



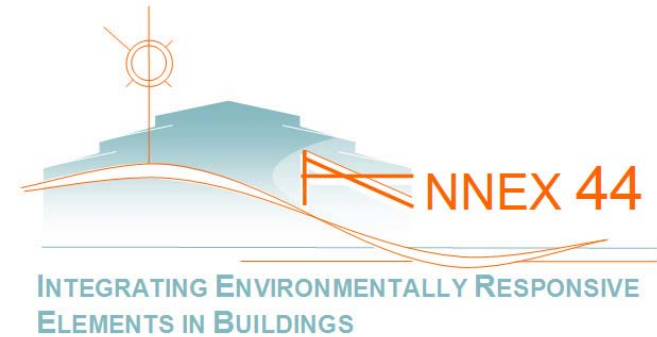
INTEGRATING ENVIRONMENTALLY RESPONSIVE ELEMENTS IN BUILDINGS

Solar 2006, September 6-8, 2006, Gleisdorf, Austria

Annex Background



- The built environment is a large energy consumer
- A large saving potential exist. With existing technology at least a 50% reduction can be achieved
- However, to contribute to long term GHG reduction goals the built environment will have to do better (>100%)
- Requires a need to revolutionize efficiency of energy use and shift to renewable (non-carbon) and low valued energy sources



Annex Background

Realization of saving potential requires efforts on three levels:

- **Reduction of energy demand**
 - Thermal insulation, air tightness, utilization of passive solar loads, buffering, reduction of heat and contaminant loads, natural cooling
- **Application of renewable energy**
 - Sun, wind, geothermal heat, biomass
- **Efficient energy conversion**
 - HE gas boiler, heat/power applications, heat pumps, efficient ventilation, heating, cooling and lighting systems

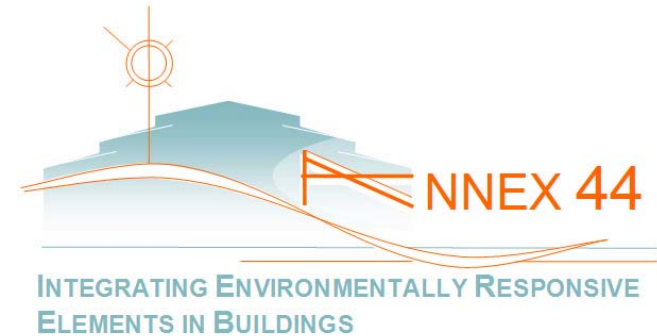
Realization requires:

- **A Whole Building Concept Approach**

Scope



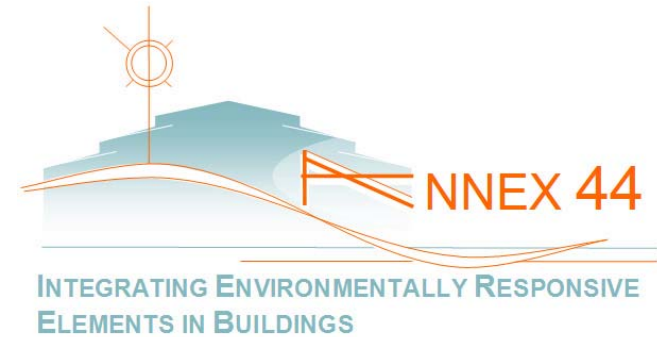
- To develop **Integrated Building Concepts**, where appropriate **Responsive Building Elements and HVAC-systems** are integrated into one system to reach an optimum **Environmental Performance**.



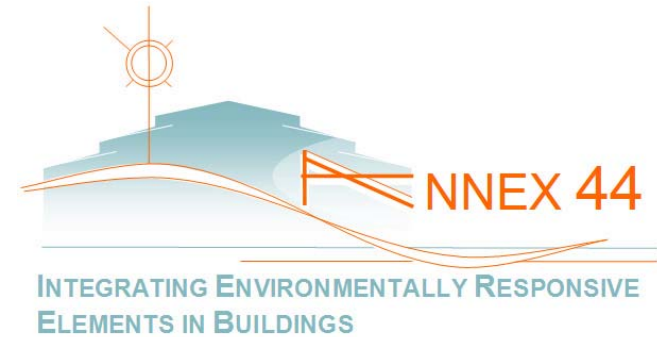
Annex 44 Definition

- Responsive Building Elements
 - Building construction elements that assist to maintain an appropriate balance between optimum interior conditions and environmental performance by reacting in a controlled and holistic manner to changes in external or internal conditions and to occupant intervention.
 - Examples include:
 - Facades systems (ventilated facades, double skin facades, adaptable facades, dynamic insulation)
 - Foundations (earth coupling systems, embedded ducts)
 - Storages (active use of thermal mass, material - concrete, massive wood - core activation for cooling and heating, phase change materials (PCM))
 - Roof systems (Green roof systems)

Annex 44 Definition

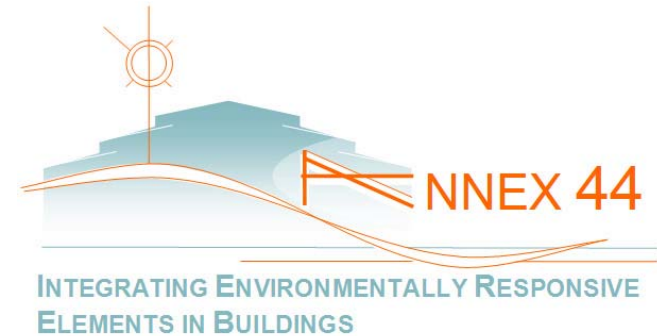


- Integrated Building Concept
 - Integrated design solutions where responsive building elements and energy-systems are integrated into one system to reach an optimal environmental performance in terms of energy performance, resource consumption, ecological loadings and indoor environmental quality.



Objectives

- Define state-of-the-art of responsive building elements and their integration with building services, of whole building concepts and of environmental performance assessment
- Improve and optimise the integration of responsive building elements and building services
- Develop and optimise new building concepts with integration of responsive building elements, building services as well as natural and renewable energy strategies
- Develop guidelines for procedures and tools for detailed estimation of environmental performance of responsive building elements and integrated building concepts



Annex Organization

Subtask A: Responsive Building Elements

- The subtask will focus on development and improvement of responsive building element concepts including assessment of the advantages, requirements and limitations. The subtask will focus on systems that has the potential to be successfully integrated with integrated building concepts

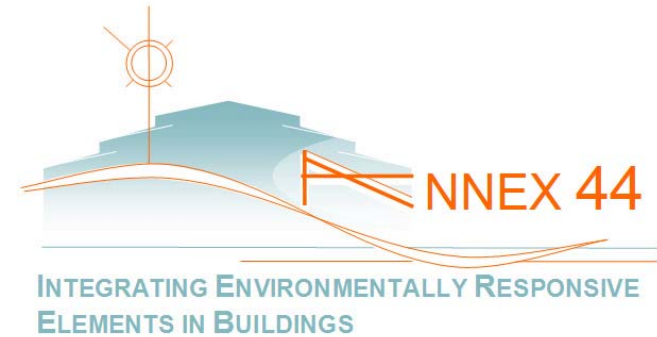
Subtask B: Integrated Building Concepts

- The subtask will focus on development of integrated building concepts where responsive building elements, energy-systems and control systems are integrated into one system to reach an optimal environmental performance.

Subtask C: Implementation and Dissemination

- The focus of the subtask will be to guide, collect, packet, transform and disseminate the findings generated in Subtasks A and B. The main target groups are designers (architects and engineers), but also end-users and building owners.

Workprogramme



Subtask A

Responsive Building Elements

Activity A1: Review and classification of existing responsive building elements

Activity A2: Investigation of performance of existing responsive building elements

Activity A3: Improvement of concepts for responsive building elements

Activity A4: Analysis of robustness, performance sensitivity and simulation accuracy

Activity A5: Manufacturers' Guide

Subtask B

Integrated Building Concepts

Activity B1: Review of design processes for integrated building concepts

Activity B2: Investigation of Performance of existing integrated building concepts

Activity B3: Development and optimization of integrated building concepts

Activity B4: Analysis of performance sensitivity of integrated building concepts and prediction tools

Activity B5: Experts' Guide

Subtask C

Implementation and Dissemination

Activity C1: Investigation of implementation barriers

Activity C2: Identification of information needs of target groups

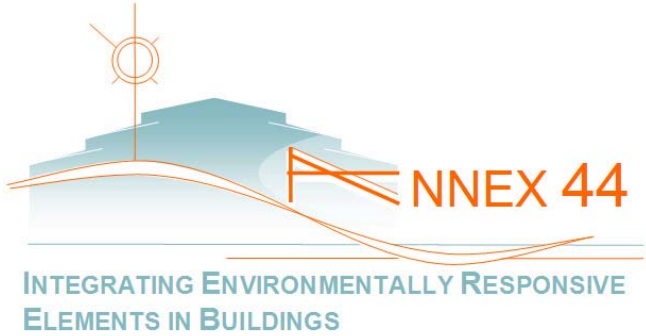
Activity C3: State-of-the-art

Activity C4: Designers' Guide

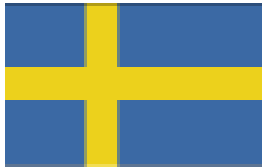
Activity C5: General Booklet

Activity C6: Information Activities

Participation



Austria



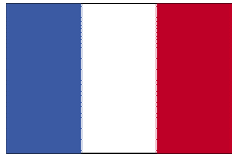
Sweden



Canada



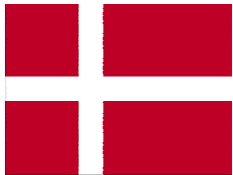
Italy



France



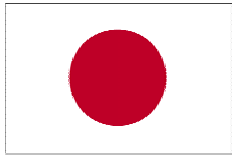
China



Denmark



United Kingdom



Japan



USA



The Netherlands



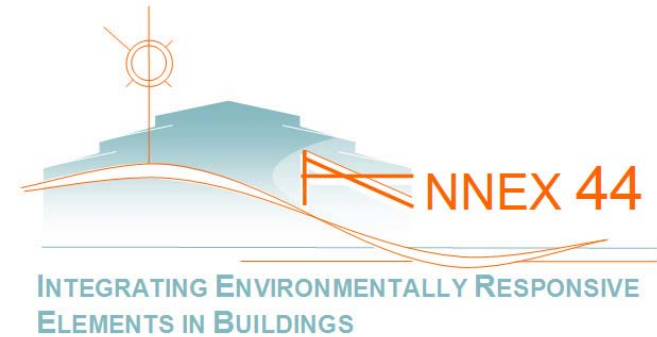
Portugal



Norway



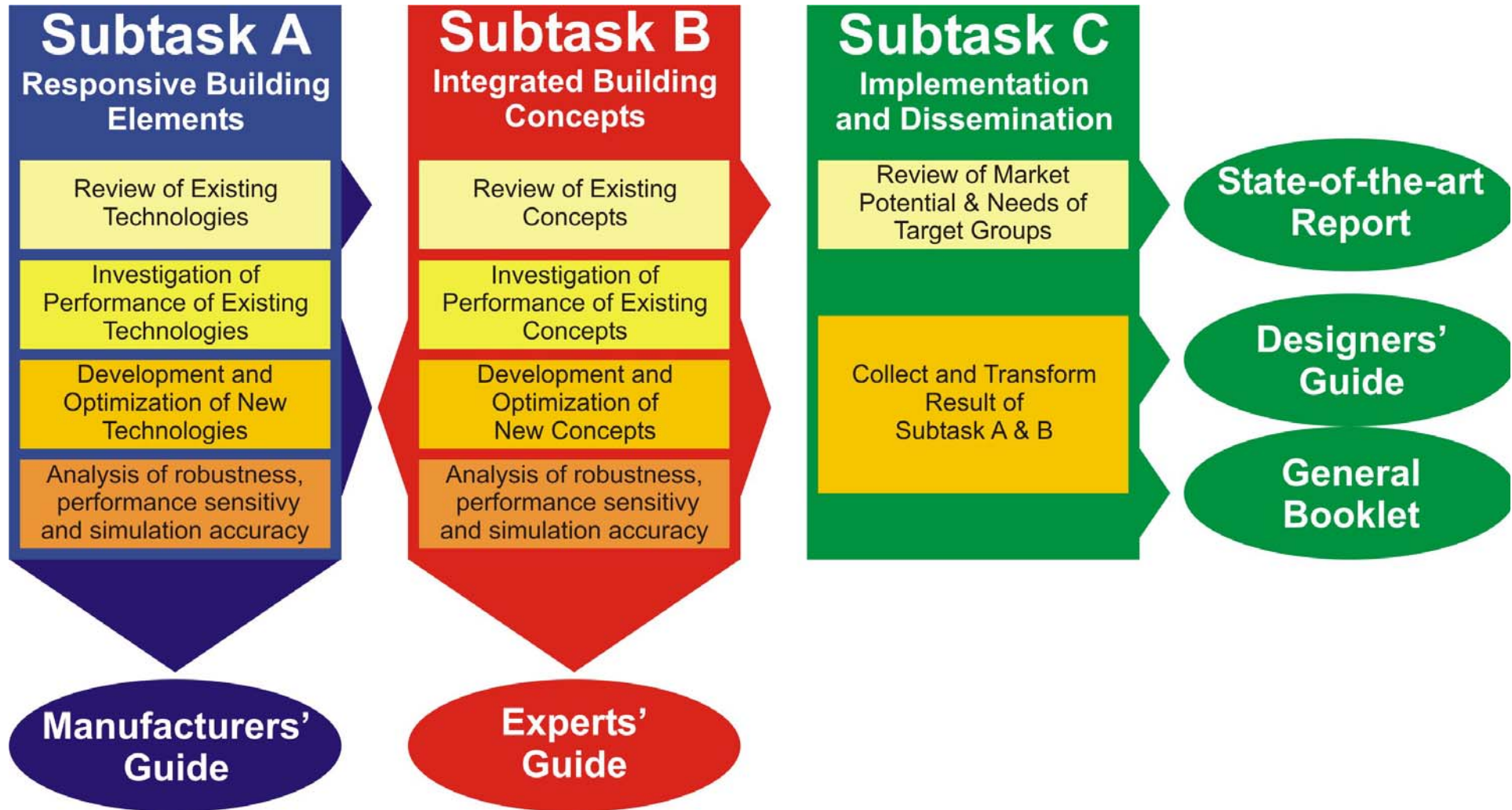
Poland



Annex Leadership

- Operating Agent
 - Per Heiselberg, Aalborg University, Denmark
- Subtask A
 - Marco Perino, Politecnico di Torino, Italy
- Subtask B
 - Inger Andresen, SINTEF, Norway
- Subtask C
 - Ad van der Aa, Cauberg-Huygen, The Netherlands

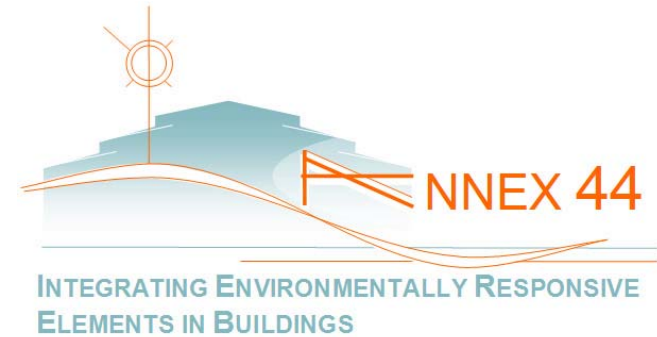
Deliverables





Deliverables

- **Manufacturers' Guide** for development, optimization and performance assessment of responsive building elements including examples of application in integrated building concepts (main target group is manufacturers)
- **Designers' Guide** for design of integrated building concepts, including integration of responsive building elements and HVAC-systems and build examples, and for rough evaluation of building performance with regard to functionality, flexibility, energy savings, indoor climate, robustness and cost. (main target group is architects)
- **Experts' Guide** with detailed information regarding design and analysis of responsive building elements, integration strategies of responsive building elements and HVAC-systems and optimum use of simulation methods and tools to assess environmental performance and robustness of integrated building concepts. (main target group is engineers)



Deliverables

- **State-of-the-art report** of responsive building elements, integrated building concepts as well as integrated design methods and environmental performance assessment tools (main target group is researchers)
- **General Booklet** describing the principles of responsive building elements and integrated building concepts, their benefits and limitations, economical feasibility and impact on energy savings, company image, comfort, productivity, building functionality and flexibility. (main target group is building owners, developers and end users)
- **Journal articles, conference papers and working reports** with detailed information of Annex research results (main target group is researchers)
- **Website, national and international workshops and seminars**



INTEGRATING ENVIRONMENTALLY RESPONSIVE ELEMENTS IN BUILDINGS

More information: www.civil.aau.dk/Annex44