COMPARISON OF SUSTAINABLE TOOLS MAXERGY AND SBTOOLCZ

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Summary

The main goal of this study is a comparison of two different approaches to sustainability assessment of buildings.

In the Czech Republic, the national system SBToolCZ exists. It is based on an international platform SBTool. It belongs to a group of assessment tools that evaluates complex quality of buildings (like LEED or BREEAM). All of these assessment tools have in common the principal approach to buildings. Their motivation is to provide healthy environment for the people living in the assessed buildings and their surroundings hand in hand with minimization of environmental impacts caused by the buildings. These tools put together soft and hard criteria (for example internal comfort and energy consumption) and at the end the assessment process leads into a final result which indicates the level of sustainability of the building.

MAXergy that represent another approach, on the other hand, is considered to be the next level of sustainability assessment tools. Its goal is to find the real sustainability level of a building (or any other industrial product). It is based on one ultimate indicator (embodied land) and its result is always a hard number based on exact data.

This study explores the main differences between these two approaches and implies the future of sustainability assessment of buildings.

Keywords: sustainable assessment, embodied land, embodied energy, sustainable indicators, sustainability

1 Principles of SBToolCZ and MAXergy assessment

1.1 SBToolCZ assessment method

SBToolCZ is a Czech environmental assessment tool created at the Faculty of Civil Engineering, CTU in Prague. This tool is fully modified for the Czech conditions (legal, life habits etc.) and environment [1].

As mentioned above, SBToolCZ is a conventional sustainability assessment tool based on an evaluation of three basic groups of criteria:

- Environmental criteria;
- Social criteria;
- Economics and management.

Little bit aside stands the assessment of locality (based on soft criteria like public transport) of the building. It does not influence the overall result of the evaluation of the building. Embodied energy of materials in the building is assessed with a help of Envimat catalogue [2].

SBToolCZ is most of all a motivational tool which should provoke investors and real estate owners to improve their buildings in order to become more sustainable and environmental friendly.

It can be paraphrased in a way that SBToolCZ does not say that a build is sustainable in a global point of view of sustainability of our lives on the planet Earth. The result of the assessment just says that the building is relatively more or less sustainable in comparison to the current situation in building sector (based on statistical data).

This approach seems to be insufficient nowadays when resources are being depleted and human population is growing. The urge of creation of an ultimate sustainability assessment method is understandable and necessary.

1.2 MAXergy

The approach to sustainability of the assessment tool MAXergy is quite different from SBToolCZ, LEED or BREEAM. MAXergy tool is being developed within the Research Institute for the Built Environment of Tomorrow (RIBuilT) in Heerlen, the Netherlands guided by professor Ronald Rovers.

It uses a thermodynamic concept and exergy principles. It is based on the notion that "solar energy is the sole driver of the world, and the future will be (again) based on a renewable resource based society" [3]. The only unit it uses is Embodied Land and it combines both energy and materials into one indicator without any weighting factors.

The principle of MAXergy is to relate all our resource use to the amount of solar input needed to generate these resources, via the land needed to capture and convert the solar radiation into useful resources. In other words: to maximize exergy in a system, and prevent loss of exergy (increasing entropy).

For a building for instance, it means that we have to calculate:

- The amount of land occupied over a time period, needed to install solar panels to generate the required energy (operational and embodied): X m^2/year;
- The land for growing crops for building materials: wood construction, hemp, flax, straw etc: Y m^2/year;
- The use of minerals and metals are compensated by calculating the energy, in land and time, to re-produce/restore the mineral/metal from a dispersed sink, like seawater.

MAXergy uses for evaluation of embodied energy ICE 2.0 database [4].

2 Comparison

2.1 Criteria comparison

As MAXergy deals only with hard criteria and involves energy and materials used in the building, it covers only a few criteria that are used in SBToolCZ. The overlap is represented only by criteria that involve operational and embodied energy.

Tab. 1 *Criteria overlap in SBToolCZ and Maxergy – criteria that are assessed both in SBToolCZ and Maxergy are marked +.*

		Maxergy		
		Operational Energy	**Embodied Energy**	**Embodied Land**
SBToolCZ	**Environmental criteria**			
	E.01 Primary energy consumption	+	+	-
	E.02 Global warming potential	+	+	-
	E.03 Acidification potential	+	+	-
	E.04 Eutrophication potential	+	+	-
	E.05 Ozone depletion potential	-	-	-
	E.06 Photochemical ozone creation potential	-	-	-
	E.07 Renewable energy production	-	-	-
	E.08 Use of building materials during construction	-	-	-
	E.09 Use of certified building products	-	-	-
	E.10 Potable water consumption	-	-	+
	E.11 Outcome of rainwater	-	-	-
	E.12 Land use	-	-	-
	E.13 Use of greenery on building site and constructions	-	-	-
	E.14 Ecological value of site	-	-	-
	Social criteria			
	S.01 Visual comfort	-	-	-
	S.02 Acoustic comfort	-	-	-
	S.03 Thermal comfort in summer	-	-	-
	S.04 Thermal comfort in winter	-	-	-
	S.05 Indoor air quality	-	-	-
	S.06 Radon protection	-	-	-
	S.07 Health safety of materials	-	-	-
	S.08 User comfort	-	-	-
	S.09 Flexibility of building use	-	-	-
	S.10 Space Efficiency	-	-	-
	S.11 Accessibility for disabled	-	-	-
	S.12 Architectural competition	-	-	-
	S.13 Use of building exterior	-	-	-
	S.14 Building security	-	-	-
	Economics and Management			
	C.01 Life cycle cost	-	-	-
	C.02 Facility management	-	-	-
	C.03 Realization and operation documentation	-	-	-
	C.04 Measuring energy and water consumption	-	-	-
	C.04 Sorted waste management	-	-	-
	Locality			
	L.01 Accessibility of public spaces for relaxation	-	-	-
	L.02 Accessibility of services	-	-	-
	L.03 Public transport accessibility	-	-	-
	L.04 Location risks	-	-	-
	L.05 Local air quality	-	-	-
	L.06 Crime prevention in urban space	-	-	-

SBToolCZ for assessment of new residential buildings has in total 39 criteria that cover multiple issues connected to the construction and operation of the building including internal comfort perceived by habitants.

MAXergy, on the other hand, focuses on the very basic meaning of sustainability of our lives connected to the build environment and does not aggregate soft (comfort) and hard (energy etc.) criteria. Soft criteria are taken as existing externalities.

2.2 Data sources for embodied energy and materials included in the assessment

When embodied energy is assessed materials included in the embodied indicators in SBToolCZ are different from MAXergy. MAXergy calculates with all materials and constructions in the house. SBToolCZ does not count with sanitary equipment, electric installations, heat pumps and small whitesmith elements.

The difference is also in the source of data that are used for assessment of embodied energy. Differences among various databases are significant and it is crucial to know the meta data origin.

Calculated embodied energy (PEI) values of a certain wooden building using databases IBO and ICE can be in a ratio 2:3. There can be several reasons for such results as different system boundaries in the methodology (what life cycle stages are included, what processes enter the assessment etc.), data sources (from manufacturers or from secondary sources) or age of the data (modern versus older technologies) [5].

2.3 Internal floor area related to indicators

When a building is assessed, the final results are numbers relative to a physical scale indicator which is in case of both MAXergy and SBToolCZ floor area of the house.

Floor area that is included in MAXergy calculations sums the usable area of the house which is represented by living room, sleeping room, kitchen, bathroom or toilet. But non-usable areas like corridors, staircases, boiler rooms or any other facilities are not included. This can mean that in a typical small one family house approximately 25 % of total floor area is not included in the calculation. The resulting effect is that during a design process the non-usable areas are being minimized so that the final Embodied Land number (m^2/year) is minimal. Another effect is that both embodied energy and effectiveness of use of floor area are aggregated and assessed in one number at the same time.

SBToolCZ, on the other hand, calculates total floor area including corridors and technical facilities when assessing embodied energy per year. So, the floor area is bigger than floor area in MAXergy which logically means that the amount of embodied energy per square meter per year is lower in SBToolCZ. Regarding the effectiveness of space use, SBToolCZ uses particular criteria for this purpose (S.10 Space Efficiency).

3 Conclusions

When comparing these two approaches to sustainability assessment of buildings it becomes much clearer which one of them is closer to define the real sustainability. SBToolCZ, as a complex quality assessment tool, can provide us more data on comfort quality of a building but the results are always disputable from point of view of sustainability of our lives on Earth. MAXergy, thanks to embodied land indicator that is strictly based on hard data, shows us exact and understandable sustainability level of our buildings.

However, the role of SBToolCZ is very important for building practice in the Czech Republic. It brings sustainability issues in focus of building industry participants and presents the complex quality of buildings in a transparent way.

Acknowledgement

This outcome has been kindly supported by ZUYD University in Heerlen, the Netherlands.

References

[1] VONKA, M., et al. *Metodika SBToolCZ – Manuál hodnocení bytových staveb ve fázi návrhu*. Praha: CIDEAS, SUBSTANCE, Fakulta stavební ČVUT v Praze, 2011.

[2] Faculty of Civil Engineering, CTU in Prague. *Envimat. Envimat – Catalogue of Environmental Profiles of Building Materials and Constructions*. [Online] 2010. [Cited: 30 1 2013.] http://www.envimat.cz/.

[3] ROVERS, R. *Evaluation of 0-materials house design*. Proceedings of PLEA2012 – 28th International PLEA Conference. Lima, Perú: s.n., 2012.

[4] HAMMOND, G., JONES, C.: *Inventory of carbon and energy*. ICE. Bath: University of Bath, 2008.

[5] HODKOVA, Julie, et al. *Envimat.cz – Online Database of Environmental Profiles of Building Materials and Structures*. ISESS 2012. Berlin: Springer Science+Business Media. ISBN 978-3-642-22284-9, 2011, pp. 272–279.