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Horizon 2020 - DIRECTORATE-GENERAL FOR RESEARCH & INNOVATION
Directorate D - Key Enabling Technologies

Smart Façade Materials in European Research Programmes

European Smart Façade Conference

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European Commission

Research and Innovation

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Background

- *Buildings need to be urgently improved in EU:*
  - **40% of final energy demand**
  - **36% of greenhouse gases emissions**
- *Legislation is in place at European and national levels:*
  - **Energy Performance of Buildings Directive (EPBD) (2010/31/EU)**
  - **Energy Efficiency Directive (EED) (2012/27/EU)**
  - **Eco-design (2009/125/EC) and Energy-labelling (2010/30/EU) directives**
  - **…**

Background

- *New initiatives are constantly taking place to check appropriateness of legislation and strengthen it:*
  - **Review of the EPBD and EED (2015)**
  - **SET Plan revision (2015-16)**
- *Sustainability of new solutions is critical (Construction Products Regulation, Waste Framework Directive etc…)*
  - **Environment**
  - **Economy**
  - **Social**
- *All European research programmes in EeB PPP Materials aim to provide new solutions to these policy challenges*

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Research on construction materials
General messages

- Importance of **holistic approach**: complete life cycle assessment/cost including production, use phase and end of life
- Importance of **social aspects**: improved comfort of living, thermal comfort, indoor air quality, noise reduction…
- Importance of **building design** to increase flexibility and adaptability for new needs and prolonged service life
- Importance of correct **implementation** (thermal bridges…)
- Importance of **spreading information**, educating engineers, architects & workers…
- Importance of **material durability**
- Develop **multi functional materials**
- Favour **performance based standards**

Research needs for façade materials

- *Performance: fit for purpose as defined by standards*
- *Environment*
  - **Low embodied energy** **(2011 & 2014)**
  - **Durability: reduced maintenance** **(2017)**
  - **End of life, reuse, recyclability…** **(all)**
  - **Insulation** **(2011 & 2016)**
- *Economic: affordability, life cycle costing* *(all)*
- *Social*
  - **Health** **(all)**
  - **Improved indoor air quality** **(2013)**
  - **Improved comfort, noise reduction…** **(all)**

Research needs on structural elements

- Increased use of environmentally friendly alternatives (recycled aggregates, waste…) in cement/concrete
- Bio based polymers
- Geopolymers
- Carbon negative cement & concrete (magnesium silicate)
- Materials combining structural properties and thermal resistance (hempcrete…)
- Insulation materials with load bearing functions
- Lightweight materials
- Phase change materials
- Nanomaterials to improve surface properties & reduce maintenance (self cleaning, anti graffiti…)

Sources: SET Plan 2011/2014, IEA Technology Roadmap 2013

Research projects on Smart Façade Materials – Reduced embodied energy

Project	Max EU contribution (Mln €)	Key words
BioBuild	4.9	High Performance, Economical and Sustainable **Biocomposite** Building Materials
ISOBIO	5.5	Development and demonstration of Highly Insulating, Construction Materials from **Bio-derived Aggregates**
SUS-CON	4.5	SUStainable, innovative and energy-efficient **CONcrete**, based on the integration of **all-waste materials**
LEEMA	4.7	Low Embodied Energy Advanced (Novel) **Insulation Materials and Insulating Masonry Components** for Energy Efficient Buildings
ECO-Binder	5.8	Development of **insulating concrete** systems based on novel low CO2 binders for a new family of eco-innovative, durable and standardized energy efficient envelope components

Total: 25.4 Mln €

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Current research projects on Smart Façade Materials – Lightweight components

Project	Max EU contri-bution (Mln €)	Title
ADAPTIWALL	3.3	**Multifunctional** light-weight **wall panel** based on **Adaptive insulation and nanomaterials** for energy efficient buildings
ELISSA	3.6	Energy efficient lightweight sustainable safe-**steel** construction
Foam-BUILD	3.5	Functional adaptive **nano-materials** and technologies for energy efficient buildings
MF-RETROFIT	3.6	**Multifunctional facades** of reduced thickness for fast and cost-effective retrofitting
SESBE	3.5	**Smart elements** for sustainable building envelopes
Total	17.5	

Research needs on insulation

- Advanced materials (aerogels, VIP, PCM…)
- Nano cell foams with radiation absorbing materials
- Structural insulated panels
- Bio based insulation (lower embodied energy)
- Reduced thickness
- Moisture control
- Special formulations for very cold climate
- Improved performance based standards, LT performance

Sources: SET Plan 2011/2014, IEA Technology Roadmap 2013

Current research projects on Smart Façade Materials - Insulation

Project	Max EU contri-bution (Mln €)	Title
AEROCOINS	3	**Aerogel-Based** Composite/Hybrid Nanomaterials for Cost-Effective Building Super-Insulation Systems
HOMESKIN	4.5	HOMES Key INsulating material Advanced **aerogel based composites**
NANOPCM	2.4	New advanced isolation **Phase Change Materials**
HIPIN	2.1	High Performance Insulation based on **Nanostructure** encapsulation of air
Cool-Coverings	3	Development of a novel and cost effective range of **nanotech improved coatings** to substantially improve Near Infrared Reflective properties of the building envelope

Current research projects on Smart Façade Materials - Insulation

Project	Max EU contri-bution (Mln €)	Title
Nanoinsulate	4.4	**VIP:** development of nanotechnology based high performance opaque and transparent insulation systems for energy efficient buildings
VIP4ALL	0.9	Highly Sustainable and Effective Production of Innovative Low Cost **Vacuum Insulation Panels** for Zero Carbon Building Construction
2016 Topic		Highly efficient insulation materials with improved properties
Total	20.3	

Current research projects on Smart Façade Materials – Indoor air quality

Project	Max EU contri-bution (Mln €)	Main goals/characteristics
BRIMEE	4.0	Cost-effective and sustainable Bio-Renewable Indoor Materials with high potential for customisation and creative design in Energy Efficient buildings
ECO-SEE	6.5	Eco-innovative, Safe and Energy Efficient wall panels and materials for a healthier indoor environment
H-HOUSE	4.7	Healthier Life with Eco-innovative Components for Housing Constructions
OSIRYS	6.3	Forest Based Composites for Façades and Interior Partitions to Improve Indoor Air Quality in New Builds and Restoration
CETIEB	2.5	Cost effective tools for better indoor environment in retrofitted energy efficient buildings
Total	24.1	

Research needs on Smart Windows

- Window glazing & frames with high thermal insulation performance
  - **Lower U values**
  - **Triple, quadruple glazings**
  - **Vacuum glazing**
  - **Energy harvesting glasses**

  - **Insulated window frames, passive frames**
  - **Edge and seals with lower conductivity materials & metal to glass bonding**

Sources: SET Plan 2011/2014, IEA Technology Roadmap 2013

Research needs on Smart Windows

- Optimisation of solar energy transmittance & daylight transmittance
  - **Low-emissivity, reflection surfaces**
  - **Electrochromic glazing**
  - **Advanced solar control, optimization of solar energy and daylight transmittance (vacuum glazing, combination with automated exterior shading…)**
  - **(Dynamic) Solar shading devices such as louvers, venetian blinds and their mechanical control systems**
  - **Nanotechnology window coatings – self darkening glass, self cleaning coatings, switchable glass…**

Sources: SET Plan 2011/2014, IEA Technology Roadmap 2013

Research needs on Smart Windows

- Advanced & high performance window glass & frames
  - **Light directing elements guiding daylight in rooms**
  - **Intelligent windows (integration to indoor and outdoor temperatures monitoring)**
  - **Glass with controlled light transfer**
  - **Aerogel glazing**

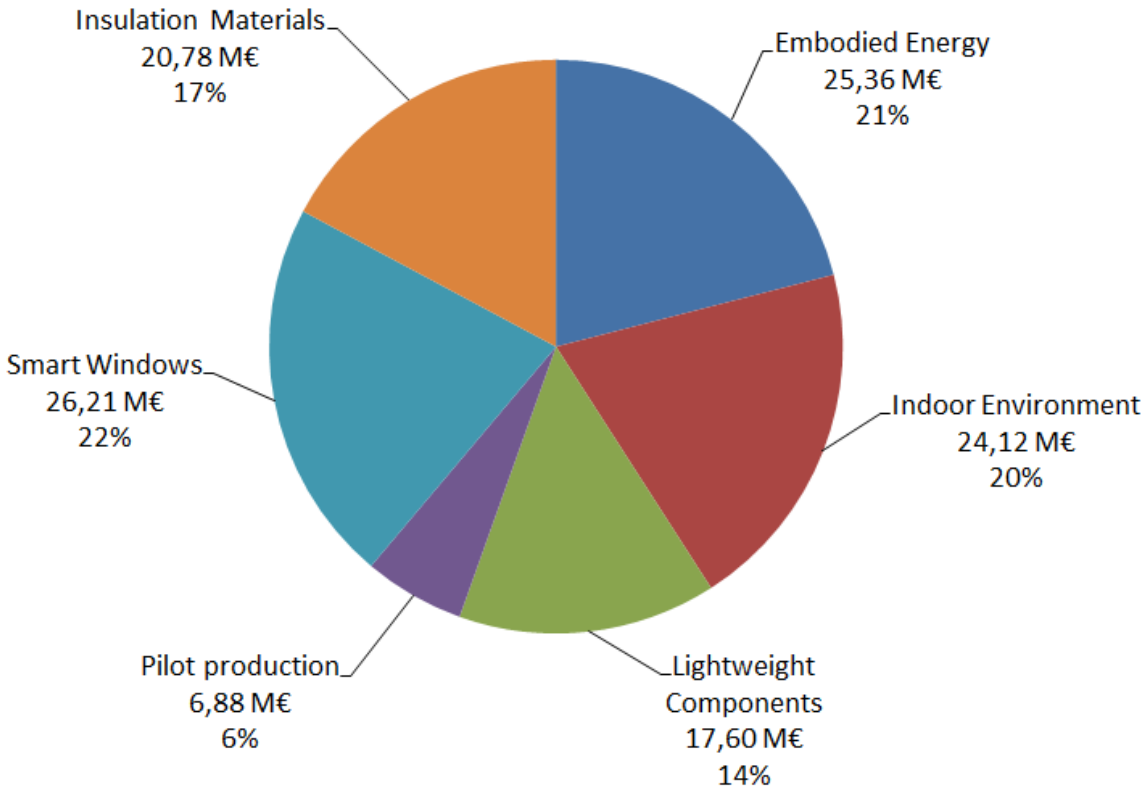
- Advanced production processes for glass, including recycling content

Sources: SET Plan 2011/2014, IEA Technology Roadmap 2013

Current research projects on Smart Windows

Project	Max EU contri-bution (Mln €)	Title
HarWin	3.4	Harvesting solar energy with multifunctional glass-polymer windows
MEM4WIN	4.0	Ultra thin glass membranes for advanced,adjustable and affordable quadruple glazing windows for zero-energy buildings
SmartBlind	3.7	Development of an active film for smart windows with inkjet method. Application to a building envelope component: autonomous smart device
WINSMART	3.9	Smart, lightweight, cost-effective and energy efficient windows based on novel material combinations
EELICON	5.2	Enhanced Energy Efficiency and Comfort by Smart Light Transmittance Control
LaWin	6.0	Large Area Fluidic Window
Total	26.2	

EU Research projects on façade materials (max EU contribution: 121 M €)



Clustering of projects

- Purpose: increase synergy between projects working in the same area: WIN-WIN situation
- Respect of Intellectual Property developed by each project
- Activities are open. Examples:
  - **Information sharing on common issues (eg databases…)**
  - **Coordinated work on selected topics (standardisation, LCA…)**
  - **Common dissemination activities (workshops, demonstrations…)**

Some actions for more sustainable façade materials

- Policy makers: accelerate deployment of proven technologies, financing, training, communication, public procurement, life cycle approach…
- Public authorities: d*rive by example*
- Research community, Manufacturers including SMEs: *Disseminate and exploit results of research*
- Architects: promote new solutions
- Performance based standards

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Many thanks for your attention!

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  http://setis.ec.europa.eu/system/files/Scientific_Assessment-EEMBuildings.pdf
- Roadmaps
  - **IEA technology roadmap Energy efficient buildings 2013**
    http://www.iea.org/publications/freepublications/publication/TechnologyRoadmapEnergyEfficientBuildingEnvelopes.pdf
  - **"Energy-efficient buildings", multi-annual roadmap for the contractual PPP under Horizon 2020 (2013)**
    http://ec.europa.eu/research/industrial_technologies/energy-efficient-buildings_en.html
- Cordis Theme Packs http://cordis.europa.eu/home_en.html
- Questionnaire sent to experts in Summer 2014
  - **306 replies received from 33 countries**