (heat exchanger);
- Advanced energy management, safe and environmentally friendly.

RIA 100%

TRL 4-6

Expected Impact:

- Provide advanced thermal energy storage solutions.
- Demonstrate solutions that have a stable long term performance in multi-cyclic seasonal use of at least 20 years.
- *Validate in the case of pumpable energy storage materials, an energy density comparable to the best solid-gas systems.*
- *Deliver compact system < 2,5 m^3 per dwelling.*
- *Reduction of the net energy consumption of a building by at least 15% and have a return-on-investment period below 10 years.*

EeB 7 – 2015 New tools and methodologies to reduce the gap between predicted and actual energy performances at the level of buildings and blocks of buildings

Specific Challenge:

- **Monitor** the **real energy use** in energy-efficient buildings and for a set of interacting buildings.
- **Capture** the real **complexities of the energy performance** of the actual **buildings** and **districts**.
- Effective methodologies to describe **user behaviour**.

Scope (1):

- Develop **methodologies and tools** to monitor and assess actual building energy performance considering user behaviour, complex energy systems performance and weather forecast, etc.
- **Predict accurately** building energy loads and consumption along the whole lifecycle ;

EeB 7 – 2015 New tools and methodologies to reduce the gap between predicted and actual energy performances at the level of buildings and blocks of buildings

IA 70%

Scope (2):

- A **holistic "open" approach** to building control and monitoring systems is required;
- Support decision making during the whole life of the building;
- **Real time** optimisation of energy demand and supply using intelligent energy management systems at the level of a block of buildings.

TRL 5-7

Expected Impact (1):

- **Significant reduction** in the **difference** between **real** and **predicted** energy behaviour in a building or a block of buildings after demonstration of the viability of the new tools and methods for measuring and analysing **real building energy performance**.

EeB 7 – 2015 New tools and methodologies to reduce the gap between predicted and actual energy performances at the level of buildings and blocks of buildings

Expected Impact (2):

- The **gap** is **narrowed down** to a value consistent with energy performance contracts.
- Provide solutions with a **high replication potential**.

Significant participation of SMEs with R&D capacities is encouraged.

EeB 8 – 2015 Integrated approach to retrofitting of residential buildings

Specific Challenge:

- Focus on **deep rehabilitation of residential buildings** (including buildings of historic value)**;**
- Innovative, efficient and cost-effective retrofitting solutions to meet the planned **net-zero energy standards**.
- **Breakthrough solutions :** affordable along the whole life cycle, reducing maintenance with higher performance reliability and reduced energy use.

Scope (1):

- **Systemic approaches** integrating the **most promising** cost-effective technologies and materials to **reduce building heat needs**;
- The **district scale**, as well as the **interactions** between the buildings and the thermal and electrical energy networks should be taken into account;

EeB 8 – 2015 Integrated approach to retrofitting of residential buildings

Scope (2):

IA 70%

- Innovative solutions with a high degree of **flexibility** to the **grid**;
- Integration of compact thermal energy storage unit;
- Full **potential of ICT:** control systems, modelling, simulation, virtual reality, etc.;
- Large scale demonstration - high replicability - financial model;
- Standardization work;
- Participation of building owners;
- Low intrusive techniques;
- Speeding up the construction process at high quality standards

TRL 5-7

EeB 8 – 2015 Integrated approach to retrofitting of residential buildings

Expected Impact :

- **Real case demonstration** of innovative retrofitting solutions close to **net zero energy** standards.
- Reduction of **at least 60% in energy consumption** compared to the values before renovation while ensuring affordability.
- Demonstrate a **high replicability potential**.
- **Return on investment should be below 7 years** in the case of deep retrofitting.
- Advent of a **new generation of skilled workers and SME contractors** in the construction sector aware of the need of a systemic approach towards energy efficiency should be promoted through the proposed activities.

Significant participation of SMEs with R&D capacities is encouraged.

EE 2 -2015 Buildings design for new highly energy performing buildings

Specific Challenge:

- All buildings must achieve "nearly zero energy" by end of 2020 (end of 2018 for public buildings)
- Encourage "plus energy buildings" to reduce overall energy use and increase share of renewables
- Costs of such buildings are a barrier to investment
- Industry needs to deliver affordable solutions to meet these targets

EE 2 -2015 Buildings design for new highly energy performing buildings

What we mean by:

- **Nearly Zero Energy Buildings (nZEB)**
The very low amount of energy required should be covered to a "very significant extent" by energy from renewable sources, produced either on-site or nearby

- **Plus Energy Buildings**
Buildings that produce more energy than they consume

EE 2 -2015 Buildings design for new highly energy performing buildings

Scope:

- Demonstrate reduced costs with nZEB performance, whilst accelerating market uptake
- Passive or active solutions
- Automated or cost-effective maintenance of installations
- Assess and minimize gap between predicted and actual energy performance
- Address the challenge to move to a large scale e.g. net-zero energy neighbourhoods
- Focus on on-site and nearby RES designs and energy efficiency methods that go beyond nZEB standards

EE 2 -2015 Buildings design for new highly energy performing buildings

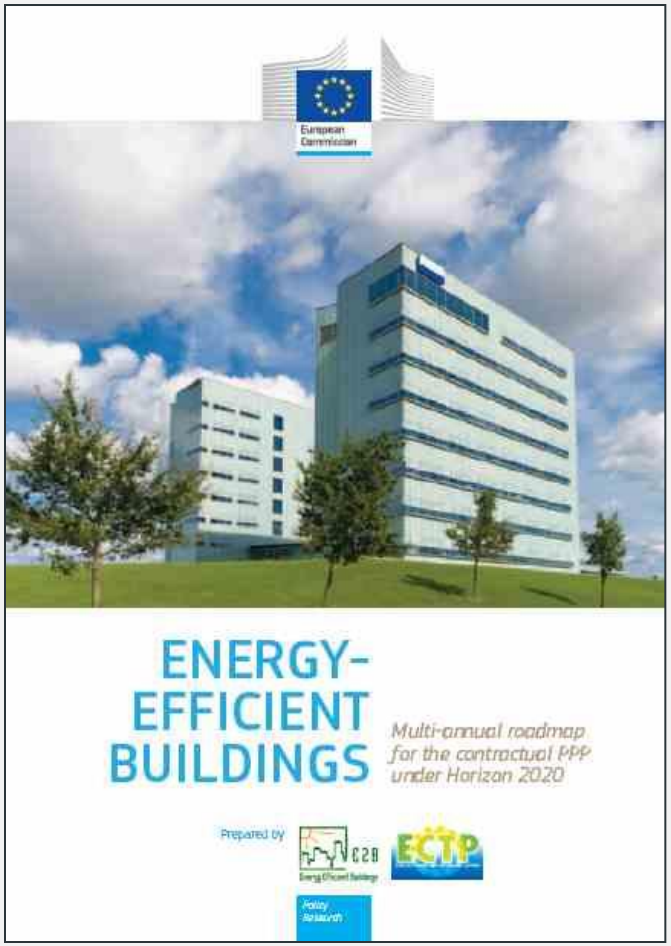
Expected Impact:

- Increased share of nZEBs, aiming for 100% by end of 2020.
- Cost reductions at least 15% compared with current situation
- Additional benefits in terms of energy reduction
- Demonstration for net-zero energy districts that use onsite or nearby RES

TRL 5-7

IA 70%

THANKS FOR YOUR ATTENTION



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