



Conference organized by:

PhotoVoltaic TECHNOLOGY PLATFORM

Energy Efficiency in Buildings & Building-integrated Photovoltaics: Where Sustainability meets Aesthetics

London, UK,
8 July 2015, 10.00- 17.30
RIBA Venues,
66 Portland Place, London W1B 1AD

EeB PPP Roadmap and the role of PV

Luc Bourdeau
ECTP Secretary General

ECTP INNOVATIVE BUILT ENVIRONMENT

www.ectp.org
secretariat.ectp@cstb.fr

With a yearly turnover around € 1.2 trillion, the European **Construction Sector**, including its extended value chain (e.g. materials & equipment manufacturers, construction & service companies), is the largest European single activity (**10% of GDP**) & the biggest industrial employer (**14.6 million direct jobs**).

ECTP
INNOVATIVE BUILT ENVIRONMENT

The **European Construction Technology Platform** (ECTP) gathers around 180 member-organizations from the Construction sector and other sectors from the whole supply chain of the **Built Environment**.

Its main mission is to develop new **R&D&I** strategies to improve **competitiveness**, meet **societal needs** & take up **environmental challenges**.

The **Built Environment** is mainly constituted by buildings, infrastructures & cultural landscapes. It can also be considered as a set of natural, physical, economic, human, social and cultural capitals.

The **Built Environment** is a place of tightly interconnected private & public infrastructure. Its composition & dynamic are very complex, since it offers & is associated to a lot of various services which support our day-to-day life.

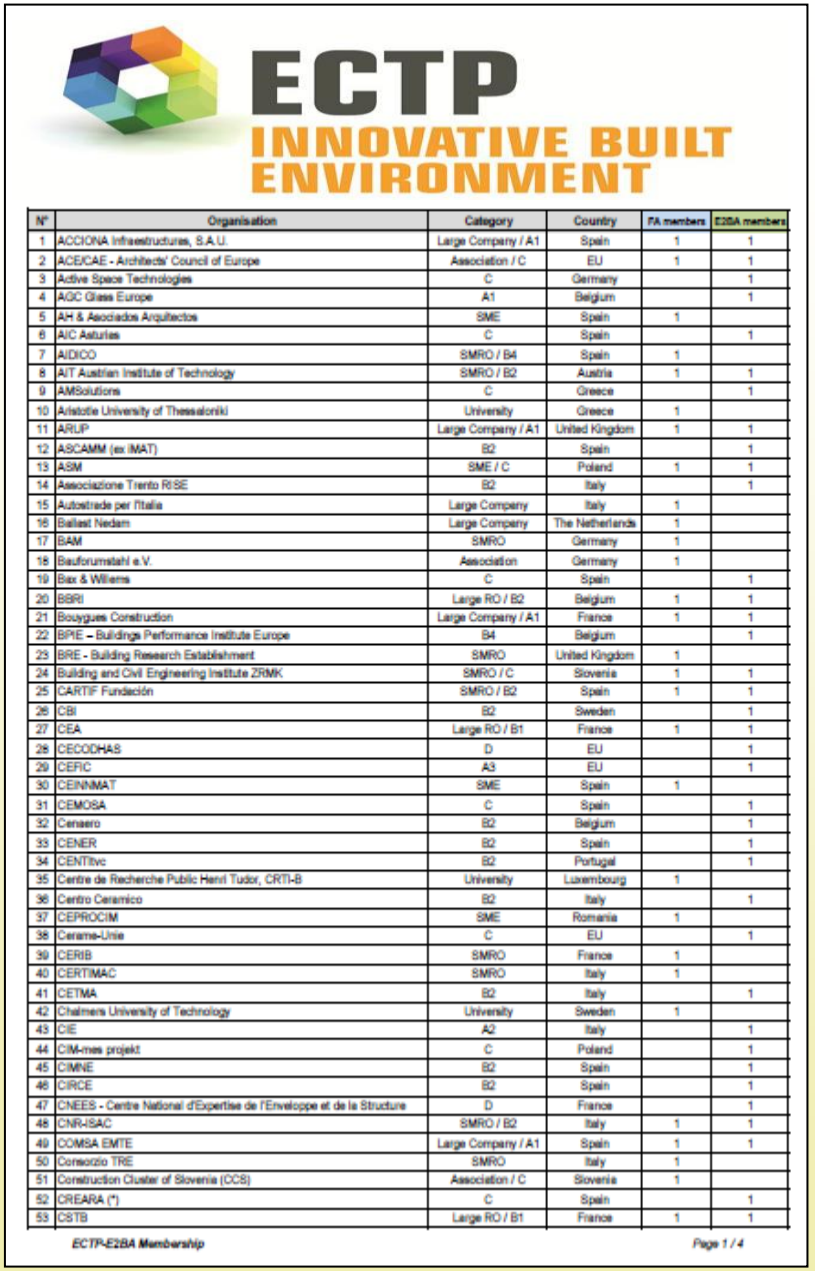
The **Built Environment** serves a lot of industries and services (transport…). It impacts therefore the performance of many sectors.

The **Built Environment** is our major living environment; this is the place (homes, offices, transport infrastructures, cultural places, etc.) where we spent more than 80% of our time. The quality of the **Built Environment** therefore directly impacts the quality of our life.

Last but not least, paramount challenges such as **energy, climate change, efficiency & more generally sustainability** prove to become of utmost importance for the **Built Environment** and very often need to be tackled within an **integrated approach**.

ECTP Membership

- >180 Members
  - Industry: 35%
    - Large Companies : 18%
      (including ENCORD Members)
    - SMEs: 17%
  - RTOs: 28%
  - Universities: 22%
  - Miscellaneous: 15%
- 26 Countries



ECTP
INNOVATIVE BUILT ENVIRONMENT

N°	Organisation	Category	Country	PA members	E2BA members
1	ACCIONA Infraestructuras, S.A.U.	Large Company / A1	Spain	1	1
2	ACE/CAE - Architects' Council of Europe	Association / C	EU	1	1
3	Active Space Technologies	C	Germany		1
4	AGC Glass Europe	A1	Belgium		1
5	AH & Asociados Arquitectos	SME	Spain	1	
6	AIC Asturias	C	Spain		1
7	AIDICO	SMRO / B4	Spain	1	
8	AIT Austrian Institute of Technology	SMRO / B2	Austria	1	1
9	AMSolutions	C	Greece		1
10	Aristotle University of Thessaloniki	University	Greece	1	
11	ARUP	Large Company / A1	United Kingdom	1	1
12	ASCAMM (ex IMAT)	B2	Spain		1
13	ASM	SME / C	Poland	1	1
14	Associazione Trento RISE	B2	Italy		1
15	Autostrade per l'Italia	Large Company	Italy	1	
16	Ballast Nedam	Large Company	The Netherlands	1	
17	BAM	SMRO	Germany	1	
18	Bauforumstahl e.V.	Association	Germany	1	
19	Bax & Willems	C	Spain		1
20	BBRI	Large RO / B2	Belgium	1	1
21	Bouygues Construction	Large Company / A1	France	1	1
22	BPIE – Buildings Performance Institute Europe	B4	Belgium		1
23	BRE - Building Research Establishment	SMRO	United Kingdom	1	
24	Building and Civil Engineering Institute ZRMK	SMRO / C	Slovenia	1	1
25	CARTIF Fundación	SMRO / B2	Spain	1	1
26	CBI	B2	Sweden		1
27	CEA	Large RO / B1	France	1	1
28	CECODHAS	D	EU		1
29	CEFIC	A3	EU		1
30	CEINNMAT	SME	Spain	1	
31	CEMOSA	C	Spain		1
32	Cenaero	B2	Belgium		1
33	CENER	B2	Spain		1
34	CENTIVC	B2	Portugal		1
35	Centre de Recherche Public Henri Tudor, CRTI-B	University	Luxembourg	1	
36	Centro Ceramico	B2	Italy		1
37	CEPROCIM	SME	Romania	1	
38	Cerame-Unie	C	EU		1
39	CERIB	SMRO	France	1	
40	CERTIMAC	SMRO	Italy	1	
41	CETMA	B2	Italy		1
42	Chalmers University of Technology	University	Sweden	1	
43	CIE	A2	Italy		1
44	CIM-mes projekt	C	Poland		1
45	CIMNE	B2	Spain		1
46	CIRCE	B2	Spain		1
47	CNEES - Centre National d'Expertise de l'Enveloppe et de la Structure	D	France		1
48	CNR-ISAC	SMRO / B2	Italy	1	1
49	COMSA EMTE	Large Company / A1	Spain	1	1
50	Consorzio TRE	SMRO	Italy	1	
51	Construction Cluster of Slovenia (CCS)	Association / C	Slovenia	1	
52	CREARA (*)	C	Spain		1
53	CSTB	Large RO / B1	France	1	1

ECTP-E2BA Membership *Page 1 / 4*

ECTP

INNOVATIVE BUILT ENVIRONMENT

ENERGY EFFICIENT BUILDINGS
AN ECTP COMMITTEE

INFRASTRUCTURE MOBILITY
AN ECTP COMMITTEE

MATERIALS SUSTAINABILITY
AN ECTP COMMITTEE

HERITAGE REGENERATION
AN ECTP COMMITTEE

ACTIVE AGING DESIGN
AN ECTP COMMITTEE

ENERGY EFFICIENT BUILDINGS
AN ECTP COMMITTEE

It would be great if (for example)…

Smart systems and control could allow energy usage optimization whilst guaranteeing optimal comfort, a healthy environment and numerous other services (security, assistance to elderly people…)

Existing buildings could have high insulating envelopes to reduce energy use much below 50 kWh/m^2/year while achieving thermal comfort

Buildings could satisfy their own energy needs or even contribute excess power to the community (zero/positive energy buildings)

Renewable and non polluting energy sources could be easily integrated

Equipment could be operated at optimal energy performance level (lighting, HVAC…)

Users could change their behavior towards a reasoned usage of energy and being proactive

ENERGY EFFICIENT BUILDINGS
AN ECTP COMMITTEE

PPPs in HORIZON 2020

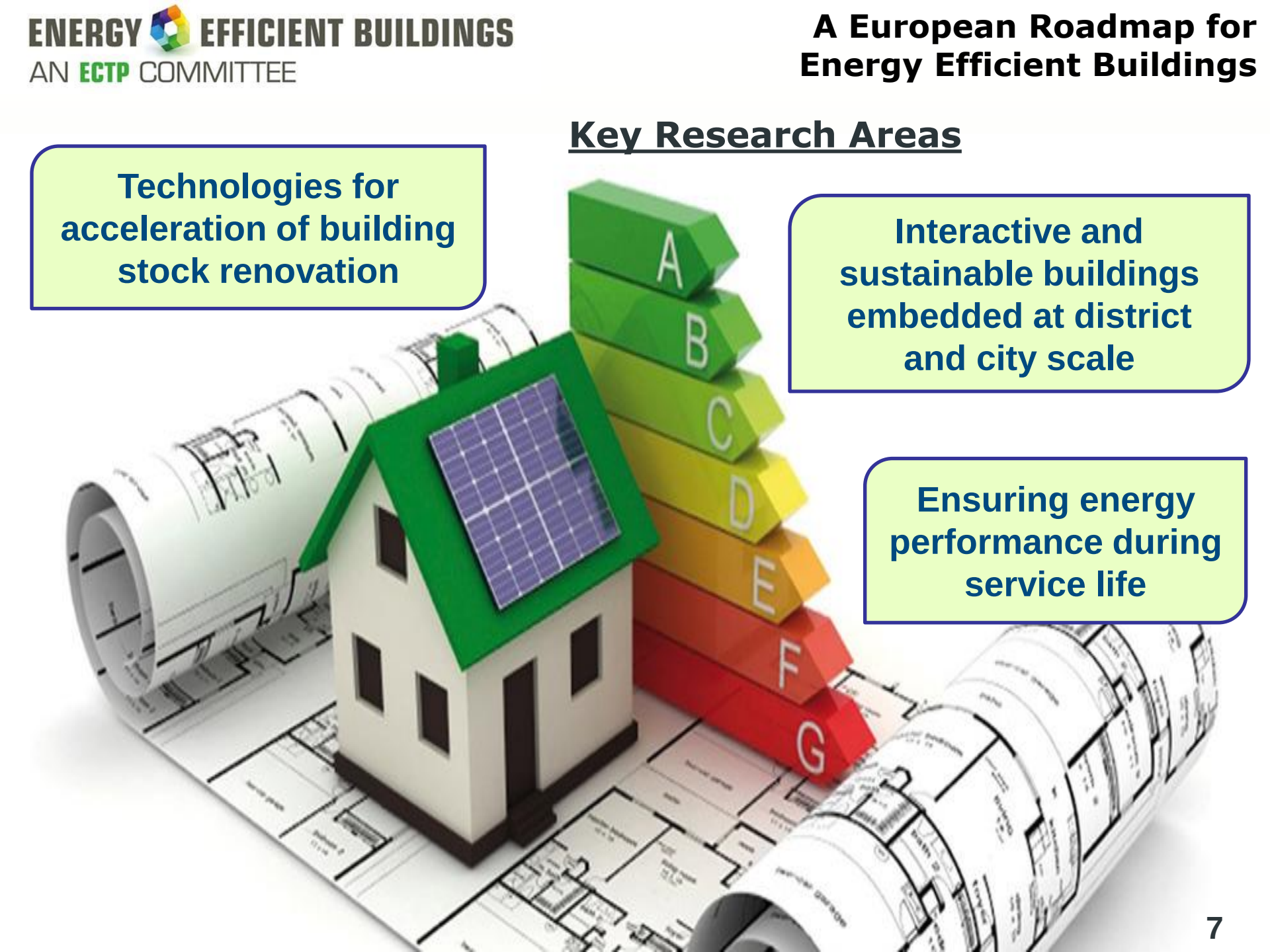
Joint Technology Initiatives	Contractual PPPs
• Innovative Medicines (IMI) • Clean Sky • Single European Sky ATM Research (SESAR) • Fuel Cells and Hydrogen (FCH) • Electronic Components and Systems (ECSEL - old ARTEMIS + ENIAC) New: • Bio-based Industries (BBI)	• Factory of the Future (FoF) • Energy-efficient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

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



ENERGY EFFICIENT BUILDINGS
AN ECTP COMMITTEE

A European Roadmap for Energy Efficient Buildings

A value chain & challenge based approach

PV PV PV

Design | Structure | Envelope | Energy equipment | Construction process | Energy Performance | End of life

Design

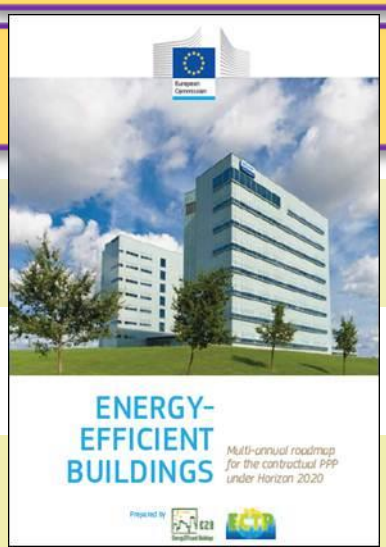
Technology building blocks

Construction process

Energy performance monitoring and management

End of life

Cross-cutting



Roadmap 2014-2020

"Turning energy efficiency into a sustainable business"

Some Challenges and Drivers related to PV

- Renewable energy sources have not yet reached mature integration into existing or new buildings to provide users with heat and/or electricity that are independent from fossil fuel uses. Innovation is still needed to optimise renewable energy impacts and uses at building and district level.
- Interaction with other research areas especially the integration of supply systems for renewable energy including storage systems would be mandatory.
- The energy equipment must adapt to the new smart grids and to lower unit energy demands from more energy efficient buildings, which requires sizing down the current portfolio while keeping energy efficiency at the highest level possible as well as unit investment cost down. Beyond existing technologies, breakthrough solutions can be expected from heating/cooling systems combined with renewable energy sources, storage (heat and electricity) and building or district integrated solutions in combination with smart grid technologies.
- Growing interaction between buildings or districts and grids/networks: building design would more and more benefit from evolving electricity, heating and cooling distribution networks which integrate more decentralised and renewable energy sources, as well as emerging flexibility in the consumers' demand (demand response schemes).
- Future buildings would be able to communicate with each other and their environment. They would manage the energy use taking into consideration the availability of local renewable resources and the more profitable periods for network connections.

Some Targets related to PV

- **Target 8: Envelopes are adaptable to a dynamic and complex environment**
  - TA8.2: Development and manufacturing of energy storing converting materials (e.g. Phase Change Materials and switchable glazing (e.g. thermochromic, photochromic or electrochromic) combined with PV in glazing panes)
- **Target 9: Envelopes are able to integrate generation and conversion of incoming solar radiation**
  - Both PV and thermal conversion can be smartly integrated to recover further solar incoming radiation, together with storage solutions. Façades can then be made active or reactive to signals from energy management systems. System integration must then be based on interoperable IT systems and interfaced with building energy management systems, smart grids or smart cities.
  - TA9.2: Integration of existing and innovative PV components (e.g. OPV, DSSC) into building envelopes
- **Target 10: Energy efficient, interoperable, self-diagnostic and scalable storage, HVAC, lighting and energy solutions in line with energy consumption standards are available for integration into new and refurbished buildings**
  - *TA10.7: Renewable energy production (heating, cooling, electricity) integrated at building level*
  - *TA10.8: Renewable energy production (heating, cooling, electricity) integrated at district level (incl. heat networks)*

ENERGY EFFICIENT BUILDINGS
AN ECTP COMMITTEE

A European Roadmap for Energy Efficient Buildings

Overview of priorities along time

Core area	Priority	Short Term (2014-16)	Medium term (2017-18)	Long term (2019-20)
Design	Integrated (holistic) design	✖	✖	✖
	Tools to disclose existing knowledge and technologies (e.g. ICT BIM)		✖	✖
Structure	Sustainability, adaptability and affordability of structures		✖	✖
Envelope (incl. finishes)	Energy and environmental performance of the full envelope	✖	✖	✖
	Prefabrication		✖	✖
	Multifunctional and adaptive components, surfaces and finishes	✖	✖	✖
Energy equipment	Thermal storage	✖	✖	✖
	Distributed/decentralised energy generation on a district level		✖	✖
	Advanced heating and cooling, domestic hot water including renewable energy sources and heat recovery	✖	✖	✖
Construction process	ICT aided construction		✖	✖
	Improving delivered energy performance	✖	✖	
	Automated Construction Tools	✖	✖	✖
Performance monitoring	ICT systems interoperability	✖		
	Open data standards		✖	✖
	Prediction – reality (incl. occupancy modelling)	✖	✖	✖
End of Life	Innovative solutions and decision-support on renovation or new building		✖	✖


PV


PV

Current Achievements

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

PV

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

Current Achievements

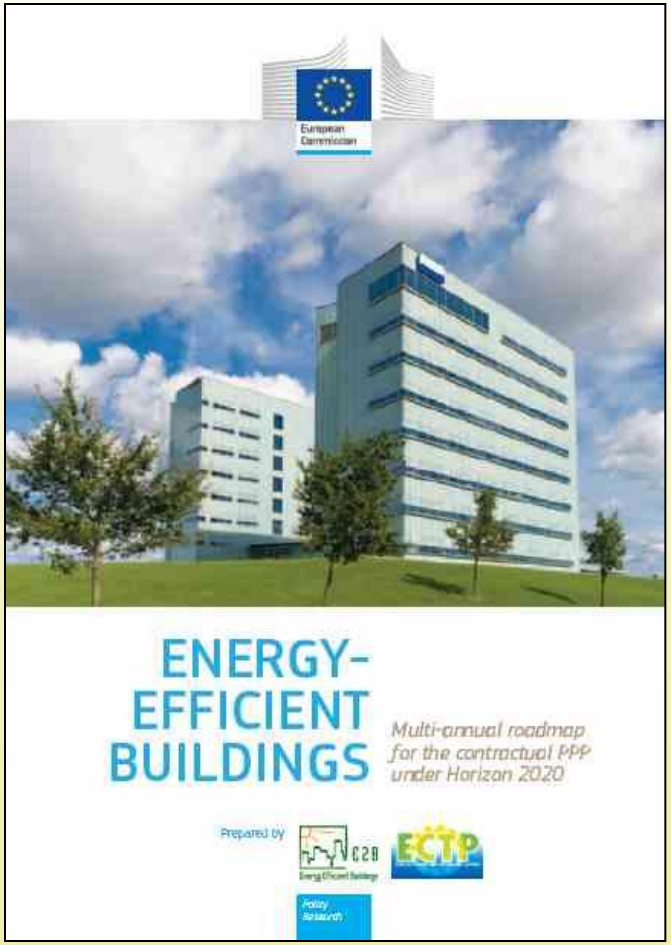
- **Energy and CO_2 Savings**
  - Average reduction in energy use: **34 and 32 %**
- **Demonstrators**
  - An average of **2.8 demo sites** per project
- **Dissemination**
  - **10 training courses or workshops** per project
  - Over 70,000 end-users engaged
- **Innovation**
  - An average of **4.9 innovations** per project
  - An average of **1 patent** per project
- **Standardization**
  - **17%** of the overall project portfolio is undertaking standardization activities while an additional **40%** has planned standardisation activities as key component of their projects.

ENERGY EFFICIENT BUILDINGS
AN ECTP COMMITTEE

A European Roadmap for Energy Efficient Buildings

MORE INFORMATION

Roadmap

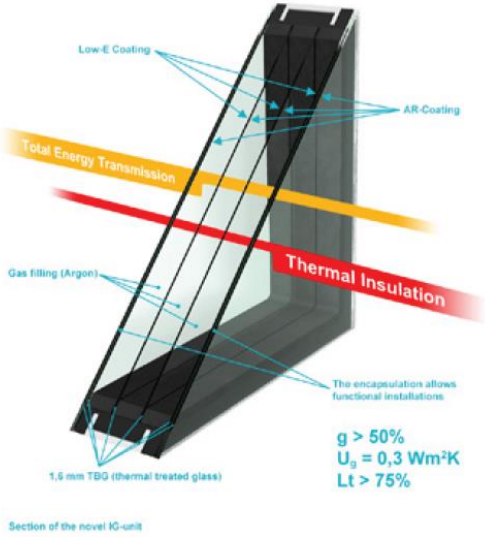


Project Review

MEM4WIN

Ultra-thin glass membranes for advanced, adjustable and affordable quadruple glazed windows for zero-energy buildings

- **Novel, insulated glass unit for quadruple glazing which contains ultra-thin glass membranes**
- **Incorporated into frameless, openable windows which can be directly incorporated into façades**
- **Expected properties**
  - heat transfer coefficient of 0.3W/m²K
  - weight reduction of more than 50%
  - cost reduction of 20%
- **Integrated features**
  - ink-jet printed Organic **Photovoltaics**
  - fully integrated solar thermal collectors for energy harvesting
  - micro-mirror arrays for energy control and advanced day lighting



Section of the novel insulated glass unit

KEY FACTS

Start date: October 2012

Duration: 42 months

Total budget (€): 6.6M

Website: www.mem4win.com

Coordinator: LiSEC Austria GmbH, Austria

Partners: Austria: Profactor, Tiger Coatings, University Linz. Germany: Aixtron SE, Belectric OPV, Energy Glas, University Kassel. Italy: CNR, Durst Phototechnik. South Korea: Korea University. UK: Aixtron Ltd, University of Cambridge.

Development of a clean and energy self-sustaining building

- Hydrogen used as an energy supply in the case of an energy shortage from renewables
- Photovoltaic panels and wind turbines
- Management system
  - based on optimised operational strategies
  - coordinates the system components, renewable energy technologies and the electricity grid

View of the Lavrion demo installation

KEY FACTS

Start date: October 2008

Duration: 48 months

Total budget (€): 6.6M

Website: www.h2susbuild.ntua.gr

Coordinator: Coordinator: D'Appolonia, Italy.

Partners: Germany: CirComp, Institut für Verbundwerkstoffe. Greece: Centre for Renewable Energy Sources, National Technical University of Athens, Schneider Electric. Italy: CAVE, ICI Caldaie, Idrogen2, SCAME Sistemi. Norway: Det Norske Veritas. Poland: Decsoft. Spain: Acciona Infraestructuras, Ikerlan. Sweden: Catator, SKANSKA. The Netherlands: Van Berkel & Bos UN Studio. UK: The University Court of the University of St Andrews.

NEXT buildings

Demonstration of net zero-carbon/energy affordable buildings

- **Technological developments of**
  - transmission controllable glazing
  - dual function **photovoltaics**
- **Prototype of the insulating photovoltaic panel created**

Core construction of the Hikari building in Lyon

KEY FACTS

Start date: January 2012

Duration: 72 months

Total budget (€): 8.4M

Website: www.next-buildings.com

Coordinator: KEMA Nederland BV, Netherlands

Partners: Denmark: COWI A/S. France: Bouygues Immobilier, HESPUL, SPLA Lyon Confluence. Germany: University of Kassel. The Netherlands: Gemeente Amsterdam Stadsdeel West, Liander NV, Vrije Universiteit Amsterdam (VU-VUmc). Sweden: BKAB Boende Komfort, Helsingborgshem. Switzerland: Ecole Polytechnique Federale De Lausanne.

MEEFS
RETROFITTING

Multifunctional energy-efficient façade system for building retrofitting

- **Several technological units completed**
  - Insulation
  - Green façade
  - Ventilated façade
  - Advanced passive solar protector
  - Glazed, building-integrated **photovoltaics** and solar thermal collector
  - Energy absorption auto mobile unit
  - Advanced passive solar collector and ventilation module

MEEFS façade design proposal for a residential building in Spain (example of south façade)

KEY FACTS

Start date: January 2012

Duration: 48 months

Total budget (€): 9.9M

Website: www.meefs-retrofitting.eu

Coordinator: ACCIONA Infraestructuras, Spain

Partners: Belgium: Greenovate! Europe. Finland: TeknologianTutkimuskeskus VTT. France: CQFD Composites SARL, TBC Générateurs D'innovation. Germany: Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung EV. Greece: GK Rizakos – ABETE, National Technical University of Athens. Israel: Technion – Israel Institute of Technology. Italy: AntWorks SRL, Vipiemme Solar SRL. Poland: SKA Polska Sp z o.o, TPF Spólka z ograniczona odpowiedzialnoscia - E&L Architects. Spain: Consejería de Fomento - Junta de Extremadura, Fundación Tecnalia Research & Innovation, Advanced Simulation Technologies.

Energy-hub for residential and commercial districts

- Maximise the local use of renewable energy in a district by matching energy demand and supply
- Local use of a large renewable supply such as a **photovoltaic** panel array or a large wind turbine
- Excess renewable heat can be stored in advanced Thermo-Chemical Materials (TCM) in distributed storage vessels or boreholes

"The newly constructed "Balk van Beel" apartment building in Leuven, Belgium, where a smart energy management system was installed

KEY FACTS

Start date: December 2010

Duration: 48 months

Total budget (€): 11.7M

Website: www.e-hub.org

Coordinator: TNO, The Netherlands

Partners - Belgium: Ertzberg, ISPE, VITO. Finland: VTT. France: EDF. Germany: Fraunhofer-ISE, HSW. Italy: Finlombarda, D'Appolonia, University of Genoa. The Netherlands: ECN. Poland: Mostostal. Spain: Acciona, Solintel. UK: ICAX.

Energy-efficient lightweight-sustainable-safe-steel construction

- Nanotechnology-enhanced, steel skeleton, drywall systems that provide improved thermal, vibration, seismic and fire performance
- Vacuum insulation panels, aerogels and intumescent paints, nanostructured electrodes and nanostructured organic **photovoltaics**

KEY FACTS

Start date: September 2013

Duration: 36 months

Total budget (€): 3.6M

Website: www.elissaproject.eu

Coordinator: National Technical University of Athens, Greece

Partners: Germany: Wölfel Beratende Ingenieure GmbH + Co KG, ZAE Bayern eV, KNAUF Gips KG, va-Q- tec. Italy: STRESS S.c.a.r.l, Farbe SpA, Università degli Studi di Napoli Federico II, Knauf di Lothar Knauf Sas. Switzerland: Häring Nepple AG. UK: University of Ulster.





Conference organized by:

PhotoVoltaic TECHNOLOGY PLATFORM

Energy Efficiency in Buildings & Building-integrated Photovoltaics: Where Sustainability meets Aesthetics

London, UK,
8 July 2015, 10.00- 17.30
RIBA Venues,
66 Portland Place, London W1B 1AD

Thank you for your attention

Luc Bourdeau
ECTP Secretary General

ECTP INNOVATIVE BUILT ENVIRONMENT

www.ectp.org
secretariat.ectp@cstb.fr