



Sustainability Performance Assessment and Benchmarking of Buildings



Final Newsletter



Welcome to the final Newsletter of SuPerBuildings, a research project funded by the European Commission under the FP7 Cooperation Programme. This newsletter summarizes the main outcomes of our project. We would like to use this opportunity to thank to all the partners from our network and also external experts who provided us with their invaluable thoughts on the research topics and helped us to deliver keep high quality of our outcomes.

Thank you.

On behalf of SuPerBuildings partners

Tarja Häkkinen, project coordinator

SUPERBUILDINGS FINAL WORKSHOP

By Antonín Lupíšek, Czech Technical University in Prague

The Final workshop of the SuPerBuildings project took place in Brussels 18th December 2012. The 59 registered attendees were representatives of various stakeholders in sustainable building: architects and designers, academic and research bodies, representatives of professional organizations, producers of building components, construction companies and officers from DGs ENTER and ENV.

Presented outcomes

The workshop consisted of the three main parts. The first one has been focused on presentation of sustainability indicators for buildings and their **validity, functional equivalency and maturity for comparability of assessment results** across Europe. These indicators have been presented in detail:

- Green house gases
- Rational use of water
- Solid waste
- Land use
- Building performance related indicators as social indicators of buildings
- Thermal comfort
- Aesthetic quality
- Economic indicators

The second part of the workshop aimed at presentation of the experience coming out from the case studies carried out within the SuPerBuildings project and also within the partner FP7 project OpenHouse.

The final part has been dedicated to recommendations and conclusions. The first presentation of the session on research needs in development of benchmarks has been given by prof. Thomas Lützkendorf from (KIT, Germany). Guidelines for the use of BIMs as sources of information for the assessment of buildings were discussed by Bruno Fies (CSTB, France). Tarja Mäkeläinen (VTT, Finland) presented recommendations for the use of sustainable building assessment and benchmarking methods in steering.

The workshop was closed by brilliant motivation speech provided by invited speaker Greg Foliente (CSIRO, Australia and Fraunhofer WKI & TU Braunschweig, Germany).

The presentations from the workshop are available on the SuPerBuildings website at <http://cic.vtt.fi/superbuildings>.

INSIGHTS ON THE PROJECT OUTCOMES PRESENTED AT THE FINAL SUPERBUILDINGS WORKSHOP

After the event we have approached several experts attending the final SuPerBuildings workshop and asked them for their opinion on the presented results.

Hereby is view of **Manfred Fuchs** from European Commission, DG Enterprise & Industry:

*“By summarizing the main indicators of the different schemes used right now in the EU, SuPerBuildings is not only providing a good overview for decision makers at EU and national level on what **is** actually assessed but - even more important - what **can** be actually measured. Keeping in mind that assessment schemes are not a goal on their own but also tools to provide information for policy makers who are focusing on global targets (e.g. energy efficiency, resource efficiency), the robustness of indicators (availability and quality of data) is essential. The SuPerBuildings report will help to facilitate the dialogue between policy makers and scheme providers to improve both political targets and assessment schemes.”*



Eleni Goni from the Architects' Council of Europe (and member of the OpenHouse) noted:

“As a member of the Consortium of the OpenHouse FP7 project, I found the results of SuPerBuildings project to be very useful especially under the prism of OpenHouse. In overall, the work that has been done both in the analysis of the current situation and the definition of indicators is of very high quality. Through this research, a common framework for assessing sustainable buildings is finally possible: Important steps have already been made in order to facilitate market movement towards a better level of sustainability and to have a common view on building sustainability.”

SUPERBUILDINGS RESULTS PRESENTED TO ENCORD



The main outcomes of the SuPerBuildings project have been presented at the meeting of the Environmental Group of European Network of Construction Companies for Research and Development (ENCORD) on 12th February 2013 in London by Tarja Häkkinen and Carmen Antuña.



ABSTRACT OF THE FINAL REPORT OF THE SUPERBUILDINGS PROJECT

The report presents and summarizes the results of the SuPerBuildings project.

The consortium developed and selected sustainability indicators for buildings, develop understanding about performance levels considering new and existing buildings, different building types and different national and local requirements, developed methods for the assessment and benchmarking of sustainable buildings and made recommendations for the effective use of benchmarking systems as instruments of steering and in different stages of building projects.

The final report presents the main results of the project and makes references to the original project deliverables available on the project's web at <http://cic.vtt.fi/superbuildings>.

The final report has been edited by the project coordinator Dr Tarja Häkkinen and the main authors of the report are: prof. Thomas Lützkendorf, Maria Balouktsi, Andrea Immendörfer, KIT, Sylviane Nibel, Boris Bosdevigie, Alexandra Lebert and Bruno Fies, CSTB, Dr Patxi Hernandez Iñarra, TECNALIA, Antonín Lupíšek and prof. Petr Hajek, CVUT, Susanne Supper, ÖGUT, Erik Alsema W/E, Laetitia Delem and Johan van Dessel, CSTB, together with Tarja Häkkinen, Carmen Antuña, Tarja Mäkeläinen from VTT.

The final report introduces the current SB assessment systems and discusses barriers and drivers for sustainable building.

From the beginning, SuPerBuildings agreed not to add another sustainability system to the numerous existing ones. Instead, the principles for the design and development of assessment systems were worked out, discussed and made publicly available. As the sustainability of buildings should always be assessed with the help of indicators, one of the key objectives of SuPerBuildings is to ensure "validity" for sustainability indicator systems. This determines the true possibility of an indicator system to give information about the sustainability of buildings. Project selected indicators for further development. Regarding these indicators the final report presents information about their validity, assessment methods, and performance levels.

The final report also discusses the problematic of functional equivalent, and weighting and normalization of criteria.

Finally, the report gives recommendations for the use of indicators in different stages of building processes, in connection of building information models and in the connection of different steering instruments.



LIST OF CONTENTS OF THE FINAL REPORT

Sustainability and performance assessment and benchmarking of building. Final report Espoo 2012. VTT Technology [No.72]. ISBN 978-9-1-38-7908-2.

- 1. *Introduction*
- 2. *Current assessment systems and conclusions about needs of development*
- 3. *Barriers and drivers for sustainable building*
- 4. *Top-down approach*
- 5. *Description and explanation of the selected indicators and related measurement and assessment methods with special focus on reliability, comparability and compatibility*
- 6. *Performance levels of buildings*
- 7. *Developing benchmarking criteria for sustainable buildings*
- 8. *Recommendations about the use of sustainability indicators in building processes*
- 9. *Recommendations about the use of indicators in Building Information Modelling*
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- 11. *SuPerBuildings summary and future prospects*

PROJECT SUMMARY AND FUTURE PROSPECTS

By Tarja Häkkinen, VTT, and Thomas Lützkendorf, KIT

The Lead Market Initiative is the European policy for 6 important sectors that are supported by actions to lower barriers to bring new products or services onto the market. The policy instruments deal with regulation, public procurement, standardization and supporting activities. Sustainable construction is one of these lead markets in the EU. To reinforce the integration and implementation of the principles of sustainable development in the construction and real estate industry, manageable principles, methods and tools for the sustainability assessment and benchmarks are needed.

It is estimated that the demand for results of a sustainability assessment of buildings will grow even more in the coming years. Both voluntary processes as well as policy steering and municipal steering instruments need sustainability assessment methods and indicators.

Possible reasons for an increased need for assessment results and assessment tools are seen in:

- The concern about greenhouse gases and the knowledge about construction sector's potential in the reduction of GHGs may lead to the further development of regulatory and fiscal instruments;
- The intention of the public sector to become a role model, leading to an integration of sustainability aspects into the procurement process;
- The intention of cities to search for significant savings in energy consumption and GHGs, which may lead the increased consideration of sustainability aspects in building supervising processes;



- An integration of sustainability aspects into the analysis and management of large building stocks (portfolio analysis and portfolio management concerning both private and public owners and developers), leading to a demand for different system variants for the use phase (sustainability assessment - in use);
- An integration of sustainability aspects into the risk analysis and valuation, leading to a demand for disaggregated assessment results;
- The integration of sustainability aspects into the establishment of conditions for the financing and insurance of buildings leads to a demand from banks and insurance companies;
- Companies want to integrate information on the sustainability of their corporate offices and building stocks into the sustainability report and need information;
- Sustainable property funds give emphasis on a positive sustainability assessment as a condition for the purchase of objects;
- An integration of sustainability aspects into planning and architectural competitions, leading to the question of suitability of rating systems for early stages of planning;
- An integration into the planning process, which must lead to a development of new approaches;
- Sustainable buildings increase the user satisfaction and productivity.

The role of a sustainable construction sector has been assessed to be crucial for reaching the EU's long term 80-95% greenhouse gas emission reduction objective. According to the Roadmap for moving to a competitive low carbon economy in

2050 (COM 2011 112) the cost-efficient contribution of the buildings sector would be around 40 to 50% reduction in 2030 and around 90% in 2050. As the potential of the construction is seen big and there is a strong willingness to make it realize effective steering instruments will be needed. These will probably be used on all levels of steering. Especially regarding control and regulatory instruments as well as fiscal instruments and incentives, precise indicators and assessments methods are required. The more the focus is on GHGs the more clearly the methods have to measure it directly and comprehensively.

To significantly speed the renovation rate of existing building stock, both mandatory and voluntary steering processes will be needed. As the owners of big portfolios face the need to accelerate renovation processes that improve the energy performance and reduce the GHGs of the stock, they will need comprehensive methods with the help of which essential aspects – including environmental, economical and social aspects – can be simultaneously considered.

There is a further development of assessment methods and principles in two directions. On the one hand there is finally the transition from systems that focus mainly on the issues of environment and health protection to systems that take into account the issues of sustainability in their full breadth and depth. At the same time, a transition from predominantly qualitative assessment systems to predominantly quantitative assessment systems takes place. Concurrently, the state of the international and particularly European standardization has been evolved.

From the view point of effective steering mechanisms it is of utmost importance that the guidelines are clear and the tools needed in assessment and verification of



results are available and accessible for all who need those in different stages of building processes. The adoption of further sustainability aspects to be part of control, regulatory and fiscal instruments and subsidies emphasizes the need of quantitative assessment methods and indicators and their accurate description on the basis of commonly agreed principles.

Regarding existing rating systems the further development of assessment systems has among others the following consequences:

- There is a great action over the introduction and testing of indicators related to the social and economic dimension of sustainability;
- There is a great need for action in the field of integration of quantitative assessment procedures (including life cycle assessment and life cycle costing). At the same time, the need for LCAs results in a need for data-bases with LCA data for building products. The data must reflect the state of standardization in the EU.

Often the most important decisions regarding sustainable building are done in planning districts and in early stages of design. Such fundamental decisions as new building / renovation, location, main functions and volume have very significant impact on the environmental, economical and social impacts. The early decisions concerning the energy concept and energy supply solutions are essential. Important architectural choices – such as size, shape and orientation, and the main construction materials of the building – are done in the preliminary design phase.

In the past, the sustainability assessment was mostly used for marketing purposes. Now the situation has changed. The definition of project objectives and the process of planning are increasingly guided by the sustainability content.

This has changed the course of the sustainability assessment. Now this is predominantly applied as early as during the planning phase. No longer is in the foreground the examination of sustainability at the end of the planning but the "optimization" of sustainability during the planning. Particularly, when using sustainability assessments for supporting the planning and design process the relationships and interdependencies between the assessment criteria (which also represent planning goals) must be identified and considered in order to find the "optimal" solutions. To just examine the assessment criteria independently without considering the trade-offs and different effects among them, which is usually the case in the final assessment of sustainability, is not enough.

Often, assessment criteria have been evolved to assess technical features and characteristics in the direction of building performance assessment. The impact of technical characteristics and properties cannot always be assigned to one dimension of sustainability, as there are multiple effects. The solution of the methodological problem of a transition from a "double counting" to an assessment of multiple effects," will be seen as an important task for the coming years.

The current standards (developed by CEN TC 350) support the assessment and comparison of buildings but those give less support for the early stages of sustainable building.



Regarding environmental assessment quantitative indicators following a life cycle approach are the primary indicators for the assessment of the environmental impact of buildings and products. However, those are not easy to use in preliminary stages of planning and design, where limited information is available.

More tools are needed for the design phase. Also tools that use simplified input are needed for early stages of design. To ensure the quality of the tools and comparability of the results, new standards may be needed at the same time.

Early stages of design might also benefit from guidelines and standards that characterize the process, list issues to be considered and outlines tasks of design for sustainable buildings.

The willingness to consider the sustainability aspects from the beginning of building and renovation projects also emphasizes the need for knowledge about benchmarks. Targets should be set for all relevant aspects of social performance and economical aspects with help of building level indicators.

Minimum requirements on the nature and scope of assessment criteria have been developed as well as calculation methods and rules. Although the current standards support the assessment and comparison of buildings, the standards, however, provide no information on benchmarks. There is a great need for the further setting-up and development (tightening) of benchmarks.

As SuPerBuildings project has shown there is a lot of – especially local – understanding about the typical and best performance values of different building regarding certain sustainability indicators. However, much work is still needed to improve understanding of benchmarks and also to develop good processes for the determination of benchmarks.

SuPerBuildings project has developed new understanding about core sustainability indicators with having the focus on the validity of indicators and assessment methods of indicators to provide comparable results. SuPerBuildings project has developed recommendations for the further development of existing sustainability assessment methods and tools. These enable the existing tools, while maintaining their independence, to improve their content. For this purpose the top down approach was developed, where the assessment criteria are derived from the areas of protection and the protection goals.

The project has also described and given recommendations for the use of indicators in different stages of building processes, together with building information models and in the connection of different steering instruments. The project brings this knowledge and recommendations for policy makers, local building authorities, sustainable building practitioners and tool developers for the further development of practical methods and tools that will be powerful when used in target setting, design, portfolio management, and municipal and other steering processes.



SUPERBUILDINGS DELIVERABLES, PAPERS AND PRESENTATIONS

Public deliverables (available at <http://cic.vtt.fi/superbuildings>)

- D2.1 Conclusions about the needs of development of sustainability indicators and assessment methods
- D2.2 Conclusions about the needs of development of performance levels and benchmarking criteria and weighting methods
- D3.1 Literature and interview survey about stakeholders' needs and requirements for SB assessment and benchmarking methods
- D3.2 Opportunities to integrate sustainable building benchmarking methods with steering mechanisms and potential effect of sustainable building benchmarking methods on promoting sustainable building
- D3.3 Needs, levels and potentials of integrating SB assessment and benchmarking with BIMs
- D4.1 Systematic structure for sustainable building assessment with special focus on the validity of sustainability indicators
- D4.2 Description and explanation of the selected indicators and related measurement and assessment methods with special focus on reliability, comparability and compatibility
- D5.1 Conclusions about the performance levels of buildings considering the requirements of sustainable building and considering the economic and technological barriers and regional differences
- D5.2 Benchmarking criteria for sustainable buildings in Europe
- D6.1 Summary of the results and recommendations for the use of sustainable building assessment and benchmarking systems in different phases of building process
- Online tool to browse through the recommendations
- D6.2 Recommendations for the use of sustainable building assessment and benchmarking methods and systems in steering of sustainable building
- D6.3 Recommendations for the integration of sustainable building assessment and benchmarking methods with BIMs
- D6.4 Development of materials for display at selected conferences and exhibitions
- D7.1 Report on the selection of the case studies
- D7.2 Summary report on the results of the case studies
- D7.3 Feedback report on the results of the piloting phase

Papers in journals

- Häkkinen, T., Helin, T., Antuña, C., Supper, S.: Land use as an aspect of sustainable building. Submitted to Sustainable Land Use and Urban Planning.
- Häkkinen, T.: Building performance related indicators as social indicators of buildings. Submitted to Building Research and Information.
- Lützkendorf, T. - Hájek, P. - Lupíšek, A. - Immendorfer, A. - Nibel, S. - et al.: New trends in sustainability assessment systems – based on top-down approach and stakeholders needs. International Journal of Sustainable Building Technology and Urban Development. 2012, vol. 3, no. 4, p. 256-269. ISSN 2093-761X. DOI: 10.1080/2093761X.2012.747113.



- Häkkinen, T., Belloni, K.: Barriers and drivers for sustainable building. *Building Research and Information*, Volume 39, Number 3, May 2011, pp. 239-255(17). ISSN 0961-3218. DOI: 10.1080/09613218.2011.561948.

Conference papers

- Fies, B., Lützkendorf, T., Balouktsi M.: Life Cycle Assessment and BIM. Abstract submitted to SB13 Graz.
- Fies B.: Recommendations for the integration of sustainable building assessment and benchmarking methods with BIM, ECPPM2012.
- Lupíšek, A.: Building sustainability assessment system corresponding to needs of users. In *Life-Cycle and Sustainability of Civil Infrastructure Systems*. Leiden: CRC Press/Balkema, 2012, p. 1802-1806. ISBN 978-0-415-62126-7. Presented at IALCCE2012 conference.
- Hernandez, P., Nibel, S., Bosdevigie, B.: Thermal comfort and sustainable building assessment: a discussion of current practice and conflicting issues, 1st International Conference on Building Sustainability Assessment, BSA 2012, Porto, Portugal, 2012.
- Lützkendorf, T., Hájek, P., Lupíšek, A., Immendörfer, A., Nibel, S., Häkkinen, T.: Next generation of sustainability assessment - top down approach and stakeholders needs. In *SB11 Helsinki - World Sustainable Building Conference*. Helsinki: VTT Technical Research Centre of Finland, 2011, vol. 2, p. 234-235. ISBN 978-951-758-534-7.
- Häkkinen, T., Mäkeläinen, T., Lupíšek, A.: Sustainable building assessment systems as integrated tools for effective policy level steering. In *SB11 Helsinki - World Sustainable Building Conference*. Helsinki: VTT Technical Research Centre of Finland, 2011, vol. 1, p. 148-149. ISBN 978-951-758-531-6.
- Hernandez, P., Häkkinen, T.: Sustainability and Performance assessment of Buildings – SuPerBuildings. Presented at Seminar “Towards European sustainable housing” 19th May 2011, Barcelona.
- Lupíšek, A., Häkkinen, T., Hájek, P., Pavlů, T.: Sustainability assessment of buildings and needs of stakeholders. In *Sustainability of Constructions Towards a better built environment*. Malta: University of Malta, 2011, p. 225-228. ISBN 978-99957-816-0-6.
- Häkkinen, T., Nibel, S., Delem, L.: Sustainability and Performance assessment of Buildings - SuPerBuildings. In *SB10 Finland - Sustainable Community - buildingSMART(TM)*. Helsinki: VTT Technical Research Centre of Finland, 2010, p. 38-43. ISBN 978-951-758-506-4.
- Lupíšek, A., Hájek, P., Pavlů, T., Häkkinen, T.: Sustainability and Performance Assessment and Benchmarking of Buildings. In *Central Europe towards Sustainable Building*. Prague: Czech Technical University, 2010, p. 583-584. ISBN 978-80-247-3624-2.
- Van Dessel, J., Häkkinen, T.: Sustainability and Performance assessment and Benchmarking of Buildings. In *European Construction Technology Platform, 4th conference*, Brussels, November 24 - 25, 2009.



SUPERBUILDINGS CONSORTIUM

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Thank you for your cooperation and feedback.

